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The study of supply chain management in Chery Automobile Co., LTD

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The Study of Supply Chain Management in Chery Automobile Co.,LTD

By

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China

A research paper submitted to the World Maritime University in partial Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

In

INTERNATIONAL TRANSPORT AND LOGISTICS

DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dessertation reflect my own personal views, and are not necessarily endorsed by University.

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ABASTRACT

Title of dissertation: **The Study of Supply Chain Management in Chery Automobile Co., LTD**

Degree **:** **Master of science in international Trasportation and Logistics**

Abstract: CACL has its own supply chain system which is developed by itself. And it has make great success in the process of using supply chain management system. CACL has tried himbest to learm the experience from other advanced automobile corporation. This dissertation introduces the situation of CACL's supply chain management, includes the procurement management, production management, logistic management and information system management. And then compare them to the situation of other advanced automobile companies. Then we analyze the problem of supply chain of CACL. In the last chapter, I build up a new systematic supply chain. And use AHP method to measure the performance of CACL's supply chain. Finally, I will give the suggest for CACL.

Keywords: CACL, Supply chain management, Performance measurement, AHP

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LIST OF ABBREVIATIONS

CACL: Chery Automobile Co.,LTD

SCM: Supply Chain Management

TQM: Total Quality Management

JIT: Just In Time

ERP: Enterprise Resource Planning

VMI: Vendor Management Inventory

CPFR: Collaborative Planning Forecasting and Replenishment

EDI: Electronic Data Interchange

BCS: Balanced Scorecard

SCOR: Supply Chain Operation Reference

R&D: Research and Development

SAP: Systems Applications and Products in Data Processing

LMS: Logistics Management System

DCS: Distributor Information System

CRM: Customer Relationship Management

LAN: Local Area Network

EPS: Enterprise Project Structure

DFAC: Dongfeng Automobile Co.,Ltd

AHP: Analytic Hierarchy Process

QR: Quick Response

ECR: Effective Consumer Response

Chapter 1: Introduction

1.1 Background of the dissertation

Under the background of globalization and with the rapid development of information technology, the space-time distance between enterprises as well enterprises and users continuously shorten. And also because the demand changes daily and the competitive environment between enterprises become complicated, depending entirely on the enterprise's own strength establishes competitive advantage has become increasingly difficult. Then, through the development of the world economics, a concept called supply chain management has got widely attention.

The importance of the supply chain in today's market competition is obviously. And the concept of the Supply Chain Management (SCM) has becomes another key management concept after the Total Quality Management (TQM), Just in Time (JIT), and Enterprise Resource Planning (ERP). In a certain extent, these advanced technologies promote the development of enterprises. So, each of them was studied by the most of scholars. However, the production mode of this new technology just concentrating on the optimal utilization, not make the operating mode and organization structure changes substantially. Then, the enterprises realize the most fundamental thing is changing the operating mode and organization structure. Then SCM as a new management method aroused widespread concern. We can say it is a systematic management mode. And SCM theory was considered as an effective method to enhance core competitiveness of enterprises under an open economy and comprehensive competitive environment.

Automobile industry is always considered as the most complicated research aspect. All of the world automobile manufacturers pay more attention to the supply chain management. In order to improve the efficiency of supply chain, they try their best to reduce the cost. Based on the latent capacity of China's automobile industry, most of

the auto manufacturers have follow with interest with it. However, in the links of auto supply chain, the traditional and obsolete logistics operating forms and methods still used everywhere. Therefore, we can clear see the distance of China's mobile industry and the international auto industry is still great.

1.2 The significance of the dissertation

So far, the academia doesn't have a uniform definition to supply chain management. Some Scholars and experts said that SCM is the concept that the connection an overall management mode from supplier Manufacturers, retailers and dealer, until the end users through the feed-forward information and the feedback of information flow, material flow. Other scholars give another definition that SCM can get value-added for users and shareholders with providing products, service and information, and it is an integrated management of key business process from original to the end user. American association gives the most authoritative explanation for supply chain, they said the supply chain contains all the efforts refers to production and delivery the final products and service, from supplier's supplier to customer's customer. SCM including the management to raw material supply and demand, the procurement to inventory, manufacturing and assembly, storage and check of inventory, order entry and management, distribution and delivery to the final client.

The emergence of SCM will promote the enterprise re-examine its operating mode. Through the promotion of strategic management and transportation of operating mode, the SCM will give a new connotation for the competition and development strategy of the enterprise. Through using SCM, the cooperation between enterprises will strengthen, and the barriers between the internal business departments will eliminate, finally it will reach the effective integration between resource and business process. At the same time, the communication will make the information transparency, and then reduce the uncertainty. All of these functions not only reduce the operating risk of enterprises, but has very important significance to strengthen the competitive

advantage of enterprises.

At present, some Chinese forward-looking strategic business has aimed at SCM, and uses it as management methods. Our enterprises' small scale make them couldn't form a scale. And for their complicated structure, large expenditure, multiple levels, structure bloated make it couldn't form a cohesive force, the SCM can be a new solution to enterprises. However, Chinese enterprises' SCM is in the traditional stage. Chinese traditional enterprise management system is affected by the thoughts of "rather ask themselves than other people". It makes the enterprise a closed system. And it is far away with the open global manufacturing and SCM, so it couldn't adapt to the request of SCM. The departments of purchase, production, sales, and transportation couldn't form as a whole business. Lack of communications and coordination leads to lack of sufficient information sharing and effective coordination mechanism between production and delivery. Finally, the problems of inefficient linking between production and circulation, irrational industrial structure, large inventory make domestic enterprises hard to adapt to the needs of the global competition. Therefore, it is no exaggeration to say that SCM has more important theoretical significance and practical significance to China.

China's auto industry is an important branch of the national economy. Whether it can adapt to the new economy environment and win a new economic environment, it is a issue which has a relationship with the use efficiency of scarce social resources and numerous the upgraded of related industrial and the operating condition of the national economy.

Currently, the competition in the market of auto industry is very fierce. The fusion of the SCM and E-commerce has become a powerful weapon to strengthen the global competitiveness for world auto enterprise. The connection of SCM and E-commerce are not only a tool to improve the efficiency of production and operating, but a tool to remodel the operation framework for future automobile industry. Obviously, Korea and Japan companies have realized this point.

The rising and development of the Supply chain management mode will profoundly affect and change the current state-to-state segmentation competition environment and competition planning. We can say that who set up and control the supply chain, which will have the leadership of the market. Any company who want to survive must face this trend and give a necessary and scientific adjustment. Facing the challenges of international automobile company, China's automotive industry must accelerate to apply SCM, and enhance their enterprise ecological environment; otherwise multinational auto companies will take market Control.

We can say that who set up and control the supply chain, which will have the leadership of the market. Any company who want to survive must face this trend and give a necessary and scientific adjustment. Facing the challenges of international automobile company, China's automotive industry must accelerate to apply SCM, and enhance their enterprise ecological environment; otherwise multinational auto companies will take market Control.

At present, the supply chain management system of CACL was build by itself dependently. Through the application of supply chain management, CACL has got some achievement. However, the application of supply chain management was only used in the suppliers and other workshop. It doesn’t form a systematic supply chain system. And the function of it was very single. Therefore, this dissertation was tried to find some methods to solve this question.

1.3 The literature review

1.3.1 Current abroad research

From the late 1980s, international academic began to study SCM. The study on it is very large. This dissertation only gives the major research parts of the SCM.

IT (information technology) is an issue that has got large research in supply chain management. Hau L.Lee (1997) proposed bullwhip effect which leads to information distortion in supply chain. The research of Hau L.Lee&Seungjin Whang (1997) stated the development of information technology on supply chain management and discussed why and how information shared in enterprises. They also give three convertible system models of information sharing.

The importance of Logistics in supply chain management also gets universal attention. Professor Martin Christopher (1994) in the University of Newcastle proposed lean logistics technology. And he said that we must be market-oriented, and should invest logistics and supply chain management from the angle of customer satisfaction.

Petrovic (2001) proposed fuzzy model and simulation method in uncertain environment, and consider uncertain of customer needs and external suppliers of raw material. And he used the fuzzy number representation. Optimized objectives are keeping total costs of supply chain in a reasonable ranger. The model makes sure every links' inventory levels and order quantity under the limited time to realize the delivery capabilities.

With the development of strategy management, more and more scholars also consider the supply chain management as a strategic management system. They study all the links in the strategic cooperation relationships, not only limited on short-time economic cooperation research which based on business activities.

1.3.2 Current domestic research

Domestic study on supply chain began in mid 1990s. The research focus on introducing on supply chain and supply chain management theory, the models of supply chain management, the constructing of integrated structure models and supply chain performance evaluation. And they combined with the characteristics of supply chain management, does system analysis to the choice of suppliers and the

relationship between manufacturers and suppliers. Wu Zhou (2001) use fuzzy multi-objective multi-level comprehensive evaluation model for supplier selection. Xu Zheng (2002) proposed a Genetic BF algorithm to optimize the artificial neural network optimization. Zhen Jiazhen (2002) study the performance and evaluation system from four angles: The whole supply chain, the core enterprise, suppliers and distributors. Peng Xing (2004) analyzed the cultural integration of supply chain strategy.

1.3.3 Major aspects of supply chain management research

In recent years, the problems of supply chain management aroused wide attention of scholars at abroad and domestic, and have got some achievements. The following are representatives.

(1) The general supply chain management strategies. The general supply chain management strategies include: Quick Response (QR), Effective Consumer Response (ECR), E-commerce and Vendor Managed Inventory (VMI), Postponement and Just in Time (JIT).

(2) Integrated supply chain. In order to successfully implement supply chain management and make supply chain management become competitive weapon, we should consider enterprise interior and various businesses in the links of supply chain among enterprises as a integrated function process and form a integrated supply chain management system. The development process of supply chain is a constantly integration process. This process should have four stages: the primary stage, functional integration stage, internal integration stage, external integrated stage. After finishing the four stages, we have formed a network enterprise structure. So we realize the integrated and optimization of enterprises' dynamic control and various resources. We in order to get the dynamic optimum goal of the entire supply chain.

(3) Design supply chain. The design and operation of an effective supply chain is crucial for each enterprise. Different product types have different request to the supply chain design. The design of effective supply chain process is for low profit margins and stable demand function products; the design of reactive supply Chain process is for high profit margins and unstable demand innovative products.

(4) Supply chain partner selection. Supply chain management is through the cooperation between members of the supply chain and the ability of synergy in order to achieve various resources integration and optimization effectively. Partnership is one of the most important parts in supply chain management. The selection of Supply chain partner involves many factors: product quality, price, delivery lead time, processing ability, transportation distance, and enterprise credit, batch flexible, technical strength, and finances and so on. Most research about selection of suppliers in essence is qualitative or empirical. Considering the importance of economy, quantitative analysis is very suitable. At present, supplier selection method mainly divided into three types: the linear weighted method, the mathematical programming method and statistical& probability method. Julie J. Gentry (1996) consider that supply chain management expands the partnership to the situation that much enterprise management do business together, that is the process of all inventory flow from supplier to the end user. Some scholars proposed that concept of "cooperation with competition", that means an activity which integrated enterprise internal and external events in a larger range and multidimensional vision. They also proposed the concept of borderless organization and establish a long-term relationship of trust with internal and external partners.

(5) Supply chain inventory technology. Inventory management aims at under the premise of high level of customer service it can control and reduce inventory cost, and then improve the market competitiveness. Inventory problems generally divided into uncertainty inventory and random stock. The uncertainty inventory

means continuous and certain demand, and reach at fixed rate. It is not allowed to lack of stock, and the product should fill immediately. Every order quantity and unit of cost and inventory costs are unchanged. Random inventory model is close to reality. The need of it is random, and the ordering cost is variable. It is also allowed to lack of stock, and is Newsboy Model. Supply chain inventory management techniques include Vendor Management Inventory (VMI), Joint Inventory management (JMI), and Collaborative Planning Forecasting and Replenishment (CPFR). VMI is a joint inventory management in order to get the lowest cost based on supply chain partners. In a joint agreement, the supplier established inventory, determine the inventory level and supply strategy. The suppliers have the right of stock control. This method reflects supply chain's integrated management thoughts. JMI is an inventory management method based on coordination center. It emphasizes both supply and demand, which should coordination, and make inventory plan together. It can eliminate the demand variation and amplification phenomenon in supply chain. CPFR is a synergy inventory management technology. It can also reduce the size of the sellers' stock cooperative and increased sales of suppliers. Its biggest advantage is timely and accurate predict selling climax and volatility which caused various sales promotion measures or abnormal changes. Thus distributors and suppliers can make full preparations, finally won the initiative.

(6) Supply chain modeling technique. It is very necessary to study supply chain modeling technology and build corresponding supply chain model for various analysis and decision activities in supply chain management. At present, supply chain modeling technology mainly include: web design method, approximation method, based on the simulation method. Network design method commonly used integer programming or mixed integer programming to describe and solve problem model. The model can cover all areas of the supply chain management decisions, but for large scale model it has some solving problems. In addition, the ability of considering model random factor is very limited. Approximation

method is mainly used in multi-stage supply chain inventory problem, and it study in building inventory control strategies and determine the control parameters in considering multi-stage inventory stock. This method are quite important aspects in reducing inventory, improve customer service levels, however it ignores the non-stationary random factors and the problem of production and transportation. Based on the simulation analysis method can be used in the overall supply chain model. Because there is no mathematical problems, the model can consider various complicated factors, includes the random of structure and parameters. So it is suitable to evaluate existing strategies.

(7) Logistics system planning. Logistics system planning include layout problem, location problem, and the location problem have assign problem and path problem. Select the appropriate number of facilities and facility location, determine of facilities reasonable, arrange vehicles and path, all of them can reduce the logistics cost of supply chain and improve the level of supply chain management.

(8) Performance evaluation. The supply chain performance evaluation is an important part of the study of supply chain management. It is the guarantee to the accurate measure node enterprise performance and the performance of the whole supply chain. And it is also the "gauge" of coordination the relationship between enterprises and reasonable distribution of interests of supply chain. Establishing a scientific and reasonable evaluation index system is the key of supply chain performance evaluation.

1.3.4 Future research direction of supply chain management.

(1) Agile supply chain. In the late 1980s, American put forward the concept of agile manufacturing and emphasizes information sharing and open, integrated based on Internet Network. The concepts of agile manufacturing and supply chain management

will expand the enterprise resource from one unit to the whole society. The enterprises will form a strategy alliance for the common market interests. By the implement of agile supply chain, the supply chain management gets more and more attention and becomes the most influential kind of enterprise operation mode.

(2) The green supply chain. New environment is a new challenge to global manufacturers and production-oriented enterprise, namely how to make industrial production and environmental protection to mutual coordination development. Due to the public, regulations and environmental standards force, environmental management has become an important problem of enterprise couldn't allow to ignore. Face this kind of pressure, enterprise must be readjusted supply Chain process and melt the environmental problem into the supply chain process.

(3) Supply chain information technology. Information sharing is the basis of supply chain management Effective supply chain management system should not without providing reliable information technology. Information technology application in supply chain management, mainly including: Supply chain management information technology support system which based on EDI, based on internet, based on E-commerce. The application of information technology effectively promoted the development of supply chain management. It can save time, improve the accuracy of the information exchange, reduce human error on work, and finally improve the efficiency of supply chain management.

1.4 Research methodology of this dissertation

This dissertation uses lots of supply chain management theory and some models. Such as the performance evaluation models of supply chain. This dissertation use BCS (Balanced Scorecard) and SCOR (Supply Chain Operation Reference) models. The main methodology of this dissertation is AHP. AHP is the main method used in the performance of supply chain. It has been widely used in lots area of research.

The ideas of AHP are that the experts must divide complex problems to several basic elements. According to the dominating relations, he should make the elements form an orderly hierarchical structure. And then do comparison and get the comparative importance of the elements, namely the weight. Finally comprehensive the important degree of elements in the level and get the every element's comprehensive assessment data, and do the decision according to this.

1.5 The framework and content of this dissertation

This dissertation introduces the background of research and gives the purpose of the dissertation in chapter one. Chapter one also introduce the Literature Review. In chapter two, the author introduce the current situation of CACL, includes the situation of procurement, inventory, information, production and logistic. The third part of this dissertation proposes the problems of CACL in the aspect of supply chain. Then the author gives the method to solve the problems in the supply chain in chapter four. Finally there is a conclusion.

Chapter 2: The current situation of CACL Automobile Co., Ltd

2.1 The basic condition of CACL Automobile Co., Ltd

CACL was founded in 1997 by five of Anhui's local state owned investment companies. The first car came off the production line on December 18, 1999. At present, CACL possesses a full set of production and R&D units, such as Car Factories, Engine Factories, Transmission Factory, Automotive Engineering and Research Institute, Planning & Design Institute and Testing Technology Center, and boasts an annual output of 650,000 cars, 650,000 engines and 400,000 sets of transmissions[1].

[1] http://www.chery.cn/about/about_jsp_catid_11|17|21.html

In 2006, CACL achieved a total sales volume of 305,200 units[1], representing an increase rate of 61.5% over 2005; and in 2007, the annual sales volume of CACL reached 381,000 units, increasing by 24.8% compared with 2006. In 2007 also, CACL achieved an annual export volume of 119,800 units. As a result, the overseas sales of CACL had doubled again with an increase rate of 132%, ranking 1st for 5 consecutive years in car export in China.

We know, CACL has been developed for about 10 years. And it gets very great success. CACL has its own R&D project to the vehicles and some key spare parts. It has its own core technology. And CACL has invest great cost in the research in every parts, includes the development of information system. The managers of CACL have realized the importance of the information system. It has used the SAP in the earliest time.

2.2 The current situation of supply chain management in CACL

2.2.1 The situation of purchase management

The purchasing procedure of CACL is done by many department, includes purchase department, product management department, logistics department, quality department and other departments. The purpose of it is control the activities of purchase, and make sure that the products comply with the requirements. The figure 2.1 is the procedure of CACL's purchasing situation.

Before the purchase procedure starts, the purchase department makes files. And the product department provides the outsourcing component list which has been approval led. The list must contain the level of the name, the type and the number of spare parts. Then the product department should provide the specification requirements of drawings, process requirements, inspection rules, and other relevant documents to suppliers. If necessary, the product department should provide samples to suppliers. The quality department provides applicable quality system standard, numbers, and

[1] http://www.cheryinternational.com/node/15

version to suppliers. Then the purchase department signs purchasing contract with suppliers.

At the first third of every month, product management department make the produce plan of next month. And the purchase department makes the outsourcing component purchasing plan of next month based on produce plan and inventory condition. The plan should be approval led by purchasing minister. The buyer make open or close supply plan to suppliers based on purchasing plan. The price of spare parts, payment terms, and packing requirements should execute according to the latest agreement or contract.

The buyers allot supply plan to the suppliers and the request the supplier ensure the quality and quantity is good, and timely delivery. When the outsourcing components arrivals, the suppliers hand the supplier list attached inspection report to logistics Phillip administrator. And the administrator checks and accepts of the arriving goods' quantity and packing. And the goods should storage according to the requirement, and make marks.

Within one working day after accepting the outsourcing components, the storekeeper gives the supply lists and supplier quality reports to quality department and the quality inspector check the outsourcing components according to the *Purchasing Product Validation Method*. And tell the results to the storekeeper within one working day. And marks the test condition of products according to the *Product Identification And Traceability Procedure*. If the product is qualified, it was stored in the warehouse. And the unqualified products were disposal according to the *Nonconforming Control Procedures.*

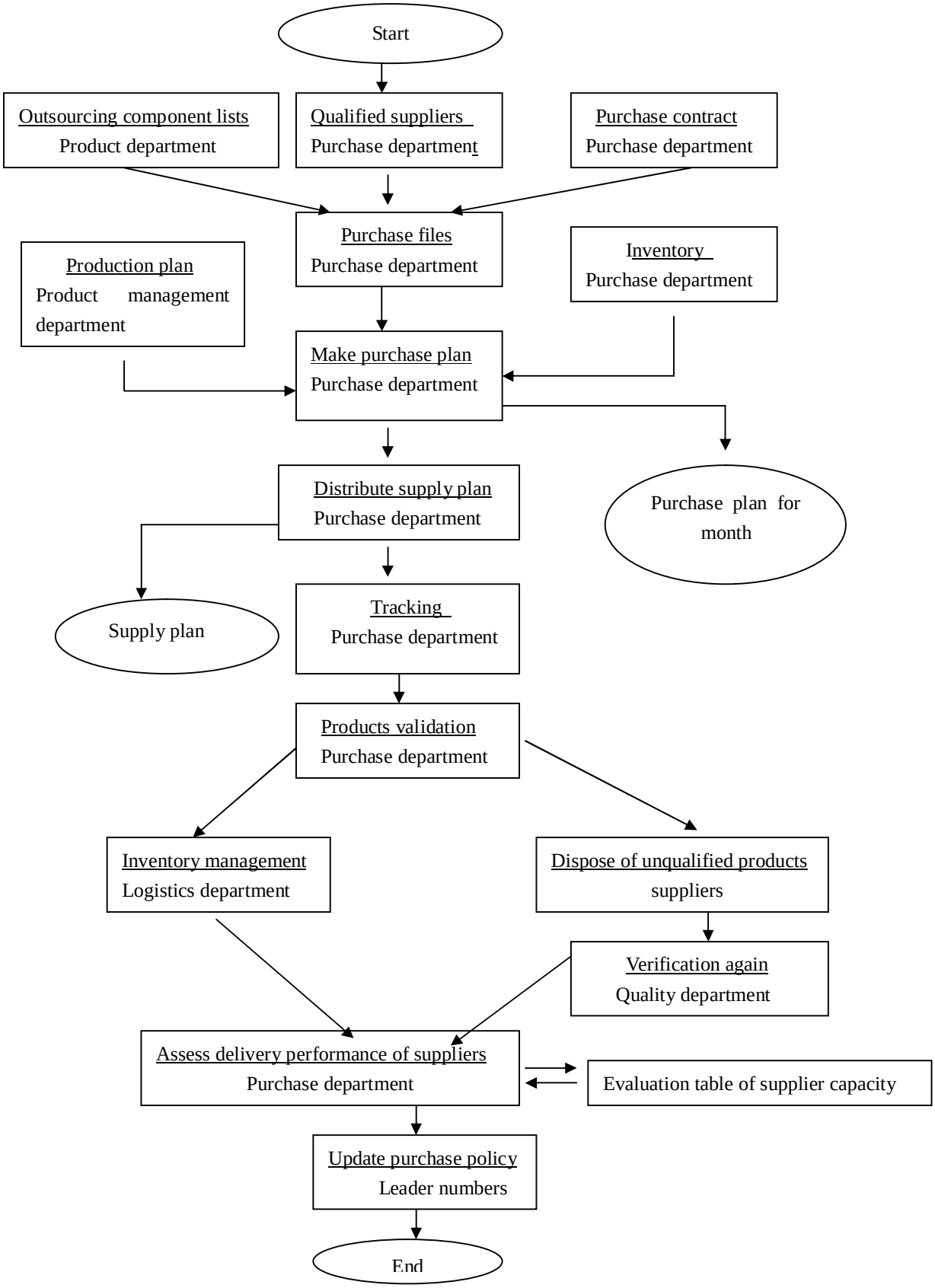

Figure 2.1 procedure of CACL's purchasing situation[1]

The inventory management is very important. The qualified products should be stored classified, but the centralized management should be executed. And the first in, first out rules should be done.

Assess delivery performance of suppliers is another important point in the purchasing. The quality department statistics the quality of products and assess the product quality and rectification efforts of suppliers. Product department assess the R&D capability and technical problems' action coordination of suppliers. The purchase department assesses and statistics the supply quantity, timely delivery and after-sales service of suppliers quarterly. Every quarter, the purchase department fills the *Supplier Performance Rating Table* according to the assessment result of quality department and product department. And tell the result to the suppliers and request them propose corrective actions according to the existing problems. At the end of year, the purchasing department statistics the assessment result then assess the comprehensive evaluation of suppliers. The result was the basis of the contract. If the suppliers doesn't pay attention to the problems or continue to supply unqualified products, the purchase department will warn the suppliers. If the suppliers don't make measure after warning, he will be cancelled the rights to supply to CACL.

2.2.2 The situation of produce management

Production parts approval procedure of CACL is very strict. It is a process that many departments of CACL participate.

[1] Procurement control process, 2008, CACL's procurement department

The following situation should do production parts approval procedure:

(1) A new spare part or product (never provide special spare part or materials to CACL before)

(2) The product is unqualified that serious influence the product function, reliability, appearance should be improved. And now it submits to CACL again.

(3) The product changed because of the product design, design standard and materials.

(4) The production that uses new or changed instruments, modes, casting and copy type, includes additional and replaceable instrument

(5) New key equipment does structural and functional repair and adjust.

(6) The production that after the production process and production method has apparent change.

(7) The production that has transfer the equipment and instrument to other production place

(8) The supply chain that the source of the spare parts, materials and service, has changed.

(9) The equipment put into product again after the batch production stop longer than 6 months.

The decision of the approval process:

(1) When using new product, new materials, new suppliers, it needs the reorganization to the samples.

(2) When it needs to change the production define which influences the cooperation, technology, product appearance, performance, reliability and durability, the research department should require the supplier to provide the reorganization of OTS.

(3) If the research department confirm the change of product define besides the above two situation, the research department should give a written notice to the quality department. And then the quality department decide to enter into small batch production or big batch production

(4) When the following situation happens, the quality department decides whether require the suppliers and the research department to do the reorganization of the samples. If need, it should give a written notice to the research department; if it doesn't need, the quality department should do process reorganization, then decide to enter small batch or big batch. The situation contains the following five terms: ① The change of the key equipment, key sample, production place, production process, and control plan. ② Add new production process. ③ The non-critical supply chain changes of suppliers. ④ Happens serious unqualified condition. ⑤ Put into production again after the production stop over 6 months

The Figure 2.2 shows the working process of products approval

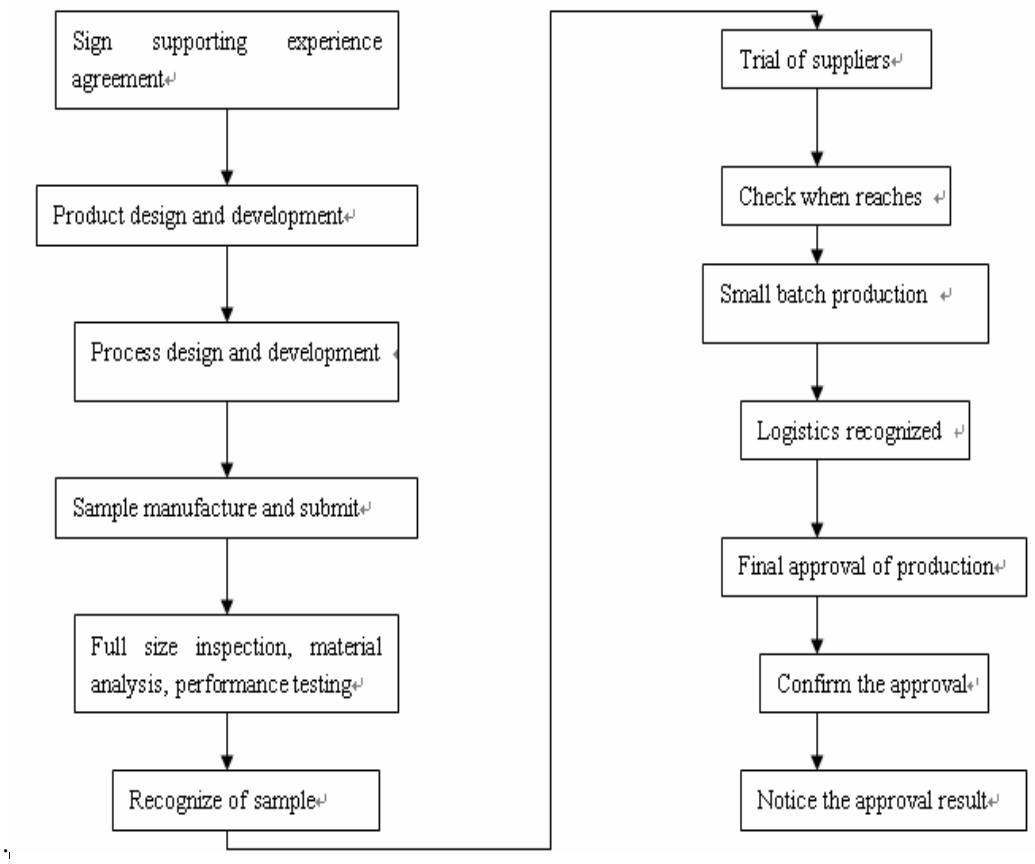

Figure 2.2 working process of products approval

And now, I want to give the pictures for you about the production process of CACL. I think through this way you will get a more direct and clear idea about it.

Stamping line

Engine assembly

Welding

Coating

Production line

Assembly Line logistic platform

The sequence production mode in the production is very important. The sequence production of CACL is very meticulous.

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(1) Before sequence production

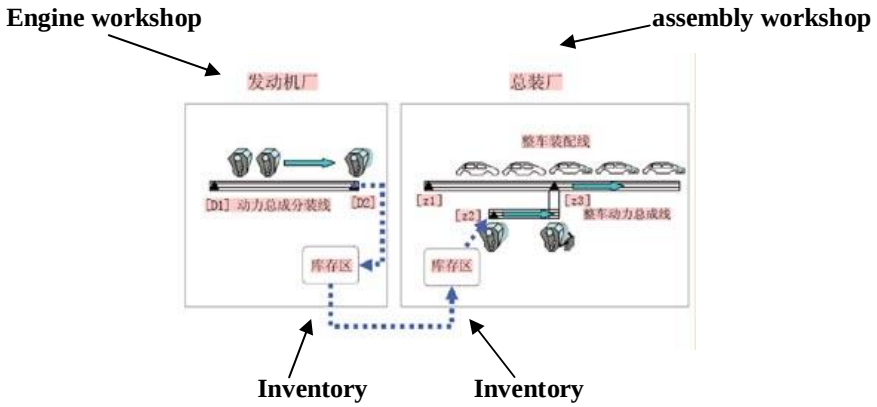

Figure 2.3 Process before sequence production

The engine dynamic does packing in engine workshop (between D1 and D2), then transport to assembly line. The assembly line need do assembly to other engine parts between Z2 and Z3. In the point of Z3, transfer the assembly to the line[1].

Car body before the Z1 needs to configurate specific power train model according to the production plan system. The engine workshop must ensure that every type engine should supply to Z2 process.

Before the sequence production, we build the inventory in the assembly workshop. Every type should set the lowest safety inventory about 40 engines. If it is lower than the safety inventory, it needs to replenish the inventory. In this way, inventory warehouse has about 10 types of machines require about 400 engines.

This production mode exists following defects[2]:

(1) Great dynamic makes mass inventory

[1 2] http://www.ai.vogel.com.cn/ShowArticle.asp?ArticleID=6112

After sequence production:

(2) In the transit process makes the occupy and consumption of materials

(3) In the transit process makes the loss of product quality

(4) Production and logistic chain couldn't perform a flow production, and it exists mass waste.

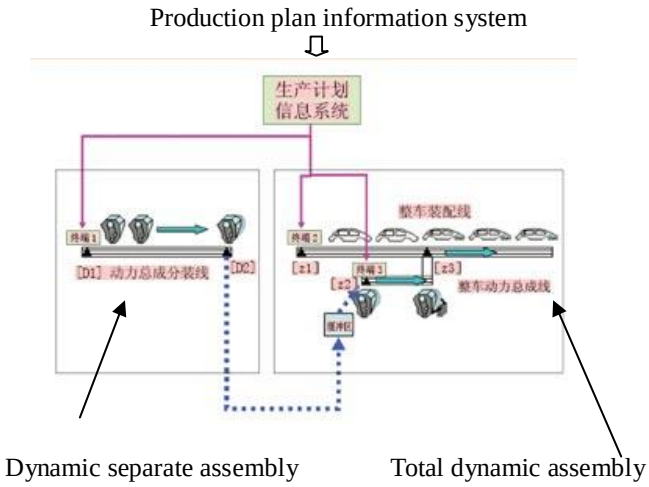

Figure 2.4 Process after sequence production[1]

Because of the SAP system, it set the terminal of SAP in D1, Z1 and Z2. The production plan information sends to these three terminals. According to the production process and cycle, in the same production and D1 terminal will get sequence information firstly, and the terminal of Z1 will later about 60min, Z2 is latter 15min than Z1.

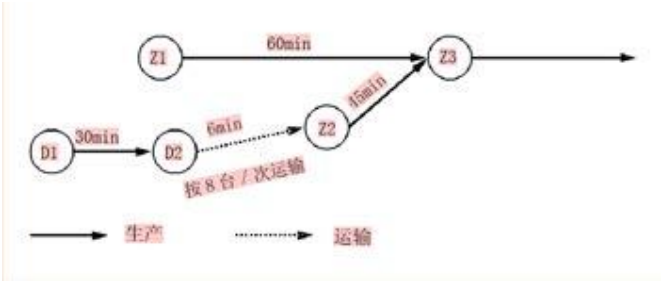

Figure 2.5 The time about the sequence process[2]

[1] [2] http://www.ai.vogel.com.cn/ShowArticle.asp?ArticleID=6112

From the above picture, we know that from Z1 to Z3 the assembly time is 60min. D1 get sequence information before Z1, so the production cycle from D1 to Z3 must be lower than 120min, and the production time from Z2 to Z3 is 45min, so the production time from D1 to Z2 must lower than 75min.

Sequence production must reach the condition that the materials should supply in time. Firstly it must ensure the supply in time and can take every machine parts use standard container, and it must set the highest and the lowest line; or through the way of site billboard. When the production materials are in the lowest line, the person who sends the material will send the material in the shortest time. The sequence requires collecting the process change, stop line for accident, production time change and other production information.

After the engine production line takes the sequence production mode, the inventory is decreasing. And it also reduce the lost in transit process and reach a state of flow production.

The sequence production line is a success experience to JIT (just in time). Through this way, CACL improves the management efficiency and reduce the cost, and it also changes the idea of the managers of CACL. It is a specific performance of constant innovation.

2.2.3 The situation of logistics management

In the link of Vehicle Logistics, CACL takes the form of outsourcing. Different places have different logistics companies. At present, the main logistics suppliers of CACL are Changyuan Logistics Company and West Shanghai Logistics Company. And the two companies have occupied 60 percent of CACL logistics. When choose the logistics suppliers, we should consider the responsiveness and safety, and the cost is another very important element we should pay attention. And the ballast rate is the key to the logistics cost. To be short, if the logistics supplier want go from place A to

place B, the car is full loaded. When it want go back from place B to place A, if it can load other clients' goods, it means avoid vacant load, then the cost will be lower.

CACL has paid more attention to improve the efficiency of the logistics. He knows that if want to improve the effect of logistics he must manage the logistic company which has provides service for CACL.

CACL has made lots of evaluation terms for logistic company. If the logistic company couldn't reach the score that CACL has set for them, this logistic company will be kicked out of CACL's logistic suppliers. The table 2.1 gives the specific terms.

Evaluation terms	Buckle score
The report and supply list don't be regular	-1
Lead to the production line don't work because of the problem of logistic company	-5
The palletizing and packaging don't follow the standard height or the instruments cannot satisfy the distribution demand	-1
Don't do effective protects according to the characteristic of products, just like moisture proof, shockproof, and anticorrosion	-1
Don't wait to discharge according to the order	-1
The packaging mark of spare parts is incorrect, incomplete, not easy to position and doesn't conform to the provisions of the agreement	-1
The non inspection-free product stick inspection-free logo or inspection-free product doesn't stick inspection-free logo	-2
The quantity of external package logo don't accord with the internal quantity of goods	-5
It has supply certificates but don't have goods when supplies	-10

Without permission, change the package and specification and size of package	-1
Packing number is not unified	-1
Logistics instruments couldn't be return in time	-1
Instrument is dirty or not protected	-1
Don't deal with the defective parts according to the provisions of the time	-0.5
The service person is not competent	-1
The service person don't conform to the rules of Chey auto	-1
The logo of warehouse and workshop region partition are not clear	-2
The logo of spare parts is not clear and no batch management	-2
Cargo yards is not neat in the process of storing	-1
The warehouse is mixed and disorderly	-2
Accounting management is not regular	-2
Use and occupy other manufacturer's instruments	-2
Fire-fighting equipment is not enough or couldn't effective use	-2
Couldn't understand the daily production plan of CACL auto	-0.5
Don't send the inventory information into the third logistics network	-1
The inventory information send into the network is inaccurate and incomplete	-3
Don't switch the manufacturers according to switch table without any reason	-2
Send the defective parts to CACL	-5
The logistics companies don't send according to the contract	-1
Distribution is not timely or billboard management is not standard	-2
Don't notice CACL if companies has great change, just like operating condition and inventory condition	-2
Don't send the logistic company's plan and summarize to CACL auto	-1

The ability to supply of supplier is insufficient	-5
Express delivery was delay	-1
The employees of logistics company don't cooperate with the arrangement of CACL auto	-1
The phone of logistics company was unanswered	-1
Logistics company has strong sense of cooperation and teamwork with CACL	2
Logistics company has great innovation in the distribution factor	2

Table 2.1 The evaluation terms to the third logistic company[1]

2.2.4 The situation of inventory management

With the development of the output, the inventory of spare parts becomes more and more large. And we know, if the inventory is excessive, the cash flow will be low, so that the burden of interest will become large. If the inventory becomes large, CACL should invest the equipment, industrial instruments and the human resource, and then some management problem will not be solved. Therefore, it will influence the overall development of CACL. Company' host manufacturers could no longer establish large equipment in association with the machinery manufacturers. All of this required the CACL to reduce the inventory of spare parts, but it should also ensure timely delivery. How can CACL do this? It needs the help of the third logistics.

We have discussed the CACL auto's evaluation terms to the third logistic company. The third logistics company should improve the level of management. On the one hand, they should perfect the software and hardware equipment. On the other hand, they should integrate the most important

[1]The evaluation terms to the third logistic company, 2008, logistic department of CACL

the third logistic companies with the logistic companies, and build up a full functional logistics alliance. They should try their best to reach the maximum security for the suppliers.

There is an important point in the process of the third logistics companies do their work. The point is the computer supply management system. Through the barcode technology and network technology to connect the third logistic companies, host manufacturers and suppliers, that will perform the real sense of JIT (just in time). Then build a freight-distribution center in the place that supplier are comparative concentrated. And then through the help of the third logistic companies build a complete and agile supply logistic platform.

The above supply chain management measures improve CACL auto's supply chain management level deeply and gain great effects. But the contradiction among the branch, host manufacturers and suppliers is hard to coordinate, and the resources efficiency is low, the waste is comparative high. The problem of decentralized procurement resources makes it couldn't form a strategic alliance relationship. Decentralized procurement also couldn't form economies of scale. Although CACL will take new measures to reduce the cost, and the suppliers has try them best to help CACL to reduce the cost every year, both of the CACL and suppliers couldn't achieve their expected benefits. The procure cost and quality still couldn't ensure the market competition needs, and CACL couldn't get the resource support of the most outstanding suppliers. CACL lacks the contact and communication with the users, and user resources was controlled by dealers.

2.2.5 The situation of information system

CACL is a famous auto manufacturer who has the independent brand. In 2008, the sales of CACL were over 356,000 cars. From 2001, with the development of output and sales, CACL faces new challenges. There are two choices. The first is based on

existing simple information technology to add labors and infrastructure. And second is absolutely change, build a low cost, high efficiency, high value-added mode based on network information system. CACL drain advanced enterprise experience, and adopt E-commerce strategies. The purpose of this strategy is through the application of network and information technology to integrate the supply, produce, sales and delivery, and improve the produce capacity and operating efficiency. Then it can reduce the operating cost, improve service capacity, and strengthen the market competition ability.

Before the leaders of CACL choose the model of ERP, the set the goal of build a integrated management system with producing, sales and finance, and in order to reach the goal of improving the operating efficiency. The leaders of CACL are very cautious when choice ERP software, after several rounds of selection, finally decided to use the SAP R / 3 systems which are the choice of almost all international leading automotive companies.

The supply chain of CACL is a network system. In order to realize supply chain integration management, in 2002, CACL applies the ERP, and then implement the SCM (supply chain management), LMS (logistics management system), and DCS (Distributor information systems). In 2004, CACL build EPS (enterprises portal system), and integrate the SCM, LMS, DCS, and ERP. Implement the integrate the management of logistics, information flow and cash flow. Gradually build an E-commerce application system.

The business model of CACL's E-commerce continues to improve, and it forms its own special ideas. CACL makes the ERP system as the core business.

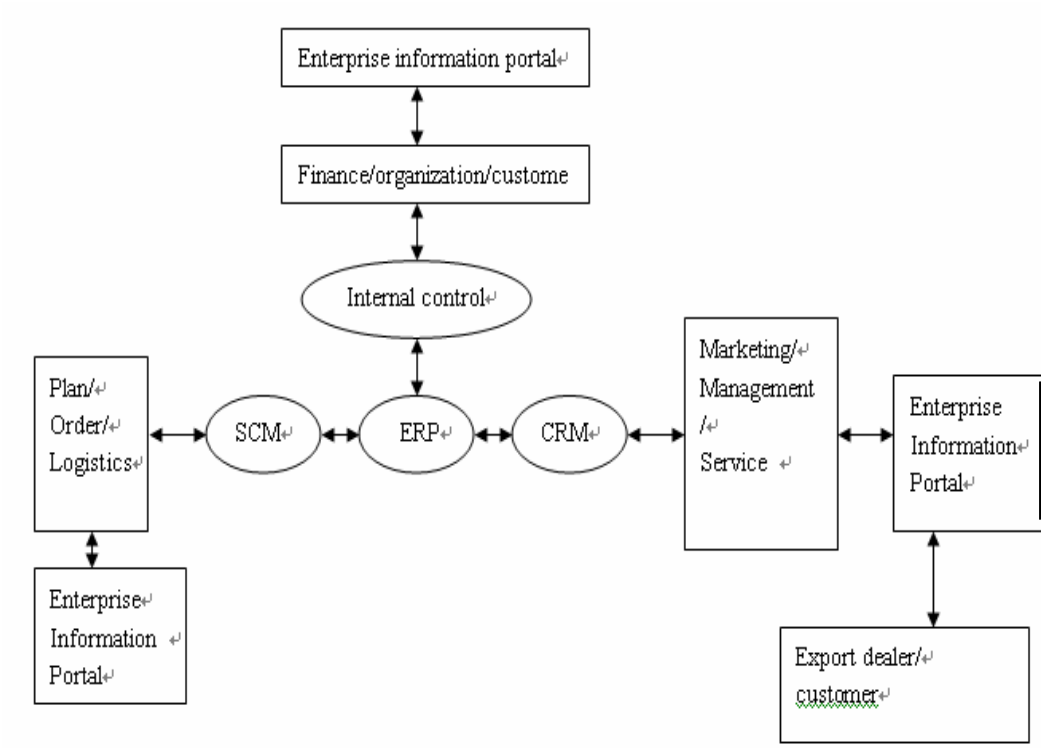

Figure 2.6 E-commerce application systems

In the research process of SCM project, CACL has its own special features. In the system of SAP, it defines background work. After the treatment of specific data, and uploads it to the application server in SAP. At the same time, in the logistics network of CACL automatic access SAP application servers. So the suppliers can synchronous access into the data of SAP system in CACL Company LAN. Then they can do the pilot of JIT (just in time), and realize the paperless purchase orders and real-time inquiry of inventory information.

The SCM of CACL not only limited in the coordination of enterprise internal departments and exchanges the information data between suppliers, but also improves the SCM into the cooperation of every part in SCM, includes strategy planning and risk sharing. In order to reach information sharing and collaborative operation, EPS provides the following two functions. The first is the Electronic board. The purpose of

it is timely delivery the material requirement information to suppliers and the third logistics company. It requires the suppliers make the goods just in time. This function refers to the traditional experience redefined format and handling methods of CACL. It reduces the inventory efficiency and avoids frequent delivery which leads to increase cost. The second is Electronic bulletin, it release information to the suppliers, and it supports one –on-one or one-on-more information release. At the same time, suppliers also can feedback all kinds of information to CACL. Through this way, the CACL and suppliers can reach good cooperation.

In order to improve the efficiency of the supply chain management, CACL makes the *management method of SCM system implement and running*. The provisions said that the purchase department is responsible for centralized management, and is responsible for the connection and communication with suppliers and the third logistic company.

Internal business applications

(1) Business application

Each department proposes the *SCM system business demand application*. The director of the department need sign, and then give the file to the purchase department. In the two days after the purchase department receives the SCM system business demand application, the purchase department needs to organize relevant business department and assess the business. If the purchase department approvals the application of the department, the purchase department will give the table and relevant assessment opinion to the management department. The management department will finish the technology assessment in the two days, and then confirm the develop feasibility, develop cycle and specific develop demand. If the application of the department has been refused by the purchase department and management department, the relevant business and technology problem will be feedback to the relevant department.

(2) Business test

After the demand department receive the notice about business test which made by

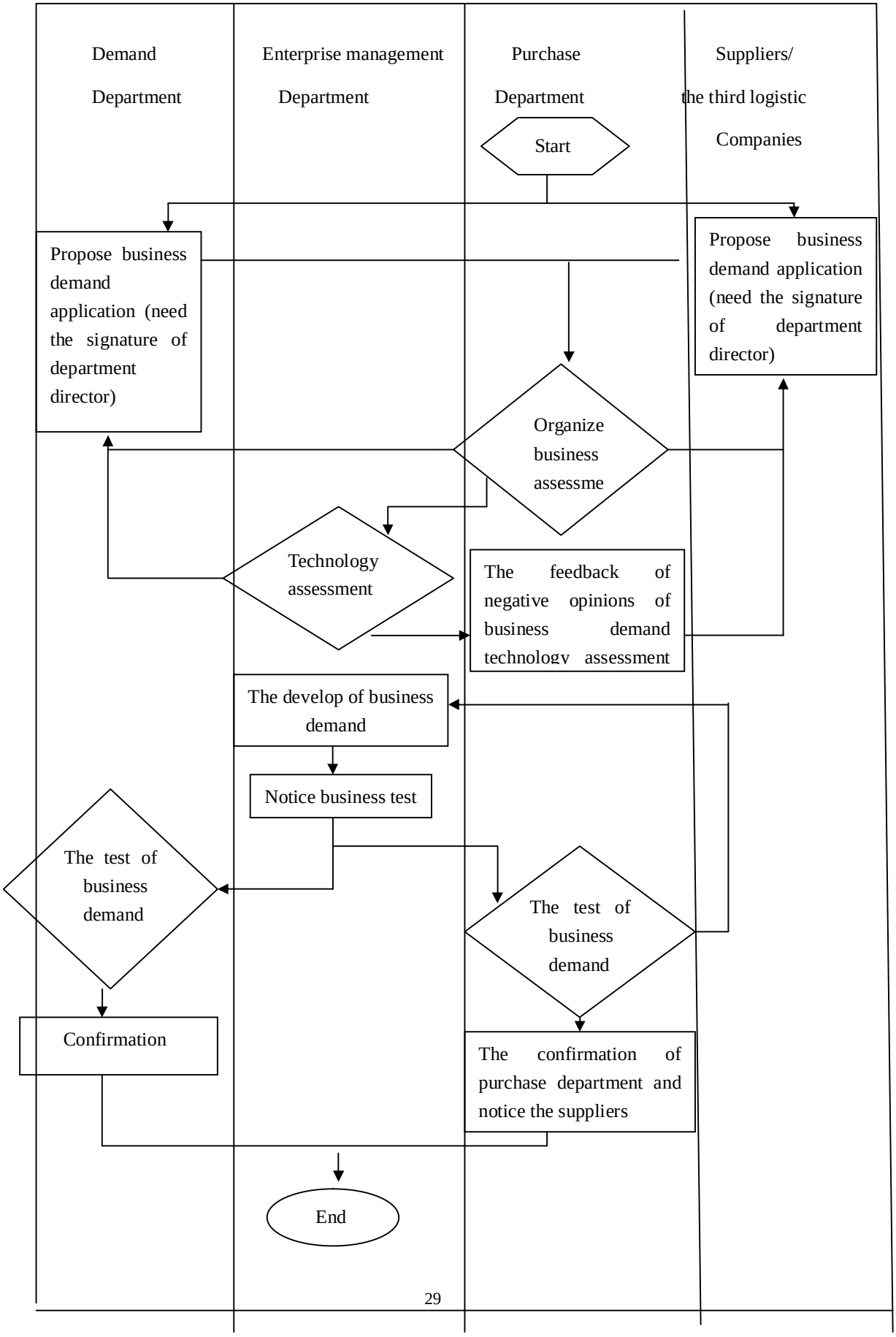

Figure 2.7 the maintenance of SCM system[1]

management department, it should do systematic test to business. If the test doesn't have problems, the director should sign. If the procedure doesn't meet the need of the business, the management department will be responsible for the change of the procedure, until the business department meets his satisfactory.

(3) The maintain of the permissions

Each department needs to add, delete and change the systematic users. And they should propose the written file with the need of the user permissions. Then the director signs and gives the files to the purchase department. After the two days of the purchase department receives the *SCM system business demand application*, the purchase department should handle the demand and feedback to relevant departments.

External business applications

(1) Business application

Suppliers and the third logistic company propose the written file of *SCM system business demand application*. The general manager of the suppliers and the third logistics companies give the signature, then they gives it to the purchase department of the CACL. The purchase department sees the fax, and they should handle the demand and notice the suppliers and the third logistic companies within two days. If they need system development, the purchase department of CACL will give the assessment. And the purchase department will give the *SCM system business demand application* and relevant opinion to the enterprise management department. The management department receives the files and then gives the technology assessment. They will work together with the purchase department, and gives the develop feasibility, develop cycle and specific develop demand.

[1]SCM operation management system, 2009, procurement department of CACL

(2) Business test

When the purchase department receives the notice about the business test of the enterprise management department, the purchase department should do business system test within one week. If the test result is passing, the purchase department should confirm the signature and feedback to the suppliers and the third logistic companies. If the procedure doesn't meet the demand of the business, the enterprise management department will be responsible for the change of the procedure, until meet the demand.

In the production process, CACL fully absorbs the philosophy of Toyota manufacturing mode, and it choose the continuous "pull" delivery system between purchase logistics and workshop logistics. Compared with the "push" system of producing material according to the plan, it is closer to the actual needs of production site. And it can perform the small batch and much frequency supply, so it can reduce the inventory effectively. The "pull" system reduces the dependence to the MRP (materials resource plan) system. In the process, CACL makes full use of system contains business processes and practical experience and to improve the logistics business. Within three months, CACL successfully achieved the meshing of "best practices" and the actual business of Infor SupplyWEB.

At present, in the workshop of CACL, once there is the spare parts was removed from the supermarket warehouse to production line, the logistics person only need a simple barcode scanning, the system immediately pull the circulation of billboard. Through the network, it can form a new electronic billboard need, so that can give a guide to the suppliers, and they can supply timely.

Because CACL successfully integrate the preparation of suppliers, invoice printing, delivery such activities into the supply chain management system and strictly corresponding with supply demand, CACL can effectively regulate suppliers and logistics company's delivery behaviors and avoid delay, leakage send, send the wrong

and repeat delivery such problems. In other words, it reduces the influence of logistics link to production.

The visualization of supply chain makes every participant can fully enter into the supply chain business and becomes an active participant. In the supply chain of CACL auto, not only the purchase, planning and logistics department can understand the delivery condition of suppliers at any time, but the suppliers also can understand the condition of goods or whether the goods still stranded in CACL's warehouse.

2.3 Current situation of supply chain management in other automobile corporation

DFAC:

I want take Dongfeng Automobile Co., Ltd (DFAC) as an example. The supply chain of DFAC does very good. From the study of DFAC, CACL will learn something to improve itself.

DFAC build up in the 1990s. From the beginning, it pays more attention to the Factory logistics distribution. No matter the factory design or the distribution of spare parts does much to the supply chain management.

After the year of 1999, the managers of DFAC pay much attention to management, and then consult with other companies. They ever want to use ERP, but give up for reasons. However, the ERP has been got many supports. For many years, DFAC has invested about over 350,000,000RMB into computer information management. They had reformed in Research and invention, manufacture, supply, storage, and marketing network and so on.

In the factor of procurement, the Group Corporation of DFAC makes the great procurement plan, and the branch does scattered procurement. The group corporation

does key monitoring management mode to the operation of branch. In the branch, the process management department identifies the suppliers, and then the finance department identifies the price. The procure department is responsible for the procurement and the management to the suppliers.

The production management of DFAC is very strict. Through the correct forecasting to the need of marketing, and it does simulation and analysis to the capability of production and timely monitoring to the process of production. Change the mass production way to the small batch production way, and then the production plan will accurate and flexible. Through the combination of order and the way of added inventory consumption, it will perform the month production plan to the ten-day production plan. Finally, it will reach the day production plan.

The vehicle logistics condition of DFAC is that sales company is responsible for the distribution of spare parts, sales, after-sales service, marketing policy, dealer management, car modification and so on. The vehicle logistics system of DFAC does monitoring management to the process from the front line to give the users. The key is the vehicle warehouse management, and it covers assembly operations department product line, product adjustment, packing, check of incoming storage, inventory management, new car ready, service in sales, handle certificate, the government one-stop office, transportation management business and so on, at the same time, give the support to the packing business, the return goods, traffic accident business.

FAW-VOLKWAGEN:

The volkwagen automobile corporation takes the four-layer supply chain, the first layer is Kassel in German, and the supply chain business of it is in charge by Schenker logistic company. The second layer is Singapore spare parts diversion centre which is also in charge of Schenker logistic company. The spare parts importers and retailer is the third and forth layers. The service of Singapore spare parts diversion

centre covers the many important places in the world. And it provides great value-added service to volkwagen. The contents contains the develop capacity of information technology system, design planning of warehouse, training and evaluation to technology person, finance management and data statistics, the lower supply chain cost and the improvement of operating management efficiency and so on. Through the good cooperation between the two enterprise, volkwagen perform the order of spare parts, manufacturer, transportation

Chapter 3: the problems of supply chain management of CACL

3.1 The narrow application scope of supply chain management

At present, the SCM of CACL is development independently. Through the issue of SCM project implementation, CACL has made significant gains. But the application of supply chain management is comparative narrow. The supply chain management doesn't cover every point of the ERP. The specific flaw reveals in the following aspects:

- The application of SCM only confine on supplier management level. The SCM is a system that should cover every point in the chain. But the SCM of CACL limited in the management level. Some specific technology and connection problem doesn't be solved. And the part with the dealers doesn't work very well.

- And the application of SCM only in the part of workshop department processes. Some other department of CACL doesn't inter into the SCM. It will lead to the problem that the relationship among department couldn't work very well. And it also cause information lag.

- The application of SCM limited in part of on-site supply third-party logistics companies and suppliers. It doesn't refer to vehicle and spare parts distribution

management. It means that the functions of SCM are single. The effect of logistic is the life of SCM. If the logistic system couldn't work very well. That means the SCM is fail. In general, the SCM of CACL has the dual problem with transverse and longitudinal.

3.2 The lack of practice application of information system

E-commerce applications has cause widely attention of world car manufacturers and also has made great progress. At present, if we see from all over the world, we can get that the status of E-commerce in automobile industry is growing development day by day.

Automotive manufacturing is an industry that depended on information system, and the information system of automobile enterprise is very complex. With the development of CACL automobile, on the one hand, the product data and business data becomes more complex day by day; on the other hand, the organizational structure has great change. We should say that information system has more forward-looking. The managers of CACL should pay more attention to the information system, building the enterprise culture that is suitable for application of information system.

E-commerce of CACL is the application of electronic technology that covers the whole car industry chain, includes automobile materials supply, auto parts processing, vehicle assembly, automobile retailing and after-sales service. The information technology which based on the core of internet technology plays a role in every links, and reaches the goal of improving the enterprise operating efficiency and economic effects and customer service.

As large automobile manufacturing enterprises, CACL automobile has its own success and features in the application of E-commerce, but it still exists some problems:

(1) Business cooperation, business intelligence is not enter into actual application

The E-commerce of CACL automobile lacks of effective filter and analysis to the sales data, customer data and supplier data, and that makes large distance between the management decision supports.

(2) The application of customer relationship management needs to In-depth and expansion.

The CRM system' monitoring and management to the suppliers and service station is not comprehensive. The mining and application to the customer information is not deep. And with the development of foreign market, the foreign customer management system stays in the manual management phase.

3.3 The reasons of existing problem

Through 3.1 and 3.2 we know that the SCM of CACL still exist lots of problem. It doesn't mean that SCM of CACL is fail. There are some reasons that lead to the above problems.

- The time of application of SCM is short. As we know, the history of CACL is only ten years. In some sense, CACL is a miracle of the automobile industry of China. Even through from 2003 CACL has realized the importance of ERP and SCM, it has only 5 years time to do that. The SCM of CACL has made progress step by step. Of course, it needs time to prove the operation of SCM.

- Based on the consideration of cost. The development of SCM need invest large capital and human resource. It has risk if CACL has invested large resources. So consideration of cost is another reasons lead to the problem of SCM.

- The management of CACL exist some loophole. On the one hand, the number of

employees of CACL is very large. This may cause the high cost. And it also leads to the low effect. On the other hand, the incentive mechanism of CACL is not very well. This may cause low incentive of employees.

- Technology reasons. As we know, the SCM of CACL is independent development. Though CACL has absorbed lots of experience from other famous automobile corporation. But some technology problem couldn't be solved.

Chapter 4: the method to solve above problems

4.1 The performance evaluation system of supply chain management

The supply chain performance evaluation is a complete process， namely the evaluation process including three layers of meaning. The first layer is performance included information, infrastructure, human resources, technological development and other internal and external resources, namely support performance. The second layer is to do performance evaluation to create the value, namely result performance. The third layer is to do the evaluation of various activities, namely process performance. The three levels together constitute a whole supply chain performance.

Automobile manufacturing enterprise's supply chain management exist large amount of information and data. What data should be selected or how many data should be selected when we do the performance evaluation, and how to do processing organization to these data, such problems should be solved. In order to make car manufacturing enterprise's supply chain performance objective, scientific and reasonable evaluation, when we constructs the performance evaluation system must follow the following principles:

(1) Multi-level and multi-channel and all-round evaluation principles

Collecting enough information, executing multiple levels, multi-channel and all-round

evaluation principles, these will help with emphasis and comprehensive as possible to reflect the automobile manufacturing enterprise's supply chain performance, and also helps to enhance the maneuverability of performance evaluation. In practice, often comprehensive use of superior examination, expert evaluation, clerks evaluation, customer evaluation and other various forms.

(2) Systematic and integrity principle

Automobile manufacturing enterprise's supply chain is a seamless connection network chain structure which constituted by numerous automobile parts suppliers, automobile manufacturers, distributors and users. Automobile manufacturing enterprise's supply chain performance evaluation should emphasize the characteristic of cross enterprise in supply chain operation. And it also should reflect the correlation between the enterprises that operate at every point in supply chain and the whole operation conditions in supply chain. And it should also reflect the integrative movement, coordination and integration of the automobile manufacturing enterprise's supply chain.

(3) Dynamic and developmental principle

In the process of automobile manufacturing enterprise supply chain performance evaluation, we not only should do static evaluation and analysis to the various internal factors of automotive manufacturing enterprise supply chain performance, but also
To study the dynamic among these factors and the factors and the interaction between external factors

(4)The principle of combining the general principles and set the weight

Automobile manufacturing enterprise's supply chain has different strategic orientation, so the corresponding performance evaluation index may be different, but some key indicators should be consistent. For the common characteristic of most automobile industry supply chain, we can construct a general performance evaluation system. In practical application, we can reflect the strategic orientation of supply chain according

to actual situation to set different weight to key indicator and through the way of adding or deleting individual indexes.

There are lots of model of performance measurement, now I want to introduce to important models which has been widely used.

(1) SCOR: supply chain operation reference model

SCOR has four components: planning, acquiring resources, production and delivery. It can describe, classify and evaluate a complex management process. It provides a common cross-industry standard for enterprise supply chain management. Through the layered analysis to the process of supply chain, it provides an effective way for the improvement of supply chain. It proposes 11 indicators. There are delivery performance, perfect flexibility, fill rates, production flexibility, supply chain response time, value-added employee productivity, total supply chain management cost, cash-to-cash cycle time, warranty processing costs, asset turns and inventory days of supply

According to the degree of process analysis，SCOR considered that the supply chain can divide into three layers: process type, process category, process elements, give the assessment from the following five points: reliability, respectively, elastic, response ability, cost and assets. Reliability, response ability and elastic is the assessment indicators from the external angle, and these are mainly driven by customers; cost and asset are the assessment indicator from the internal angle, and the decision is made by the supply chain itself.

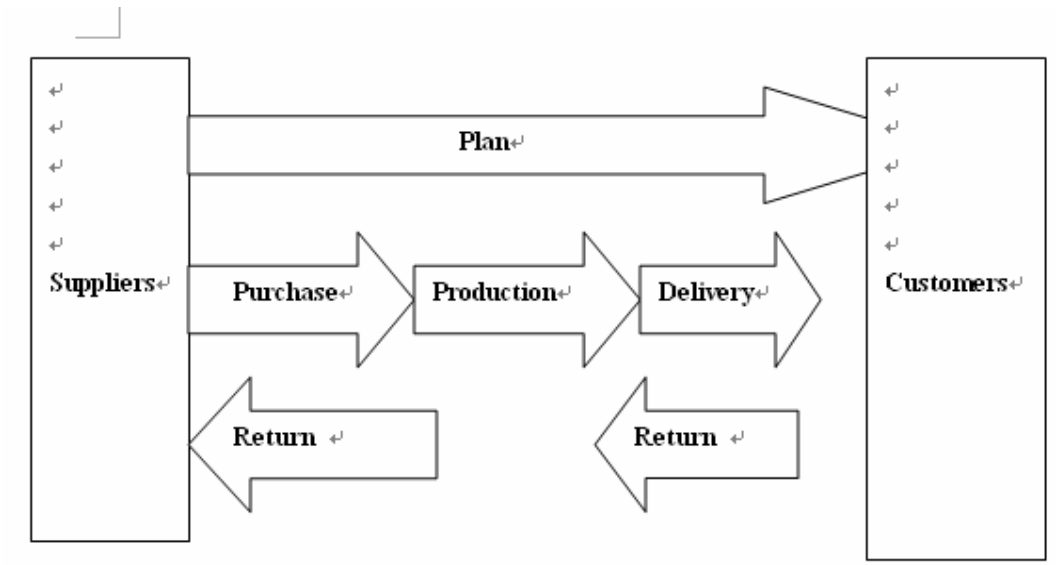

Figure 4.1 First layer of SCOR model

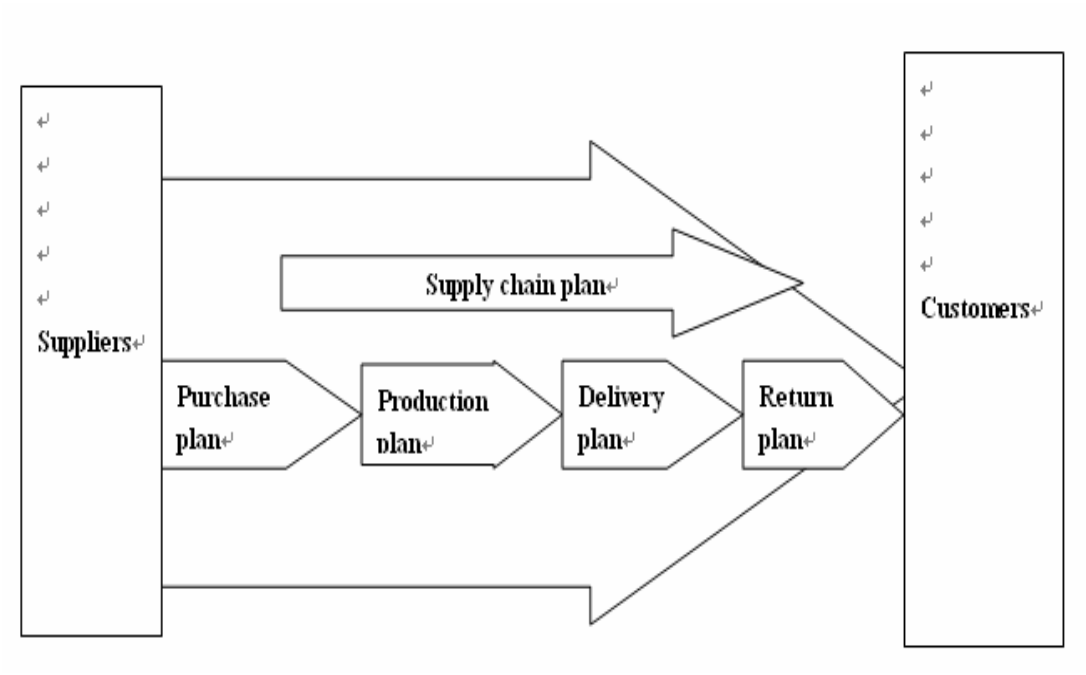

Figure 4.2 the second layer of SCOR model

(2) BSC (Balanced Score Card)

The balance score card retains traditional financial measures. But financial measures tell the story of past events, an adequate story for industrial age companies for which

investments in long-term capabilities and customer relationships were not critical for success. These financial measures are inadequate, however, for guiding and evaluating the journey that information age companies must take to create future value through investment in customers, suppliers, employees, processes, technology, and innovation (1996)

The core of BSC is to reflect the balance among a serious of index. The balance includes the balance between short-term goals and long-term goals, the balance between finance indicators and non-finance indicators, the balance between backward indicators and leading type indicators, and the balance between internal performance and external performance.

The basic framework of Balanced Score Card

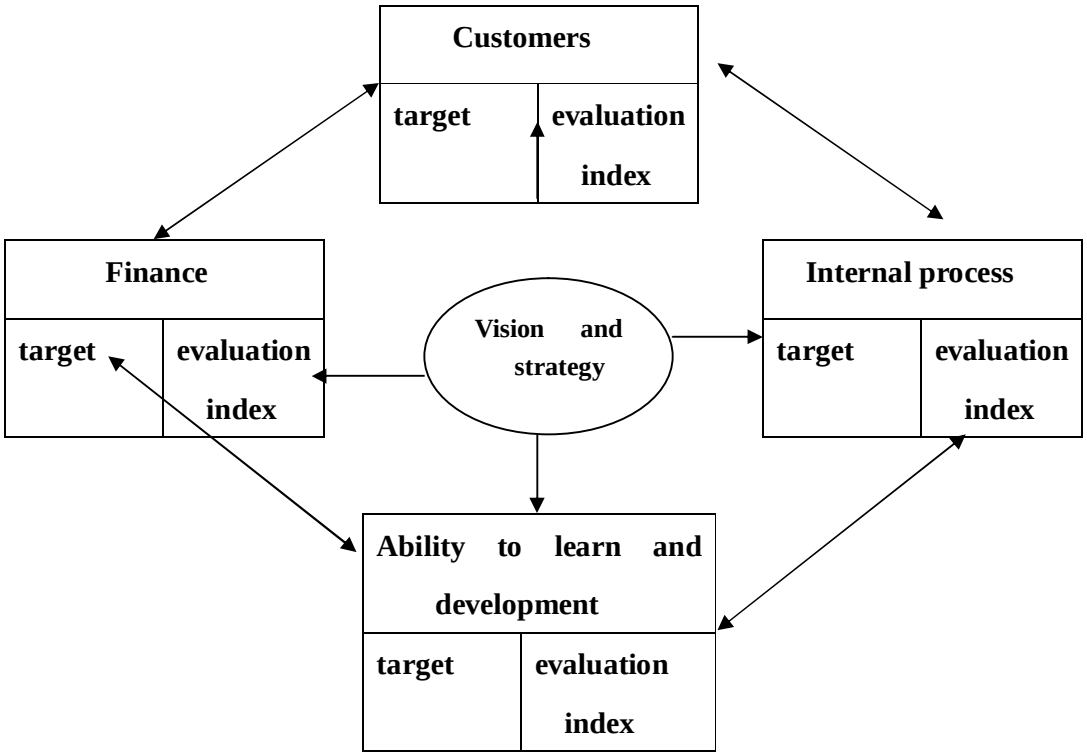

Figure4.3 the basic framework of BSC[1]

[1] Kaplan,R.S., & Norton,D.P., The balanced scorecard: Measures that drive performance. Harvard Business Review(January to February),71-79

The above is the models of performance measurement. Now I want to introduce the comprehensive assessment method of supply chain performance measurement:

(1) Grey relevance analysis

Grey relevance analysis refers to the uncertain association among the things. Grey relevance analysis judges whether the degree of relationship between compared sequence and reference sequence according to the similarity degree of sequence's geometrical curve, and finds the main factors to influence the target through relational computation. It is a method to do evaluation to various elements.

It can overcome the disadvantage of traditional quantity statistical methods which needs excessive samples, and it adapts the fact that domestic supply chain management is at the primary stage which the sample data is comparative lack. Grey relevance analysis is based on the analysis with dynamic development process of things are measured. It is mainly used in the change analysis of develop situation, namely the quantitative analysis to systematic dynamic development process.

Because Grey relevance analysis is the analysis based on development trend and doesn't have high requirements to the size of sample and typical distribution rules, and also the generally the result is the same with the qualitative analysis, it has wide practice. But in the evaluation process of grey relevance analysis, it is hard to choose the reference list which directly reflects the evaluation purpose. The workload is big if we use traditional grey relevance analysis to determine weight and comprehensive evaluation. However, the expert Mr Li solved the problems with a method that uses vector angle cosine. It constructs the optimal sequence, the worst sequence according to the many indicators in evaluation methods. And it calculates deviation matrix and the worse deviation ratio matrix. Then it calculates the angle cosine of response vector in the two matrixes. Finally does the normalized processing and get weight of every indicator. This method solved the problem of needing multiple information of the

process of evaluation. And it is the main method used in the supply chain performance evaluation process of automobile manufacture enterprises.

(2)Fuzzy comprehensive evaluation method

Fuzzy comprehensive evaluation method is a systematic evaluation method based on fuzzy mathematics. Supply chain performance evaluation has quantitative indexes and qualitative indexes, and the boundary between the two is fuzzy. So it is very hard to handle it.

The fuzzy mathematical theory can describe this kind of fuzzy phenomenon that relied on .accurately mathematics method. And it combines the quantitative and qualitative index, so the fuzzy comprehensive evaluation method can be used in the supply chain performance evaluation. When the method is used in the specific application, we should follow the following steps. The first step is to build supply chain performance evaluation system. The second step is to establish the fuzzy comprehensive evaluation factors. The third step is evaluating the single factor and then building fuzzy relation matrix. The forth step is to determine the weight vectors of evaluation factors. The fifth step is using the appropriate operators and then making the every right vector of evaluation objects and fuzzy relationship matrix multiplied. Then it will form the fuzzy evaluation result vector. In the process of calculation, we should determine the index membership and the weight

(3) AHP

AHP is a multiple goals and criteria decision method founded by American operational researcher Saaty in the 1970s. AHP is one of widely used multi-criteria decision making methods. Saaty(1980) Said that AHP involves the principles of decomposition, pair-wise comparisons, and priority vector generation and synthesis(satty,1980)It combines quantitative and qualitative analysis, and makes

people's thinking methodical, layered. The method sorts the decision-making. It has the characteristic of practicality, systematic and simplicity, and can effectively analyze the non sequence relationship of target criterion system. AHP has been widely accepted by people, and widely used in many research fields. The research of AHP is comparatively mature.

The basic ideas of AHP are that the evaluation person must decompose complex problems for several elements firstly, and makes the elements form a orderly hierarchical structure according to the dominating relations. And then do comparison and determine the comparative importance of the elements. Finally comprehensive the important degree of elements in the level and get the every element's comprehensive assessment data, and do the decision according to this.

The main steps of AHP

(1) Build up hierarchical structure model based on research object and research goals.
(2) Tectonic judgment matrix and calculate index weight
(3) Do dimensionless processing to assessment index and calculate the comprehensive assessment result to assessment object
(4) Total hierarchical sorting and consistency check

The following is the hierarchical models:

Target layer: it reveals the problem's total target and goal

Criterion layer: it is the specific embodiment of the total target, in other words, it is the specific standard.

Method layer: it reveals the alternative method, measures, policies which service for the total target

After building the model, the subordinate relationship among the levels was established. The next thing is to tectonic judgment matrix and calculates index weight.

When the comparative importance of elements can reveal directly, it is not need to calculate, the weight can know directly. But for the multiple goals, multiple standard supply chain performance assessment system, the weight of element couldn't get directly; it needs a certain method to export. AHP get the comparative importance of elements from the method of comparing between two elements. So-called the comparing between two elements is comparing two different indexes that in the same standard and then tectonic judgment matrix. It uses certain algorithm to the sequence vector of judgment matrix. In order to tectonic comparing judgment matrix, it must repeat to answer the question: In certain criteria, which element is more important and the degree of the importance. It uses a method called 9 class scale method. The meaning of the 9 class scale method has been given in the table4.1:

scale	The meaning
1	The two element is same importance
2	The former is more slightly important than the latter
3	The former is more obviously important than the latter
5	The former is more very important than the latter
7	The former is more extreme important than the latter
2,4,6,8	If the comparing result of importance between element s and the element j is $a_{sj,}$ it means the comparing result of element s and element j is $a_{js=}1/ a_{sj}$
reciprocal	

Table 4.1 the meaning of scale in AHP

Now I want to do supply chain performance measurement of CACL through the above steps.

Through collecting relevant literature and consult experts, I get the main supply performance measurement index system according to the method of BSC.

In the all process of performance measurement, we need to use the expert evaluation method. If we want to use this method, we must pay attention to the following matters:

- Determine the number of experts and recognized experts qualification. The number of experts must adequate. If the number of expert is excessive, it will lead to hard to statistics. And different expert will have different opinions that may lead to the high cost. If the number of expert is too little, the subjective is strong. And the result couldn't convince the readers. In general, the number of experts is 7 may be the most appropriate.

- In the application of expert evaluation method we need to get the questionnaire. The survey, design and the statistic to the result of the questionnaire needs according to the standard procedure. The principles of the questionnaire are that it must easy to understand and operate. The questionnaire needs to have comprehensive analysis. And we should kick out the result which has shortage of trust. And then we should do statistics to the believable results.

After the survey to the CACL, and I got the following materials. And do the analysis to the CACL's supply chain performance measurement.

I ask five experts to connect the materials about the indicators of CACL's supply chain performance system. The figure 4.4 is about the indicators system about the supply chain performance system of CACL. The professional level of the five experts is average. The expert gives the score according to the 9 scale system. I average the result of every expert, and then I get the table 4.2. The questionnaire and the survey result are in the appendix of the dissertation.

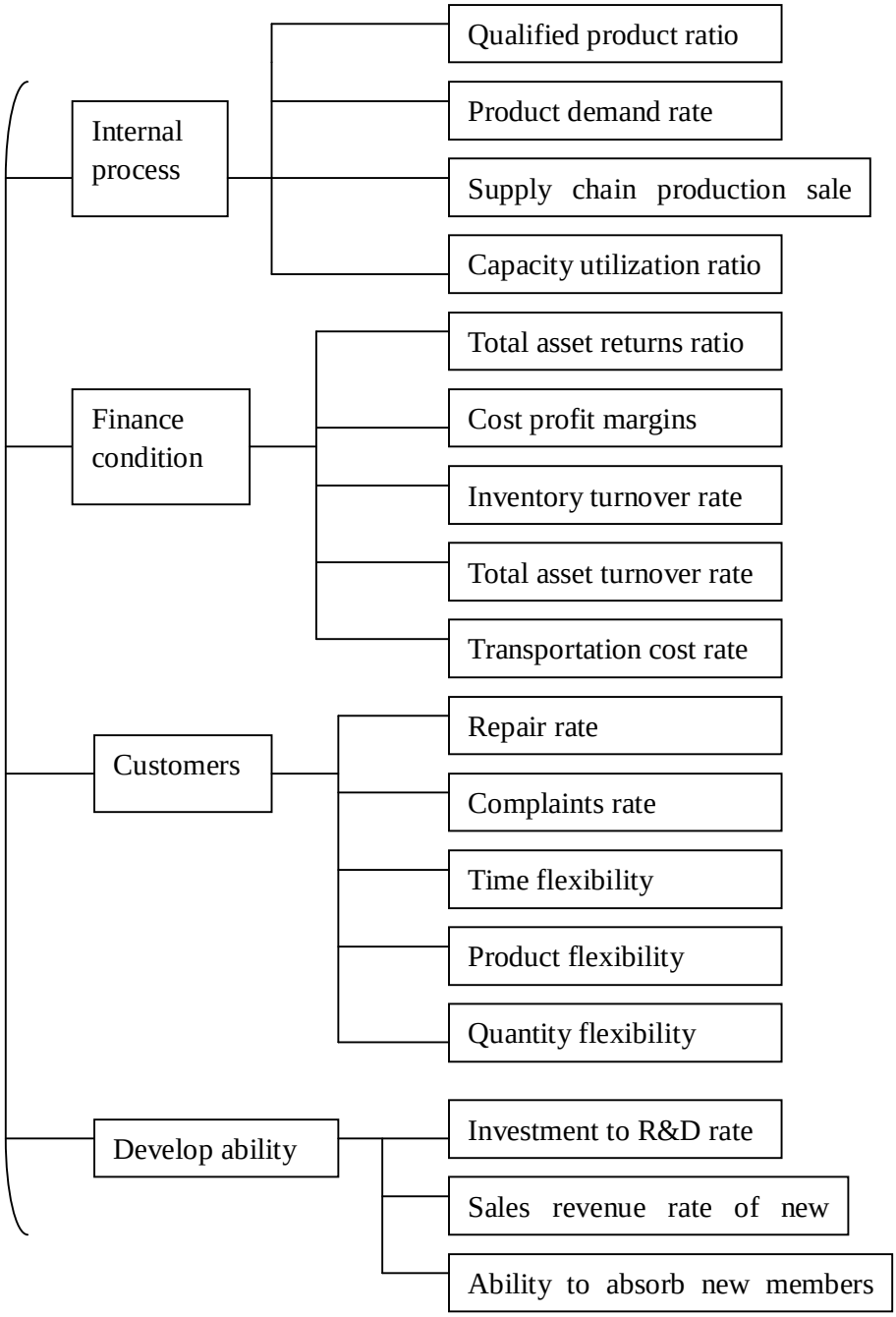

Figure 4.4 the CACL's supply chain performance measurement index system

The comparing matrix.

Index	A_1	A_2	A_3	A_4
Internal process A_1	**1**	**1/3**	**3**	**4**
Finance A_2	**3**	**1**	**2**	**5**
Customer A_3	**1/3**	**1/2**	**1**	**3**
Develop ability A_4	**1/4**	**1/5**	**1/3**	**1**

Table 4.2 comparing matrix

According to the matrix we can get the standard matrix

	B_1	B_2	B_3	B_4
Internal process B_1	**0.2181**	**0.1639**	**0.4737**	**0.3077**
Finance B_2	**0.6545**	**0.4918**	**0.3158**	**0.3846**
Customer B_3	**0.0727**	**0.2459**	**0.1579**	**0.2308**
Develop ability B_4	**0.0545**	**0.0983**	**0.0526**	**0.0769**

Table 4.3 the standard matrix

Through calculation, we get the weight:

The weight:

W1= 0.29

W2=0.46

W3=0.18

W4=0.07

It means that the finance indicator is the most important, and the send is internal process. And the develop capacity is comparative less important.

Then we do the consistency check:

(1) Calculate the right vector

$$0.29\begin{pmatrix}1\\3\\1/3\\1/4\end{pmatrix}+0.46\begin{pmatrix}1/3\\1\\1/2\\1/5\end{pmatrix}+0.18\begin{pmatrix}3\\2\\1\\1/3\end{pmatrix}+0.07\begin{pmatrix}4\\5\\3\\1\end{pmatrix}$$

$$=\begin{pmatrix}0.29\\0.87\\0.097\\0.07\end{pmatrix}+\begin{pmatrix}0.15\\0.46\\0.23\\0.092\end{pmatrix}+\begin{pmatrix}0.54\\0.36\\0.18\\0.06\end{pmatrix}+\begin{pmatrix}0.28\\0.35\\0.21\\0.07\end{pmatrix}$$

$$=\begin{pmatrix}1.26\\2.04\\0.717\\0.294\end{pmatrix}$$

(2) Right vector divides the weight

Internal process: 1.26/0.29=4.34

Finance: 2.04/0.46=4.435

Customer: 0.717/0.18=3.983

Develop ability: 0.294/0.07=4.2

After calculating the average of the above four data, then we get the number of

$$\lambda_{max}=(4.34+4.435+3.983+4.2)/4=4.2$$

(3) Calculate the consistency index:

$$CI=(\lambda max-n)/(n-1)=(4.2-4)/(4-1)=0.06$$

(4) Calculate the consistency rate:

$$CR=CI/RI=0.06/0.89=0.067<0.1$$

So the consistency can be accepted.

According to this way, we can calculate the weight of every indicator (Table 4.4)

The following step is that we should collect data and do dimensionless processing

If we want do supply chain performance measurement to CACL, we must not only collect the information and data about CACL itself, but also the suppliers, dealer, the third logistic company who provide service to CACL. Of course, there are many indexes. In these indicators, there are quantity and qualitative indicator. We should do calculation to the quantity indicator and do give the levels to the qualitative indicator. The qualitative index can divide into positive indicator, negative indicators and moderate indicators. The dimensionless processing can change the indicators whose nature and dimension are different into the relative number who can do comprehensive measurement.

The formula is:

$$X_j'=(x_j-x_{min})/(x_{man}-x_{min}) \qquad X_j'=(x_{man}-x_j)/(x_{man}-x_{min})$$

The result reveals in table 4.5

Criterion layer	Indicators	Weight
Internal process	Qualified production rate	0.11
	Product demand rate	0.09
	Supply chain production sale rate	0.05
	Capacity utilization rate	0.04
Finance condition	Total asset return rate	0.12
	Cost profit margins	0.1
	Inventory turnover rate	0.08
	Total asset turnover rate	0.11
	Transportation cost rate	0.05
Customers	Repair rate	0.03
	Complaints rate	0.02
	Time flexibility	0.05
	Product flexibility	0.04
	Quantity flexibility	0.04
Develop ability	Investment to R&D rate	0.03
	Sales revenue rate of new product	0.02
	Ability to absorb new members rate	0.02

Figure 4.4 the weight of indicators

Criterion layer	Indicators	X_j'
Internal process	Qualified production rate	0.89
	Product demand rate	0.92
	Supply chain production sale rate	0.72
	Capacity utilization rate	0.89
Finance condition	Total asset return rate	0.82
	Cost profit margins	0.48
	Inventory turnover rate	0.21
	Total asset turnover rate	0.31
	Transportation cost rate	0.21
Customers	Repair rate	0.17
	Complaints rate	0.12
	Time flexibility	0,231
	Product flexibility	0.23
	Quantity flexibility	0.342
Develop ability	Investment to R&D rate	0.45
	Sales revenue rate of new product	0.32
	Ability to absorb new members rate	0.21

Figure 4.5 dimensionless processing

Comprehensive measurement

:

$Q=W_j*X_j'$

$=(0.11,0.09,0.05,0.04,0.12,0.1,0.08,0.11,0.05,0.03,0.02,0.05,0.04,0.04,0.03,0.02,0.02)$

$*(0.89,0.92,0.72,0.89,0.82,0.48,0.21,0.31,0.21,0.170.12,0.332,0.23,0.342,0.45,0.32,0.21)^T=0.53118$

So we can conclude that the supply chain management of CACL is not very good, it still exist many problem. And we should take measures to improve it

4.2 The overall conceptive of supply chain management system

The target for a company is very important, if a company doesn't have its own target, it may have problems in the develop process. With the development of the world economics and market, and for the development for the company itself, the enterprise needs to increase the competitive. And we should know the challenge is not only from the external environment, but also from the internal management environment.

The overall development plan of CACL is enter into high-end market. CACL automobile Co.,Ltd set a goal in 2009, the target is the annual turnover is over 356,000cars. In January 2009, CACL sales over 35,000 cars. Yin Tongyue, the chairman of CACL, said that the year of 2009 is a year that the automobile market will be rapid development, and it will have more opportunities and challenges. And he also said that CACL will always keep three policies. The first is insist innovation, and make independent international brand. The second policy is to do development penetration in the secondary and third market. The third policy is to launch new style and models cars.

In order to reach the target, CACL must to perform its marketing system, manufacture system, research system, and the most important point is to perform its supply chain

management system, and improve the management level of enterprises and the ability to adapt to the market. It must make the goal that the supply chain of CACL is systematic software. And it should include all of the business the CACL has faced which is effective economic system.

The system must construct and integrate the traditional organization structure, namely the production management organization structure. And it must build up an organization structure which must cater to the needs of the market, namely supply chain management organization structure. One the one hand, it integrates the person and materials. On the other hand, it fully uses the social resource. At the same time, it changes the competition to the supply chain with the competitors. The new organization structure provides a hard environment for the supply chain management.

This system must optimize the existing business process. The existing business process limited one specific business or department, and it doesn't effectively connect the different business. And constructs new business process provides soft environment for building supply chain management system.

I build up the systematic supply chain management in figure 4.5.

A network: the network is the basic technology support to the supply chain management system. It includes lots of network. The most important the supplier resource network, manufacture information network and user resource network

There are two flows: user order flow and materials flow. It has close contraction with the network. And the platform of research and develop provides a strong support to the supply chain performance measurement.

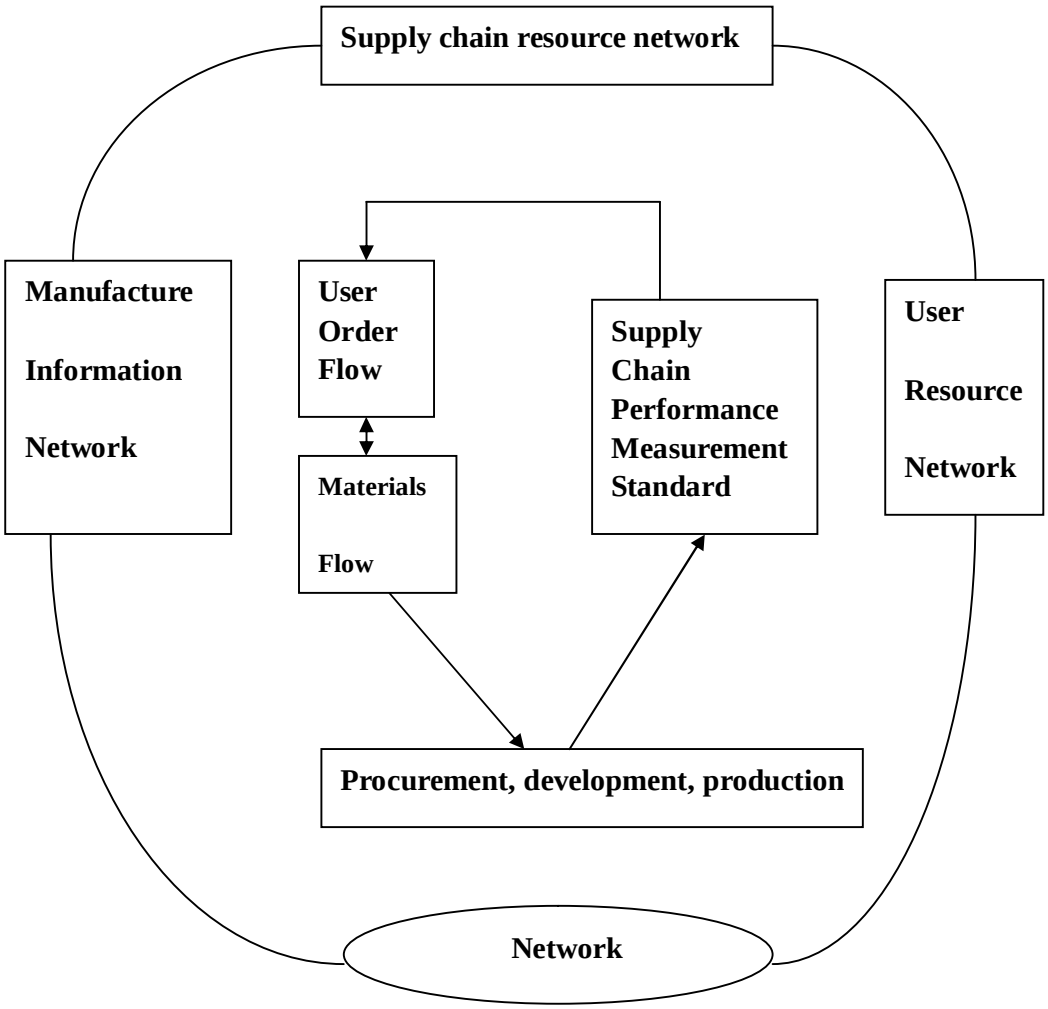

Figure 4.5 systematic supply chain management

4.3 Build a systematic information network

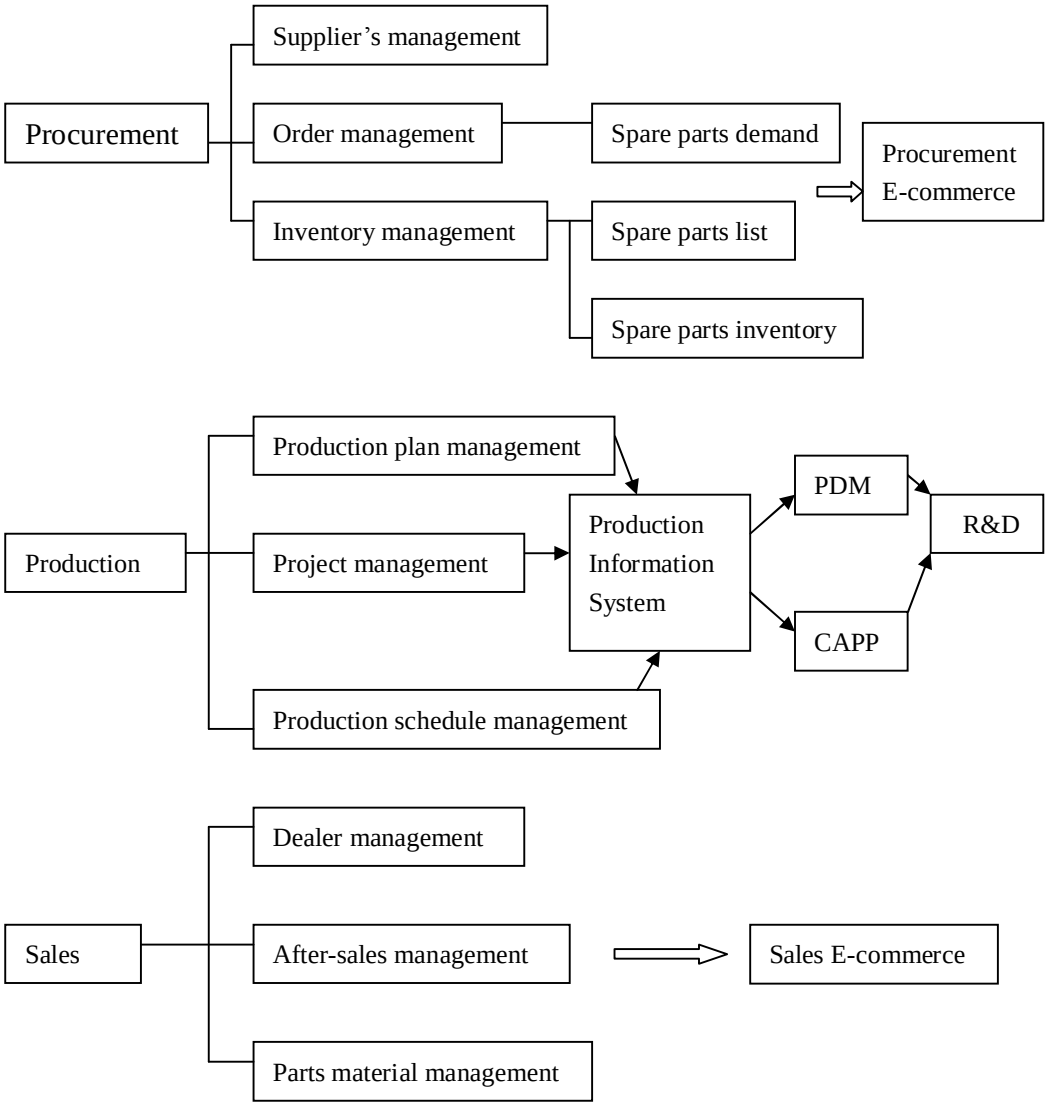

Figure 4.6 Overall systematic information network

The systematic information network covers the main three parts: procurement, production and sales. This system through the platform of internet forms a overall sales, production, procurement management process and integrates human resource management, finance information system and office management. The core business of it is ERP.

What we should pay attention is that we must pay much attention to the safety management of the information system. The safety and reliability are the life line to the information system. The safety system should expand to the suppliers, every department of CACL, logistic company, ocean business department, dealers and other service station.

Procurement system:

The picture reflects the ideas of new procurement system of CACL which based on the management information system. The supplier management means the select of suppliers and does performance measurement to suppliers. According to the spare parts quality, price, cost and other elements to decide buy which product. Then the procurement manager can order at the system. Then the suppliers will send the parts to CACL as soon as possible. The system also can check how much time the spare parts can reach the warehouse. The inventory system gives the information about the quantity of every spare part. If the inventory is not enough, the system will send this information to the manager, then he should purchase this spare parts.

Production management system:

Production plan management: it manages the annual production plan, month production plan day production play

Spare parts demand management: calculate the demand of spare part according to the production plan and spare parts list

Spare parts inventory management: does inventory management to the factory warehouse and other warehouse

Production schedule management: does statistic analysis to the production performance

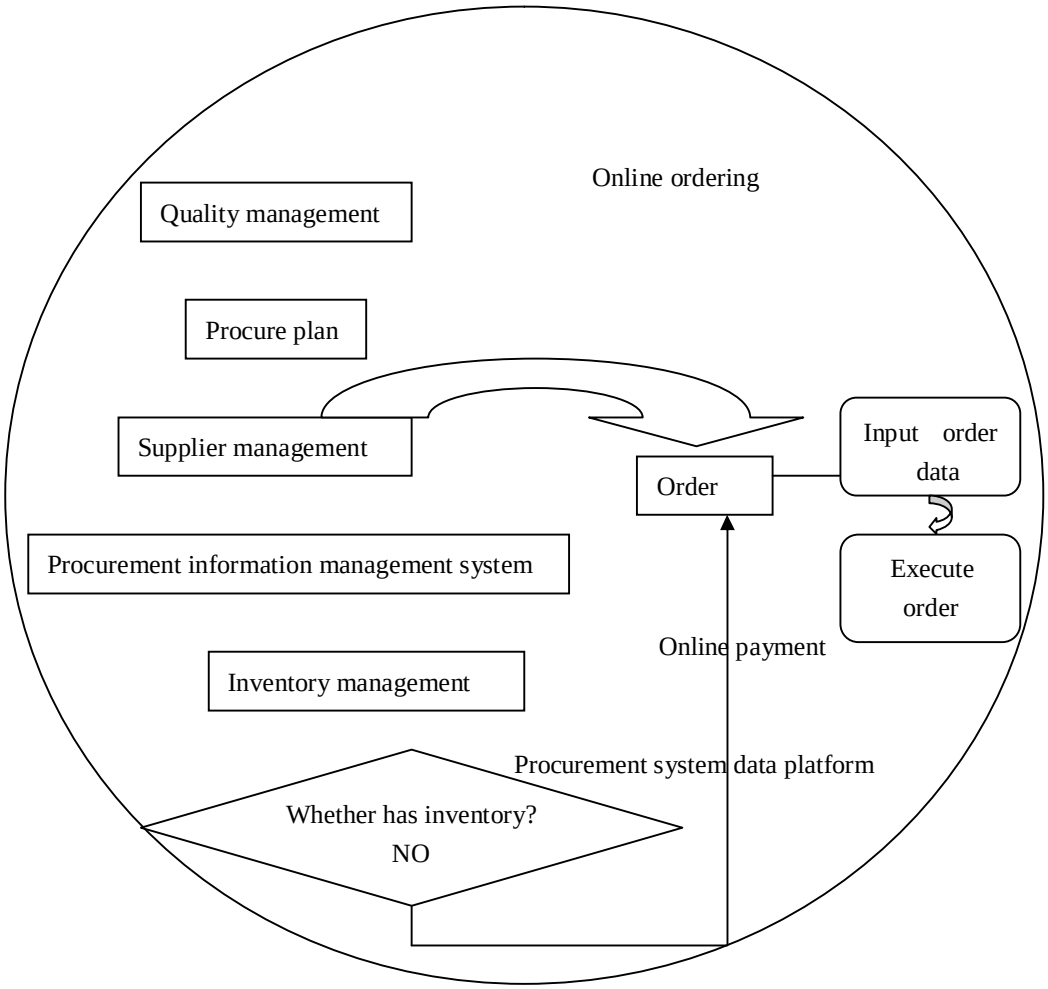

Figure 4.7 production management system

Sales management: CRM

Customer information management: Unified management to the customer material of every department and person, includes the partition to the customer type, customer basic condition, customer person information, the track record of enterprise sales person, customer state and contract information.

Marketing management: make marketing promote plan, and do record, classify and

identify to the customers. It must provide the management to potential customers and evaluate the effect of every marketing activity.

Sales management: the expand function of sales management is building online shop, and it must support online payment management and the connection to the logistics software system.

Call center: the call center will dispose the requirement of customers as soon as possible.

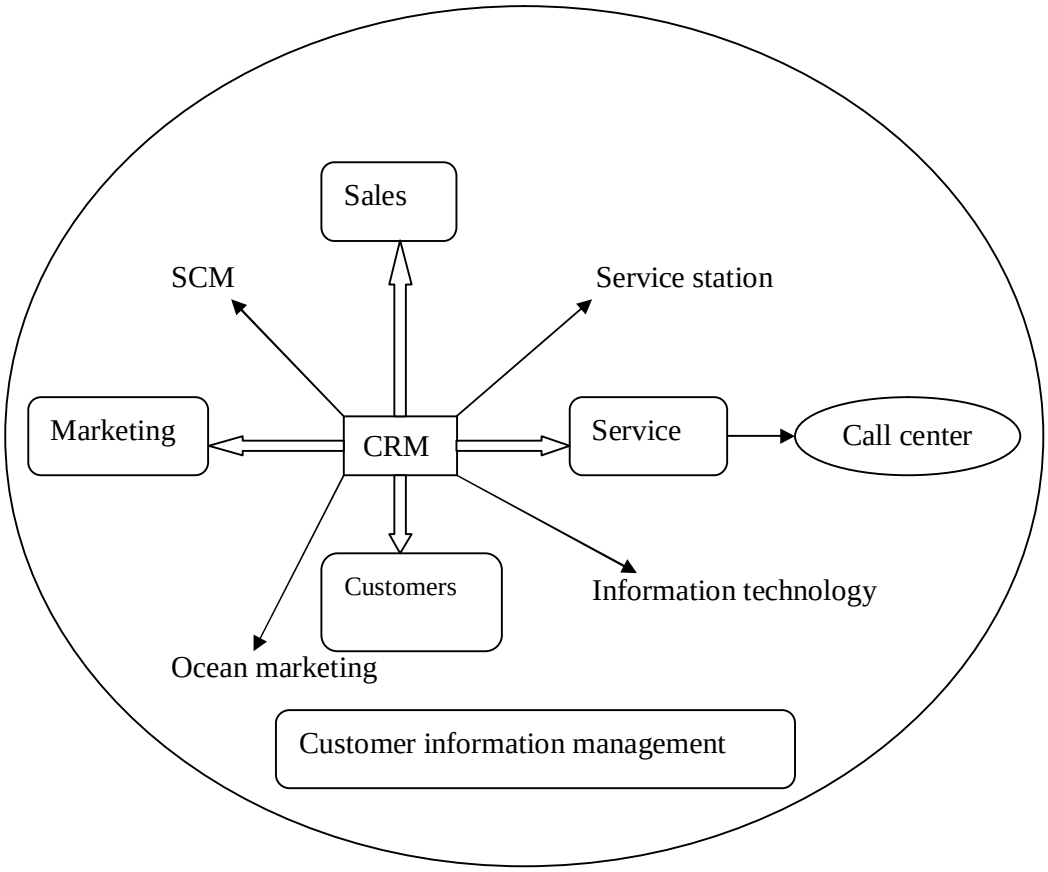

Figure 4.8 CRM system

Chapter 5: Conclusion

With the development of world automobile economics and technology management, the competition will become fierce. As a potential automobile enterprise, CACL has tried his best to improve himself. And we know, in some sense, the competition among enterprise is the competition of supply chain management. So if CACL want to become a world famous automobile enterprise, it should perform its supply chain system as soon as possible. Through the dissertation, we know that CACL has paid more and more attention to the supply chain. But it still has gap between other world famous automobile corporations. The problems of CACL we has discussed in the chapter3. And we know there are still many problems of CACL. So we do a performance measurement to its supply chain. Through the evaluation we know the problem is also exists and influence the development of CACL. So we should solve them. The dissertation proposes two very important points are systematic information management system and systematic supply chain management process. These opinions may have value to the improvement of CACL. And finally I hope that CACL has a beautiful future.

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Appendix

Name of the expert		Date		
Target layer	Criterion layer	Condition	Importance	Estimated weight
Internal process	Qualified product ratio			
	Product demand ratio			
	Supply chain production sale			
	Capacity utilization ratio			
Finance condition	Total asset returns ratio			
	Cost profit margins			
	Inventory turnover ratio			
	Total asset turnover rate			
	Transportation cost rate			
Customers	Repair rate			
	Complaints rate			
	Time flexibility			
	Product flexibility			
	Quantity flexibility			
Development ability	Investment to R$D rate			
	Sales revenue rate of new			
	Ability to absorb new members			

Table A: questionnaire

Expert 1	A1	A2	A3	A4
A1	1	2/5	2	9/2
A2	5/2	1	17/10	5
A3	1/2	10/17	1	4
A4	2/9	1/5	1/4	1
Expert 2	A1	A2	A3	A4
A1	1	5/16	12/5	19/5
A2	16/5	1	19/10	28/5
A3	5/12	10/19	1	3
A4	5/19	5/28	1/3	1
Expert 3	A1	A2	A3	A4
A1	1	5/17	18/5	21/5
A2	5/18	1	2	5
A3	5/18	1/2	1	5/2
A4	5/21	1/5	2/5	1
Expert 4	A1	A2	A3	A4
A1	1	1/3	37/10	39/10
A2	3	1	12/5	24/5
A3	10/37	5/12	1	5/2
A4	10/39	5/24	2/5	1
Expert 5	A1	A2	A3	A4
A1	1	10/29	33/10	18/5
A2	29/10	1	2	23/5
A3	10/33	1/2	1	3
A4	5/18	5/23	1/3	1

Table B survey result