

**Research on competitive advantages
of supply chain based on its time
competition**

Case analysis of automobile industry

Chuyue Mao

Bachelor's thesis

May 2018

Technology, communication and transport

Degree Programme in Logistics Engineering

Jyväskylän ammattikorkeakoulu

JAMK University of Applied Sciences

Author(s) Mao, Chuyue	Type of publication Bachelor's thesis	Date May 2018 Language of publication: English
	Number of pages 36	Permission for web publication: x
Title of publication Research on competitive advantages of supply chain based on its time competition Case analysis of automobile industry		
Degree programme Logistics Engineering		
Supervisor(s) Vauhkonen, Petri		
Assigned by Vauhkonen, Petri		
Abstract <p>In the fierce market competition, the transformation of market competition based on price and quality of the original product competition gradually shifts to the time of the supply chain competition, which makes scholars begin to study the supply chain based on time competition and enterprises especially in automobile industry begin to explore suitable time-based supply chain.</p> <p>The objectives of the thesis are (a) to carry out a detailed study of the supply chain based on time competition; and (b) to provide an innovative research direction for many companies.</p> <p>The study of the supply chain based on time competition was carried out by analyzing the existed problems in supply chain and putting forward three possible strategies. By proposing a conceptual model and analyzing two cases, the understanding of time-based supply chain was deepened.</p> <p>As a result, the benefits and challenges of supply chain based on time competition are clearly shown. Besides, different time management strategies that two enterprises adopted in supply chain management in cases provide a guidance for enterprises to use time management techniques in supply chain management.</p>		
Keywords/tags (subjects) Supply chain, supply chain management based on time, competitive advantage		
Miscellaneous (Confidential information)		

Contents

1	Introduction.....	4
1.1	Research background	4
1.1.1	The changing needs of customers.....	4
1.1.2	The shortening of the lifecycle of product.....	5
1.1.3	Conflict of supply chain management objectives	5
1.1.4	Changes of enterprise competition direction	5
1.2	Objective and significance of research.....	6
1.3	Relevant literature review	7
1.3.1	Supply chain and supply chain management.....	7
1.3.2	Time factors in supply chain management	8
2	Theoretical analysis of supply chain management	9
2.1	The concept and structure model of supply chain.....	9
2.2	Supply chain management	10
2.2.1	Concept	10
2.2.2	Objective.....	10
2.2.3	Methodology	11
2.3	Existing problems in supply chain management	11
3	Possible strategies.....	12
3.1	Just-In-Time	12
3.2	Quick Response.....	14
3.3	Efficient Consumer Response	15
3.4	Summary.....	16
4	Time-based competition of supply chain competitive advantage model used in automotive industry	17
4.1	An overview of the model	17

	2
4.2 Supply chain time cycle and supply chain time structure	18
4.2.1 supply chain time cycle	18
4.2.2 Supply chain time structure	20
4.3 Supply chain capability	21
4.4 Supply chain status	22
4.5 The relationship between time competition and supply chain capability and supply chain status.....	23
5 Case study.....	24
5.1 Toyota Company	24
5.1.1 General situation of Toyota Company	24
5.1.2 The time based competitive advantage of TOYOTA automotive supply chain	25
5.2 General motors	27
5.2.1 General situation of General Motors	27
5.2.2 The time based competitive advantage of General Motors automotive supply chain.....	28
5.3 Comparison of time-based competitive advantage between TOYOTA and General Motor.....	29
5.4 Summary.....	30
6 Conclusions.....	31
References.....	33
 Figures	
Figure 1 :Direct Supply Chain	10
Figure 2: Extended Supply Chain.....	10
Figure 3: Ultimate Supply Chain.....	10
Figure 4: JIT Process	14

Figure 5: Time-based competition of supply chain competitive advantages model... 18
Figure 6: Supply chain time structure 21

Tables

Table 1: A comparison between General Company and Toyota Corporation..... 30

1 Introduction

In the fierce market competition, product life cycle is becoming shorter and shorter because of diversified and personalized customer demand trends. In the meantime, the trend of production changes to varieties and small batch. The demand trends, production trends and the development of information technology make the pressure of enterprise increase. The transformation of market competition based on price and quality of the original product competition gradually shifts to the time of the supply chain competition. Therefore, enterprises must be equipped with rapid response and adaptability to the market.

In this paper, the related theory and structure of supply chain management in supply chain will be introduced, aiming at the existing problems in the supply chain management, and put forward some methods like time compression. Secondly, some possible strategies for improving supply chain management based on time management, such as Just-In-Time(JIT), Quick Response(QR), Efficient Consumer Response(ECR), are introduced to find an appropriate strategy that can be used in automotive industry. Then a theoretical structure for competitive advantages for supply chain management is established. Finally, through two cases from auto producing companies, how to use time-based supply chain more effectively will be analyzed.

1.1 Research background

1.1.1 The changing needs of customers

In today's society, the concept of product demand has undergone significant changes, and the requirements for products are more and more stringent. This is mainly manifested in the requirements of product variety, quantity, price, quality and appearance. The business activities are changed from market orientation to customer orientation. So, how to quickly meet customer needs, shorten lead time and reduce inventory of the enterprise should be solved.

1.1.2 The shortening of the lifecycle of product

The continuous development of new technologies, the rapid development of information technology and economic globalization provide the conditions for the shortening of the product life cycle.

1.1.3 Conflict of supply chain management objectives

Supply chain management has two goals: improving customer service level and reducing operation cost. These two goals are usually contradictory. That is to improve service level requires the expense of raising cost, and reducing cost often leads to the decline of service level. Time plays an important role in two aspects: for service level, the most important is the response speed to market demand; For cost, the extension of time will lead to the increase of all kinds of operation costs. Therefore, supply chain management based on time compression can improve the responsiveness of the whole supply chain, and improve the two goals of improving customer service level and reducing operation cost.

1.1.4 Changes of enterprise competition direction

With the rapid development of economy and society, customer demand has become diversified and personalized. Production has entered the stage of small batch and multi batch, which makes the uncertainty of the economic environment in enterprises is increasing. Thus, the enterprises pay more attention to the coordination between supply chain. At this time, a single enterprise has been unable to cope with the changing market and competition among enterprises has risen to the competition between supply chains. The essence of supply chain competition is time competition, that is, to respond quickly to customer needs, to minimize the total time cycle from customers' product demand signals to the whole supply chain with satisfactory customer satisfaction. Therefore, the supply chain management based on time management has a strategic significance for the enterprise.

Based on the above research background, we can see that how to respond to customer needs quickly and reduce the time from the purchase of raw materials to the whole process of delivery to consumers have become the key to the success of

supply chain management. How to carry on the time strategies in the supply chain management have become the urgent problem that the enterprise needs to solve.

1.2 Objective and significance of research

The Objective of This Paper

First and foremost, this paper focuses on how to use time management strategies in supply chain management. In the face of diverse needs, shortened product lifecycle, multi variety, small batch production and the rapid development of advanced technology, all of these put forward greater challenges and higher requirements for supply chain management. How to deal with these challenges and high requirements is worth exploring. This paper provides an innovative research direction for many companies.

Furthermore, this paper illustrates how enterprises use time management strategies in supply chain management through two cases from two angles of product supply chain and service supply chain, which provides a guidance for enterprises to use time management techniques in supply chain management.

The Significance of this Paper

Through the research on supply chain management, it can be easily seen that supply chain management based on time management has become a new direction for the development of supply chain management. In the face of the increasing diverse demands of customers and the shortened product life cycle, the enterprises begin to think about how to quickly respond to customer needs and shorten the delivery time. This makes enterprises study supply chain management from the point of view of time management, and then comes to a supply chain management strategy with its own enterprise characteristics.

Besides, the research on supply chain management is helpful for enterprises to establish a better supply chain management system. Many enterprises do not have a set of management system that can shorten the total response time of supply chain. Most enterprises do not take advantage of the supply chain, which leads to a long response period of the supply chain and is at a disadvantage in the market

competition. Based on the theory of supply chain management and practical cases, this paper has important guiding significance for theory and practice of establishing supply chain management system for many enterprises.

1.3 Relevant literature review

1.3.1 Supply chain and supply chain management

Supply Chain(SC)

Graham (1990) thought that supply chain was the whole process of value increment and control of distribution channels from suppliers to users. It begins at supply and ends with consumption. La Londe and Masters (1994) thought that a supply chain is a set of firms passing materials forward. Usually, a few independent companies participate in the manufacture of products and deliver them to the ultimate users of the supply chain. Raw materials, component manufacturers, retailers, wholesalers, product assemblers and transport companies are all members of the supply chain. Beamon (1998) considers supply chain as an integrated process. Different business entities, such as suppliers, manufacturers, distributors and retailers, strive to purchase raw materials, transform raw materials into final products, and deliver the final products to retailers. Christopher (1992) proposed that a supply chain is the organization network that involves different processes and activities through upstream and downstream linkages. These processes and activities can produce value by providing products and services which are delivered to the ultimate consumers. Some scholars regarded a supply chain as the alignment of firms that can provide products or services to market (Lambert, Stock, and Ellram 1998).

Supply Chain Management(SCM)

The competition between different companies do not lie in organizations structure but in supply chains. Therefore, supply chain management (SCM) has become a potentially valuable way of securing competitive advantage and improving organizational performance. The researches on SCM reflect the evolutionary and complexity. This has been attributed to the origin of supply chain management. There are many definitions of SCM according to precious studies and references

relevant to supply chain management. Monczka, Trent, and Handfield (1998) thought the objective of SCM is integrating and controlling the sourcing, flow, and control of materials by applying a systems perspective while Stevens (1989) believe the objective is to realize a balance between high customer service, low inventory management, and low unit cost. Cooper et al. (1997) viewed SCM as an integrative philosophy which can manage a total flow from different supplier to ultimate users. Some scholars took SCM as a management philosophy and they thought SCM is a single entity rather than fragmented parts (Ellram and Cooper 1990; Houlihan 1988; Tyndall et al. 1998). From those related literatures, the concept of SCM can be summarized to some factors: integration of processes, cooperation, integrated behavior and mutually sharing information. It is a process of seeking the balance between synchronization, the convergence of companies and the operational and strategic capabilities.

1.3.2 Time factors in supply chain management

People are living in the era that the acceleration of change exists. This requires the effective strategies to control time. From the point of view of the enterprise, time has become the key factor to determining the winning or losing of the competition among enterprises. What many customers care about is not the price, but the delivery time. Because the shorter the time of delivery, the more profit the customers benefit from the early use of the product. Therefore, time is considered to be “an essential aspect of strategy”, especially in the context of increasing change and growing globalization (Eisenhardt and Martin,2000). For some firms that are affected by the acceleration of change and growing globalization, time management can reflect its competitive advantage (Clark and Fujimoto,1991). There are many methods of controlling the time, such as reducing the time of production and distribution, improving the time utilization rate and shortening the time-to-market. Some companies have adopted some time-based methodologies like Just-In-Time(JIT), Efficient Consumer Response(ECR) and Quick Response(QR) to help management to come up with some time-based strategies.

2 Theoretical analysis of supply chain management

2.1 The concept and structure model of supply chain

Concept

In view of these definitions that mentioned above, in this paper, the supply chain can be defined as a group of three or more entities (organizations or individuals) that directly participate in the flow of products, finance, services and other activities. The value of material in the supply chain is added through processing, packaging, distribution and other links, and brings benefits to the related enterprises. The final part of upstream and downstream linkages is the ultimate consumers.

Structure

In order to study the supply chain effectively, it is necessary to understand the supply chain structure. According to the paper, "Defining supply chain management", there are three types of supply chain structure, namely the "direct supply chain," the "extended supply chain," and the "ultimate supply chain" (Mentzer, J. T., Dewitt, W., Keebler, J. S., Min, S., Nix, N. W., & Smith, C. D., et al., 2001).

A direct supply chain is composed of a company, a supplier, and a customer that be involved in the flow of products, finance, services and other activities (Figure 1). Compared to a direct supply chain, the part of suppliers of the immediate supplier and customers of the immediate customer are added in an extended supply chain (Figure 2). An ultimate supply chain is more complex than the direct supply chain and the extended supply chain, because it includes all the organizations, which involved in all the upstream and downstream flows of products, services, finances and information (Figure 3). As it has been showed in the figure, a third party financial provider would provide financing, assume some of the risk, and offer some financial advice. Besides, a third party logistics (3PL) provider can perform the logistics activities between two of the companies. In the meantime, a market research firm can provide information about the ultimate customer to a company, which well backs up the supply chain. This example briefly shows some functions of the complex supply chains.

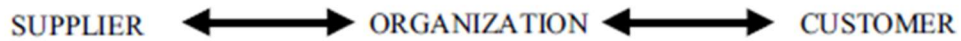


Figure 1 :Direct Supply Chain

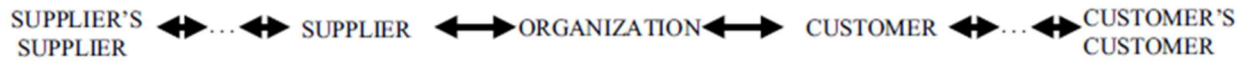


Figure 2: Extended Supply Chain



Figure 3: Ultimate Supply Chain

(From: Mentzer, J. T., Dewitt, W., Keebler, J. S., Min, S., Nix, N. W., & Smith, C. D., et al., 2001)

2.2 Supply chain management

2.2.1 Concept

There are many different definitions at home and abroad for supply chain management, which have been introduced in the relevant literature review. In this paper, supply chain management is an integrated management idea and method, which performs functions such as planning and control of logistics from suppliers to ultimate users in supply chain.

2.2.2 Objective

When it comes to the objective of supply chain management, many scholars have different opinions. The motivation of the supply chain management is to improve the competitive advantage of the supply chain (Monczka, Trent, and Handfield 1998). Giunipero and Brand (1996) held the view that improving the competitive advantage and profitability of SCM can be achieved by improving the customer's overall satis-

faction. In the same way, La Londe (1997) put forward that the goal of supply chain management was to provide better customer service and economic value by synchronizing the flow of physical goods and information from procurement to consumption. The relevant discussion leads us to conclude The ultimate purpose of the use of supply chain management is to improve the maximum customer satisfaction, reduce the cost of the enterprise and maximize the profit of the enterprise.

2.2.3 Methodology

There are many traditional methods of supply chain management, such as Quick Response(QR), Efficient Customer Response (ECR), the Performance Evaluation of Supply Chain, Just-In-Time(JIT). Among them, JIT and QR are two time competitive methods. Because time has become more and more important in the operation of the company and time has been seen as “an essential aspect of strategy” (K. M. Eisenhardt and J. A. Martin, 2000). This article will give a detailed description of the three methods (JIT, QR, ECR) in the next section to help the reader get a deeper understanding of SCM.

2.3 Existing problems in supply chain management

Through the research and analysis of supply chain management, I think there are three problems in the current supply chain management.

First, the backward supply chain inventory management model has seriously affected the cooperation and cooperation efficiency between suppliers and manufacturers. Actually, supply chain inventory is related to time management. For example, failure to arrange the production time of each step will lead to the increase and shortage of inventory. The inventory management of supply chain cooperation often obey short-term interests of strong enterprises. For example, most of the supply chain inventory management users still use their own form, suppliers get a rough month forecast only with the help of expatriates, temporary urgent orders and monthly consumption and inventory information. No agreement on joint replenishment strategy research is achieved and there is not information sharing. The result is that the bullwhip effect is significant, which greatly increases the inventory level of the whole supply chain (Lee, H. L., Padmanabhan, V., & Whang, S., 1997).

Secondly, response cycle of the supply chain is very important for some industries like clothing industry. For the clothing industry, especially in the fashion industry, enterprises are aware of the importance of diversification. Many clothing companies are looking at ZARA who would produce 10000 styles each year. However, although their slogan is "fast fashion", their production and supply chain systems are not fast. Sometimes, the production and supply chain systems remain in the era of economies of scale. The response is slow, the response cycle is long, and the result is the coexistence of shortage and backlog. It seems that the two different problems are the same: the product adopts the differentiation strategy, but the supply chain is not the response type supply chain, and the two are not matched.

Last but not least, there are too many worthless activities. The most ideal situation for the production enterprise is to go directly to the warehouse collar to carry out the production activities when the enterprise has the demand, and the material supplier will put the raw material after the production is finished and put into the manufacturer's warehouse for use. Thus, how to eliminate unnecessary costs and expenses in order to bring greater benefits to customers is the problem that needs to be solved in supply chain management.

3 Possible strategies

3.1 Just-In-Time

Since the introduction of the English language literature (Y. SUGIMORI, K. KUSUNOKI, F. CHO, & S. UCHIKAWA., 2007), its core contents such as shortening the establishment time, small batch production, the use of Kanban, horizontal production scheduling and preventive maintenance (Monden, Y., 1985). Many studies have reviewed the problems related to JIT implementation. These include the relationship between JIT and other production practices, vendor and customer relationship, and JIT implementation. The impact of JIT strategy on performance, especially the manufacturing performance, is also the subject of many research. JIT strategy is also called stockless production, it relieves the impact of inventory on the supply chain.

Just-in-time strategy is a management mode developed on the basis of Toyota Corporation's production mode (Demartini, C., & Mella, P., 2011). From 1980s, it is a strategic topic in western enterprise management area. JIT strategy was proposed in order to eliminate all waste and improve productivity. It is on the basis of a production concept. Besides, it covers from product design until finished sending a complete set of production activities. These activities are required to produce as a final product, including the elimination of all waste and the improvement of productivity in each production stage of the raw material. In one study of JIT, it can be easily seen the benefits of JIT implementation. The paper showed the cases of U.S. suppliers to Japanese automotive and electronic firms (Giffi, C., 1990). Through the implementation of JIT, shorter lead-times, flexible work forces, finished goods inventory and less raw materials are achieved. As you can see from the definition, JIT sets "get the maximum profit" as the ultimate goal of business operation, and the implementation principles include:

- a. Logistics punctuality. It is required that within limited time, all items should be delivered to the production site according to the prescribed way, required specifications, the required quality and required quantity.
- b. Management punctuality. It is required that during the management process, the company can collect, analyze, process and apply the information and data needed according to the management requirements
- c. Financial punctuality. It is required to allocate and use the required turnover funds in time, and to ensure that the financial expenditure of the enterprise is adapted to the needs of production and operation.
- d. Sales punctuality. The principle requires the company to organize the supply of goods and arrange the production and sell and deliver products according to the order or the variety and quantity required by the market, so as to satisfy the needs of customers.
- e. Production punctuality. This principle requires enterprises to ensure the special requirements of the production tasks well and to finish the task in time through the implementation of labor organization flexibility, multi machine operation and multi process management mode of production.

The process of JIT can be seen below:

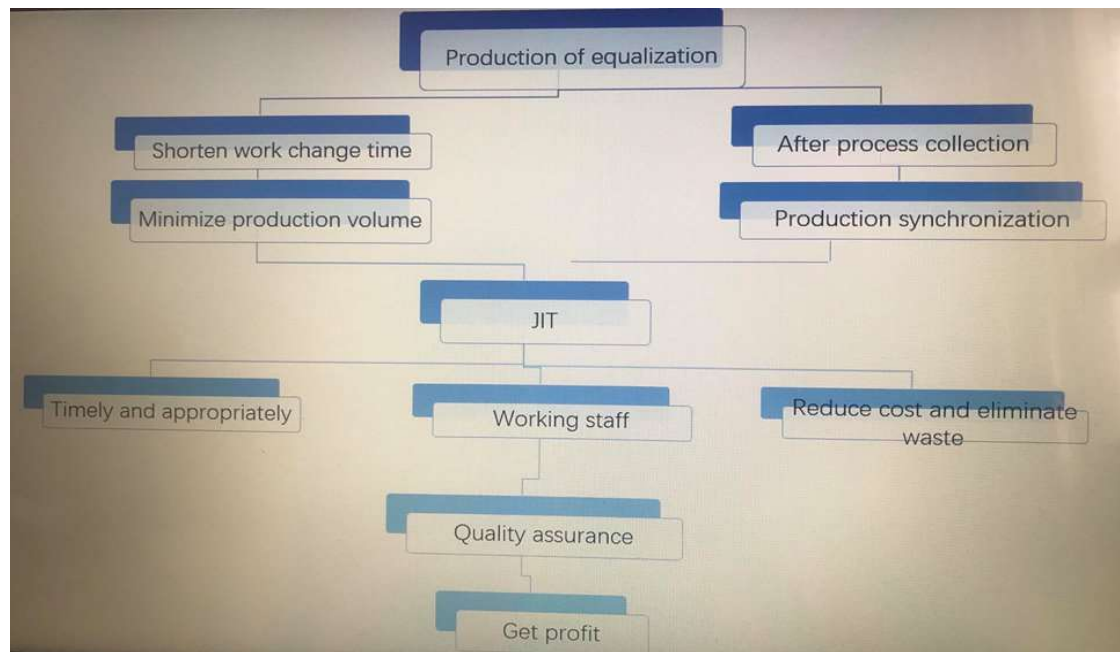


Figure 4: JIT Process

From?

Just-in-time strategy is not only a principle, but also a comprehensive structure of engineering technology. It aims to continuously improve the use of existing resources by seeking flexibility and flexibility in production, so as to ensure the timeliness of every stage of the organizational process (Hiraiwa, M., & Nakade, K., 2009). However, it is important to recognize that JIT strategy is not appropriate to some companies. For example, a company that need to produce repetitive and high-volume items may find that mass production strategy may be more appropriate than just-in-time strategy. So, the companies should evaluate their current capability before adopting JIT strategy. It is worth noting that companies which implement supply chain management strategy should openly share information with their chain partners regardless of their involvement in JIT.

3.2 Quick Response

The term QR was first developed in the United States in 1985 (Fernie, J., 1994; Hines, T., 2001) and it was a supply chain management strategy developed in the textile and garment industry of the United States (Forza, C., & Vinelli, A., 2000).

Quick Response is a method to establish a strategic partnership between retailers and manufacturers. Through the use of information technology, the exchange of information about relevant business may be realized and continuous replenishment of goods would be realized by using a small number of multi frequency distribution; therefore, it helps to shorten the delivery cycle, reduce inventory, improve customer service the level and improve the competitiveness of enterprises.

This model is best suited to the apparel-retail linkage in the basic clothing and has become an example of the QR program of other developed economies, including Japan. As explained in the related materials, the fierce competition between offshore and stagnant domestic consumption in the past ten years highlights the expensive structure and lack of partnership in the Japanese fashion supply chain. This led to the formation of Quick Response Promotion Association (QRPA) in 1994, now it is Fashion Industry SCM Promotion Association (FISPA) (Ferne, J., & Azuma, N., 2004). As a joint effort of T-A-R (textile and garment retail) industry in Japan, the industry would regain the competitiveness of the whole industry, so as to meet the changing needs of customers effectively and efficiently. From the example of QR in Japan, the expected QR benefits by eliminating the labor-intensive and costly processes of ticketing and inspections in a smooth flow of information can be seen.

3.3 Efficient Consumer Response

Efficient Consumer Response (ECR) is a business development strategy developed and widely applied in the European consumer product manufacturing retail industry in 1990s. It aims to create products and services that maximize consumer value through the collaboration between retailers and manufacturers. ECR began to be used in American supermarkets in 1992 (Lummus, R. R., Krumwiede, D. W., & Vokurka, R. J., 2001). The idea is that all waste that consumers do not add value must be excluded from the supply chain to achieve the best benefits. As a supply chain management system, ECR needs to integrate marketing, logistics management, information technology and organizational innovation technology as a whole to achieve the goal. The definition of ECR European executive board is: "ECR is a circulation mode that realizes the fastest and best realization of consumer demand at the lowest cost through the integration of the economic activities of manufacturers, whole-

salers and retailers." As you can see from the definition, ECR emphasizes the cooperation between the supplier and the retailer, and the implementation principles include:

- a. With less cost, the strategy is committed to providing products with better product quality, better quality, more variety and more convenient services to supply chain customers.
- b. The related business tycoons can take the advantage of a mutually beneficial and finally win-win business alliance would replace the traditional relationship and achieve the purpose of profit.
- c. The use of accurate and timely information to support effective market, production and logistics decisions.
- d. From production to packaging until the end of the flow to the end customer, the strategy ensures that the customer can get the product at any time.
- e. Adopt a common and consistent performance appraisal and reward mechanism to create higher value. By reducing expenses, reducing inventories, clearly determining possible gains and equitably distributing these benefits, the fastest and best realization of consumer demand would be achieved.

3.4 Summary

By comparing the characteristics of each strategy and the applicable industry, I think just-in-time strategy is appropriate in the analysis of automotive industry. It makes production a flow. The car production process begins at the last process and then pushes forward to determine the category; therefore, the production process can be properly arranged, according to the process and each link of the required number and time inventory. The strategy helps to minimize the stopping and handling of the material at the production site, and let the material flow unimpeded in the production process. So, the JIT strategy will be applied to analyze automotive industry in this paper. Through the model establishment of fourth chapters and the specific case analysis of the fifth chapters, whether the idea of closely linking the material demand

and the production link and the implementation of the five JIT principles will be beneficial to the production of the automobile industry or not will be verified.

4 Time-based competition of supply chain competitive advantage model used in automotive industry

The previous chapter discusses the competition strategies of supply chain based on time competition, which lays the foundation for building a competitive advantage model of supply chain based on time competition. This chapter focuses on the conceptual model of supply chain competitive advantage used in automotive industry, and gives a general research framework of supply competitive advantage based on time base competition.

4.1 An overview of the model

As shown in Figure 5, the model is composed of three levels (Jin Shanshan., 2012). The first level is the reason level, that is, time-based competition is the reason for the competitive advantage of the supply chain. This layer will lead to the change of time factors that can affect supply chain competitive advantage. The time factors can be divided into two types: one is the supply chain time cycle, the other is the supply chain time structure. The second level is the mechanism level, which reflects the change of supply chain capability and supply chain status under the action of time-based competition strategy. It can be divided into two categories, one is the change of supply chain capability, the other is the change of supply chain status. Supply chain capability is composed of supply chain operation capability, supply chain integration capability and supply chain learning capability. Correspondingly, the supply chain status is affected by supply chain size, supply chain investment and supply chain network. Under the action of time-based competition, supply chain capability and supply chain status are interacted. Supply chain capability is locked into supply chain status by time. Meanwhile, supply chain status strengthens supply chain capability, forming positive feedback loop. The final level is the result layer, which reflects the competitive advantage of the supply chain formed by the time-

based competitive supply chain competition strategy, that is, to increase the market share of the supply chain and to increase the overall profit rate of the supply chain.

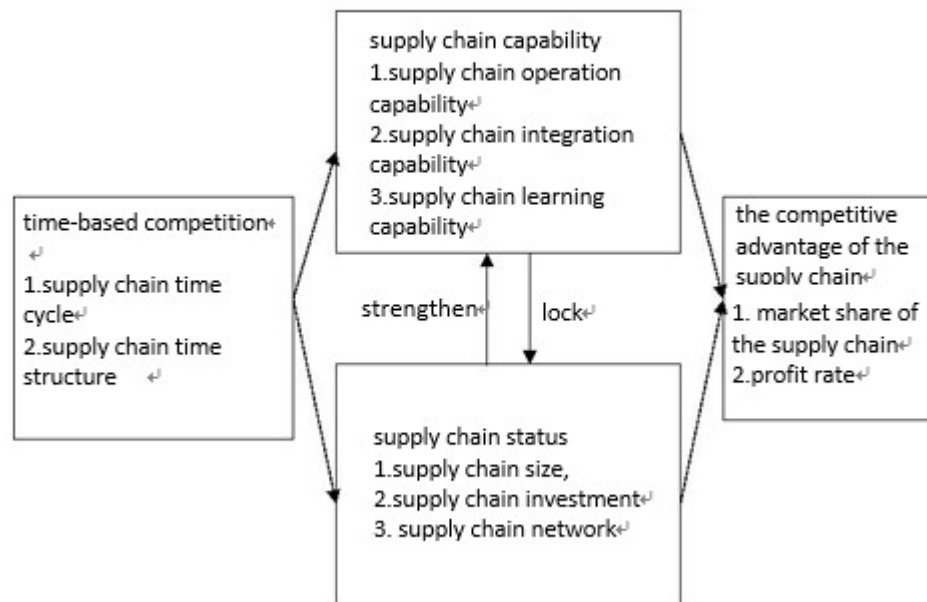


Figure 5: Time-based competition of supply chain competitive advantages model

(From: Jin Shanshan. (2012) research on the competitive advantage of Supply Chain Based on time competition. (Doctoral dissertation, Guangxi University of Technology))

4.2 Supply chain time cycle and supply chain time structure

4.2.1 supply chain time cycle

The supply chain cycle is proposed in the background of time-based competition, in the early 1990s, Stalk proposed the concept of time-based competition (Stalk, G., 1988) and time compression (Stalk, G., & Hout, T. M., 2011). Followed by the literature of this topic, qualitative descriptions, case studies and related model studies were proposed. However, the previous research is more about the partial time of the supply chain, such as production time, purchasing time, circulation time and so on. And the supply chain time cycle is not considered synthetically from the angle of the whole supply chain. This is because different researchers have different focus on supply chain; on the other hand, it is difficult to define and measure the time cycle of the supply chain. In the study of the response speed of supply chain, Ma

Shihua, Yang Wensheng and Li Li (2004) proposed the concept of multi order response cycle of supply chain, and pointed out that the supply chain time cycle is the accumulation of the response time of the product to the final customer in the whole supply chain. The time cycle model of the supply chain is constructed by the two layers planning method. This idea is a proper understanding of the supply chain cycle time.

In this paper, the time cycle of the supply chain is the cumulative value of the time consumed by all the supply chain node enterprises in the process of predicting or determining the customer's demand. The time will be accumulated until the supply chain product is eventually delivered to the customer. The largest feature of the total supply chain time cycle is its accumulation. The time consumed by supply chain nodes will be accumulated to the supply chain cycle, whether it is the time of producing value or the useless time.

Supply chain time cycle reflects the responsiveness of supply chain to customer demand. Under the background of market demand changing rapidly, supply chain can survive and develop only if it can catch the fast change of market. Response capability is the comprehensive ability matching the supply chain with the market environment, while the supply chain time cycle reflects the strength of the supply chain responsiveness. In the dynamic industry, competition is not only on the level of the final product, but also on the competitive efficiency (Linden, G, 1998); therefore, the long supply chain time cycle not only causes the supply chain to lose the important market share, but also brings a lot of stock backlog due to the sale of the supply chain, and takes up the liquidity of the supply chain. For a long time, the profitability of the supply chain is deteriorating, the trust relationship between the members of the supply chain is reduced, and the severe competition in the supply chain occurs until the supply chain is disintegrated. The efficient supply chain saves scarce economic resources and expands social welfare, and the inefficient supply chain wastes scarce economic resources and will eventually be eliminated by the market.

4.2.2 Supply chain time structure

It is pointed out that the supply chain time cycle is the cumulative value of the time consumed by all the supply chain node enterprises in the process of predicting or determining the customer's demand. The time will be accumulated until the supply chain product is eventually delivered to the customer. The time structure of supply chain is the extension and deepening of the concept of supply chain time cycle. It only emphasizes that the supply chain time cycle cannot construct the competitive advantage of supply chain in time base competition. It is only part of the analysis of the competitive advantage of supply chain. Supply chain time structure refers to the internal composition and distribution of supply chain time cycle, and its composition and distribution have different effects on supply chain.

From the time composition of supply chain, the time period of supply chain reflects the time consumption in the whole operation process of supply chain. The supply chain operation process can be described as a series of time activities triggered by the final customer submission of the order (Buttle, F., 2004): the customer submits the order and the retailer collects the order to the distributor. Then, the distributor sends the aggregated order to the production enterprise and the manufacturing department of the production enterprise designs the product according to the order form and forms the production plan and the material demand plan. After that, the purchasing department arranges material purchase according to the material demand plan and the suppliers who receiving the order sends the material through the supply network to the material bank of the production enterprise. Next, the production department leads the production according to the production plan. After the production is completed, the product is transferred to the finished product. Finally, the distributor and the retailer will produce the product. The product is delivered to the ultimate customer. Therefore, the supply chain time cycle can be divided into six categories according to the supply chain operation process: order processing time, production design time, material procurement time, material supply time, production time and product distribution time (McIvor, R., 2000). These six times occur in the supply chain of supply subsystem, production subsystem and sales subsystem, and the market environment of supply chain, a closed time ring is formed

(Vaio, T., 2006). The market is the starting point of supply chain time and the end of supply chain time. The time composition of supply chain will be showed in Figure6.

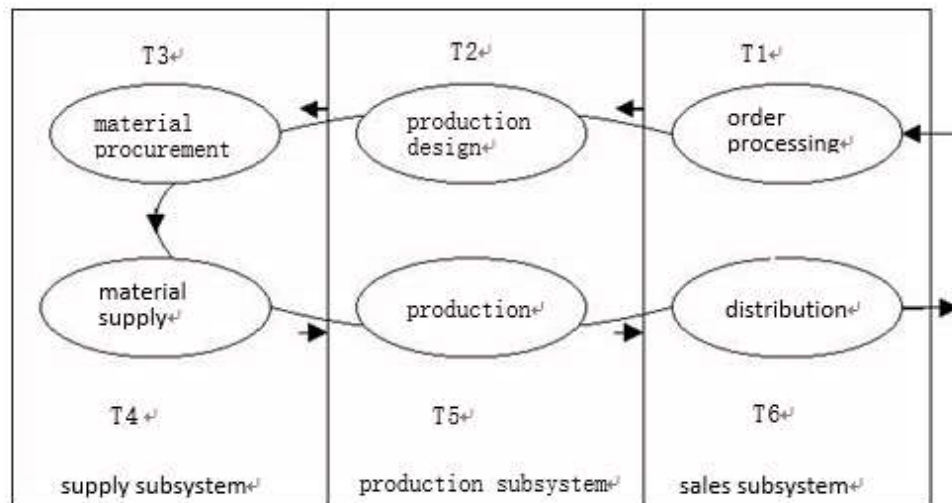


Figure 6: Supply chain time structure

(From: McIvor, R. (2000). A practical framework for understanding the outsourcing process. *Supply Chain Management: an international journal*, 5(1), 22-36.)

4.3 Supply chain capability

Supply chain capability is a difficult concept to define, because supply chain itself is a supply chain network formed by multiple agents. The capabilities of individual businesses are different from those of supply chains, but the capabilities of individual businesses have an impact on supply chain capabilities. From the point of view of time base competition, the capability of supply chain is the capability of supply chain based on time-based competition. The supply chain ability of time-based competition is the overall ability of time. It reflects the ability of the supply chain enterprises to grasp the time resources and the time coordination ability of the supply chain as a whole Yusuf, (Y. Y., Gunasekaran, A., Adeleye, E. O., & Sivayoganathan, K., 2004). It contains two meanings: on the one hand, it is the practice, process and culture on how to use the time resources in the long-term operation of the supply chain enterprises; on the other hand, the supply chain that promotes the supply chain of time based competition through the coordination, integration and reconstruction of how to use the time resources, the coordination, integration and reconstruction of

the time resources. The formation of ability. Once the supply chain ability of the time-based competition is formed, the order response speed, the flexible production system, the high inventory turnover rate and the low transaction cost are different from the general supply chain (Stalk, G., 1988). The supply chain ability of time-based competition can improve the external identification of the supply chain through these external supply chain performance, and eventually win higher market share and higher profit rate. Therefore, the supply chain ability of time-based competition is the integration ability of supply chain about how to use time resources. It is the supply chain that integrates supply chain enterprise capacity to form the overall capacity of supply chain, effectively manages supply chain time resources, shortens the time cycle and optimizes the supply chain time structure, so that supply chain can gain sustainable competitive advantage in the struggle.

4.4 Supply chain status

"Status" is a sociological concept, which refers to the position of social members in the social system (Sidanius, J., & Pratto, F., 2001). This paper uses the word of position to form the concept of supply chain status, which means the relationship between supply chain and supply chain competition environment. The status of supply chain statically indicates the status of supply chain in the current competitive environment, which has a strong correlation with the industrial environment. Supply chain position can bring a comparative advantage to the supply chain, because when the supply chain is locked in a dominant position, the supply chain can form a barrier to the competitive supply chain, thus obtaining a monopoly rent (Roberts, S., 2017). The formation and maintenance of the dominant position of the supply chain are all related to many factors, in which the time based competition strategy can make the supply chain gain a certain dominant position in the competition.

The position of supply chain with time competition is the status of supply chain which is intrinsically related to time. The performance is that it can quickly push the dominant products into the market, occupy the market, form the industry standards and brand leaders, and successfully prevent the entry and imitation of other products through the speed advantage; for example, enterprises that provide fast consumer goods in some supply chains have received praise from customers, and the

supply chain of this product is identified by brand identity. In other cases, for example, the innovative products of some supply chains have taken up the mainstream market because of their outstanding function or fashion, which has formed the industry standard and brought the corresponding position advantage for the supply chain. Therefore, this paper proposes the concept of supply chain status based on time competition, which is one of the manifestations of the competitive advantage of supply chain.

4.5 The relationship between time competition and supply chain capability and supply chain status.

One of the key words of this study is time-based competition, but what should be included in the "time" here is a question worth discussing. From the perspective of the realization of competitive advantage, factors such as cost and quality have been seen as the cause of competitive advantage. From the theoretical framework of competitive advantage, exogenous competitive advantage theory and endogenous competitive advantage theory are considered as the two basic starting points for studying competitive advantage. What is the essence of time based competition? Why can it affect the supply chain capabilities and supply chain status? The theory of resource-based competitive advantage put forward by Barney (1991) emphasized that resources were one of the sources of potential competitive advantages. This paper argues that time based competition should be understood as the time resources on the supply chain, which is both the supply chain capacity and supply chain status for the use and management of supply chain time resources. Time resources, as the elements of competitive advantage, can be understood from two aspects: static and dynamic. The static time performance is the state, the dynamic time is shown as the process, the accumulation of the history in the history is the present state of the present time, and the continuous state of seamless connection is the process (Ma Shihua, Yang Wensheng, Li Li., 2004). This paper considers that when the time resource of supply chain is represented as supply chain process, it can generate supply chain capability. The supply chain operation ability of the time base competition, the supply chain coordination ability of the time-based competition (Wong, C. Y., Boon-Itt, S., & Wong, C. W., 2011)., or the supply chain learning ability

of the time based competition can be regarded as the time flow on the supply chain. Ability is the result of resource application, and it must be reflected by a series of continuous changes. Because of the continuity of change, the ability to eliminate time factors cannot be understood, that is, ability cannot exist outside time. The ability in time is nothing more than the process of time, that is, the changing sequence. Similarly, the status of the supply chain is actually the state of the application of time resources. When a supply chain implements the strategy of time base competition, the supply chain status reflects the result of strategy implementation, that is, the supply chain is able to restrict competitors.

5 Case study

The previous chapters analyze the competitive advantage and strategy of supply chain in time base competition. This chapter will analyze the competitive advantage of supply chain in the time base competition of two typical internationally famous companies through the case of automobile industry. The supply chain of Toyota Corporation is a model of success, which has always been the focus of research at home and abroad. General motors(GM) was inferior to TOYOTA's supply chain competition in the past, but in recent years GM has stepped up management of the supply chain to restore the lost market.

5.1 Toyota Company

5.1.1 General situation of Toyota Company

Japan's Toyota Auto Body Co was founded by Toyoda Kiichiro in 1933 (Ohno, T., 1988). There's Lexus, TOYOTA, mercury, made a series of high grade brand. Over the years, TOYOTA motor has been winning the competition with its high quality, low cost and low fuel consumption. By the end of 2010, the Toyota Auto Body Co, with its annual sales of 8 million 418 thousand, defeated general motors and Volkswagen for three consecutive years. In 2011, it was affected by the Japanese earthquake and the "TOYOTA recall door" in 2010. The Toyota Auto Body Co realized the sale of 7 million 950 thousand vehicles and returned to the third place.

Toyota Corporation is widely concerned about not only the outstanding performance of Toyota Corporation, but more importantly, Toyota Corporation has carried out a series of advanced management concepts, management patterns and organizational patterns in management and production, which are attributed to the management scholars as " Toyota Production System (TPS)", also known as " Lean production System (LPS)". It's also called "just in time production(JIT)" (Monden, Y., 2011). After the Second World War, the automotive industry in Japan just started. Compared with the old European automotive industry, Toyota Auto Body Co is facing huge difficulties. In 1950, Taiichi Ohno, the general manager of Toyota Corporation, began to improve Ford's manufacturing process with the goal of TOYOTA's production capacity. He first developed the idea of "instant in place" of founder Toyoda Kiichiro, and formed the JIT production mode (Ohno, T., 1988). On the basis of JIT production, Toyota Corporation will continue to improve Kaizen's concept, Kanban management method, surface quality management theory and flexibility theory.

After that, Toyota Auto Body Co expanded the production mode of TOYOTA in the upstream and downstream of supply chain, forming the "lean supply chain". By helping suppliers to eliminate the waste of time and cost in the supply chain, the Toyota Corporation can carry out mass customization in a large range and transform customer needs into profit margins in the supply chain at a very short time. A good supply chain partnership and benefit sharing mechanism ensure the formation of the overall competitive advantage of the supply chain.

5.1.2 The time based competitive advantage of TOYOTA automotive supply chain

The Toyota Corporation supply chain activity is a series of highly integrated flow activities. Toyota Corporation compresses the supply chain time cycle by shortening the business process time (Christopher, M., 2000). It improves the supply chain time structure through the pull supply chain organization, improves the efficiency and efficiency of the supply chain, and forms the competitive advantage of the supply chain. Toyota's supply chain activities are divided into sales activities, production plans, production instructions and parts procurement activities. At the sales terminal, TOYOTA's 4S stores are all over the country, and the sales network at the top of the

whole country is TOYOTA automobile sales company. Each 4S store will register the detailed purchase information into the management system for each sales or scheduled car, which is transmitted through the network to the TOYOTA automobile sales company. TOYOTA automobile sales company will collect, collate and calculate the information from all over the world, and send the information related to the production plan to the production plant. The information is accepted by the production management department, which is responsible for production management, planning and logistics purchasing in production factories. The production management department of production management department is responsible for production plan making, new car promotion and customs clearance. The production planning group uses Global-Production Plan System (G-PPS) that is connected to TOYOTA automobile sales company management system. G-PPS is TOYOTA's global planning system (Toyota Motor Corporation., 2018). G-PPS has 2 main functions, one is to make production plans, and the other is to calculate the necessary quantity of components. Two G-PPS according to the information sent by production factories, combined with the necessary conditions such as "standardization" for production, the monthly production plan of the factory is worked out. G-PPS is a system for making production plans, so it also needs help from "Specification Management System (SMS)". SMS is another "global system" that records information about the pattern, parts and other information of the vehicle, recording the pattern information of all vehicles produced by the Toyota Auto Body Co. When G-PPS gets information from SMS, it can complete the computation. When the G-PPS completes the calculation, it will send the results of the two functions to the "production indicator system" and the "spare parts purchase" system, so as to complete the more specific "arrangement of production" and "spare parts procurement".

The purchase of parts and components is the process of purchasing the former parts (parts suppliers or other factories) to the vehicle factory. The TOYOTA car uses the Kanban mode to realize the precision and precision of the purchase and batch of parts and raw materials. The Toyota Auto Body Co has achieved a precise grasp of the supply chain cycle by converting the time of order issuance to unapparent

installation time, supplier stock time, external logistics time and internal logistics time, with an accurate information control system.

5.2 General motors

5.2.1 General situation of General Motors

General Motors is one of the Toyota Corporation 's biggest competitors. In 1908, William Durant developed stock companies on the basis of the integration of Buick Company and the auto company. The history of General Motors is full of legend, from its founding to 1927 as the world's first car company (Oosterwal, D. P., 1993). General Motors merged Buick, Chevrolet, GMC, Cadillac, Horton, and O - Mo - Bi, led by William Durant, DuPont, Sloan and other outstanding leaders. The famous brands such as Opel, Pontiac, Waxman hall and Saturn Saab have become one of the companies with many famous brands. After Sloan's presidents of general motors, he put forward the concept of "different consumers, different goals, different models", and guided the General Company to adopt the strategy of subdividing the market. The organizational management mode of the division system caters to the strategy of multi brand market segmentation, and has achieved great success. The successful GM has developed its headquarters in Detroit as the American car city, and the General Motors headquarters building is considered a sign of the city of Detroit.

However, the former brilliance does not guarantee the sustainability of the competitive advantage, and the challenge comes from the Toyota Auto Body Co, which has not yet been established when GM has grown into a world-class auto company. The Toyota Auto Body Co was not valued at the beginning of its founding, however, when Toyota Corporation relied on its strong supply chain advantages and advanced manufacturing ideas to gradually encroach on the market of general motors, General Company realized that they underestimated their opponents. Especially when TOYOTA motor entered the North American market in 2006, General Motors was in the mire of loss. The financial crisis that followed in 2008 made GM worse, leading to a century of bankruptcy, while TOYOTA won the world's biggest car company at the same time (Bunkley, N., 2009).

The bitter lesson forced the General Company to face up to the competition between supply chains. In 2005, the biggest supplier of GM's Delphi Co bankruptcy directly led to a 1-million-reduction in GM's car annual output, while GM had to cut 30 thousand people around the world (Maynard, M., 2005). After that, General Motors increased its investment in supply chain, improved supply chain management and eliminated the tense and hostile relationship with suppliers. The auto sales of GM, which was reorganized in 2011, returned to the top of the world, but it had lost half of its most brilliant performance.

5.2.2 The time based competitive advantage of General Motors automotive supply chain

The fourth party logistics model of General Motors

General Motors has always believed in the mode of large customer procurement in history. Automobile manufacturing involves a large number of components. A large number of suppliers and third party logistics of general motors have brought some difficulty to the supply chain management of General Company. In order to meet the requirements of shortening purchase time and reducing procurement cost, General Motors Corporation and Monroe logistics company co founded Vector SCM company in 2000 (Hoffman, W., 2006). With the mode of the fourth party logistics, the company integrates several of the original third party logistics companies of general motors, and integrates the logistics process in a unified way. Vector SCM has a strong database system, capable of implementing unified planning for raw material procurement and logistics activities, and providing an optimized supply chain solution.

Vector SCM relies on its powerful logistics technology platform to integrate the general automotive supply chain system. Its core component is the G-Log software developed by the Oracle Corp. G-Log software integrates the functions of supplier selection, order processing, freight tracking, integrated planning, system optimization and so on to form a unified full process visual operation platform (Oracle Corp., 2005). Vector SCM helps GM greatly solve the problem of time and cost optimization of the complex supply chain network, shortens the waiting time,

improves the accuracy of the system and the response capability of the supply chain, and reduces the average delivery time by 2.5 days.

5.3 Comparison of time-based competitive advantage between TOYOTA and General Motor

By comparing the supply chain of Toyota Corporation and the supply chain of General Company, it can be found that Toyota Corporation used JIT ideas to create "lean supply chain", trying to eliminate the waste of time in the supply chain, while General Motor did not have enough attention in this area. After several years of competitive competition with suppliers, General Motor has begun to focus on the improvement of supply chain capacity, which is highlighted by the cooperation between general motors and the third party, the fourth party logistics, the strengthening of information construction, the implementation of global procurement, improvement of the relationship with suppliers, and the strengthening of time control. Obviously, both the supply chains of General Motor TOYOTA are concerned about time-based competition. But their concerns are different, the Toyota Corporation approach is more direct and more targeted, and General Motor Company attempts to improve the overall supply chain capability in a comprehensive way. The following table is a comparison of core technologies, enabling technologies, core competence and strategies between General Company and Toyota Corporation (Hong, T., 2007).

Table1: a comparison between General Company and Toyota Corporation

(From: Hong, T., 2007).

Organization	General Motors	Toyota Motor
System	Rational system	Open system
Core Technology	Manufacturing Automation Protocol (MAP) in an open-systems interconnection standard for programmable devices of different vendors in a factory environment	Toyota Production System to accelerate the "lean thinking" revolution for manufacturing operations
Enabling Technology	Internal communication to communicate throughout the organization included roundtable discussion groups, and the training of managers and employees	Information technologies that run assembly line as a part of the foundation for vehicle refinements and improved product quality
Core Competency	Production is organized to yield the biggest market share and the highest profit. Mass-produced cars with a minimum of changes each model year at the lowest fixed cost per car	Manufacturing technology - <i>Just-In-Time Stockless Production</i> that produces in timely fashion at the lowest possible cost in flexible process
Strategy	<ul style="list-style-type: none"> • General Motors has historically used an arm's-length model. • GM fosters vigorous supplier competition and maintaining arm's-length relationships, and outside suppliers is by short-term contracts (one year). • GM plans to eliminate approximately 30,000 jobs and close 12 plants. • GM offers too much similarity among its models, and generally out of touch with its customer base. • GM has been resting on laurels 	<ul style="list-style-type: none"> • Toyota has employed a partner model. • Toyota develops long-term partnerships with suppliers who are given implicit guarantees on future business. • Toyota plans to expend its operation opening new plants and hiring more workers in North America. • Toyota develops cars new features that customers want. • Toyota's technology has progressed steadily

Table 1: A comparison between General Company and Toyota Corporation

According to the latest data, Toyota had approximately 27.6 trillion Japanese yen (or about 248.4 billion U.S. dollars) sales and revenue streams while the data of General Motors was round 145.6 billion U.S. dollars (Statista, 2018). Referring to global vehicle sales in the fiscal year of 2017, the data of Toyota was 10 million compared to 9.6million of General Motors. When it comes to vehicles produced in the fiscal year of 2017, Toyota produced some 9.1 million vehicles. In the fiscal year of 2016, General Motors produced 7.8 million vehicles (Statista, 2018).Overall, Toyota Corporation is better than General Motors in terms of production and sales.

5.4 Summary

This chapter analysed the supply chain of TOYOTA and the General Motors. It can easily be found that the use of time-based competition to build the competitive

advantage of the supply chain is the direction of the two companies. The difference only lies in different strategies that they have adopted. Toyota Corporation focused on JIT ideas in order to create "lean supply chain", while General Motor paid more attention on the improvement of supply chain capacity, which is highlighted by the cooperation between general motors and the third party, the fourth party logistics. In a word, Toyota Corporation supply chain has gained more obvious competitive advantages by establishing supply chain based on time-based competition.

6 Conclusions

The competition pattern of enterprises has also changed due to the joint action of globalization and technological progress. The competition pattern of enterprises has changed from competition between enterprises to supply chain, and competition means has changed from the emphasis on cost and quality to time. So, it is of great importance to do research on time-based competition of supply chain competitive advantage. Starting from the importance of the research and combining the knowledge of management and economics, this thesis explores the competitive advantage of supply chain with time based competition. The work is summarized as follows:

- (1) The thesis reviewed the relevant literature and analyzed the concept of supply chain and supply chain management. Combined with the understanding of time-based competition and competitive advantage of supply chain.
- (2) The thesis put forward three possible strategies to enhance the competitive advantage of supply chain. By comparing the characteristics of each strategy and the applicable industry, it concluded that Just-In-Time strategy is appropriate in the analysis of automotive industry.
- (3) The thesis put forward time-based competition of supply chain competitive advantage model used in automotive industry so that readers can better understand the principle of supply chain based on time competition.
- (4) The competitive advantage of time-based supply chain in Toyota Corporation and General Motor Company was analyzed. It can be found that Toyota Corporation supply chain achieved a more obvious competitive advantage by establishing a supply chain based on time-based competition.

The competitive advantage of supply chain in time based competition is an important research field, which has important theoretical value and practical significance. Although this paper has done some research, there are still many problems to be studied.

References

- Barney, J. (1991). *Firm resource and sustained competitive advantage*. Journal of Management, 17(1), 99-120. Accessed on 19 January 2018. Retrieved from <https://studysites.uk.sagepub.com/harzing3e/Ch.1%20Barney..pdf>
- Beamon, B. M. (1998). *Supply chain design and analysis: : models and methods*. International Journal of Production Economics, 55(3), 281-294. Accessed on 19 January 2018. Retrieved from https://ac.els-cdn.com/S0925527398000796/1-s2.0-S0925527398000796-main.pdf? tid=5d286e06-1e1d-4b2e-a718-9f87c5b30936&acdnat=1525520682_b1a4390e95335c4d2075d17b950da600
- Buttle, F. (2004). *Customer relationship management*. Routledge.
- Bunkley, N. (2009). *Toyota Ahead of G.M. in 2008 Sales*. The New York Time. Accessed on May 1st 2018. Retrieved from <https://www.nytimes.com/2009/01/22/business/22auto.html>
- Christopher, M. (2016). *Logistics & supply chain management*. Pearson UK.
- Christopher, M. (2000). *The agile supply chain: competing in volatile markets*. Industrial marketing management, 29(1), 37-44. Accessed on May 1st 2018. Retrieved from https://ac.els-cdn.com/S0019850199001108/1-s2.0-S0019850199001108-main.pdf? tid=00df3c34-9bbf-48dc-853d-05f07c6552ec&acdnat=1525521385_3b6065a103ec1a4415098e8f2e3cddf5
- Cooper, Martha, Lisa M. Ellram, John T. Gardner, and Albert M. Hanks (1997), "Meshing Multiple Alliances," Journal of Business Logistics, Vol. 18, No. 1, pp. 67-89.
- Demartini, C., & Mella, P. (2011). *Time competition. the new strategic frontier*. Ibusiness, 3(2), 136-146. Accessed on February 15th Retrieved from http://file.scirp.org/pdf/IB20110200004_80842697.pdf
- Ellram, Lisa M. and Martha C. Cooper (1990), "Supply Chain Management, Partnerships, and the Shipper-Third-Party Relationship," The International Journal of Logistics Management, Vol. 1, No. 2, pp. 1-10. Accessed on February 15th Retrieved from <https://www.emeraldinsight.com/doi/pdfplus/10.1108/95740939080001276>
- Fernie, J., & Azuma, N. (2004). *The changing nature of Japanese fashion: Can quick response improve supply chain efficiency?*. European journal of marketing, 38(7), 790-808.
- Fernie, J. (1994). *Quick response: an international perspective*. International Journal of Physical Distribution & Logistics Management, 24(6), 38-46. Accessed on February 15th Retrieved from <https://www.emeraldinsight.com/doi/full/10.1108/09600039410066178>
- Forza, C., & Vinelli, A. (2000). *Time compression in production and distribution within the textile-apparel chain*. Integrated Manufacturing Systems, 11(2), 138-146. Accessed on February 27th. Retrieved from <https://www.emeraldinsight.com/doi/full/10.1108/09576060010314134>
- Giffi, C. (1990). *Competing in world-class manufacturing: America's 21st century challenge*. Business One Irwin.

Hines, T. (2001). *From analogue to digital supply chains: implications for fashion marketing*. Fashion Marketing: Contemporary Issues. Oxford: Butterworth Heinemann, 26-47. Accessed on February 15th. Retrieved from

History of General Motors. (n.d.). In Wikipedia. Accessed on April 4th, 2018. Retrieved from http://en.wikipedia.org/wiki/History_of_General_Motors

Hiraiwa, M., & Nakade, K. (2009). *Periodicity of cycle time in a u-shaped production line with heterogeneous workers under carousel allocation*. Journal of Service Science & Management, 2(4), 265-269. Accessed on February 27th. Retrieved from <https://pdfs.semanticscholar.org/d84d/4190a3a72eb7a0825441f3109c758ec2c84a.pdf>

Hoffman, W. (2006). *GM Buys Out Vector SCM*. Traffic World, Inc. Accessed on April 4th, 2018. Retrieved from

https://www.joc.com/economy-watch/gm-buys-out-vector-scm_20060709.html

Hong, T. (2007). *Comparison and Contrast of General Motors and Toyota Motor*. Accessed on May 1st, 2018. Retrieved from <https://zh.scribd.com/document/97532258/Comparison-and-Contrast-of-General-Motors-and-Toyota-Motor>

Jin Shanshan. (2012). *research on the competitive advantage of Supply Chain Based on time competition*. (Doctoral dissertation, Guangxi University of Technology) (in Chinese)

K. B. Clark and T. Fujimoto, *"Product Development Performance: Strategy, Organization, and Management in the World Auto Industry,"* Harvard Business School Press, Boston, MA, 1991.

K. M. Eisenhardt and J. A. Martin, *"Dynamic Capabilities: What Are They?"* Strategic Management Journal, Vol. 21, No. 10-11, 2000, pp. 1105-1121. Accessed on March 10th, 2018. Retrieved from http://www.rcmewhu.com/upload/file/20150527/20150527205719_4660.pdf

Lambert, Douglas M., James R. Stock, and Lisa M. Ellram (1998), *Fundamentals of Logistics Management*, Boston, MA: Irwin/McGraw-Hill, Chapter 14.

Loomis, C. J. (2006). *The tragedy of General Motors*. Fortune, 20, 30-45.

Lee, H. L., Padmanabhan, V., & Whang, S. (1997). *Information distortion in a supply chain: the bullwhip effect*. Management Science, 43(4), 546-558.

Linden, G. (1998). *Building production networks in Central Europe: the case of the electronics industry*. Accessed on March 30th, 2018. Retrieved from <http://pdfs.semanticscholar.org/7b96/ec005d11da69997fda7c7b6c5473df4d9199.pdf>

Lummus, R. R., Krumwiede, D. W., & Vokurka, R. J. (2001). *The relationship of logistics to supply chain management: developing a common industry definition*. Industrial Management & Data Systems, 101(8), 426-432. Accessed on March 15th, 2018. Retrieved from <https://www.emeraldinsight.com/doi/full/10.1108/02635570110406730>

Maynard, M. (2005). G.M. to Cut 30,000 Jobs and Close Some Factories. *The New York Times*. Accessed on March 30th 2018. Retrieved from <https://www.nytimes.com/2005/11/21/business/gm-to-cut-30000-jobs-and-close-some-factories.html>

Masters, J. M., & Londe, B. J. L. (1994). *Emerging logistics strategies: blueprints for the next century*. International Journal of Physical Distribution & Logistics Management, 24(7), 35-47. Accessed on January 20th 2018. Retrieved from <https://www.emeraldinsight.com/doi/full/10.1108/09600039410070975>

Ma Shihua, Yang Wensheng, Li Li. (2004). *The decision-making model of the multistage response period of Supply Chain Based on the two level planning*. Journal of management science in China, 7 (5), 31-39. (in Chinese)

Mentzer, J. T., Dewitt, W., Keebler, J. S., Min, S., Nix, N. W., & Smith, C. D., et al. (2001). *Defining supply chain management*. Journal of Business Logistics, 22(2), 1-25. Accessed on January 20th 2018. Retrieved from <https://onlinelibrary.wiley.com/doi/full/10.1002/j.2158-1592.2001.tb00001.x>

Monczka, Robert, Robert Trent, and Robert Handfield (1998), *Purchasing and Supply Chain Management*, Cincinnati, OH: South-Western College Publishing, Chapter 8.

Monden, Y. (1985). *Toyota production system: practical approach to production management*. Quality & Quantity, 19(2), 145-153.

Monden, Y. (2011). *Toyota production system: an integrated approach to just-in-time*. CRC Press.

Ohno, T. (1988). *Toyota production system: beyond large-scale production*. crc Press.

Oosterwal, D. P. (1993). *Product development--a case study of General Motors* (Doctoral dissertation, Massachusetts Institute of Technology).

Oracle Corp. (2005). *Oracle Buys Global Logistics Technologies*. Accessed on April 4th 2018. Retrieved from <https://www.oracle.com/corporate/acquisitions/g-log/index.html>

Roberts, S. (2017). *Barriers to Entry and Implications for Competition Policy*. Competition Policy for the New Era: Insights from the BRICS Countries, 1, 199.

Sidanius, J., & Pratto, F. (2001). *Social dominance: An intergroup theory of social hierarchy and oppression*. Cambridge University Press.

Stalk, G. (1988). *Time-the next source of competitive advatage*. Harvard Business Review, 66(6), 41-51.

Stalk, G., & Hout, T. M. (2011). *Competing against time: how time-based competition is reshaping global markets*. , 33(2).

Statista. (2018). *General Motors - Statistics & Facts*. Accessed on May 4th 2018. Retrieved from <https://www.statista.com/topics/2480/general-motors/>

Statista. (2018). *Toyota - Statistics & Facts*. Accessed on April 24th 2018. Retrieved from <https://www.statista.com/topics/1893/toyota/>

Stevens, G. C. (1990). *Successful supply - chain management*. Management Decision, 28(8). Accessed on January 20th 2018. Retrieved from <https://www.emeraldinsight.com/doi/pdfplus/10.1108/00251749010140790>

Stevens, Graham C. (1989), "Integrating the Supply Chains," International Journal of Physical Distribution and Materials Management, Vol. 8, No. 8, pp. 3-8. Accessed on January 20th 2018. Retrieved from <https://www.emeraldinsight.com/doi/pdfplus/10.1108/EUM00000000000329>

Toyota Motor Corporation. (2018), "Illustration of the Toyota Production System", Toyota Global Site

Accessed on April 4th 2018. Retrieved from http://www.toyota-global.com/company/vision_philosophy/toyota_production_system/illustration_of_the_toyota_production_system.html

Tyndall, Gene, Christopher Gopal, Wolfgang Partsch, and John Kamauff (1998), *Super-charging Supply Chains: New Ways to Increase Value Through Global Operational Excellence*, New York, NY: John Wiley & Sons. Accessed on January 20th 2018. Retrieved from https://www.researchgate.net/publication/240268603_Supercharging_Supply_Chains_New_Ways_to_Increase_Value_Through_Global_Operational_Excellence

Vaio, T. (2006). *Six Key Trends Changing the Supply Chain Management Today*. Supply&Demand Chain EXECUTIVE

Accessed on April 24th 2018. Retrieved from <https://www.sdexec.com/sourcing-procurement/news/10358095/six-key-trends-changing-the-supply-chain-management-today>

Wong, C. Y., Boon-Itt, S., & Wong, C. W. (2011). *The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance*. Journal of Operations management, 29(6), 604-615. Accessed on April 24th 2018. Retrieved from https://ac.els-cdn.com/S0272696311000325/1-s2.0-S0272696311000325-main.pdf?tid=49937162-e0a3-44a9-879b-4888e252a9ab&acdnat=1525524840_dd797d395172b479482cc5ff5706ffb3

Sugimori, Y., Kusunoki, K., Cho, F., & Uchikawa, S. (1977). Toyota production system and kanban system materialization of just-in-time and respect-for-human system. The International Journal of Production Research, 15(6), 553-564. Accessed on March 10th 2018. Retrieved from <https://www.tandfonline.com/doi/abs/10.1080/00207547708943149>

Yusuf, Y. Y., Gunasekaran, A., Adeleye, E. O., & Sivayoganathan, K. (2004). *Agile supply chain capabilities: Determinants of competitive objectives*. European Journal of Operational Research, 159(2), 379-392. Accessed on May 4th 2018. https://ac.els-cdn.com/S0377221703005241/1-s2.0-S0377221703005241-main.pdf?tid=d987d046-6c65-4544-ba6b-7ba1088464bd&acdnat=1525525351_054f453801ad0d575e8cbe26f6be7256