



JÖNKÖPING INTERNATIONAL
BUSINESS SCHOOL
JÖNKÖPING UNIVERSITY

Master Thesis

Postponement Implementation in Supply Chain Management

Three Case Studies on Postponement Implementation

Author:

Yuping Fan

Jingyi Zhang

Tutor:

Anna Nyberg

Hamid Jafari

Jönköping

August 2012

Master Thesis in International Logistics and Supply Chain Management

Title: Postponement Implementation in Supply Chain Management -- Three Case Studies on Postponement Implementation

Authors: Yuping **Fan**, Jingyi **Zhang**

Tutor: Anna Nyberg, Hamid Jafari

Date: 2012-08-08

Key words: Postponement, Logistics, Supply chain, Postponement Implementation

Abstract

Facing the increasing pressure of international competition, firms are trying out kinds of solutions on reducing costs through marketing, manufacture and logistic, and on improving customer satisfaction, such as avoiding lack of stock, raising order fulfilled rate and increasing mass-customization, etc. Postponement is one of the strategies helping achieving the targets above.

However, the implementation of postponement is not run smoothly by all the firms all the time in reality. This thesis aims at analyzing the motivations, challenges and results on applying postponement strategy and whether the findings correspond with the previous theories.

Previous studies and theories are reviewed and summarized followed by the depth interviews on three chosen cases. These cases are selected considering the location, supply channel and level of implanting postponement strategy. According to the interviews, the actual situation on utilizing postponement in reality is analyzed.

The results of the research and analysis can be summarized as: 1) not all companies are suitable for all types of postponement strategy; 2) the firms do get the benefits which the previous studies mentioned if they applying the postponement properly; 3) there are several types of challenges during applying this strategy and rebuilding the supply chain.

Table of contents

Abstract.....	i
Table of contents.....	ii
1 Introduction.....	1
1.1 Problem Definition.....	2
1.2 Purpose of Study.....	3
1.3 Research Question.....	3
1.4 Limitation.....	4
2 Literature Review.....	4
2.1 Defination of Postponement.....	4
2.2 The History of Postponement Strategy.....	5
2.3 Types of Postponement.....	6
2.4 Drivers to Adopting Postponement.....	9
2.5 Benefits of Postponement.....	10
2.6 Challenges of Implementing Postponement.....	12
3 Methodology.....	13
3.1 Research Strategy.....	13
3.2 Research Approach.....	14
3.2.1 Literature review.....	15
3.2.2 Cases.....	15
3.3 Validity and Reliability.....	15
4 Case Studies Presentation.....	16
4.1 ComfortSystem.....	16
4.1.1 Products.....	16
4.1.2 Customers.....	17
4.1.3 Supply chain.....	17
4.2 Arctic Treasures.....	20
4.2.1 Products.....	20
4.2.2 Customers.....	21
4.2.3 Supply chain.....	21

4.3	Zhongping Wood Co. Ltd	22
4.3.1	Products	22
4.3.2	Customers	23
4.3.3	Supply chain	23
5	Analysis Based on Case Studies	25
5.1	ComfortSystem.....	25
5.1.1	Drivers of applying postponement.....	25
5.1.2	Challenges in postponement implementation	26
5.1.3	Outcomes of applying postponement	26
5.2	Arctic Treasures	28
5.2.1	Drivers of applying postponement.....	28
5.2.2	Challenges in postponement implementation	28
5.2.3	Outcomes of applying postponement	28
5.3	Zhongping Wood Co. Ltd	28
5.3.1	Drivers of applying postponement.....	29
5.3.2	Challenges in postponement implementation	29
5.3.3	Outcomes of applying postponement	30
6	Conclusion and Areas for Future Research	31
	References.....	34

1 Introduction

Marketing, Manufacturing, and Logistics are the three big areas in today's business world. More and more companies start to focus on logistics to achieve efficiency since the other two areas are comparably well developed. Many concepts were brought to logistic industry, such as lean system, agile system, intermodal, third party logistic and so on.

Postponement, among them, is a business strategy with the focus on maximizing possible benefits and minimizing risks by delaying further investment into a product or service until the last possible moment (Graman and Magazine, 2006). When talking about postponement in supply chain management, it refers to a way that the manufacturer produces a generic product which can be modified at the later stages when the final hand over to the customer happens (Nair, 2005). There are five basic types of postponement strategy: Labeling, Packaging, Assembly, Manufacturing and Time postponements (Zinn and Bowersox, 1988).

Dell is a very good example for manufacturing postponement strategy because of its build to order online store. Dell creates a new retailing system with rapid growth and profits which is almost non-existent in the physical retailing world. Dell does not make products and save the finished goods in stock, and it does not have stores or any other outlets. Instead, Dell sells directly online or via call centers to individual customer. It buys modules and does not do the final assembly of products until actual customer orders have been received. It also provides customers with customized products which are delivered directly within a number of days (Remko and Hoek, 1998).

Published literature has revealed that postponement has its own advantages and challenges. It does not benefit the companies all the time. Previous study showed amount of theories and case studies. The reasons underlying the use of postponement and how to implement it successfully have been of great interest to many researchers, such as Gubi(2005), Federgruen (2001), Bucklin(1965), Bowersoxand Closs(1996), VanHoek(2001). In 2001, Van Hoek identified gaps in the existing literature and mentioned five challenges for future postponement researchers:

- Postponement as a supply chain concept
- Integrating related supply chain concepts
- Postponement in the globalizing supply chain
- Postponement in the customized supply chain
- Methodological upgrading of postponement

From then on, the literature of postponement started to go to different directions and has grown significantly. In this study, postponement as a supply chain concept is what we focus on.

1.1 Problem Definition

The issue focused on this research is the benefits and challenges of postponement strategy within the supply chain.

Postponement strategy which plays an important role in nowadays becomes one of the favorite options for more and more manufactures and logistics firms with various benefits, such as cost reduction, scale benefits, efficiency, and flexibility etc. However, postponement strategy is not positively perfect for it also brings risks, for example, potential to lose customers, Managerial changes and costs causing by implementing the postponement strategy in the supply chain.

The existing researches have variety of theories on the postponement focusing on the different angles, such as dissimilar study purposes, cases selection and analyze methods, etc. As a result, some of the views are basically similar or support each other mutually, as well as the others can even be entirely opposite.

So as to analyze the postponement strategy in reality, getting the knowledge of various points of the postponement in supply chain must be the foundation. With the basis of postponement analysis within the related research paper, the definition, types, drives benefits as well as the challenges of postponement strategy will be studied and discussed theoretically.

The study of the three real cases of postponement in supply chain will lend support to either the previous theories completely or at least the points of views inside, and more importantly, it can supplement the original point of view in order to expose the practical problems. With the help of the cases study involving both Europe and Asia, the paper will get a clear picture of the problems while the postponement strategy is implemented. Ultimately, based on the research step by step above, the benefits and challenges after implementing postponement strategy in reality will be discussed.

1.2 Purpose of Study

As the globally competition intensified, reducing the costs as much as possible and containing customer satisfaction at an acceptable level simultaneously become the common tasks for every company along the supply chain. Since the postponement strategy was proposed with the performance as cutting down the inventory and transportation costs, more and more companies have shown their preference on it. However, the problems become disclosed and highlighted recently, that is problems relating to whether postponement works for all types of companies and if and how it benefits the company all the time.

Based on the research both theoretically and practically, this research paper aims to not only dissect the definition, types, drivers of postponement strategy, but also come up with the benefits and challenges on implementing the postponement strategy, in order to help reduce the manufacturing cost, inventory cost, and transportation cost, smoothing the entire supply channel and improving the customer satisfaction and the level of service in the industry as a whole.

This study will compare the theoretical benefits and challenges of postponement strategy and the implementation of postponement in real cases.

1.3 Research Question

In response to the problems outlined above, this paper integrates the purposes into the research questions shown below.

1) What are the drivers, benefits and challenges of applying postponement?

2) How do the studied cases compare to existing theory on postponement?

1.4 Limitation

This paper mainly refers to the articles from 1998-2006, it did not consider the new recovery and theories. Another limitation is that most of the articles mentioned in this paper are from Journal and not many other types of publication were taken into account. In addition, this study is exploratory in general, and more empirical data is needed to further validate the postulated results.

2 Literature Review

Supply chain management strategies have the common goal, although the methods to achieve them might be varied, that is reducing uncertainty and cost. Postponement is a way attempting to do both (Boone et al., 2007).

2.1 Defination of Postponement

Postponement is a concept whereby activities in the supply chain are delayed until a demand is realized (Van Hoek, 2001). It refers to delaying the decision-making process about a product. In order to better match between the inventory and orders, it is better for a company to delay commitment to finish the final product with specific characteristics (Rietze, 2006). It does not mean postponement is related to incompleteness; instead postponement is a strategy that delays the execution of an activity internally (Yang et al., 2004). It is widely used by many industrial giants, such as Xilinx, HP, Mars, Motorola, Toyota, Gillette, Benetton (Brown et al., 2000; Van Hoek, 2001; Yang et al., 2004).

Postponement can be searched as a single company's perspective, but its range can be expanded to the whole supply chain level (Huang and Lo, 2003; Nair, 2005; Pagh and Cooper, 1998; Yang and Burns, 2003). Figure 1 shows the spectrum of opportunities for postponement that extends from procurement to distribution.

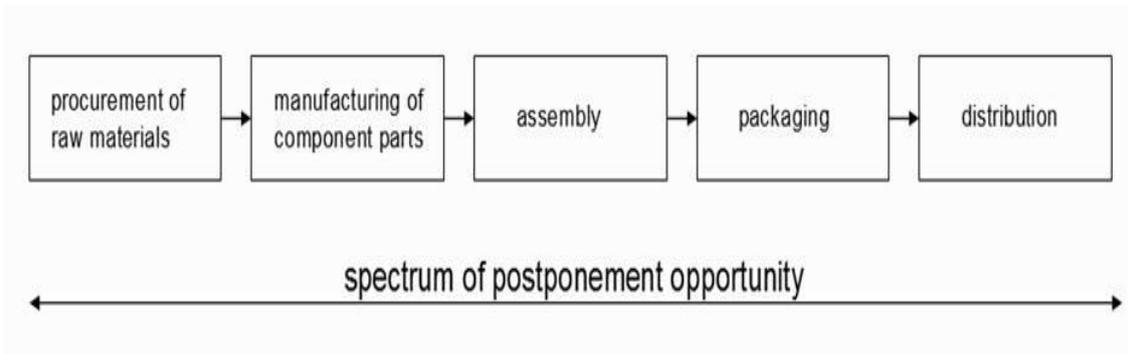


Figure 1 Spectrum of postponement opportunity

2.2 The History of Postponement Strategy

Postponement is not a new concept, instead, it has a long history of practical business application back to the 1920s (CLM, 1995). Postponement refers to delaying activities until the latest possible point in time. As the environment became highly competitive, companies naturally looked for ways to better respond to the rapidly changing markets. In order to satisfy customer’s ultimate requirements, postponement has been brought as an important method to achieve it (Lacocca Institute, 1991).

Postponement first appeared in academic literature was in 1950. Alderson stated that by postponing a differentiating stage of the production, the total costs would be reduced (Alderson, 1950). Later in 1965, Louis Bucklin put forward a new concept of postponement by seeing it as an opportunity to reduce the risk and lower the uncertainty. He argued ” a speculative inventory will appear at each point in a distribution channel whenever its costs are less than the net savings to both buyer and seller from postponement”(Bucklin,1965; Rietze, 2006).

Zinn and Bowersox presented their five specific types of postponement in 1988, labeling, packaging, assembly, manufacturing, and time, which is continually used by today’s postponement theories (Zinn and Bowersox, 1988). According to Zinn and Bowersox, manufacturing postponment has a great postential to save cost in inventory, which occurs when shipping parts to the finishing center, because it can increase the value through the addition of each successive component (Zinn and bowersox,1988; Rietze,2006)

Later on, Swaminathan and Lee go further about the reacher and found the factors that

have big influence on the costs and benefits of postponement, including market factors, process factors, and product factors. Market factors are about demand and uncertainty. Process factors are about two parts, which are internal factors, such as operating policies within the companies and external factors, such as the location of the suppliers and managerial support (Swaminathan and Lee, 1998).

Around that time, some researchers consider postponement mainly as is mainly a pragmatic means to move towards mass customization (Feitzinger and Lee, 1997; Kotha, 1995; Lampel and Mintzberg, 1996). However, other people argued that postponement is a useful tool to achieve leanness and agility in the configuration of global supply chains and virtual logistics (Clarke, 1998; Christopher, 1992; Christopher and Towill, 2001; Cooper, 1993; Van Hoek, 1998). The researcher holding different opinions classify postponement into different types, and it is summarized in Table 1.

2.3 Types of Postponement

Table 1 Types of postponement

Zinn and Bowersox (1988)	Labeling postponement, packing postponement, assembling postponement, manufacturing postponement and time postponement
Bowersox and Closs (1996)	Time postponement, place postponement, manufacturing/form postponement
Lee (1998)	Full postponement, logistics postponement and form postponement
Pagh and Cooper (1998)	Full speculation, logistics postponement, manufacturing postponement and full postponement
Brown et al. (2000)	Product postponement and process postponement
Waller et al. (2000)	Upstream postponement, downstream postponement, product postponement and place (distribution) postponement

Yang and Burns (2003)	Engineering-to-order, buy-to-order, MTO, assemble-to-order, MTS, ship-to-stock and make-to-forecast
Yang et al. (2004)	Product development postponement, purchasing postponement, production postponement and logistics postponement
Hill John M. (2004)	manufacturing, assembly, configuration, or logistics operationsh
Rietze (2006)	manufacturing and assembly postponement, and logistical postponement

Labeling postponement refers that using a label distinguish standardized products by brand. Packaging postponement is best for products varied by package size, paint, chemicals, medicine, razors, and so on. Assembly postponement is applied to products which have various cosmetic features like cars, iPods, t-shirts, and printers (Zinn and Bowersox, 1988). Bowersox and Closs (1996) mention three types of postponement:

1. Time postponement which involves the delaying of activities until orders are received in time.
2. Place postponement means the delaying of moving goods downstream in the chain until orders are received, which refers to keeping goods centrally and not making them place specific.
3. Form postponement which delays of activities that determine the form and function of products until orders are received.

According to Pagh and Cooper, Full postponement is defined as "using make-to-order (MTO) in manufacturing and centralized inventories and direct distribution in logistics; in contrast, full speculation is defined as using make-to-stock (MTS) in manufacturing and decentralized inventory in logistics" (Pagh and Cooper, 1998).

Product postponement refers to delay the set of the product's specific functionality design

until the customer receives it. Process postponement can be divided into two steps; first is to manufacture a generic part and the second step is to customize the generic part to make the final product (Brown et al., 2000).

On a supply chain level, upstream postponement means manufacturers receive the customer's order first, then to order raw materials from suppliers; in contrast, downstream postponement means the product will be changed physically after it leaves the primary manufacturing step (Waller et al., 2000). Finally, purchasing postponement refers to delaying the purchase activities until the demand is known, including components or raw material (Yang et al., 2004).

Rietze (2006) considers only two general types of postponement as a supply chain concept: manufacturing and assembly postponement, and logistical postponement. He said in 2006 "Manufacturing and assembly postponement involves the engineering of a product as a module or platform which can take on several different features thereby increasing the variety of end products". In a report on the fundamentals of product modularity, Tung and Ulrich defined five levels of manufacturing and assembly postponement:

1. Component-swapping modularity – designing the components to fit the standard. Example: car tires, radios, vacuum cleaner attachments.
2. Component-sharing modularity – standardizing the components to fit the different platforms. Example: batteries, power sources, plugs, microprocessors.
3. Fabricate-to-fit modularity – changing a specific quantity of finished product from a batch of bulk product tailored to customized dimensions. Example: bulk goods, plastic sheeting used between layers of glass, clothing, electric cable wires.
4. Bus modularity - serving as a vehicle to accept one or more different varieties of components. Example: computers, cars.
5. Sectional modularity – combining the components with their interfaces. Example: Logos, construction pipe, tubing, scaffolding (Rietze, 2006).

Logistical postponement can be connected to all other types of postponement including packaging, labeling, and distribution. Packaging and labeling postponement is mostly used by the companies whose products are small consumer goods like razors, batteries, compact disks, film, and snack foods. Large retailers, like Wal-Mart, require different

configurations of packages to fulfill its customer demand and shelf space capacity. Gillette is well known for their packaging postponement operations. In 1996 Gillette made a decision to outsource its packing for its health and beauty products to Sonoco. Large quantities of products are sent to Sonoco waiting for the final packaging. After receiving the order, the company packages the products and ships the product to retailers (Rietze, 2006).

2.4 Drivers to Adopting Postponement

In today's market, many manufacturers' primary goal is to satisfy customers. Consumers are empowered by interactive media and technologies with the power to let their voice get heard in product design and performance. However, customers do not want to pay more or wait longer time to get high level of customization. It makes the companies have to face the increasing cost pressures and shortened product lifecycles. Considering this situation, many companies started to adopt postponement strategy. Figure 2 shows the drivers to consider a postponement strategy (Matthews and Syed, 2004).

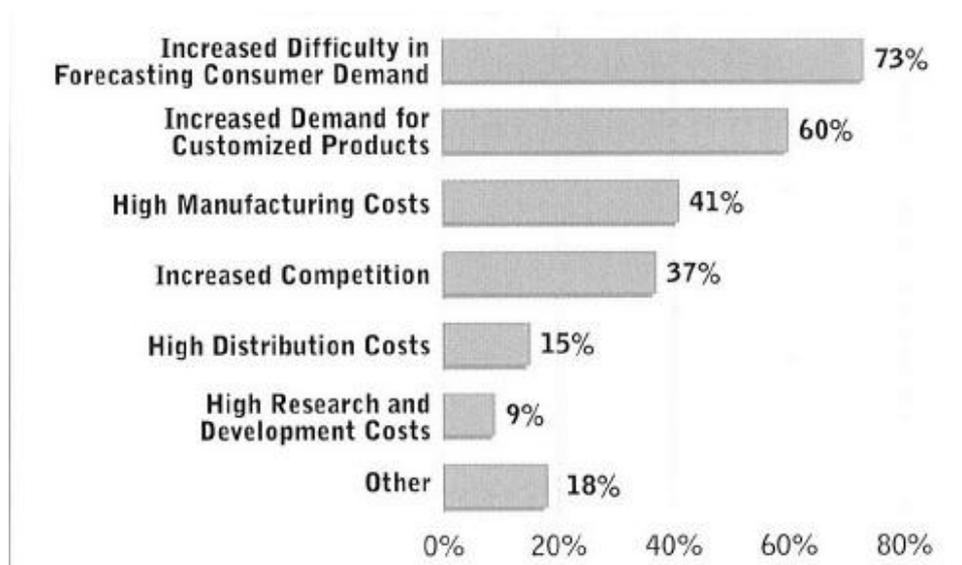


Figure 2 Drivers to adopting postponement

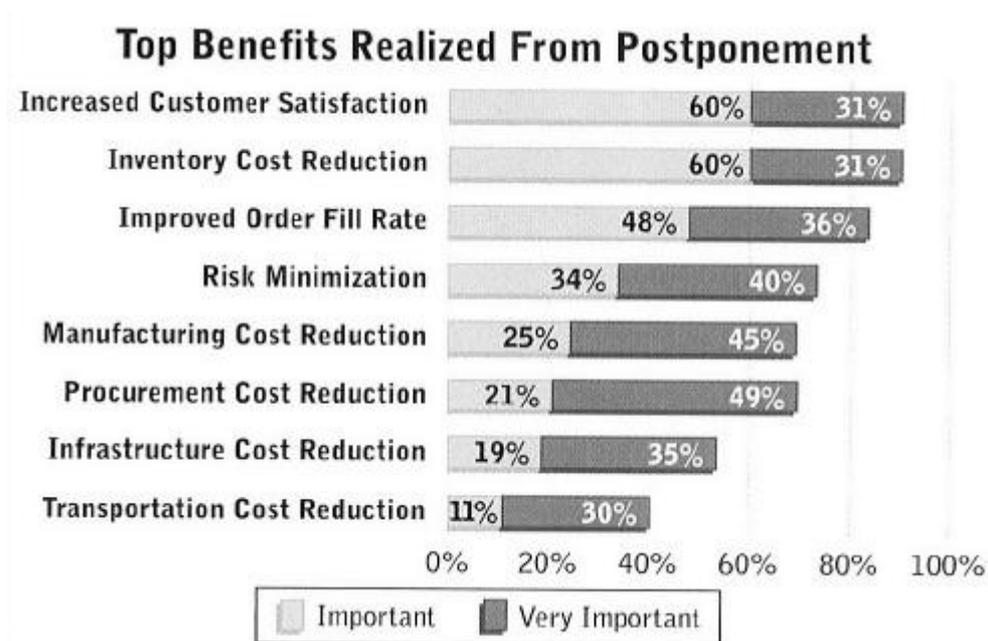
Source: APICS Membership Internet Survey, August 2003

According to the survey, 73% of respondents consider increased difficulty in forecasting consumer demand is the primary driver to adopting postponement strategy. High manufacturing costs and increased competition are also important factors drive companies to consider adopting postponement. In addition, the willing to reduce the increasing

distribution costs is also a big motivation for implementing postponement (Matthews and Syed, 2004).

2.5 Benefits of Postponement

Postponement has many potential benefits to the manufacturers. According to the survey from APICS Figure 3, from some of the companies that have adopted postponement strategy, increased customer satisfaction and inventory cost reduction are the top benefits the companies have after implementing postponement (Matthews and Syed, 2004).



Figur 3 Survey on top benefits realized from postponement

Source: APICS Membership Internet Survey, August 2003

1. Reduction of inventory and storage costs

Study shows that postponement can help improve responsiveness by reducing inventory , transportation and storage costs (Yang et al., 2004).

Reduction in inventory under a fixed level of service is a benefit of postponement. Keeping too much products in storage may cause higher inventory costs. Postponement can help

minimize the inventory. Holding safety stock ensures better customer service and reduces the storage and inventory costs (Rietze, 2006).

2. Increasing Customer Satisfaction

Customer service satisfaction is related to lead time - how long it takes an order to arrive, and item fill rate - how often orders are filled from inventory on hand.

Postponement strategy can help to improve the manufacturing processes or shorten the distance between customers and manufacturers, therefore providing a short lead time to increase the customer satisfaction. Customers' willingness to wait is a key factor when assessing a product for postponement and determining the location of the postponement point within the supply chain (Rietze, 2006). If customers are only willing to wait, for example, one week, then the manufacturer must do some change about the structure so that the finishing lead time and delivery time is less than or equal to one week. Therefore, the manufacturer can better fulfill the requirements with short lead time (Matthews and Syed, 2004).

3. More Variety

Having variety can be closer to customers' preferences and increase the sales, even sometimes heightened the price (Benjaafar et al., 2004). Postponement allows for more variety by standardizing the product and holding intermediate product inventory (Rietze, 2006).

4. Better forecast accuracy

Postponement can lead to better forecast accuracy through delaying the final customization of a product until more information is realized. This way allows forecasters to make better predictions of finished product demand. In order to make better forecast, it is also necessary to know the feature of the product (Rietze, 2006).

5. Increasing the flexibility level

postponement increases a company's flexibility level to fast respond to the change of demand and minimizes the inventory. (Hill,2004).

.for example, postponement can help companies attain agility with the three following contributions:

- Customization of products and services
- Use of customer order information through the supply chain
- Cross functional efforts (Van Hoek, 2000).

Other benefits were mentioned in the survey too, such as improved order fill rate and risk minimization (Matthews and Syed, 2004).

2.6 Challenges of Implementing Postponement

Although postponement has many potential benefits, it also faces many challenges. Companies sometimes cannot afford to implement postponement in logistics. It is because postponement requires a fast and responsive transportation system and it can thus lead to a significant increase in transport cost (Christopher, 1998).

In addition, it may not work for some types of companies, like economies of scale associated with make-to-stock, because it can make the product more expensive (Hill, 2004).

According to the survey from APICS challenges in implementing postponement (2004), Figure 4 difficult to align organizationally, too much of management time, too complex to implement, and too costly to implement are also the challenges that happen when implementing postponement.

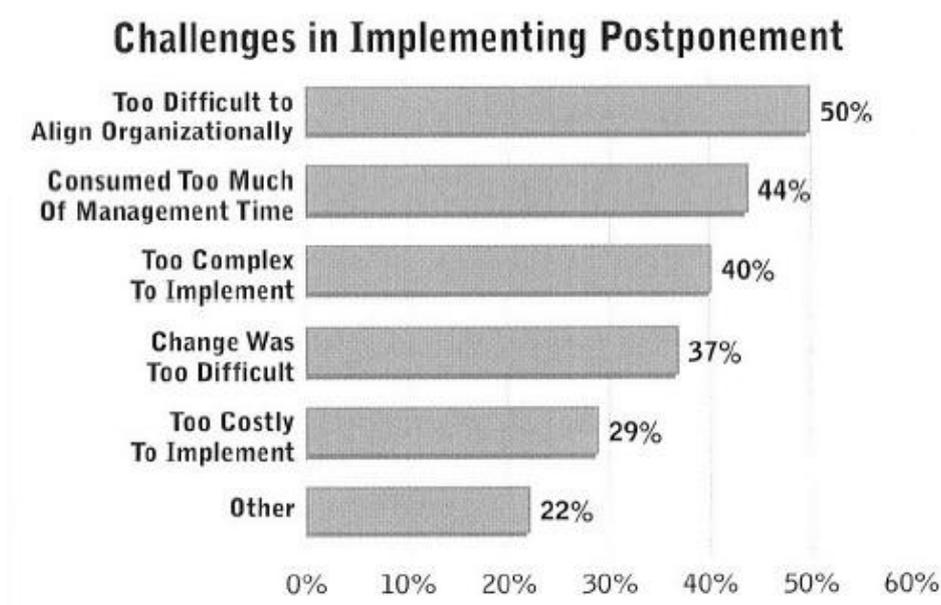


Figure 4 Survey on challenges in implementing postponement

Source: APICS Membership Internet Survey, August 2003

3 Methodology

3.1 Research Strategy

The main purpose of a research determines what kind of research methodology needs to be used. Nyamongo (2001) said “Qualitative research seeks to understand a given research problem or topic from the perspectives of the local population it involves. Qualitative research is especially effective in obtaining culturally specific information about the values opinions, behaviors, and social contexts of particular populations”.

Qualitative research is a type of scientific research. It has the following characteristics:

- seeks answers to a question
- Systematically uses a predefined set of procedures to answer the question
- collects evidence
- produces findings that were not determined in advance
- produces findings that are applicable beyond the immediate boundaries of the study

Quantitative and qualitative methods have some key differences:

- Quantitative research is mainly about to quantify variation, to predict causal relationships and to describe characteristics of a population. Qualitative research is mainly about to describe variation, to describe and explain relationship, to describe individual experience and to describe group norms.
- Quantitative research's question format is closed-ended. Qualitative research's question format is open-ended.
- Quantitative research's flexibility in study design is stable from beginning to end. Qualitative research's flexibility is flexible from some aspects.

In this master thesis, the main purpose is, by reviewing the issues in the process of the applications of postponement strategy, so qualitative method is more suitable.

There are three most common qualitative methods:

- *Participant observation* is appropriate for collecting data on naturally occurring behaviors in their usual contexts.
- *Semi-structured interviews* are optimal for collecting data on individuals' personal histories, perspectives, and experiences, particularly when sensitive topics are being explored.
- *Focus groups* are effective in eliciting data on the cultural norms of a group and in generating (Denzin and Lincoln, 2000).

During this paper, semi-structured interviews are used in all the three cases via email, phone calls and skype interview.

3.2 Research Approach

Different approaches can be used for conducting qualitative research. For this research, literature review and cases analysis within the qualitative method are adopted.

The thesis can be divided into three parts: literature review of the current theories, cases analysis focused on postponement applications, and then coming up with the proposal of the possible solution to the issues.

3.2.1 Literature review

All the articles we reviewed has been already published. We approached the scientific articles by using ABI/INFORM Trade & Industry (ProQuest) database and International Journal of Logistic. We can clearly see the current theories by searching these articles and make a good foundation to compare with the practical cases later on.

3.2.2 Cases

To explore the issues of the postponement application, we choose three cases to analyse. Interview, emails, review of the typical cases were involved in the process. The cases we choose are all international related cases. The first case comforsystem is the local case in Jonkoping, Sweden. The second case is Arctic treasures, that is a trading company importing products from Canda and selling it in China. The last case is Zhongping Wood, which is a local Chinese company producing products in China and selling it in both China and the United States.

These three Cases are from different countries and doing different business. The purpose to choose these three cases is to see if the postponement strategy is useful in different areas, for example Europe and Asia.

During the research, the authors mainly interviewed the swedish company face to face and the Chinese companies by Skype and email. For the fist case ComfortSystem, we interviewed Bossen Rickman, who is the CEO of ComfortSystem, and Viktor Dembacke, who is the Logistics Manager at CS. In addition, Anna Olsson, who is the Logistics Manager of Bengtssons Mekaniska which is one of the suppliers of CS was interviewed by email. For Arctic Treasures, Yun Zhang, who is the Logistics Manager was interviewed by emails and skype video interviews. The last case, we interviewed two persons, one of them is Li Han, the Logistics Management of the company, and Min Lee, the Project Manager of the Company.

3.3 Validity and Reliability

Patton (2001) states that validity and reliability are two factors which any qualitative researcher should be concerned about while designing a study, analysing results and judging the quality of the study.

Validity is to measure the degree to which they accomplish the purpose for which they are being used (Worthen et al., 1993). In the research, we increase the level of validity by organising the literature review and analysing the relevant cases. In addition, all the scientific articles and cases are used to present the main purpose and research questions.

Reliability is used to measure of how stable, dependable, trustworthy, and consistent a test is in measuring the same thing each time (Worthen et al., 1993). The authors used the primary data like interview and company's presentation and also used the Database and scientific journal to support the theories.

4 Case Studies Presentation

Based on the theoretic level, companies which implement postponement strategy can benefit from it and face the challenges at the same time. Three cases are discussed in this part, revealing the issue when implementing postponement in reality and test the theories.

4.1 ComfortSystem

ComfortSystem(CS) is located close to Jonkoping, Sweden with the business idea as developing and maintaining productivity to sell special beds for those who need them - mainly for the health sector both in Sweden and abroad (ComfortSystem, 2011). In other words, CS primarily provides special bed systems for disabled and elderly people in order to make their live easier, for example lifting their legs up or sitting up in the bed by themselves with the help of the integrated electrical engines rather than the others.

CS was established in 1987 located in Huskvarna, Kaxholmsvägen 18, Jönköping Kommun, which provides them a central place to operate and to control their supply chain when the situation requires.

Acting as the second largest firm within Swedish market, CS is responsible for a market share of approximately 35%. Meanwhile, CS also serves the markets of some other European countries and some far east countries as well.

4.1.1 Products

Qvintett bed is main product of CS, which has been put into market since 1996 and become a well known product among communities and elder care facilities with a

reputation for its high quality. The beds have a life expectancy of 12-15 years and are guaranteed a 10 year warranty.

There are three main parts of the bed frames in the production. The chassises are on 5 different models while liftings are in 2 different models and the bed itself is in 3 different models. This composition provides customers 30 varieties (5x2x3) of Qvintett beds combining with 4 different widths of mattresses which are 80cm, 90cm, 105cm and 120 cm with the standard length of 200cm. It means that CS has 120 variations of beds in total (5x2x3x4).

CS differentiates their products into 2 categories which are base production and bulk orders, based on the common orders and requirements. As the most popular products, 8 types bed with 90cm-width only are counted as base production while the other products are usually ordered with huge quantity and relatively looser requirement on the lead time.

4.1.2 Customers

CS sells its products to communities and private elder homes mainly in Sweden. CS also expands its business abroad and it markets its product all over in Scandinavia such as Denmark, Finland and Norway. Moreover CS has British, Dutch and Japanese customers as well. Apart from communities and private elder homes, CS sells to county councils that provide special products for people with disabilities for free of charge.

Historically their customers consisted mainly of community governments however nowadays CS's customer mix is shifting more towards the private sector due to the increasing numbers of new private elder care facilities. This poses new challenges for the firm as it must adjust its marketing operation to service better this new market. However, too much adjustment was not necessary because the product does not vary between the two markets and the firm's logistical operation can satisfy both markets.

4.1.3 Supply chain

In 1991, ComfotSystem overhauled and rebuilt the production and operational systems and began to outsource the manufacturing and assembling of their bed frames. Till now, the manufacturing of all components of their beds has been outsourced and CS is in charge of managing a warehouse where they store the finished products and from where they

coordinate with outbound logistical operations. Since then, the core tasks and main activities of CS turns to be marketing, product development and business development.

CS cooperates with 5 main suppliers producing and assembling the components of beds which are Bengtssons Mekaniska, Wigells, CM Elektronik, Textil Interior and Linak, and some other small suppliers. The following figure (Figure 5) shows both the physical flow and the information flow between CS and its suppliers and customers.

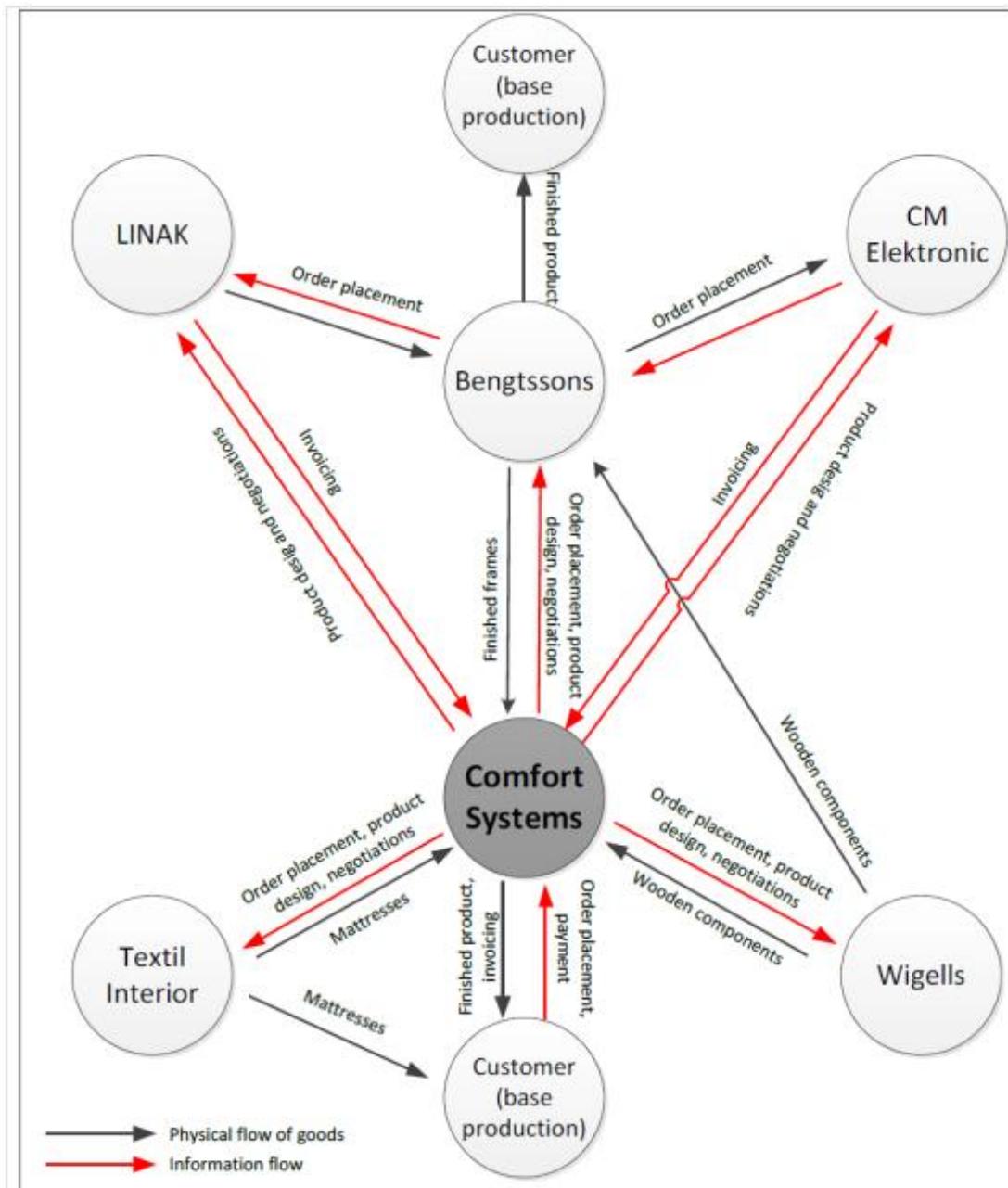


Figure 5 Physical and information flow within CS's supply chain

Among CS's suppliers, *Bengtsoons* is located 40 km from CS which is responsible for the manufacturing of most components, such as the metal components for the bed frame, and final assembling as well. *Bengtsoons* also produces the frame for electronic parts for *CM Elektronik* when additional components are required during final installation at the customer's site.

Wigells is located 50km from CS. They are specialized in producing wooden components for the beds. *Wigells* transports the wooden components to CS and also to *Bengsstons*. From transportation point of view, it turns out to be cheaper for CS when wooden parts are shipped to *Bengsstons* and then directly delivered to customers because *Bengsstons* is located 15km from *Wigells* instead of 50km.

CM Elektronik is located 30km from CS providing the electronic components for the bed. The orders for these parts are always placed by *Bengtssons* during the manufacturing process, however, *CM Elektronik* engaged CS directly in design and negotiation matters.

Textil Interior is located close to *Bengtssons* supplying the mattresses. CS works directly with *Textil Interior* in order to complete and improve placement, price negotiation and design. Mattresses are never delivered directly to *Bengtssons*, they are delivered either to CS's warehouse or directly to the customers.

Linak is based in Denmark providing the engines and actuators used to position the bed. These products are delivered to its sales office in Stockholm and from there to *Bangtssons* for assembly. *Linak* is also engaged CS directly in design and negotiation matters.

Based on the interview with the logistics manager *Viktor Dembacke*(2011-09), the short delivery times is one of their major advantages. In order to satisfy the most customers with the requirement of keeping the delivery time within 5 days, ensuring enough safety stock becomes necessary. However, it is practically impossible because there are 120 kinds of beds as mentioned above, while CS's warehouse facility has a finite capacity, approximately 250-300 beds, and the company tries to control their stock under 150-200 at any given time.

Hence, CS divides their products into two categories - base production and bulk orders. The former is promised with the short lead time. All the other models are usually ordered in

bulk order with the lead time of 4 weeks usually, or delivered for the long-term contractors' orders which has been scheduled for 1 or 2 years ahead.

4.2 Arctic Treasures

Arctic Treasures (AT) is also known as Beijing Beijibao Technology Development Co., Ltd located in Beijing, China. AT as a trade company imports the refined Seal Oil from Canada to China and attempts to expand Chinese health care product market. Arctic Treasures presents their mission simply as introducing the outstanding products and technological achievements, Refined Omega-3 Series, to China.

With the increasing care on health in nowadays society, the health care product become more and more popular. Thus, in recent years, there are large amount of companies either import health care products or produce by themselves. Among them, Arctic Treasures is the sole owner of invention patent of Refined Omega-3 Series and the sole owner of the right to import Refined Omega-3 Series (Arctic Treasures, 2012).

At the beginning, AT imported small batches of the complete Refined Omega-3 Series products with complete set of original package and so on. With the market developing, the demand became steady. AT builds the stable supply chain and transfers its business from importing manufactured goods alone to purchasing the core component (refined Seal Oil) and raw materials, and processes to the finished products. Now, AT has already account a large market share and still keeps growing.

4.2.1 Products

Arctic Treasures processes and sells 11 species of health care products currently with the foundation of refined Seal Oil, but the 3 of them, YiKang, Yifu and Yijin, have become their best seller since they got into market 6 years ago and they are responsible for the majority sales. As a result, the following research will focus on these 3 typical kinds of products.

Today, according to many scientific research reports, the sub-health and many diseases are mainly caused by fat metabolism, lack of double-stranded multi-carbon Omega-3 polyunsaturated fatty acids. In Canada, the Omega-3 series contains essential EPA, DPA, DHA, are refined from the Seal Oil with the world's unique low-temperature extraction technology (Arctic Treasures, 2012).

All of the 3 typical products can help cleaning the fat in blood vessels and enhancing the human immune system, however, in fact, YiKang, Yifu and Yijin focus on different diseases individually.

All of YiKang, Yifu and Yijin have 2 specifications in size, medium packaging containing 60 capsules each bottle and large packaging containing 120 capsules each bottle.

4.2.2 Customers

The target markets of Arctic Treasures are the middle to high class with health consciousness mainly in Beijing, Tianjin, Hangzhou and the northeast area of China.

Hypertension, cardiovascular disease and diabetes become common diseases in China, especially in the relatively developed cities. The majority of the patients are the middle-class and the rich because of their unhealthy lifestyle and dietary habits. Now, more and more of them realize the impotence of health and they can afford the better health care products at the same time, which are exactly the reasons why they become the target market of AT.

At present, AT has a stable source of customers. AT does not only focus on attracting new customers, but also on building customer loyalty by high level of after-sales service and so on so old customers account for a large share of sales.

4.2.3 Supply chain

In the beginning of the establishment, Arctic Treasures imported the manufactured products including the complete capsules, finished bottling, packaging and labeling. All of these production are completed in Vancouver, Canada.

The goods were transported from Vancouver to Beijing by ocean shipping and trucks. During that time, Beijing was the main market so there was only one warehouse in the suburb of Beijing.

Nowadays, Arctic Treasures import the refined Seal Oil from Canada only. Then, AT purchases the empty capsules, bottles, boxes and prints the labels in China. Arctic Treasures produces the seal oil capsules by themselves and stores in 2 warehouses in Beijing. The smaller rental warehouse is used for storing the refined Seal Oil, 6 types of bottles (3 kinds of products with 2 different size for each) and other components with no

employees there. The other warehouse is larger acting as a factory of seal oil capsules also. When the order arrives, they start to complete bottling, labeling, packaging according to the order, and make the delivery.

Besides, the customs duty on the completed health care products are much higher than the duty of the Seal Oil only. The saving in purchasing, transportation, inventory and so on reduces total cost of products, which increases the benefits for AT.

4.3 Zhongping Wood Co. Ltd

Zhongping Wood Co., Ltd is a Chinese company located in Yichun, Heilongjiang Province. Heilongjiang Province is famous of its abundant wood resources, and Zhongping Wood mainly produces wooden product. When the company was just founded in 2003, it only focused on Chinese market, and then started to have American customers who become the key customers later on. Therefore the company has to make a change about its strategy and management system to adjust the new situation. As the customers increase, the company expands its scale from one factory to three, and purchased new technology equipments. During the last ten years, Zhongping Wood have overcome many difficult problems, including paying big amount of compensation, losing customers, and facing highly competitive environment. Now, it has good manufacturing and transportation system, and it becomes one of the most promising companies in Heilongjiang with government's support.

4.3.1 Products

The main product of Zhongping Wood is chopsticks. In the beginning they bought wood from the government and made floors, simple furnitures and use the left wood to make chipsticks. Later on, they found out the floors and furnitures markets' competition is very keen and the company did not have big profit. So they started to buy the left wood from other factory and started to mainly make chopsticks. The chopsticks it made was only for chinese restaurant in China Mainland until more and more american customers showed up. So Zhongping Wood bought new machines to make the product more variety. Nowadays, Zhongping Wood makes two types of chopsticks; one of them is comparely simple to supply to the chinese restaurants(middle to small size) in the middle of China Mainland, the other type is comparatively high standard chopsticks provided to the Chinese

restaurants in the United States. All the covers of the chopsticks are bought from Jilin which is in the neighbor province.

4.3.2 Customers

Zhongping Wood's customers can be mainly divided into two types: Chinese customers and American customers. When the company was just founded, Chinese customers are the only customers, however, recently as the chinese food gets more and more popular, the American customers make the order no less than Chinese cutomers. Heilongjiang Province is in the North East of China, and the main cutomers in China are in the Middle East of China. Most of them are the owners of small or middle size of restaurants which does not require high standard chopsticks. They contact the company every 2-3 months by themselves and Zhongping Wood sends the chopsticks to the train station of their cities. The American customers are mainly in the West of the United State, and most of the customers are the international trade companies instead of the owners of the restaurant. Therefore the American customers usually make big orders. They require the chopsticks to be in a comparatively high standard and the covers should be in English instead of Chinese. In addition, the company sometimes gets special order too, such as make special marks on the chopsticks or special covers with specific words on them.

4.3.3 Supply chain

Zhongping Wood used make-to-order strategy from 2003-2005. First it is because in the beginning time, chopsticks are not the mainly product in the company. Second, the company did not expect to get a big amount of orders of chopsticks. Finally, the company considered the customers with special requirements. Make-to-order can fulfill all the requirements from customers. During the two years, the orders became more and more, and the company found some problems:

1. When the order is very small, it is costly to start the machine to make a small amount of chopsticks.
2. Sometimes the company sent chopsticks to the same city within 2 days but can not combine the product to transport because the factory did not have enough chopsticks in stock as using the strategy make-to-order. It makes higher transportation fees

3. The company lost some customers because the factory could not provide a big amount of chopsticks in a short time.

4. The number of customers with special orders are very few, and most of the customer orders standard chopsticks.

Considering this situation, and the increasing orders from the United States, from 2005, Zhongping Wood started to mainly focus on making chopsticks and change the strategy from make-to-order to make-to-stock, and it made the company have big profits and expanded to three factories.

However, after 5 years, new problems showed up.

1. The increasing of the transportation fees gave the factory a big pressure. Because Heilongjiang is the very end province in China, the transportation is not so convenient, and the main Chinese customers the company have are in the east middle, there are not many choices for the companies. These years, the transportation fee is getting higher and higher and it made a big problem for the company.

2. Long distance transportation makes the risk higher. Zhongping Wood delivered the chopsticks to the train station for the Chinese customers, while delivering the product to Tianjin Port from where the products go to San Francisco in United States. Delivering products inside China does not have so many difficulties. Even sometimes the product is delayed by one or two days, it is still acceptable by the owners of restaurants. However, the ship goes from Tianjin port to San Francisco does not wait for the products delayed because of the bad weather. The company have paid higher transportation fees a few times and have paid big amount of compensations too, which caused a big loss.

3. It is hard to make prediction for the company. Sometimes the factory stocked too many chopsticks and the quality might get bad if stored for a long time with bad condition, for example, the degree of air humidity is too high can make the chopsticks bended.

The company made a decision after a long discussion of the current problem in 2010. They decided to rent a warehouse in Shijiazhuang which is in the middle east of China. The company delivers the chopsticks based on the prediction of the demand. The covers supplier delivers the cover to the warehouse directly. The warehouse is responsible for the

final packing and delivering the chopsticks to the Chinese customers and the Tianjin Port. The transportation fees from the new warehouse are much cheaper than it before and it minimizes the transportation risks. Although renting the warehouse costs money, the company's future is more promising in a long run. The Logistic Manager Mr. Han said" in 2010 we did not make profits because we just changed to a new supply chain and many adjustment have taken place. However, in 2011, we has already saved 8% transportation cost totally, I believe our company has a bright future".

5 Analysis Based on Case Studies

The three cases from Sweden and China display the postponement implement in reality world. Benefits and challenges were usually concomitant. The following analysis show the differences between the three cases.

5.1 ComfortSystem

ComfortSystem has totally changed its manufacturing model, and successfully manage it for many years. Analysing this case can reveal the issues that can happen during the implementation of postponemen strategy.

5.1.1 Drivers of applying postponement

The conflicts in forecast and inventory - It is one of the most attractive strength of CS to squeeze its lead time into 5 days, which improves the level of customer satisfaction. As a result, accurate forecasts on customer demands of each different products and sufficient stocks are apparently required. However, the fact is that the more focus on the specific product varieties, the more violent the demand fluctuation will become, and the harder the forecast will be gotten. Meanwhile, increasing safety stock is evidently conflicting with the situation of limited warehouse space and the needs of reducing inventory cost.

The growing demand of mass-customization - When CS gets an order, it may have to unpick and reassemble the finished products if the existing products cannot fulfill the order, which will cost additional loss.

The desire of reducing transportation cost - The transportation cost could be high if CS assembles all the components by itself in its own plant by transporting every component to

it because some suppliers are far more closer in distance to the main manufacturer or the customers. For example, Wigells is much more closer to Bengtssons so it deliver its electronic components to Bengtssons only instead of to CS; Textil Interior is closer to CS and some of the customers so it deliver the mattresses to either CS's warehouse or the customer directly. The desire of reducing transportation cost drives CS to adjust its supply chain.

The pressure of competition – Although CS account for the second largest market share in Swedish market, there are still many competitors such as Invacare, Proton, Merivara and Care of Sweden. These companies are famous for their bigger size and the serious financial background they possess. On the other hand, for CS, the price pressure is huge and the productivity cannot be maintained in every situation” (Dembacke, interview, 2011-09-20).

5.1.2 Challenges in postponement implementation

Cost - The core business activities and roles of CS has been changed from manufacturing to product designing, marketing, supply chain conducting and managing since it outsourced all of it manufacture. Since then, the postponement strategy is utilized and the supply chain has to be redesign. The functional transformation and the alteration of supply chain cause the management cost and labor treatment cost as well.

Information sharing - In order to change to a new supply chain, CS must encourage information sharing both with its suppliers and customers also. The more information shared, the closer relationship can be built through the supply chain and the deeper postponement level can developed.

Applicability - There are various types of postponement strategy as presented before. However, the specific type of postponement does not adapt to any kinds of firms or any varieties of products randomly because of the various characteristic of the products. In CS case, time postponement cannot be used straightway with the base production or it may lead to lack of stock and lower availability and agility.

5.1.3 Outcomes of applying postponement

CS has outsourced all of the component production since it rebuilt its production and operational systems. CS applies both push and pull strategy aiming at its 2 categories of products individually, base production and bulk orders.

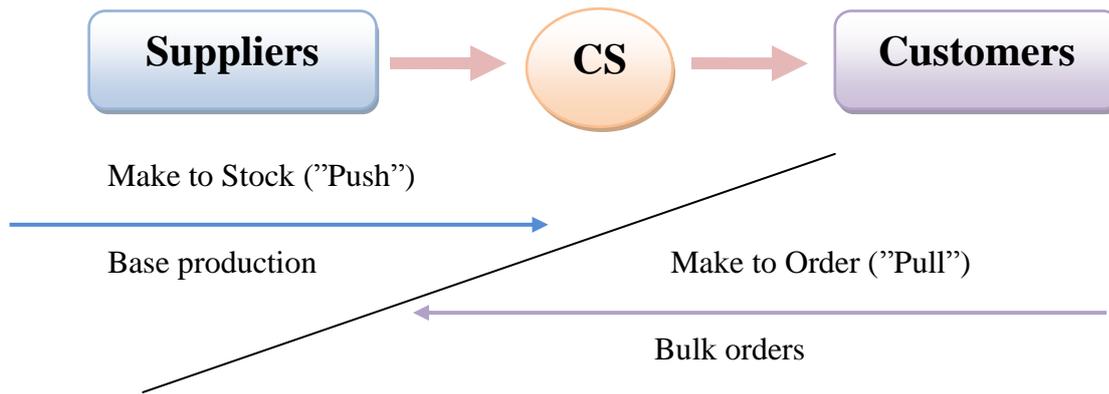


Figure 6 Practice of push and pull strategies in CS's product categories

On the one hand, CS purchases components of the base 8 types beds from its suppliers and store in its warehouse. This "push" strategy utilized to satisfy its smaller and more immediate orders. The base products are ordered the most commonly so the demands are easier to forecast than the other products based on the previous order records. In addition, taking the advantage of applying assembling postponement, CS delays its final assembling to cope with the orders of similar products. In this way, the accuracy of forecast and calculation of safety stock gets improved for the prediction on the sum of components for all the base products is much easier than that on the individual product. The inventory cost is reduced and CS improves its flexibility and the level of customer satisfaction.

On the other hand, for the bulk orders, CS implements purchasing postponement and time postponement with "pull" strategy, which means that CS does not get into the stage of components purchase until the order is available. Additionally, as the components are manufactured by different suppliers and some of them are closer to the customer, it is more efficient and cheaper to delivery the components to the customer directly and to completely finish the final bed at the customer's side. In this way, the CS only purchases, controls the manufacture and transports, and storages 14 varieties of components during the production while actually there can be 120 kinds of beds at last. It is also decrease the transportation cost effectively.

Overall, CS is able to get the benefits, such as lower inventory level and higher flexibility and diversity, with postponement strategy utilized in several links of its supply chain, so that there is possibility to achieve the "mass customization". The lower costs on both inventory and transportation combine with higher level of customer satisfaction, enhance CS's competitive strength.

5.2 Arctic Treasures

Arctic Treasures utilizes kinds of postponement strategy in its new supply chain and get expected results. The drivers, challenges and outcomings of using postponement will be explained in the following part.

5.2.1 Drivers of applying postponement

High cost – The cost was too high for AT to make more profits if it continued purchasing the manufactured products from Canada. In order to reduce the costs, taking use of the local resources is necessary, such as cheaper labor and components. In additional, the high tax cost and overseas transportation cost can be avoided in this way as well.

Flexibility in order fulfillment – There are 3 kinds of products ranging in 2 size. If the differential can be delay to the last time, the flexibility will be increased in fact and the order fulfillment rate will be raised.

5.2.2 Challenges in postponement implementation

In order to change the existing supply chain into a new way, AT must invest in the management cost and labor treatment cost. Besides, AT has to invest in capital assets, such as the new machines to produce the seal oil capsules, to finish the labeling and packaging.

5.2.3 Outcomes of applying postponement

The rebuilt of the supply chain with the postponement in assembling, packaging and labeling, helps the localization become possible, which means that AT can take the advantages of the local resources. In this way, AT reduce the cost in purchasing, transportation and inventory. Meanwhile, AT saves a lot customs duty. The more profits AT gains though the trade.

Additionally, the delay of completeing the final products, increases the flexibility and agility and makes the "mass customization" become possible.

5.3 Zhongping Wood Co. Ltd

In the case of Zhongping Wood, many postponement strategies are involved. The company has implemmented postponement in the very beginning, but it did not work well. Later on the company tried to apply another type of postponement and finally get good results.

5.3.1 Drivers of applying postponement

When considering the reasons that drive Zhongping Wood to implement postponement, high level of inventory, high cost of transportation fees, uncertainty of the demand, competitors and high risks are the key factors.

High level of inventory- During 2005-2010, Zhongping Wood had big amount of inventory. Even though the company has expanded, the raw material, the different kind of finished products still gave the company big pressure.

High cost of transportation fees- Zhongping Wood is located in the very north east of China and the transportation is not as convenient as it is in the middle east of China. Only one train can get to the middle east of China and costs much more than it in other areas. Transportation fees had already become a big cost at that time for the company.

Uncertainty of the demand- The demand is difficult to forecast and Zhongping Wood also needs to order the cover from the supplier. It takes a few days for the cover to arrive; therefore Zhongping Wood had to order more than the amount they needed to avoid the shortage.

Competitors - As the business become better and better, the competitors smell the opportunity. The number of competitors of Zhongping Wood increases from less than 10 to 50, and lower cost is the best weapon to beat them. Therefore, Zhongping Wood started to consider postponement strategy.

High risks - Because of the high level of inventory, it is risky for the wooden product to be on fire. In addition, weather and other bad condition of the railway can influence the arriving of the products too.

5.3.2 Challenges in postponement implementation

The challenges Zhongping Wood have faced are: make-to-order does not work for them, instead it may cause high costs, and adjusting time is needed when applying a new strategy.

In the beginning, Zhongping Wood used make-to-order, it is a postponement strategy, because it delayed the manufacturing until the customer's demand is realised. However, it

does not work for all types of companies. As mentioned before, postponement may not work for some types of the companies, like economies of scale associated with make-to-stock, because it can make the product more expensive (Hill, 2004). Zhongping Wood does not need make-to-order strategy or delay the manufacturing since it does cause more cost. Make-to-stock is more suitable for it, because its orders are big enough and the level of customized is not high at all. When solved this problem, new problems showed up, so the company decided to rent a warehouse in another place.

According to Bowersox and Closs (1996), that is Place postponement which means the delaying of moving goods downstream in the chain until orders are received, which refers to keeping goods centrally and not making them place specific.

Another challenge is that when applying the postponement strategy, adjusting time is needed. Miss Lee is the Project Manager in Zhongping Wood, and she said when the company just started to use the new warehouse in middle east of China, many unexpected problems showed up, for example the two main products were mixed and sent to customers in the United States and it costs a lot of money to fix it.

5.3.3 Outcomes of applying postponement

Zhongping Wood's new system is much more stable now. The benefits of Zhongping Wood now are that it makes more profits with lower level of inventory, lower transportation fees and lower risks.

Mr. Han told us that although in 2010 the company did not make profits because the company just changed to a new supply chain and many adjustment have taken place. However, in 2011, Zhongping Wood has already saved 8% transportation cost totally. That is because in the Middle East part of China, transportation is much more well developed and the cost is much cheaper than it before.

In addition, the inventory level is lowered because Zhongping Wood sends products to the warehouse based on the demand forecast. The supplier is also in the middle east of China, so the risk of lacking of the cover is much lower now. The warehouse is close enough to the Tianjin Port and the risk of missing the ship to the United States is almost vanished.

6 Conclusion and Areas for Future Research

Postponement, as one of the most critical strategies, is utilized by more and more firms no matter in the marketing areas, for example pricing, in manufacturing areas including assembling, labeling and so on, or in logistics areas containing financial, information etc. The concepts of postponement and its types classifying are researched by lots of researchers and as business activities develop, there become more and more new types and better applying of postponement strategy. The majority researches on postponement focus on either the drivers of using it or the huge amount of benefits can be got through a successful using of postponement. On the other hand, although the challenges of applying postponement are as important as the benefits it may bring, there are few attention paid to it.

The main views and opinions mainly on the drivers, benefits and challenges are reviewed and summarized above. As the presentation of methodology, three cases are chosen. The introduction and description focusing on each supply chain of the cases are followed by the individual analysis aiming at the implementation of postponement.

The real reasons of these three firms why they decide to use postponement strategy have been listed. Meanwhile, the challenges during applying are analyzed specifically. Although, these three firms get good outcomes at last in general, the risks and difficulties of using this strategy is still highlighted.

The main findings can be generalized as:

1) Not all companies are suitable for all types of postponement strategy.

The firms which can take advantages from economies of scale and make-to-stock cannot get expected results after using time postponement in manufacture just as Hill said (Hill, 2004). Zhongping Wood is one of typical examples. When Zhongping Wood used make-to-order, the costs was increased in total and they failed to satisfy their customers. However, they got success after applying other kinds of postponement strategies, for example, place postponement.

Hence, coping with the suitability issue, firms should get well understanding on the characters of their products, production and supply chain firstly. Based on this, firms could select and apply proper type of postponement which can help them get their targets.

2) The firms do get the benefits which the previous studies mentioned if they applying the postponement properly.

Although it is not totally uncomplicated for the 3 companies to implant postponement strategy, they get benefits from it after adjusting their supply chain continually.

The benefits are proposed and explained by the previous researchers. The analysis on the three cases in this thesis proves that those theories correspond with the practical results. However, it is important to notice that the benefits can be achieved only in case of being success on selecting proper type of postponement strategies and applying it properly.

3) There are several types of challenges during applying postponement strategy and rebuilding the supply chain.

All of the selected companies above faced lots of difficulties and challenges. Generally, it is never a simply task to make changes because of the inertia of both people and firms, and the costs caused probably.

The challenges can be divided into three categories in general, based on the existing theories, survey and practical findings: extra costs, complex process and conceptual issues.

Extra costs - The changes in supply chain can be costly no matter in manufacture or logistic. Management time cost and employee treatment cost are needed during rebuilding the supply chain and the transform of firm's role. Besides, the investment in asset may be necessary, such as new production line, new warehouse, etc.

Complex process - There are quite a lot of firms say that postponement strategy is too complex to implement or the process of redesigning the supply chain is too hard.

Conceptual issues - It is never easy to change people's mind. The inertia discourage the transform of firm's role in the supply channel and their core business activities. In additional, it is hard to realize transparency between either departments or firms. However, information sharing both within one firm and between partners, is critical in applying postponement in order to build closer relationship and to implement deeper postponement strategy.

Overall, this thesis aims at proving the benefits and exposing the challenges and risks of using postponement strategy through the practical cases chosen from both European firm and Asian firms. Most findings from the real cases correspond with the previous theories.

Since the existing and the major types of the challenges are confirmed, the future study focusing on the solutions is required. Instead of offering the scattered suggestions, it will be greatly meaningful if the future research attains a result of forming a system on how to cope with these challenges and how to reduce the risks for the firms.

References

- Anderson, W. (1950), "Marketing efficiency and the principle of postponement", *Cost and Profit Outlook*, Vol. 3, pp. 13-15.
- Appelqvist, P. and Gubi, E. (2005), "Postponed variety creation: case study in consume electronics retail", *International Journal of Retail & Distribution Management*, Vol. 33 No. 10, pp. 734-48.
- Aviv, Y. and Federgruen, A. (2001), "Design for postponement: a comprehensive characterization of its benefits under unknown demand distributions", *Operations Research*, Vol. 49 No. 4, pp. 578-98.
- Bowersox, D.J. and Closs, D.J. (1996), *Logistical Management, The Integrated Supply Chain Process*, McGraw-Hill, New York, NY.
- Bowersox, D.J. and Daugherty, P.J. (1995), "Logistics paradigms: the impact of information technology", *Journal of Business Logistics*, Vol. 16 No. 1, pp. 65-80.
- Bucklin, L.P. (1965), "Postponement, speculation and the structure of distribution channels", *Journal of Marketing Research*, Vol. 2, February, pp. 26-32.
- Brown, A.O., Lee, H.L. and Petrankan, R. (2000), "Xilinx improves its semiconductor supply chain using product and process postponement", *Interface*, Vol. 30 No. 4, pp. 65-80.
- Christopher, M. (1992), *Logistics and Supply Chain Management*, Financial Times Pitman, London.
- Christopher, M. and Towill, D. (2001), "An integrated model for the design of agile supply chains", *International Journal of Physical Distribution & Logistics Management*, Vol. 31 No. 4, p. 235.
- Clark, M.P. (1998), "Virtual logistics an introduction and overview of the concepts", *International Journal of Physical Distribution & Logistics Management*, Vol. 28 No. 7, p. 486.

- CLM (1995), *Class Logistics: The Challenge of Managing Continuous Change*, CLM, Oak Brook, IL
- Cooper, J.C. (1993), "Logistics strategies for global business", *International Journal of Physical Distribution & Logistics Management*, Vol. 23 No. 24, pp. 12-23.
- Corey Billington Lee, Hau L. and Brent Carter. Hewlett-packard gains control of inventory and service through design for localization. *Interfaces*, page 11, July-August 1993.
- Denzin, N., & Lincoln, Y. (2000). *Handbook of qualitative research* (2nd ed.). Thousand Oaks, CA: Sage.
- Feitzinger, E. and Lee, H.L. (1997), "Mass customization at Hewlett Packard: the power of postponement", *Harvard Business Review*, Vol. 75, January-February, pp. 116-21.
- Graman, G.A. and Magazine, M.J. (2006), "Implementation issues influencing the decision to adopt postponement", *International Journal of Operations & Production Management*, Vol. 26 No. 10, pp. 1068-83.
- Hill, J. M. (2004), "Toward Perfect Postponement", *MSI*, Vol. 22 No. 4 pp. 16-18 Lacocca Institute, 1991
- Huang, C-W. and Lo, C-P. (2003), "Using postponed manufacturing to reconfigure the supply chain in the desktop personal computer industry: the case of Taiwan", *International Journal of Management*, Vol. 20 No. 2, pp. 241-56.
- Kotha, S. (1995), "Mass customization: implementing the emerging paradigm for competitive advantage", *Strategic Management Journal*, Vol. 16, pp. 21-42.
- Lampel, J. and Mintzberg, H. (1996), "Customizing customization", *Sloan Management Review*, Vol. 38 No. 1, pp. 21-30.
- Lee, H.L. (1998), "Postponement for mass customization: satisfying customer demands for tailor-made products", in Gattorna, J. (Ed.), *Strategic Supply Chain Alignment*, Gower, Brookfield, VT, pp. 77-91.
- Louis P. Bucklin. "Postponement, speculation, and the structure of distribution Channels". *Journal of Marketing Research*, 2(1):6, February 1965.
- Matthews, P and Syed, N. (2004), "The power of postponement", *Supply Chain Management Review*, Vol. 8 No. 3, pp.28

- Nair, A. (2005), "Linking manufacturing postponement, centralized distribution and value chain flexibility with performance", *International Journal of Production Research*, Vol. 43 No. 3, pp. 447-63.
- Nyamongo, E. and Kamau, A. (2001), "Interest rate pass-through in Kenya", *International Journal of Development Issues*, Vol. 10 No. 2, pp. 170-82.
- Pagh, J.D. and Cooper, M.C. (1998), "Supply chain postponement and speculation strategies: how to choose the right strategy", *Journal of Business Logistics*, Vol. 19 No. 2, pp. 13-33.
- Remko, I and Van Hoek. (1998) "Measuring the unmeasurable- measuring and improving performance in the supply chain", *Supply Chain Management*, Vol. 2 No.4
- Rietze, S.M. (2006), "Case studies of postponement in the supply chain", *Massachusetts Institute of Technology*, June, 2006
- Jayashankar M. Swaminathan and Hau L. Lee. "Managing broader product lines through delayed differentiation using vanilla boxes". *Management Science*, 44(12):9, December 1998.
- Van Hoek, R.I. (1998), "Logistics and virtual integration postponement, outsourcing and the flow of information", *International Journal of Physical Distribution & Logistics Management*, Vol. 28 No. 7, p. 508.
- Van Hoek, R.I. (2000), "The role of third-party logistics providers in mass customization", *International Journal of Logistics Management*, Vol. 11 No. 1, pp. 37-46.
- Van Hoek, R.I. (2001), "The rediscovery of postponement a literature review and directions for research", *Journal of Operations Management*, Vol. 19, pp. 161-84.
- Waller, M.A., Dabholker, P.A. and Gentry, J.J. (2000), "Postponement, product customization, and market-oriented supply chain management", *Journal of Business Logistics*, Vol. 21 No. 2, pp. 133-59.
- Yang, B. and Burns, N.D. (2003), "Implications of postponement for supply chain", *International Journal of Production Research*, Vol. 41 No. 9, pp. 2075-90.
- Yang, B., Burns, N.D. and Backhouse, C.J. (2004), "Management of uncertainty through postponement", *International Journal of Production Research*, Vol. 24 No. 6, pp. 1049-64.
- Zinn, W. And Bowersox, D.J. (1988), "Planning physical distribution with the principle of postponement", *Journal of Business Logistics*, Vol. 9 No. 2, pp. 117-36.