IMPROVEMENT OF ORDER FULFILLMENT LEAD TIME BY OPTIMAL POSTPONEMENT STRATEGY: A CASE OF A US SKI APPAREL MANUFACTURER

By
VIRIYA ATHIKIAT

A Final Report of the Six-Credit Course
SCM 2202 Graduate Project

Submitted in Partial Fulfillment of the Requirements for the Degree of
MASTER OF SCIENCE IN SUPPLY CHAIN MANAGEMENT

Martin de Tours School of Management
Assumption University
Bangkok, Thailand

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I, Viriya Athikiat ,declare that this thesis/project and the work presented in it are my own and has been generated by me as the result of my own original research.

Improvement of order fulfillment lead time by optimal postponement strategy : A case of a US ski apparel manufacturer.

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I confirm that this thesis/project has been carried out under my supervision and it represents the original work of the candidate.

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(Asst. Prof. Dr. Nucharee Supatn)

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Viriya Athikiat

Assumption University

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ABSTRACT

Long order fulfillment lead-time leads SAS Company to profit margin loss and failure of customers' satisfaction. This case study proposed alternative solutions based on purchasing postponement methodology to improve the order fulfillment lead time performance for the company.

The research question is how to improve SAS order fulfillment lead-time through the purchasing postponement strategy? The purpose of the study is to identify the current order fulfillment process, lead-time performance, and solution finding.

There are two alternatives of the new process, proposed to improve the order fulfillment lead-time. One is the greige fabric purchasing postponement and the other is fabric dying or printing purchasing postponement. Both alternatives provide the improved postponement lead-time from 25 weeks to 21 weeks and 18 weeks. The shorter 4 weeks and 7 weeks order fulfillment lead-time offer different total cost trading off The target of order fulfillment lead-time which can support the company business process is within 21 weeks. While greige fabric purchasing postponement still requires air transportation expense as well as additional inventory carrying cost to achieve 21 weeks lead-time. The total cost shows the competitive cost saving from the original process for the company. At the same time, finished fabric dying and printing purchasing postponement provides most effectiveness for short order fulfillment lead-time in the case study, in which inventory carrying cost, is the main cost trading off. Aside from total cost comparison, there is the aspect of forecast inaccuracy management as well as product value consideration that are reflected to the new proposed processes , with short term and long term solution suggestions.

The case study implies that the application of purchasing postponement methodology is a useful mechanic tool to increase the company benefits by the order fulfillment lead-time improvement.

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I, Asst. Prof Dr. June Bernadette D'Souza, have proofread this thesis/project entitled

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Signed

(A. Dr. June Bernadette D'S)

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Date

CHAPTER I

GENERALITIES OF THE STUDY

Time based competition is a broad-based competitive strategy focusing on compressing total throughput time in processes. Time-based competition plays an important role in business models these days. It extends into every facet of the product delivery cycle, from research and development through marketing and distribution of the finished product. While product quality is a critical factor to obtain business success, it is still not the key competitive advantage in many industries, compared to time to market.

The fast moving pace of the fashion industry is a great challenge for the apparel supply chain. Fashion trends are changing across seasons. In the apparel industry, time constraint is a common problem. Apparel firms should do anything to ensure that their products are available at the right time, at the right place, to gain most effectiveness at the selling period.

The pipelines of ski apparel industry have been significantly long, inflexible and complex. Therefore, long order-to-delivery cycle time occurs, resulting in inappropriate structures for the requirements of the modern fashion apparel industry. Snow occurs only in the wintertime each year, while chic winter trends produced only few months before this. The key success of ski apparel business is mainly depended on the nice functional design of the product as well as the effectiveness of all the members in the supply chain since they play an important role in the delivery of the right product at the right place at the right time.

1.1 Background of the Study

SAS Company is one of the largest ski-specialty brands in the USA. The company develops a broad line of high-end skiwear with innovative designs and significant features. This is one of company's core competencies. The main clients of SAS are

sporting department stores and retailers in ski resorts over the USA and Europe. All main customers perceive the value of the business via the SAS—commitment to provide the products in time and 10 percent of the products discounted are guaranteed as the case of delivery failure. The strategy leads the company to apply the make-to-stock policy to achieve the high service level achievement.

As the global financial crisis emerged like a flash, it affected the shows in the middle of 2007 and into 2008. The phenomenon forced lesser spending practice of people in the US. Plus, in the Year 2008, winter occurred late and there was less snowfall over ski resorts in the USA. The company noticed a big loss from inventory holding due to advance make-to-stock products, which is based on the sale records of the previous season, together with demand's forecast during the early of the year. The products finally ended up at big discount stores as a solution for non-holding cost through a year to erase the risk of product design obsolescence from the market during next following winter. The decision has an impact on product brand image as well as still big revenue loss from demand fluctuation due to the climate change and economy flip factors.

Consequently, the business crisis of SAS in the Year 2008 leads the company to the new decade of strategy implementation. SAS changed to play more conservative order management by applying make—to-order policy, while superior logistic service function is utilized and supplier relationship management has also been implemented to gain the collaboration and flexibility to respond according to orders made by customers.

1.2 Statement of the Problem

The new strategic approach has lead SAS's supply chain movement to experience high pressure of time constraint. However, the individual demand of products from customers over USA and Europe has increased and become diversified. Through the following 2010-2012 seasons, the production are more complicated with increasing SKU design. It caused more complexity in the production processes. The best

logistic service and best capacity flexibility from suppliers has been utilized. There is still the limitation which is to manage the finished products to be on retailers' shelves at a specific of time.

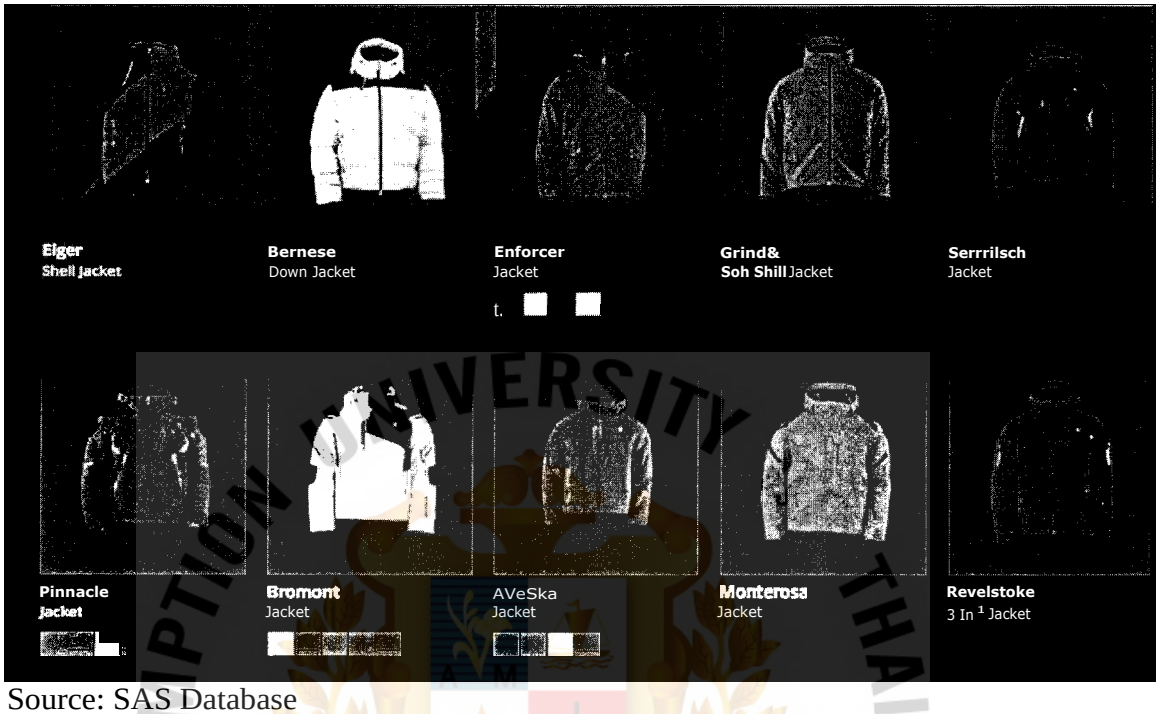
As a result, it creates a question of what should be a suitable supply chain strategy for dealing with SAS business environment at this current period to achieve the company's commitment to the customers for niche design product in perfect delivery condition at the lowest cost.

Christopher and Towill (2000) stated that postponement is a vital element in any agile strategy. The concept of postponement is about delaying activities until the latest possible point in time, when exact attributes of demand can be identified. Lee, Billington and Carter (1993) indicated that postponement as a tool can enhance a company's flexibility effectively meet the requirements of the growing product variety and quick response. Aviv and Federgruen (2001) expressed that postponement is one of the most beneficial strategic mechanisms to manage the risks associated with product variety and uncertain sales.

Thus, this case study focuses on the business process in SAS that has a problem of long order fulfillment lead-time. The order fulfillment lead-time in this study refers to the time from which SAS received the order from customers at specific order placing cutoff date to the time until the finished goods are ready to be shipped from the assembly manufacturers to the SAS warehouses or directly to customers.

Since the nature of the product such that it is used only in wintertime, the customer demands usually ramp up mainly at the end of January, February and March with the expectation of receiving the goods in the winter retail season in November – March. The increasing transportation costs and 10 percent of product price discounted for the delivery failure has been a concern for management. Thus, the problem statement of this case study was therefore formulated and the main question is: *"How to improve SAS order fulfillment lead-times through the purchasing postponement strategy?"*

Figure 1.1: Example of SAS **Skiwear** Product



Source: SAS Database

1.3 Research Objectives

The objectives of this study are as follows:

- To identify the current order fulfillment process, and lead-time performance.
- To design the new order fulfillment process based on purchasing postponement strategy, in order to improve the lead-time performance.
- To determine the order fulfillment performance and operating trade off after the purchasing postponement approach.

1.4 Scope of the Research

The case study of SAS Company is selected. Customers are the USA and Europe retailers. Key suppliers involved this case study consists of a Taiwanese fabric mill and a Chinese assembly factory. Process flow from order are placed to finished products are ready at the in-house factory. These products are monitored as order fulfillment lead-time measured. The historical data was referred to from the last

winter season of 2012, considered as the latest construction of the product design representation. The focus will be on Men's skiwear category in which takes longest lead-time of order fulfillment. This led to total 130 styles, 340 colorways, 2,380 SKUs for the winter 2012 Collection. The data collection for the study is from January 2012 to October 2012.

1.5 Significance of the Research

The significant of this research is that the model recommendations could be vital for the company to keep up a healthy business in present environment. This study may be used as a starting point for management to consider further fundamental improvement processes, increase profitability and fulfill customer needs. This study will also provide an opportunity to understand more supply chain management concepts through practical solution finding.

1.6 Limitations of the Research

The study focused mainly on utilizing the available partners in the supply chain. Adding capacity by increasing the number of supplier is always an absolute solution for any company. But for skiwear product, it is not easy to find manufacturers who are capable with complicated functional designs. Most of the processes require expensive machine investment and skillful workers. Although the researcher seeks to find practical solution improvement for this seasonal product with high demand fluctuation, it is understood that the implication of this research may be limited only by available suppliers' condition.

For forecast accuracy, demand of customers in the fashion skiwear business heavily depends on a variety of factors that are difficult to predict, such as economy, weather and fashion trends. Further, the peak of retail selling season is approximately two months long. To improve forecast accuracy is difficult because of the limitation of the database approach of the researcher.

Also, due to the limitation of time is important. The supplier relationship management is a vital factor that the researcher considered as an area for further study.

1.7 Definition of Terms

Bill of Material (BOM)	A detailed account used for defining, recording, and saving the final product and its make-up, contents, quantities, and structure. In the definition of the BOM, the final product and its structure are related as: the final product can either be the finished goods or the semi-finished goods; however, the structure is indicated as the semi-finished goods or its components. (Kinney, 1990)
Colorway	SAS Company used the term to indicate the same design but in different combination of colors for finished skiwear products.
Greige	SAS Company used the term to indicate unfinished woven or knitted fabric just off the looms or knitting machine that hasn't been bleached or dyed.
Order fulfillment	The complete process from point of sales inquiry to delivery of a product to the customer. Sometimes Order fulfillment is used to describe the more narrow act of distribution or the logistics function, however, in the broader sense it refers to the way firms respond to customer orders (Keely, 2003)
Order fulfillment lead-time	The time from order placement to finished product which is ready for shipment.

Postponement	A concept in supply chain management where the manufacturer produces a generic product, which can be modified at the later stages before the final transport to the customer. It is a business strategy that maximizes possible benefits and minimizes risk by delaying further investment into a product or service until the last possible moment. (Friedman, 2006).
SKU	Stock Keeping Unit (SKU) refers to items of stock that are completely specific as to function, style, size, color, and, usually, location (Silver et al., 1998).

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter reviews previous researches and theories that are concerned with the topic of order fulfillment lead-time reduction, which are relevant to postponement concepts and its implementation. This chapter can be categorized into five sections. First, the definition and concept of postponement is emphasized. Second, the principle of postponement is discussed followed by the postponement models, the postponement models and supply chain strategy, and postponement evaluation. Finally, the postponement application will be discussed.

The concept of postponement has a long history of practical application as well as academic literature. By employing the concept of postponement and combining it with a holistic view of supply chain, many companies have increased performance furthermore benefits supply chain as a whole.

2.1 Definitions and Concept of Postponement

Postponement is one of the most gainful strategic devices for managing the risks associated with product variety and demand uncertainty (Aviv & Federgruen, 2001). Olhager (2003) termed postponement as "order penetrating point". It is the point in the supply chain, at which the customers place an order or demand pattern has occurred. As it differentiates between the two segments, in that one operates without final demand information, while the other operates after exact customer demand emerges. The information during the first segment is forecast based while the second segment is actual data based.

In summary, postponement strategy benefits those products that have uncertain demand, high inventory carrying costs, short customer lead time and modular product design, where the production process can be separated into two phases:

manufacturing the base product first, and customizing it at a later time, given a more accurate demand forecast or an actual customer order.

2.2 The Principle of Postponement

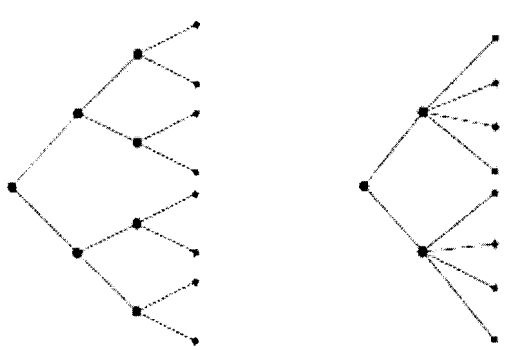
Postponement concept (delayed differentiation, or delayed configuration) has introduced by Anderson (1950) as the principle of seeking to design products, using common platforms, components or modules in which the final customization process will be carried on once the final market destination and/or customers' requirements are known.

To obtain this chance, supply chain needs to consider the potential of products design and processes for late value adding and late customization. Also, the possibility of product being keep in a semi-finished form, is sort of an option to think about. The products can be moved from surplus to deficit areas. So that, the company can increase filling rates and improve customer responsiveness without increasing inventory carrying costs because products can be completed to meet a particular customer's needs.

The efficient implement of postponement focuses on the product design not only for a single product, but also for the product family.

2.2.1 Standardization of Components and Subassemblies

Figure 2.1: The Principle of Postponement



Before Standardization After Standardization

Source: Mangan, Lalwani, Butcher and Javadpour (2012)

Figure 2.1 explains this concept. Related items in a product family start out being produced from distinct initial subassemblies and components. Standardization is obtained by substituting these by a common one.

2.2.2 Modular Design

Product structure is designed following the construction and structure of a product family to decide the best tradeoff between common parts and customized parts. The idea behind modular design is to manage a complex system as a set of distinct components that can be developed independently and later assemble together. Though this seems a simple idea, the effectiveness of the technique depends critically on the design of operational systems, divided into components and the mechanisms used to gather the components together.

2.2.3 Resequencing

It means modifying the order from the production step so that the operation resulting in differentiation of specific items are delayed as much as possible.

2.2.4 Postponement of Operations

It refers to the action of postponing the differentiating operation to a later stage, prolonging the initial phase that precedes the point of differentiation.

The postponement is possible when the modular products with standard components and customized activities are aligned to the end of production process. The constraint of postponement model is the link between manufacturers and consumers.

2.3 Postponement Model

Yang, Burns and Backhouse (2003) have summarized the postponement models into main 4 divisions, including product development, purchasing, manufacturing and logistics postponement

2.3.1 Product Development Postponement

2.3.1.1 Model Concept 373i;

Product development postponement is the concept of customization, starting since product design, and development through production. The whole process delayed till downstream demand is available. In other words, customers are involved from the beginning of the design stage.

2.3.1.2 Suitable Business Model

Product development postponement strategy is preferred in highly volatile environments, involving high levels of uncertainty in terms of consumer demands, technological development and government regulations (Yang et al., 2003). The total customization achievement reflects increase in production and downstream customers need to accept the long order fulfillment lead-time.

2.3.2 Purchasing Postponement

2.3.2.1 Model Concept

The raw materials that are purchased are postponed until the actual demand is available. Purchasing postponement strategy is preferred when the market lead-time is greater than the finished goods production lead-time (Yang et al., 2003). This would be practical when a company is able to differentiate between base demand, which can be handled by forecasted demand, and surge demand, in which a company prolong the demand until actual demand pattern is available and then proceeds to place the orders.

The company can consider applying the demand forecast for raw material purchasing or even proceed to production in case of longer production lead time.

2.3.2.2 Suitable Business Model

The design of purchasing postponement model should be based on speed and agility with emphasizes on fulfilling orders regularly rather than emphasizing lower cost by setting up fast production lines and purchasing raw materials from a different set of suppliers. This would be conceivable when the cost increases due to fast pace production and the gains raised by applying purchasing postponement strategy to less.

2.3.3 Manufacturing Postponement

2.3.3.1 Model Concept

Manufacturing postponement creates the chance for operating without the finished goods inventory. Companies gain the utility from maintaining the bulk of their inventories at a lower price and/or in a pre-customized form by postponing expensive operations and point of product differentiation. In the global sourcing business, manufacturing postponement is relevant also in those countries where the tariffs and taxes incurred on finished products are higher for semi-finished products.

2.3.3.2 Suitable Business Model

It is very crucial to consider product generations, families and explore the modularity/commonality of products and processes as much as possible (Feitzinger & Lee, 1997). Component commonality results in inventory pooling effects, such as keeping low inventory levels and reducing risk of product obsolescence from the market. Leveraging commonality in parts may further enable purchasing postponement.

2.3.4 Logistic Postponement

2.3.4.1 Model Concept

Logistics postponement concept deals with the delay of the final movement of the finished product. Product variety increase and demand uncertainty create a situation of which is impracticable to hold minimum levels of stock keeping units (SKUs) at all locations. Logistic postponement allows a company to keep the goods at a central location instead of placing the goods at the final points in the supply chain, with the purpose of following the demand pattern for the final shipments (Yang et al., 2003). This practice helps to minimize inventories through the supply chain, while it improves customer responsiveness at the same time.

2.3.4.2 Suitable Business Model

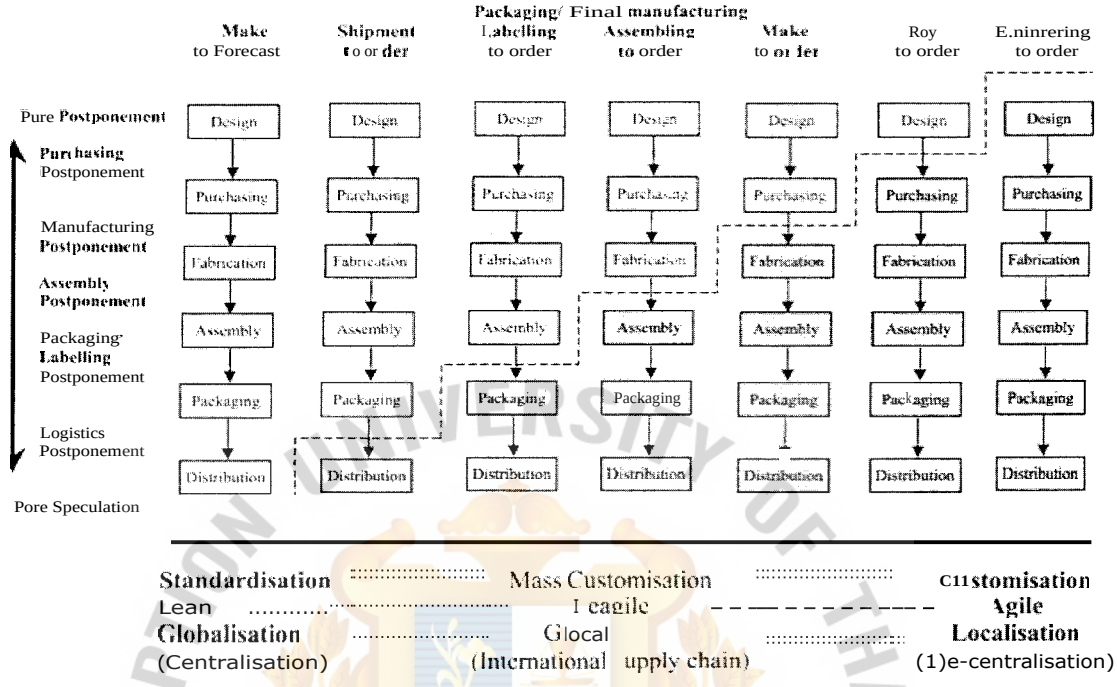
Logistic Postponement requires high speed and a responsive transportation system. Thus may lead to distinct transport cost increases (Christopher, 1998). The application is under time constraints specified by the market. The benefits existes when the distribution is not only for physical transportation, but also for obtaining the product customization process.

2.4 Postponement Models and Supply Chain Strategies

Within the supply chain management, postponement strategy serves as the effective supply chain movement by reduction of the anticipatory risk from inventory pressures. It is also a practical tool that can be leveraged to yield substantial benefits for adopting a supply chain in different competitive environments.

Yang et al. (2003) study implied that postponement strategy could support the supply chain management as shown in figure 2.2 on the next pages.

Figure 2.2: Postponement Models and Supply Chain Strategies



Source: Yang et al., (2003)

Mass Customization is assumed to balance customization and standardization objectives. Fujita (2002) indicated that mass customization is aligned with the challenge of balancing the tradeoff between product variety and production costs, where product variety leads to a potential increase of both sales and production cost.

Leagile (Hybrid) while lean seeks additional value from cost reduction through waste elimination inside the supply chain, agile seeks value from service level enhancements. In attempt to get the best of both, hybrid solutions, also called 'leagile'. Naylor et al. (1999) formally define leagile as the combination of the lean and agile paradigms within a total supply chain strategy by positioning the decoupling point so as to best suit the need for responding to a volatile demand downstream yet providing level scheduling upstream from the marketplace.

Glocalization Boyer and Drache (1996) explain that globalization is an economic phenomenon, which helps economic integration, but causes problems for the maximization concept of competitiveness in local markets. Glocalization is combination of "globalization" and "localization" concept, it is used to describe a

product or service that is developed and distributed globally, but is also fashioned to accommodate the user or consumer in a local market. Postponement is a key to balance the "globalization" and "localization" concept.

2.5 Postponement Evaluation

It is significantly obvious from the literature that postponement's utility has widely existed since a long time. The strategy of development becomes imperative to many companies, under the circumstance of intense competition in globalization, demand variety increasing, volatile technological innovation and shortening product life cycles.

While Lee (1996), Lee and Tang (1997), Swaminathan and Lee (2003), and Hopp (2003) explained the benefits in inventory. Van Hoek (2001) concentrates on the value of increase in supply chain flexibility. Significant advantages of postponement are:

1) There are fewer stock-keeping variants, when inventory can be held at a generic level. It results in fewer inventories in total.

2) It creates greater flexibility when the inventory is generic, meaning that the same components, modules or platforms can be embodied in a variety of end products.

3) Forecasting is uncomplicated at the generic level, compared to the level of finished products. It is relevant in global markets that the local forecast is less accurate than worldwide-volume forecast. The ability of local product customization results in a higher level of variety that may be offered at a cheaper price, enabling strategies of 'mass-customization' to be pursued.

Anyway, postponement requires a high level of partnership in which buyers and the sellers are deeply involved. Below are the difficulty conditions which need to be

well understood before the strategy's implementation. The failure to understand the condition below could lead to the model application being unsuccessful.

1) The level of postponement is driven by the type of the products and the position of the organization in the value chain. The postponement applications are supported by the most suitable supply chain structures that are warranted by the dynamics of a particular value chain.

2) Lack of informational linkage across the value chain is considered as the key barrier towards the application of postponement strategy.

3) Various types of relationships exist among the value chain partners in the industry. Some relationships have higher trust level signified by higher commitment levels. In terms of communication, there exist multiple levels of interaction among the supply chain partners along with varying levels of joint effort towards improving interaction and solving problems.

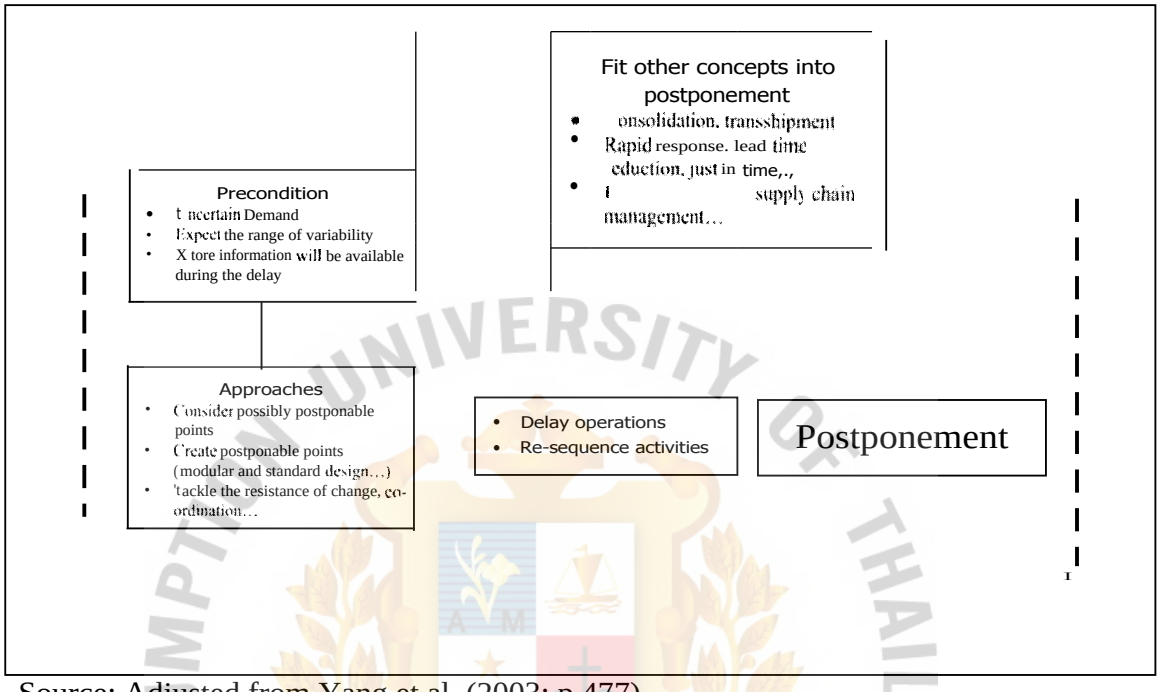
It is imperative to have high levels of collaboration between the manufacturers and the suppliers. Suppliers are required to respond to the downstream demand in a minimum possible time so that the manufacturers can deliver within the market lead times. Development of close relationships of the supply chain members could cause a high degree of postponement. Collaboration and partnerships can become the main focus for gaining competitiveness.

2.6 Postponement Application

Yang et al. (2003) recommend that a supply chain should periodically review the outcome and modify their postponement strategies, according to changes in the competitive environments, stages of product life cycle, and technological advances. To achieve an appropriate postponement strategy, different phases of the product life cycle are essential for the companies' concentration.

Postponement implementation is described in the framework, in figure 2.3 below

Figure 2.3: Postponement Implementation Framework



Source: Adjusted from Yang et al. (2003; p.477)

2.6.1 Precondition

2.6.1.1 Uncertain Demand

Firstly, it is an important key for a company to identify the product developing stage that can be forecasted and stage that should be delayed until the actual downstream demand emerges. Postponement considerations are only given to those decisions in which the product is unpredictable. It is a strategy to intentionally delay the execution of a task instead of starting it with incomplete or inaccurate input.

2.6.1.2 Expect the Range of Variability

The demand is divided over a growing number of stock-keeping units (SKUs) a company sells. Even if manufacturers and retailers can predict aggregate demand figures with some certainty, it is becoming increasingly difficult to foresee how that demand will be distributed among plenty of SKUs they offer to the market. The logic

behind postponement strategy is to delay commitment of the most uncertain items to a later time when these could be defined more efficiently. The practice aims to respond such possible major changes in customer needs, technologies and competitor's action. In this context, postponement is relevant to the principle that, in general, short-term forecasts on items that are more accurate than long-term ones.

2.6.1.3 More Information will be Available During the Delay

Accurate customer demands must be available during the delay period. Postponement is valuable only if the information about the customers 'need can be captured quickly and accurately (Lee, 1998). Companies can simply share information to gain an understanding from the supply chain, achieving low supply chain costs and high customer responsiveness. It is not required to use advance IT investment, as long as the effective communication flow of the supply flow are implemented.

2.6.2 Approaches

To Approach postponement application, the main thing is to consider the postponable points. Once the postponable point is chosen, modular/standard product design is necessary for optimal postponable points. However, modularity is necessary but not in itself sufficient for the strategy applications. Product design can further isolate the most variable portion of functionality from other functions in order to be added last.

2.6.2.1 Consider the Postponable Points

Modular/standard design in product and production is instrumental for creating postponable points (Lee, 1998).Modularity in design concept that focuses on reducing lead time and costs, while modularity in production focuses on increasing operational efficiency.

2.6.2.2 Create Postponable Points (Modular & Standard Design)

The important key of powerful postponement strategy application is in organizing product design segment. Incorporate postponement thinking is essential for the product development process. However, the approach of implementation should also consider the nature of design information. New technology movement and uncertainty demand creates the difficulty to identify the product attributes in the early stage. Thus, product development may have to look to postponement in itself (Yang et al., 2003), to avoid major changes later in the development process that are inherently expensive. By the way, with high competition in the global market and new product launched, it is impractical for companies to simply wait until the accurate data emerges.

2.6.2.3 Tackle the Resistance of Change, Coordination

To enhance information flow towards postponement strategies, companies need to understand the need for open communication, and manage the information whilst being willing to act as partners in the supply chain (Mason-Jones & Towill, 1999). Postponement can be achieved by delaying operations or by re-sequencing processes, each of which is associated with a separate attributes (Lee & Tang, 1997)

2.6.3 Fit other Concepts into Postponement

Without recognizing the strategic and tactics behind postponement application, negative effects are may occur. Typically, the postponement direct theme might lead to reducing economies of scale and increasing cycle time. Integrating related concepts/strategies for postponement is such an essential element.

2.6.3.1 Consolidation, Transshipment

Both can lead to cost reductions and improve services by enabling the sharing of stock among different locations, thereby reducing the inventory in the supply chain.

2.6.3.2 Rapid Response, Lead-time Reduction, Just in Time

Yang et al. (2003) investigated the role of postponement for the management of uncertainty, suggesting that some managerial practices, such as the reduction of internal uncertainties, have a positive relationship with the adoption of postponement.

2.6.3.3 Flexibility, Agility, Supply Chain Management

Postponement and supply chain management are mentioned and linked together by many researchers. Anyhow, Conklin (1994) asserts that in today's global marketplace, there is no company that is able to realize market opportunities quickly in cost-effective way. This assertion is relevant to the view that competition no longer takes place between individual businesses, but between supply chains. When increasingly adopting strategies to improve overall supply chain management, companies may look to wider implementation of postponement (Bowersox & Morash, 1989). Anyhow, It does not mean that all parties in the supply chain may have natural tendencies to develop cooperative rather than competitive relationships.

2.7 Summary

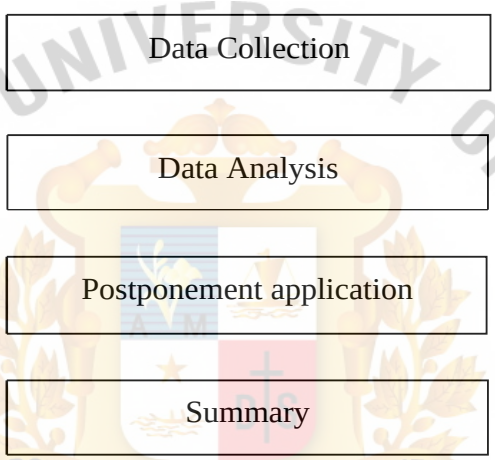
Concentration of the literature review focuses on understanding postponement strategy and its benefit and challenges that exist in implementation. The success of postponement is powerful when the right business model is linked to the appropriate optimal postponement strategy. It can be implied from many researches that companies may need to incorporate the appropriate organizational changes with the development of postponement.

CHAPTER III

RESEARCH METHODOLOGY

The research carried out a case study method, with the objective to reduce the production and deliver lead-time of SAS Company by using the postponement strategy. The research process comprised of four stages as shown in Figure 3.1

Figure 3.1: Research Process



Source: Author

The first stage is the data collection. The data will be gathered from both interviews and documentary reviews, including men's skiwear category's order fulfillment process, identifying each activity, together with its time consumption. These data would help identify the time taken and production process of each product category. Consequently, potential of postponable point would be identified in the second stage, data analysis. The third step is the postponement application that identifies the postponement strategy and describes how the selected postponement strategy could reduce customer fulfillment lead-time. The last stage is the summary of all findings. The expected performance will be specified and compared with the outcomes obtained in the current practice.

1.1 Data Collection

1.1.1 Documentary Reviews

Five related documents are reviewed from the SAS Company databases which are as follows:

1) **On-Time Delivery Performance Report:** This data summaries the performance of each shipment delivery during the whole season. The database can be directly imported from the internal SAS Company system. The scope of data collection is performance of winter 2012 Collection. The period of data collection is winter 2012 which is from January 2012 - October 2012.

2) **Winter 2012 Work-in Process Report (WIP):** This raw data provides the production planning in the fabric mill for finished garment assembly manufacturers. Its actual lead-time is broken in each process. Databases can be directly imported from internal SAS Company system. Production lots of January, February and March to USA and Europe are recorded. The period of data collection is from January 2012 - October 2012.

3) **Style Construction Sheet (Bill of Material):** The style construction sheet is the data that provides the details of each skiwear product design and list of the materials that is required for each style, together with the style SKU construction. The database can be directly imported from the internal SAS Company system. The scope of data collection is winter 2012 Collection. The period of data collection is from January 2012- October 2012.

4) **Winter 2012 Fabric Material Information Sheet:** The fabric material information sheet is the raw data that provides the material specification and its construction that is used for developing the fabric. The database can be directly imported from the internal SAS Company system. The focus of data collection is fabric detail sheet of winter 2012 Collection, in which an explanation of each

fabric yarn component and its structure is specified. The period of data collection is winter 2012, which is from January 2012 - October 2012.

5) Purchasing Order: The data represents the order quantity of each SKU. The database can be directly imported from the internal SAS Company system. The scope of data collection is winter 2012 Collection. The period of data collection is one season which is from January 2012 - October 2012.

3.1.2 Interview

Further data on details of working process and problems that are currently illustrated are gathered from interviews with the key persons who are involved with the work in process (here after is called in short as WIP) and production planning from four main key parties in the supply chain:

1) SAS's Men's skiwear production planning manager (in China office)
2) SAS's in-bound supply chain manger (in USA office)
3) Taiwanese fabric Mill production planning supervisor (in Taiwan)
4) Chinese assembly manufacturer's production planning supervisor (in China)

The researcher conducted the telephone interviews by using Skype calls. The interviews were conducted during the last week of October 2012, while all main winter 2012 order shipments were completed and the database was uploaded from the system.

The further information from the interviews, explaining how WIP and production plan was made as well as the factor in which impact the productivity and/or reason of longer time take in the same process practice. Thus, five interview questions were used which are as follows:

What is the information used for production planning? How?

Is the monthly forecast updating help supporting the production planning?

What is the time taken for processes & activities after receiving the purchasing order?

How does the increase of SKU impact to the production lead-time?

What are the reasons for late delivery?

Data verifying: The databases of the four main parties in the supply chain are gathered to match the consequent of time and planning Further information of interviews provides the linkage to the initial collaborative planning agreement.

3.2 Data Analysis

With the objective to understand the lead-time of order fulfillment and the variety of value adding steps, in order to identify the potential postponable points, the step of data collecting has been analyzed to reveal the visual clarity.

3.2.1 Product Cycle

SAS has grown into the business of designing and selling winter skiwear with the challenges in managing a global supply chain of short product cycle with a high demand uncertainty.

In this global supply chain, SAS manages the demand side of the business from the head quarter in the USA. The demand side of the business covers activities like monitoring of demand trends, designing, distributing and selling the products. The skiwear design processes and sample development starts in February. By September, finalized designs based on prototype samples are done, and salesman sample production was ready. Each style samples are shown during the sales meeting, together with the collection concept and its significant features. After the sales meeting in early November, SAS sale teams will approach the customers, and gather the orders back. Snow Sports Industries America (SIA) and Outdoor Retailer (OR) trade shows occurs in January. Most retailers place their orders and usually the company receives 70 percent of its annual volume a week after the trade shows. This

allows the company to place the precise production order to the contracted manufacturers. The remaining retailers' regular orders are received in February and March.

In June, July and August, garments are transported from the manufacturers around the world to the USA and Europe distribution centers by sea shipment. Air shipping and Courier shipping are selected under the condition of time constraint to satisfy the customer needed date. The decision of logistic method selection is based on the target to keep customers' satisfies and retain high service level of product availability which is the company's core competency.

Cumulative product cycle, design to finished skiwear products are ready at the manufacturers side turns in 76-80 weeks. The initial 40-45 weeks SAS is spent more on design development. Once the order quantity comes in from trade show, the company will have 21 weeks, for delivery to the retailers. Summary of product cycle mapping can be found in Appendix A.

3.2.2 Winter 2012 Collection and Order Fulfillment Performance

Table 3.1: Winter 2012 Order Fulfillment Performance & Loss Summary

Skiwear Category	Order Quantity (Pieces)	Profit Margin Target (USD)	Actual fulfillment lead-time (Weeks)	10% Discount (USD)	Transportation Expense (USD)	Cancellation (USD)
Men's	252,009	17,415,980	21-27	3,483,196	738,110	870,799
Women's	151,838	9,037,055	21-26	722,964	666,680	90,371
Boy's	103,848	3,676,495	21-25	36,765	428,580	-
Girl's	46,179	1,370,676	21-24	10,965	285,720	-
Mini	32,345	897,038	21-24	-	119,050	-
Bitsy	19,635	550,890	21-24	-	95,240	-
Kyd's	1,080	34,376	21-24	-	47,620	-
Total	606,934	32,982,511		4,253,890	2,381,000	961,170

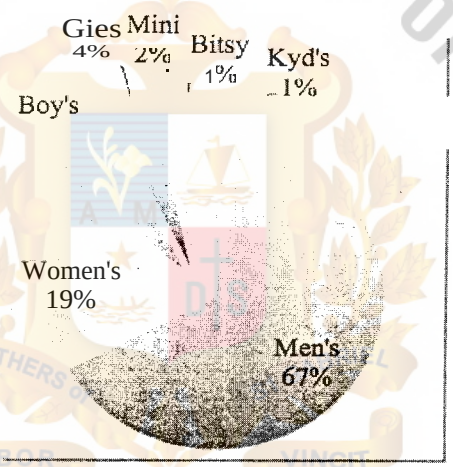
Remarks:
Target profit margin: 32,982,511 USD
Total loss (10% discount + Air-Sea expense+ Cancellation loss): 7,596,060 USD
Total loss from over 21 weeks fulfillment lead-time impact loss of target profit margin 23%
Order fulfillment lead-time for all product categories is 21 weeks

Source: SAS Database

Regarding the documentary reviews, Table 3.1 presents the order fulfillment performance of winter 2012 Collection.

Once the fulfillment lead-time exceeds 21 weeks, SAS needs to consider the fastest logistic method, and/or offer 10 percent discount to the customers. It causes extra expense and extra loss for the company's profits. Moreover, failure of perfect delivery leads to cancellation cases for some customers but in worst case scenario the loss of customers' trust can further bring the company to the loss in the long run.

Figure 3.2: Product Categories & Profit Margin Loss



Source: Author

Figure 3.2, presents the percentage of the main profit margin loss from the lead-time which exceeds 21 weeks. The figure shows Men's skiwear product category represents 67 percent loss of the target profit margin. With this result, the focus of the order fulfillment processes and time taken will be on Men's skiwear products. The results of the study should be potentially adapted to the other categories as well.

3.2.3 Winter 2012 Collection Product Variety

Table 3.2 explains the total SKUs in each category for skiwear product in the winter 2012 Collection. There are 330 finished garment designs, with a total of 1,055 colors. Breaking into each style's sizing, leads up to 7,510 SKUs.

Table 3.2: Winter 2012 Design Varieties

Skiwear Category	Style Count	Finished Fabric type	Finished Product Colorway SKUs	Size per Category	Colorway + Size SKUs
Men's	*130*	*42*	*340*	*7*	*2,380*
Women's	100	31	360	9	3,240
Boy's	50	10	155	5	775
Girl's	20	8	95	5	475
Mini	15	5	60	6	360
Bitsy	10	5	35	6	210
Kyd's	5	4	10	7	70
Total	**330**	**105**	**1055**	**45**	**7510**

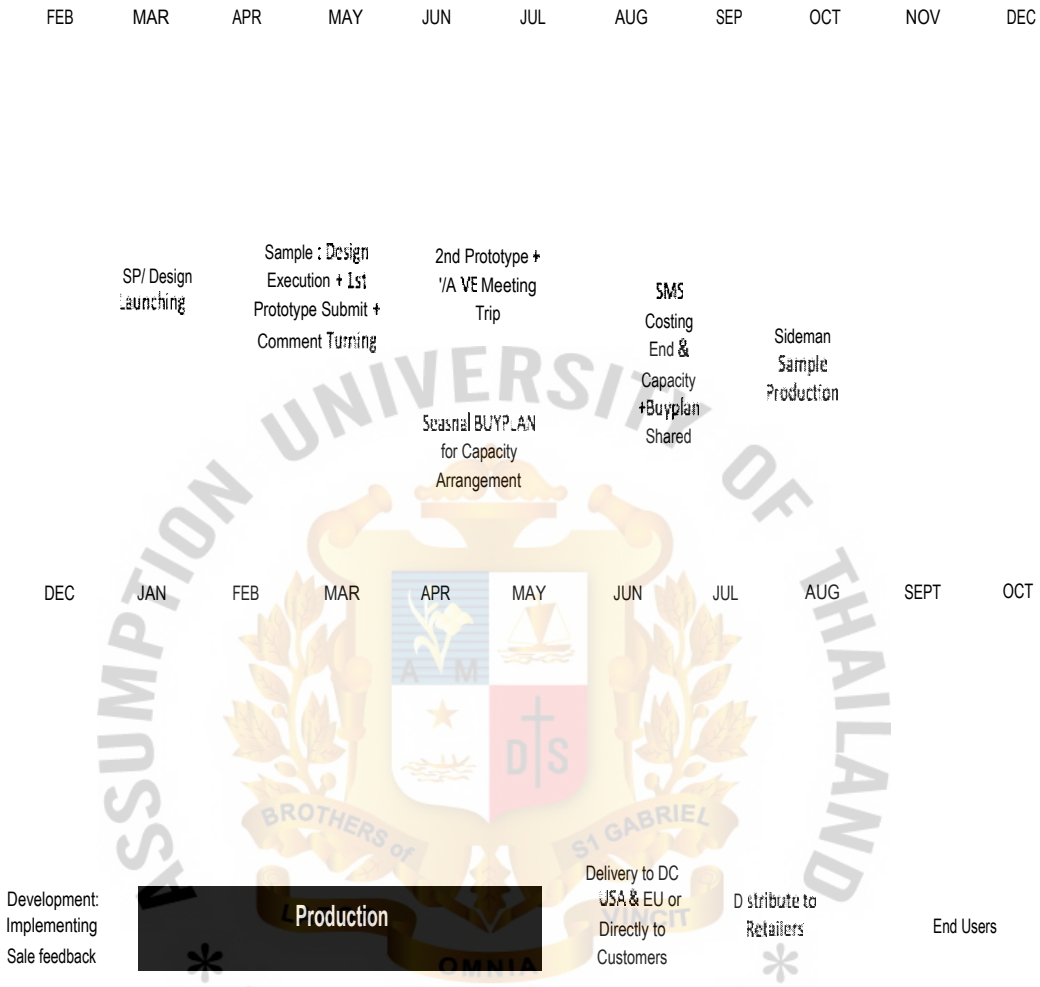
Source: SAS Database

3.2.2 Order Fulfillment Process of Men's Skiwear Category

Nowadays a general practice, SAS is conservatively strict with the make-to-order strategy for order fulfillment. The company places the order to suppliers when they receive the confirmed order from the customers' side. Anyhow, the company shares the demand forecast to whole supply chain monthly. The information could lead to the raw material preparation at the suppliers' side. By the way, the variety of SKU causes difficulty to SAS to make stable and accurate forecast. Even the suppliers are willing to share some risk of inventory keeping. There still are limitations of this flexibility from the holding cost at the suppliers' side.

The WIP report analysis and company general business flow show that it is type of a challenge to provide goods on time and customers perceive this as the success of a business. To understand the overall idea of order fulfillment process, the following part will present the general business process of the company, then, the scope of the activities that occurs to complete the order from the customer and the potential of postponable points.

Figure 3.3: SAS Company Business Flow

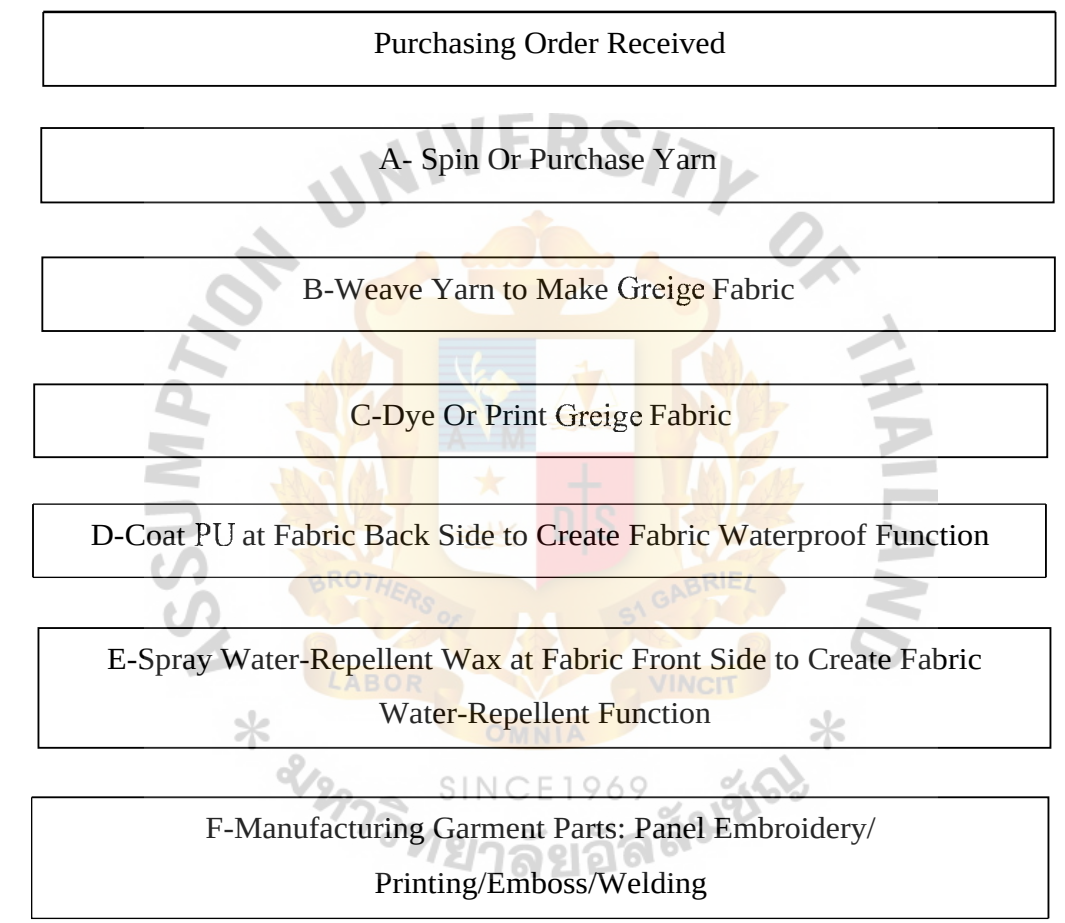


Source: Author

Figure 3.3 shows the business process mapping of the company in general. SAS's products are seasonally designed. It includes changes in style, fabrics, and colors in every winter. The company's design-and-sale cycle is relatively straightforward. They design the product, make samples and show the sample to retailers after the sales meeting, to get the order from these customers and place the production order to the supplier right away. Under the make-to-order practice, the company waits for the real order from the customers, especially during the month of January, February and March. Then, they proceed to bulk production, based on the customers' selection of product styles and features, designed by the SAS Company.

From the holistic point of view, the company business flow on scope of production. Figure 3.4 explains the order fulfillment process and presents the activities that occur after the order is received until the products are ready to be shipped to customers.

Figure 3.4: Order Fulfillment Process



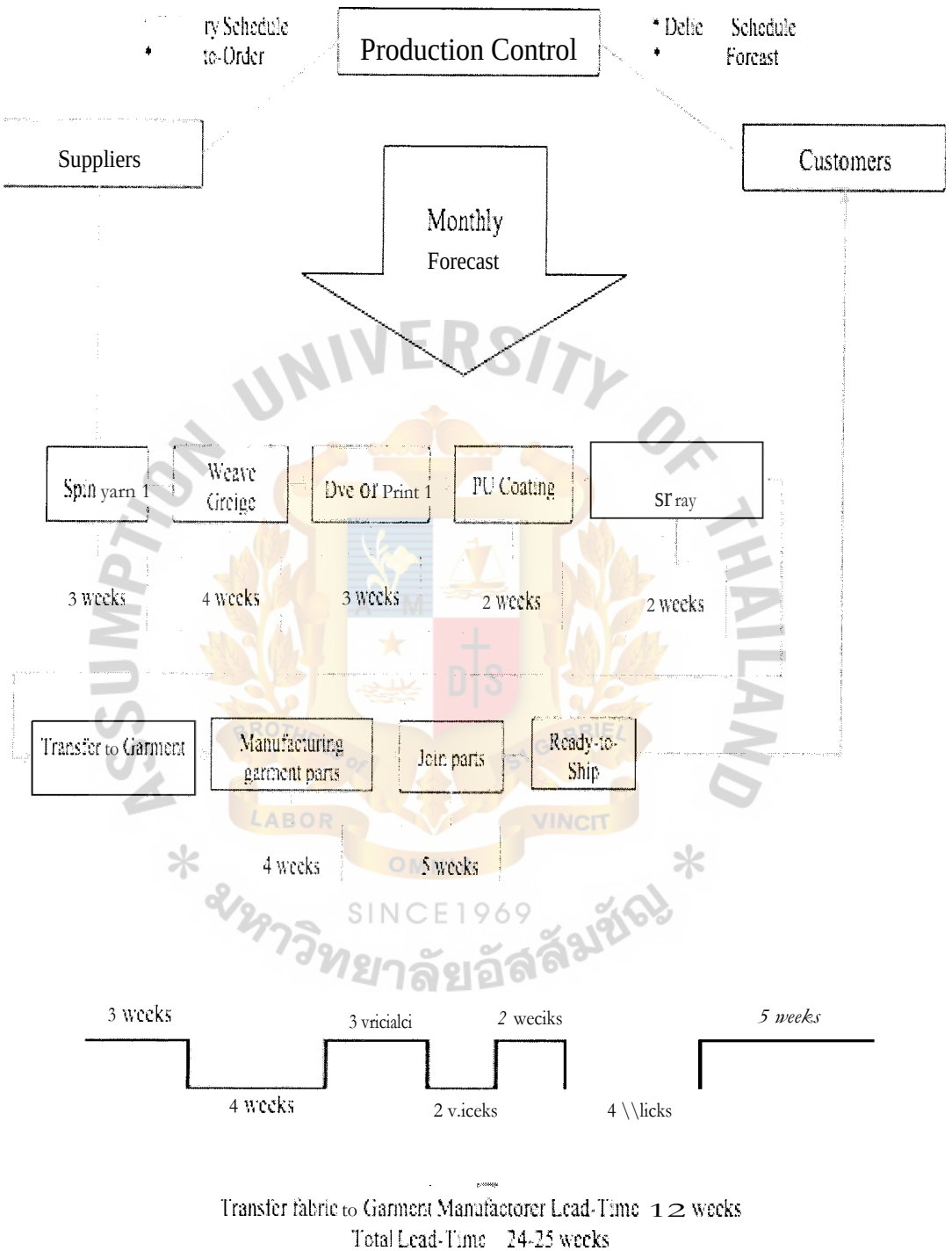
Source: Author

The process after the purchase order is made, start from yarn spinning and greige fabric weaving. These two initial stages deal with the generic raw material of yarn and greige. The design value adding processes are followed such as color dying or pattern printing. The functional features of values adding in the processes of PU coating and water-repellent spray occur at the later stage. Next, the finished fabric is then transferred to the garment assembly factory which takes around one or two weeks from Taiwan to China. The fabrics are cut in panels and sent to the decoration design after the product design construction; embroidery, embosses, print, heat transfer. Then, the panels are assembled. The quality inspection is conducted along the way through each process to ensure the right quality of end products at each stage. At the final stage the finished products are packed and ready to be shipped out to the customers.

Figure 3.5 indicates the flow of information and goods starting from the order from the customers to the end process of ready delivering of finished goods to the customers. This is shown graphically where the lead-time of each step is illustrated. Based on winter 2012 WIP from fabric mill, average process time of yarn spinning take 3 weeks, greige fabric weaving take 4 weeks, printing or color dying take 3 weeks, PU coating take 2 weeks, water-repellent spray take 2 weeks, manufacturing garment parts take 4 weeks and garment joining part take 5 weeks. Fabric transfer from fabric mill to the garment assembly factory take 1-2 weeks based on the logistic mode pick. Thus, total order fulfillment lead-time currently is 24-25 weeks on average.

Figure 3.5, shows the possible postponement points that are specified at the yarn weaving production points and dying or printing fabric production points, which are marked on the figure as postponable points. In generic at the raw material production stages, both alternatives provide flexibility to handle the demand uncertainty and the potential of 3 – 7 weeks order fulfillment lead time reduction.

Figure 3.5 SAS Company Production Mapping Processes



Source: SAS database

3.3 Postponement Application

Based on the data collection, the researcher analyzed the existing order fulfillment process and the potential of postponable points.

Figure 3.6: Purchasing Postponement Applications

A As-is order fulfilment process (Make-To-Order)		B Purchasing Postponement Application		C Purchasing Postponement Application	
	Processes Lead-time (Weeks)	Yam purchase order receiving	Processes Luc-time Weeks)	Greige purchase order receiving	Processes Lead-time (Weeks)
Purchase order receiving		Spin or purchase yarn		Spin or purchase yarn	
Spin or purchase yarn	3	Delay-Dfiiferentiate information		Weave yam to make greige fabric	
Weave yarn to make greige fabric		Weave yarn to make greige fabric		Delay-Dfiiferentiate Information	
Dye or print greige fabric	3	Dye or print greige fabric	3	Dye or print greige fabric	3
Coat PU at fabric back side	2	Cora PU at fabric back side	2	Coat PU al fabric back side	2
Spray water-repellent wax at fabric front side	2	Spray water-repellent wax at fabric front side	2	Spray water-repellent wax at fabric front side	2
M ufacturing garment parts		Manufacturing garment parts		Manufacturing garment parts	
Join parts	5	Join parts	5	Join parts	
(1-2 weeks) material transferin	2	(1-2 weeks) material transfering	2	(1-2 weeks) material transfering	2
Total order fulfilment Lead-time	25	Total order fulfilment Lead-time		Total order fulfilment Lead-time	18

Source: Author

Figure 3.6 shows that there are two possible postponable points, which could improve the order fulfillment lead-time. One is at the yarn production stage and other is greige fabric production stage. Firstly, B column shows that the order fulfillment lead-time can be improved to 22 weeks by purchasing postponement for the yarn weaving production stage. Using the demand forecast to places order and allow the fabric mill to proceed to yarn production. Later the greige fabric process is

continued once the actual order is placed. C column shows that the order fulfillment lead-time can be improved by 18 weeks by purchasing postponement for fabric dying or the printing production stage. Using the demand forecast to place orders and allow the fabric mill precede the production to finished greige stage. Approach to dying or printing is delayed once the real orders are placed.

To decide the best postponable points, design modularity and value adding will be studied to check the potential of yarn and greige fabric standardization. This will support the forecast accuracy and create flexibility to demand fluctuation. Inventory holding possibility after the postponement application is analyzed to ensure that the revenue of company does not leak into the inventory management.

The purchasing postponement strategy will be used in this case study as portrayed in the application steps of Yang et al. (2003). The researcher will follow the framework and figure out the optimal postponable points.

3.3.1 Precondition

The researcher identified based demand and surge demand, which are necessary and are first principle step of the postponement application. In this case study, the finished yarn and finished greige fabric stages are the priority. Based on the data analysis the two modules stage are generic and could easily accurately identify base demand and surge demand. The availability of the necessary information during the delay will need to be specified.

3.3.2 Approaches

To identify the postponable points, the company needs to find out how order fulfillment lead-time can be improved. High level of modularity is the key to achieving postponement successfully.

A variety of finished yarn and greige fabric are in the potential modularity level and can be useful for the case study's target. Accordingly, it needs further study to reveal the real value added focus for customers. Possibility the finished yarn or greige fabric can become more standardized design. The researcher approached the product design department and sales departments for further feedback on this point. The result of this will be optimal postponable point that needs to be implemented.

To enhance information further flow towards postponement strategies, companies need to understand the need for open communication, and managing the information whilst being willing to act as partners in the supply chain are important. Accordingly, the researcher will identify the trade off of potential risks, which may occur from the implementation as well as the benefit. The aim of this study is to prevent the burden which may occur from the strategy application, such as additional stock holding cost or the leftover of the mismatched quantities of uncertain demand at the end. The information can be used for open communication topic and discussion to gain the willingness of coordination in the supply chain.

3.3.3 Fit Other Concepts into Postponement

Time and cost reduction is of the key importance to success; most supply chains are trying to approach leagile supply chain strategies to recognize that within a mixed portfolio of products and markets there will be some products where demand is stable and predictable and somewhere the converse is true. A supply chain may need to be lean for part of the time and agile for the rest. Postponement model fits with this leagile strategy accordingly.

The researcher will study the leaking cost from the inventory holding part to ensure the strategy benefits the whole supply chain. This is the area that reflects the right identification of the differentiation stage which is appropriating case.

3.3.4 Purchasing Postponement Application

Solutions to improve the order fulfillment lead-time under leagile supply chain strategy by using purchasing postponement model will be developed by getting information from the relevant parties in the supply chain, SAS, fabric mill, and manufacturers will help solving the problem. The researcher will present the as-is situation using make-to-order strategy and compare it with the new purchasing strategy to find out how the customer order fulfillment lead-time can be improved. These solutions will be recommended to the management.

3.3.5 Expected Performance Improvement after Postponement

The expected performance after postponement application is the reduction of order fulfillment lead-time, with effective cost saving to the whole supply chain. The customers will get better service in terms of product value and perfect delivery. The researcher planned a specific period to work on each step as explained .The overall timeline for undertaking this study is around 6 months.

3.4 Summary

This chapter provides an explanation of the research methodology proposed to implement purchasing postponement model which aims at improving the customer order fulfillment lead-time. The model implementation will support SAS Company for better response to customer demand at the lowest costs. This research will provide theoretical as well as managerial benefits. On approval of the proposed model the researcher will make a critical analysis of the as-is process and present and discuss the results in the following chapters.

CHAPTER IV

PRESENTATION AND CRITICAL DISCUSSION OF RESULTS

This chapter presents the purchasing postponement application accordingly to Yang et al. (2003) framework and the result of comparisons between the current practice and the proposed alternatives. The objective of this part analysis is to determine the best alternative to reduce order fulfillment lead time by purchasing postponement and find optimal cost saving to meet the leagile concept. The implementation and results of the study is as follows:

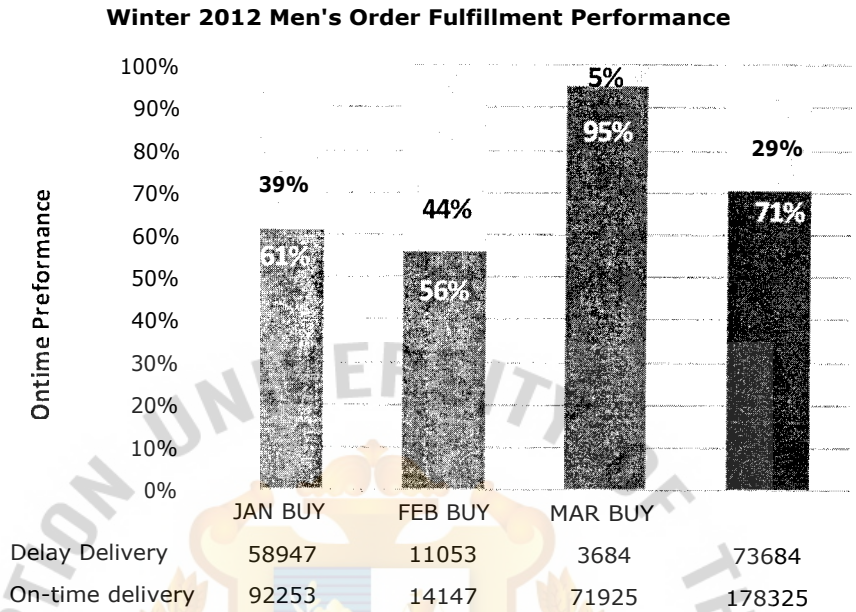
4.1 Pre-condition

Delivering the goods to the customers at the right time is one of the service expectations of SAS customers. Order fulfillment timeframe is within 21 weeks from the time of order placing to the readiness to ship the finished product. The failure of current order fulfillment performance of SAS leads to the company to profit loses. Thus the improvement of order fulfillment process within 21weeks is necessary. Situations that lead to over 21 days order fulfillment lead-time are emphasized and analyzed.

4.1.1 Current Order Fulfillment Process and Lead Time

Figure 4.1 presents the order fulfillment lead-time performance of winter 2012 Men's category, which is broken into each month. On-time delivery performance is the achievement of 21 weeks order fulfillment lead time. Delay performance is the failure of 21 weeks order fulfillment lead time.Winter2012, total men's product order are 252,009 units, and there is 73,684 units, representing 29 percent of the total order which are delayed from target of 21 weeks lead time. On-time performance of the season is 71 percent. The chart shows each buy performance as 61 percent on-time delivery during January, 56 percent on-time delivery during February and 95 percent on- time delivery during March.

Figure 4.1: Men Category's Order Fulfillment Performance



Source: SAS Database

Figure 4.2 (A) identifies the current order fulfillment process, and lead-time performance. Analysis of the WIP performance and its delay production situations are investigated, against the target of 21 weeks' timeframe process.

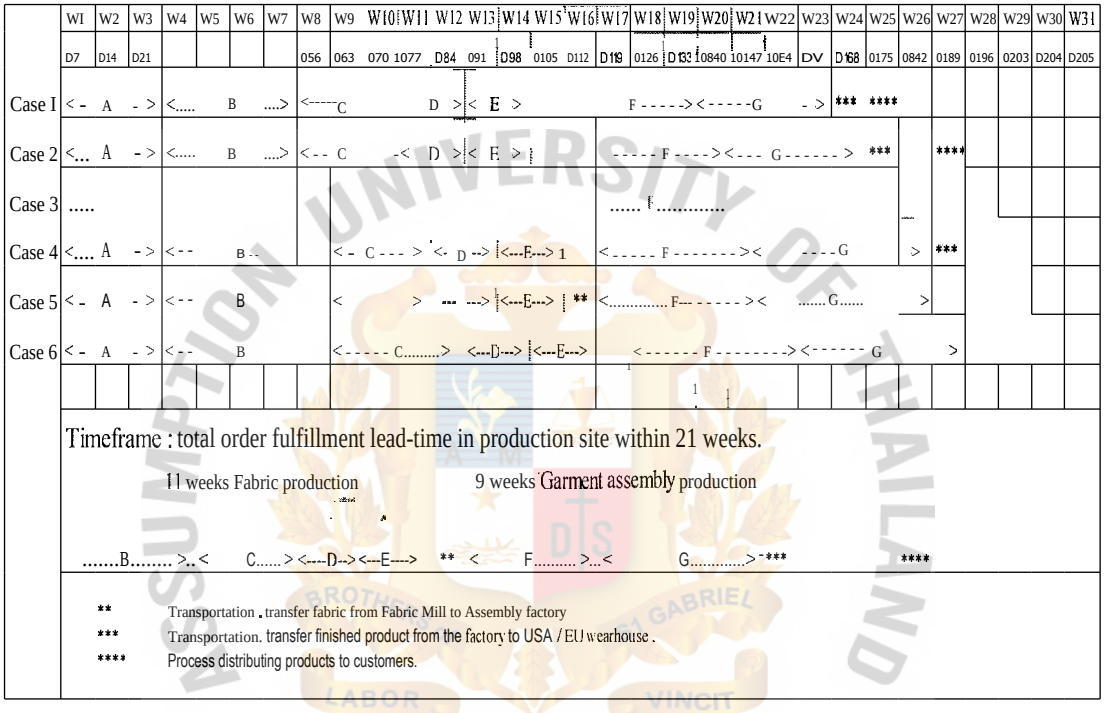
Target timeframe is 21 weeks under each processes timeframe, presented at the bottom line of the Figure 4.2 (A). SAS shares the demand forecast monthly with the fabric mill, for material preparation of finished yarn or finished greige fabrics. Once the product orders arc placed, it is expected that the fabric mill can right away utilize the prepared material, at least continue the greige weaving process, to keep 21 weeks lead-time. Anyhow the demand fluctuation at the point of real orders does not match with the earlier demand forecast, because of being too conservative at the stock keeping in the fabric mill since there is a risk of leftover liability. This leads to the insufficient materials for in-house preparation.

The six cases categorized by the actual lead time of order fulfillment during winter 2012 arc presented the process, broken from the WIP of both fabric mill and garment

manufacturing. The cause of delay in each period is extracted from the company database system and the most frequent cause of the delay in each period is represented as the main focus for finding the problem solution.

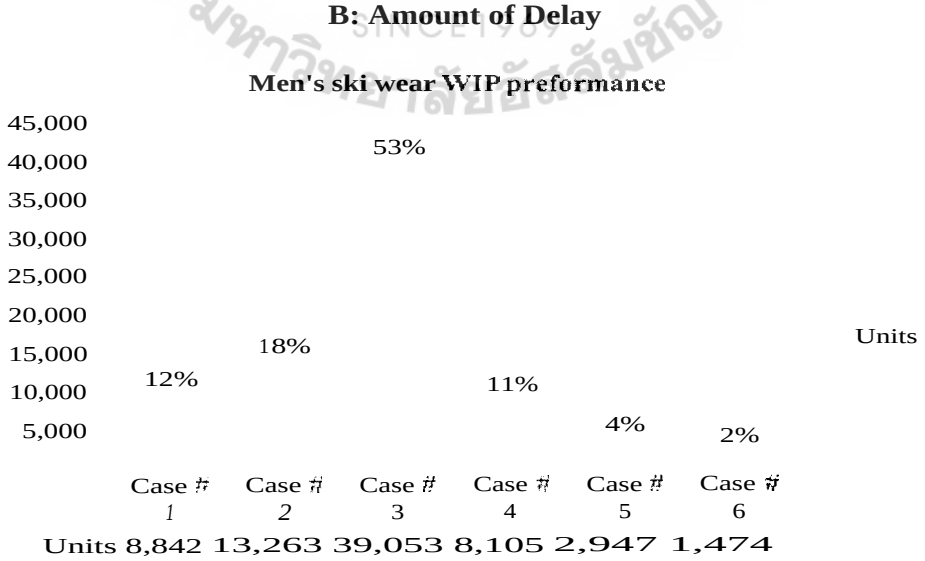
Figure 4.2: Over 21 Weeks Order Fulfillment Lead Time

A: Cases of Delay



Source: Author

B: Amount of Delay



Source: Author

Case 1 represents 22-23 weeks actual order fulfillment lead time (Delayed from the target of 21 weeks by 1-2 weeks).

Case 2 represents 24 weeks actual order fulfillment lead time (Delayed from target of 21 weeks by 3 weeks).

The breaking processes and time taking of the both Case 1 and Case 2 shows additional 3 weeks extension at fabric process, due to the unavailability of finished yarn. The flexible capacity at finished garment assembly process can squeeze up the speed faster by 1 week. In this case SAS considers trade off the option between the fastest logistic services of material transfers and adding the speed of their distribution process at the warehouse.

Case 3 represents 25 weeks actual order fulfillment lead time (Delayed from the target of 21 weeks by 4 weeks.). The breaking processes and time taken shows additional 3 weeks extension in fabric mill side similar to Case 1 and Case 2, while the normal process time frame in the assembly process is achieved.

Case 4 represents 26 weeks actual order fulfillment lead-time (Delayed from target of 21 weeks by 5 weeks). The breaking processes and time taking showed additional 4 weeks extension in the fabric mill side, due to no finished yarn available and the additional 1 week at the assembly manufacturer. It is the impact from the limited capacity in the assembly process which is caused by the delay of fabric and the original capacity plan cannot be hit so the production lead-time lengthens out one more week.

Case 5 represents 27 weeks order fulfillment lead-time time (Delayed from target of 21 weeks by 6 weeks). The breaking processes and time taking shows additional 4 weeks extension in the fabric mill side, since no finished yarn is available. The additional 2-weeks at the garment assembly manufacturer since the impact from the limited capacity in the assembly process which delays the fabric disturb the original capacity plan so the production lead-time extends one more week.

Case 6 represents 28 weeks order fulfillment lead-time time (Delayed from the target of 21 weeks by 7 weeks). The breaking processes and time taken shows additional 5 weeks extension in the fabric mill side, since no finished yarn is available and other process capacity is extended to another additional 2-week at the garment assembly manufacturer. It is the impact from the limited capacity in the assembly process. The delay of fabric cannot reach the original capacity plan so it extends out one more week.

The frequency of each case that leads to the lead-time extension is represented in Figure 4.2 (B)

4.1.2 Root Cause Analysis

Based on the analysis of the data collection in the previous topic, it can be implied that the main factor that leads to delay of over 21 weeks order fulfillment lead-time can be categorized into 2 main factors which are as follows:

First, 83 percent of the main cause of over 21weeks fulfillment lead-time is shown in Case 1, Case 2 and Case3. The long lead-time utilization is under the condition of raw material availability at the order placing point. Since the demand fluctuation brings uncertain forecasting, the fabric mill conservatively stocks the finished yarn and greige fabric, following the monthly forecast, shared by SAS. Additional interviews with the fabric mill, shows that SAS can share the risk of left over from stocked yarn and greige fabric. The fabric mill is willingly to precede extra stock to keep shorter order fulfillment lead time.

Second, 17 percent from the balanced cases reflects the peak production period of January buys in, which the capacity arrangements at both fabric mill and garment assembly manufacturers arc too tight for more flexibility. While the lead-time of fabric is lengthening, the garment manufacturers' capacity plan cannot handle the unstable lead-time from the fabric mill side. When the beginning of the process flow

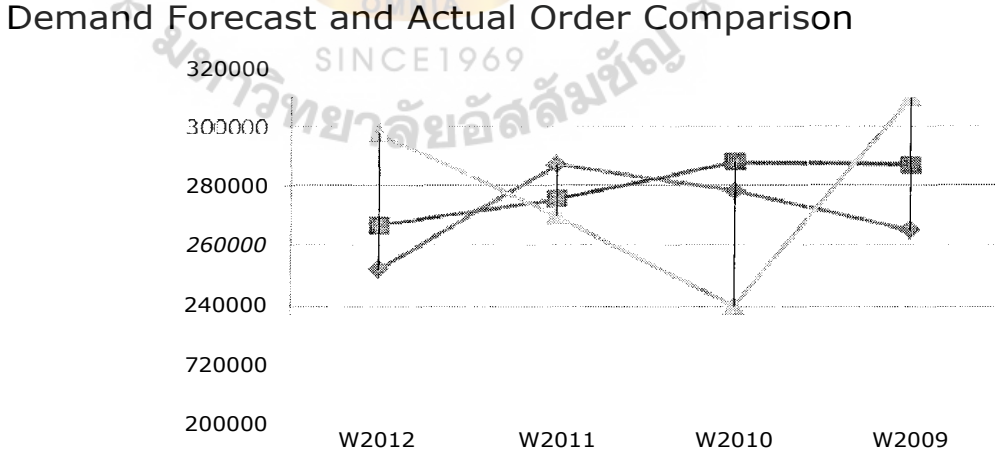
efficiency in the fabric mill was disturbed, the downstream process was affected too. In case of the January buy production plan at the fabric mill side is smoothed out, and potentially this would support shorter lead-time, too

83 percent of the delivery delay has the same root cause. The study priorities to find the solution for this root cause. Purchasing postponement model is applied as a tool for improvement. The solution of the main root cause potentially can reduce the balance causes as well.

4.1.3 Demand Forecast

First step of postponement strategy implementation is claimed that company need to figure out what can be well forecasted and what cannot be forecasted. Postponement considerations are only given to those decisions about unpredictable items. It is a strategy to intentionally delay the execution of a task instead of starting it with incomplete or unreliable information input.

Figure 4.3 Men's Category Demand Forecast and Actual Order Comparison



	W2012	W2011	W2010	W2009
Actual order	252009	287005	278003	265000
—Forecast : 4 weeks before first order come	266500	275400	*288022*	*287 000*
Forecast : 8 weeks before first order come	297600	269600	240002	310000

Source: SAS Database

Demand forecasting in SAS is available after the sales meeting in November , and it is updated monthly, feedback is given from the sale teams who are next to the direct customers, the retailers. The information of buying plan from each retailer to each product is updated from that moment. Anyhow, the fluctuation of change over the period of time still highly exists.

Figure 4.3 represents the annual demand forecast over the periods of November, four weeks before actual first order actually arrives. December forecast is updated, 8 weeks before actual first order actually arrives. The graph shows the overall total quantity of Men's skiwear products without its being broken into styles. The graph shows the forecast in each period, comparing with the actual quantity order, over four years. The demand over the time period each year is not stable and it also can be implied that the nearer time to the demand point, the more accurate the forecast is.

The demand in skiwear market is uncertain. It is hard to predict the demand of finished product when the skiwear is involved with the fashionable trends and snow condition in meantime.

The dead line for order gathering and closing the total quantity for purchasing orders for production are main 3 rounds in January, February and March.

Following the rule of forecast by Bozarth and Handfield (2008), Forecast is more accurate for shorter time periods. In this case study, to apply the latest demand forecast which available at the most needed time is.

Managing the demand uncertainty of the SAS case study: As the priority of the main order fulfillment lead-time is for January buy, which is the peak production period, hitting the limitation of capacity flexibility, can be considered to apply only for the purchasing postponement for January Buy and February Buy combined. Any leftover or excessive order quantities of actual January buy can be taken care of by February buy material preparing portion. Remaining February buy and March buy as

original make-to-order, creates room for balancing the demand errors at the final round of production.

With above reasons, the demand forecast is applied at point of time given below:

4.1.3.1 Alternative One: Greige Fabric Purchasing Postponement

Yarn production process requires 3 weeks process time. Thus, to catch up with the needed lead-time of yarn production, the yarn quantity commitment is needed to be provided in total by combining January buy and February buy quantities to the fabric mill at the beginning of December, before the actual first buy order actual arrives. The demand forecast for the month of December is analyzed for the commitment quality in the meantime.

4.1.3.2 Alternative Two: Dyed or Printed Fabric Purchasing Postponement

Finished greige fabric process requires 7 weeks process time. To create enough production lead-time of greige fabric, the finished greige quantity commitment needs needed to be provided to the fabric mill at the beginning of November, before the actual first buy order arrives. The demand forecast for the month of November is analyzed for the commitment quality in the meantime.

4.2 Approach

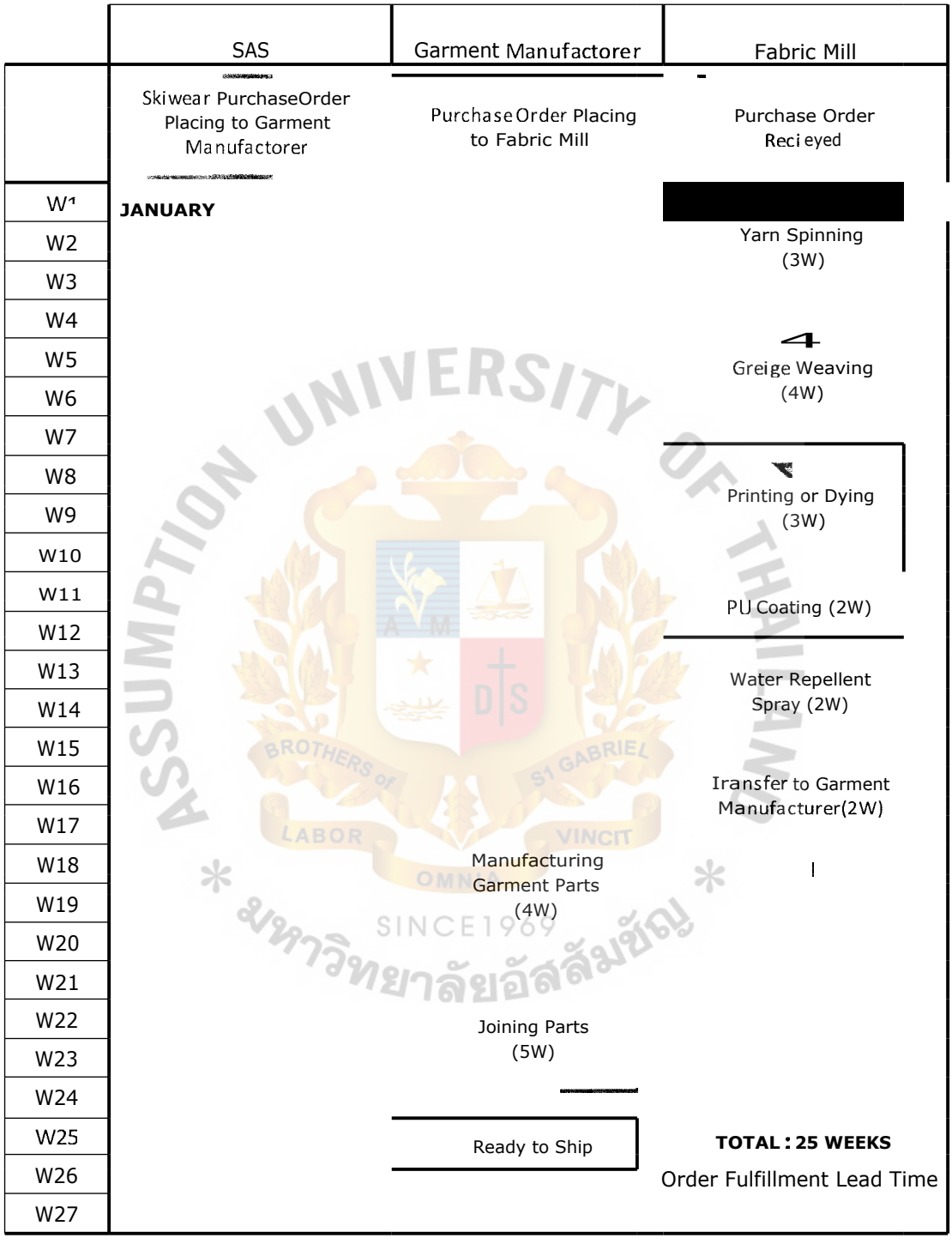
4.2.1 Identify Order Fulfillment Process

This portion identifies current order fulfillment and alternative order fulfillment sub-processes. They are applied postponable points under the purchasing postponement concept. Also specific information availability is indicated in the needed time.

4.2.1.2 Current Order Fulfillment Process

Figure 4.3 on the next page presents current order fulfillment process and the time consumed at each stage.

Figure 4.4 Current Order Fulfillment Processes



Source: Author

Once the new products have been approved and selected, the SAS sale team gathers the order back from the retailers' customers, and place the purchase order to the garment manufacturers. The first order is received as January buy, and replenishment

orders are received as February buy and March buy. Garment manufacturers calculate the materials and components based on the finished product purchase order received. Then, the fabric purchase order is placed to the fabric mill by the garment manufacturer. Fabric production starts from yarn spinning, greige weaving, fabric printing or dying, PU coating, and water repellent spray. After that the finished fabric will be shipped to the garment assemble manufacturer. Then, the finished garments are shipped out to SAS distribution center in USA, Europe, or directly to the customers' warehouses. The process is repeated the same for each buy.

4.2.1.3 New Alternatives Order Fulfillment Process

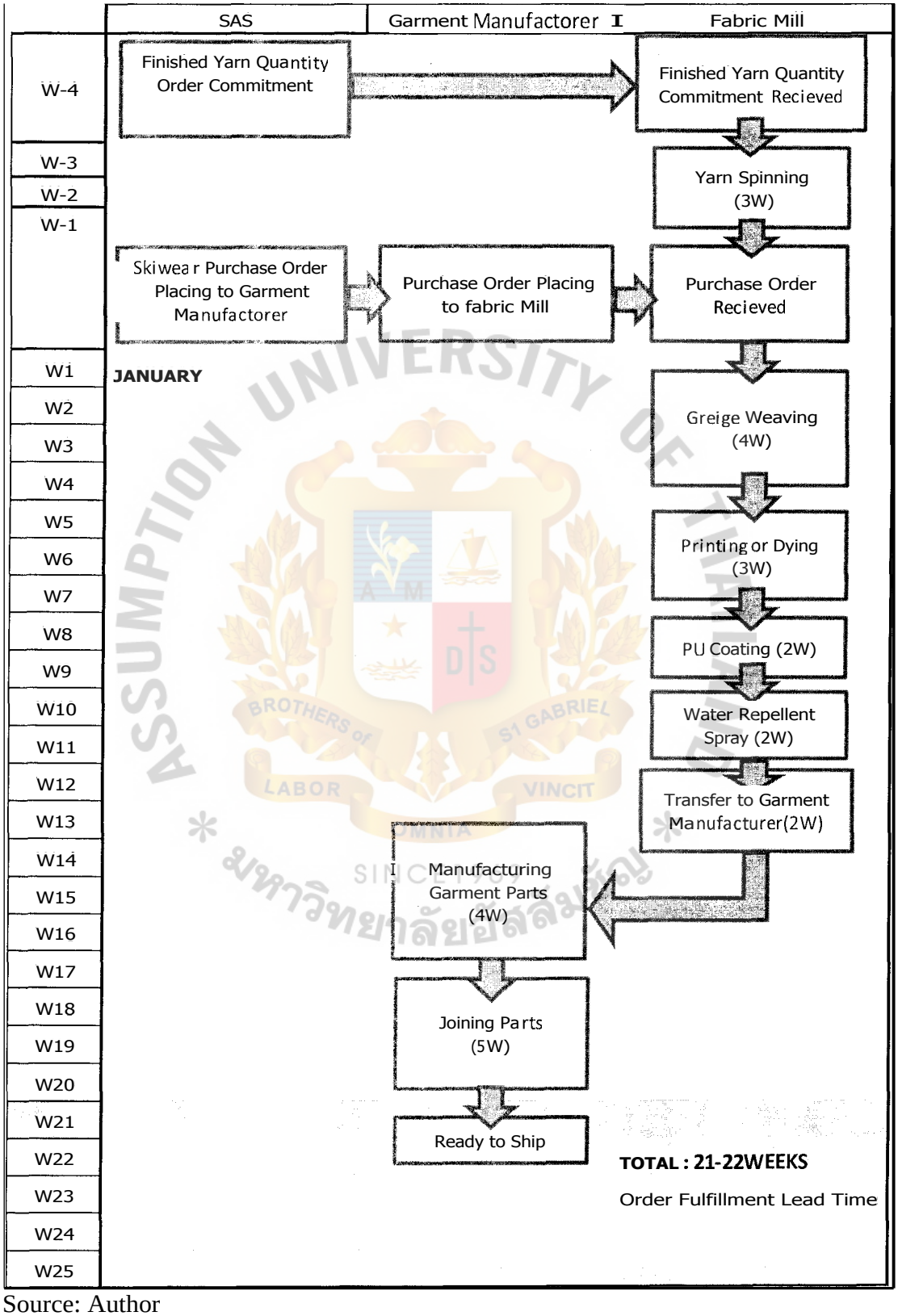
There are two alternatives order fulfillment processes based on purchasing postponement strategy which can improve lead time performance

A) Alternative One: Finished Greige Purchasing Postponement

This purchasing postponement alternative is applied to the postponable point at the finished greige stage. The preceding yarn production and waving process is delayed differentiation until the actual order arrives.

At the begining of December, four weeks before January buy actual order arrives; The SAS commits an amount of yarn quantity to the nominated fabric mill by using December demand forecast. Yarn quantity commitment includes both January and February buys. The yarn production starts at this stage. Spinning yarn process to ready-finished-yarn takes three weeks. The first actual order of January buy arrives week after that, in January, the fabric mill receives the purchase order from the the garment manufacturer for the quantities of finish fabric. The fabric mill then receives the information of the delay differentiation weaving construction types and so on, until the final stage of finished fabric. Thus, the finished yarn in stock can be used right away to feed the next stage of value adding production stages.

Figure 4.5 **Greige** Fabric Purchasing Postponement



Source: Author

Figure 4.4 presents the January buy purchasing postponement process based upon the timeframe planning, while February buy and March buy remain the same as original process with a step of stock checking before raw materials replenishment orders are placed.

Week one in Figure 4.4 represents January, the month that the first order is placed, as January buy. Due to the unstable demand over the time period before the real order emerges, the new alternative process offers the flexibility to manage the mismatch of forecast and the actual order. In the same time the priority of January buy production is smoothed out to keep shorter fulfillment lead-time for all buys.

For the January buy order fulfillment, any shortage or left over between the demand forecast and actual January buy order is, the discrepancy portion can be taken care of by February buy portion. Also, the leftover of the finished yarn is kept for the coming up February buy and March buy.

For February buy and Mach Buy the process remains as original make-to-order, the left over stocks from January order fulfillment needs to be monitored before reordering the new lot of material for February buy and March buy to manage the risk of holding incorrect material items in the inventory.

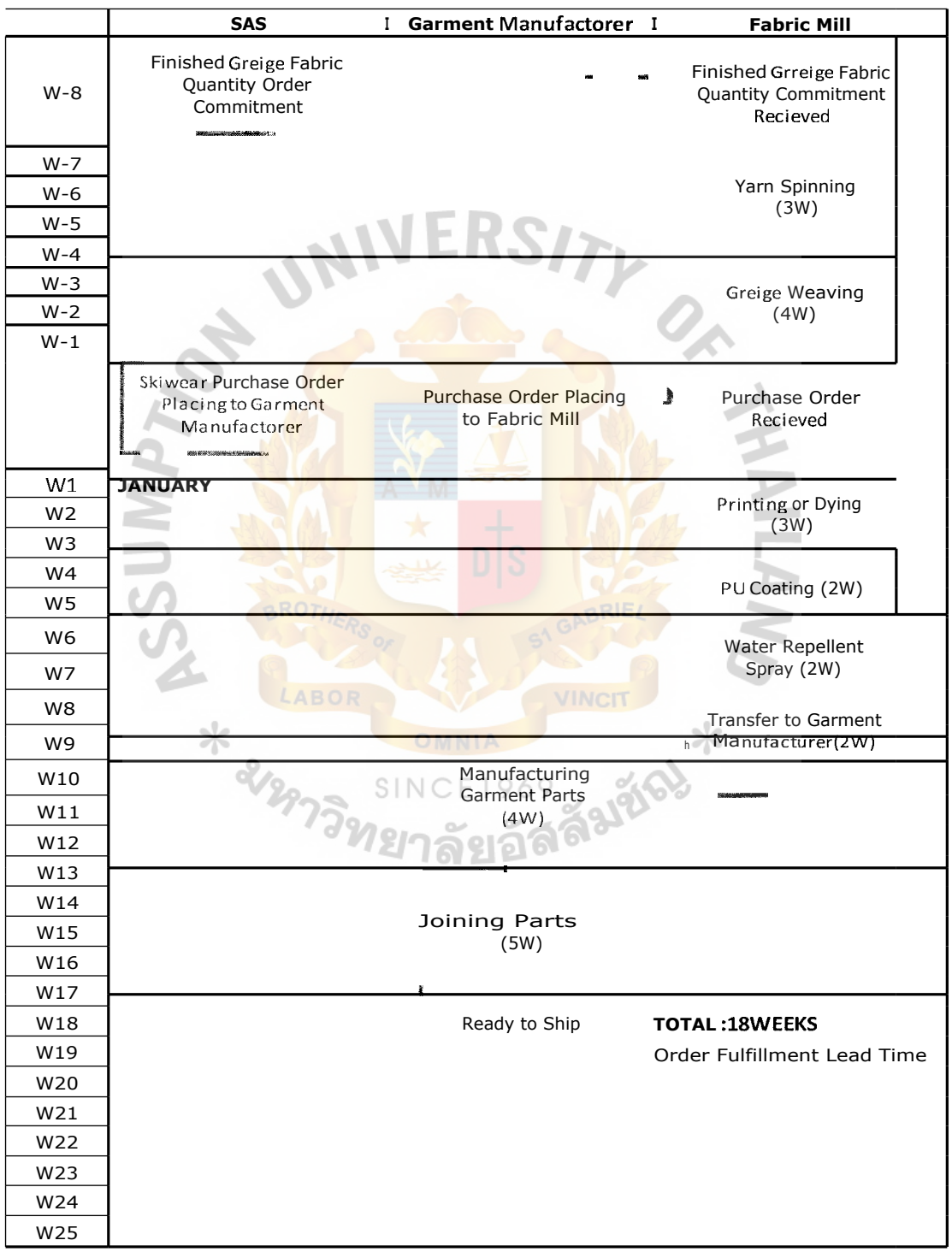
B) Alternative Two: Dyed or Printed Fabric Purchasing Postponement

This purchasing postponement alternative is applied to the postponable point at the dyed or printed fabric stage. The preceded finished greige fabric production and fabric dying or printing process is delayed differentiation until the actual order arrives.

At the begining of November, eight weeks before the January buy actual order to arrive; SAS commit an amount of greige fabric quantity to the nominated fabric mill by using November demand forecast. The greige fabric quantity commitment includes both January and February buys. The fabric production starts at this stage.

Spinning yarn process to get finished yarn ready would take three weeks. Another 4 weeks is needed for the yarn waving process.

Figure 4.6 Dyed or Printed Fabric Purchasing Postponement



Source: Author

The first actual order of January buy comes a week after that; the fabric mill received the purchase order from the garment manufacturer for the quantity of finished fabric. The fabric mill then receives the information of the delayed differentiation dying or printing construction types and so on until the final stage of the finished fabric. Thus, the finished greige fabric in stock can be used right away to feed the next stage of value added production stages.

Week one in Figure 4.5 represents January, the month that the first order is placed, as a January buy. The Figure 4.5 explains that January buy purchasing postponement process depends upon the timeframe planning, while February buy and March buy remain the same process as original with a step of stock checking before raw materials arc replenishment for the order to be placed.

Due to the unstable demand over the time period before the real order emerges, the new alternative process offers flexibility to manage the mismatch of forecast and the actual order. All the same time the priority for January buy is smoothen out to keep shorter fulfillment lead-time for all buys.

For the January buy order fulfillment, any shortage or left over between the demand forecast and actual January buy order can be taken care of by February buy. Also, the leftover of finished greige fabric can be kept for the coming up February buy and March buy.

For February buy and Mach Buy the process remains as original make-to-order. The left over stock from January order fulfillment needs to be monitored before reordering the new lot of materials for February buy and March buy to manage the risk of holding incorrect material items in the inventory.

4.3 Order Fulfillment Performance and Operating Trading Off after Apply Purchasing Postponement

The main operating cost from both alternatives of order fulfillment process is inventory cost. Below Table 4.1 represents inventory cost trade off for each alternative situation.

The Inventory cost calculation. Formula: (H) = (P)*(i)*(Q/2). (P) is the unit price of the product. Finished yarn is averaged at 0.9 USD for 1 yard of fabric, while finished griege fabric cost is averaged at 2.6 USD per yard. (i) is stock carrying cost at the fabric mill side, which is 10% of the product price. (Q/2) is the quantity of average stock to carry.

Table 4.1: Inventory Cost Comparison

Buy Breaking		JAI\ BUY	FEB BUY	MAR BUY
Actual order of Men's product	Skiwear (unit)	151200	25200	75609
Alternative One Finished yarn commitment 1 month ahead		**JAN BUY**	**FEB BUY**	**MAR BUY**
Yarn utilization (1.8 yards I garment unit)	(yard)	*272,160*	*45,360*	*136,096*
Commitment Quantity	(yard)	*317,520*	*0*	*0*
Stock carrying cost 10% (USD) Finished yarn (0.9 USD/yard)	(H)=(P) (i) (Q/2)	$157,172	*$0*	*$0*
Inventory Cost				$157,172
Alternative Two Griege fabric commitment 2 months ahead		**JAN BUY**	**FEB BUY**	**MAR BUY**
Greige fabric utilization (1.8 yards I garment unit)	(yard)	*272160*	*45360*	*136096.2*
Commitment Quantity	(yard)	*317520*	*0*	*0*
Stock carrying cost 10% (USD) Finished greige fabric (2.6 USD/yard)	(H)=(P)*(i)*(Q/2)	$454,054	*$0*	*$0*
Inventory Cost				$454,054

Source: Author

The amount of 317520 yard of fabric consumption is based on the combined usage of quantity of both January buy (which represents 60-70% of the annual order) and February buy (which represent 10-15% of annual order). Averaged stock carrying amount is from 317520 /2. This is as estimated maximum quantity for stock carrying. While some portion of January buy can be feed right away in the next stage of yarn weaving or greige fabric dying and printing after the actual purchasing order arrives. The mismatching of the forecast quantity and real January buy orders would potentially create portion of left over plus portion. Also February stocks creates the inventory holding cost.

Furthermore, the quantity of the stock to carry also depends on the demand forecast accuracy and the effectiveness of demand uncertainty management at the real demand approach. Thus, the calculation in Table 4.1 directly applies the actual order quantity of the winter 2012's January buy and February buy for calculation.

Table 4.2: Total Cost Comparison

Cost comparison (USD)	Current Order Fulfilment Process (Make-to-Order)	Alternative One Order Fulfilment Process Finished greige fabric purchasing postponement	Alternative Two Order Fulfilment Process Finished Dyed or Printed fabric purchasing postponement
Order Fulfillment Lead-time	25 weeks	21 weeks	18 weeks
A)10% Discount (Delay panelty)	3,483,196	0	0
B)Extra Transportation expense	738,110	110,717	0
C)Cancellation cost	870,799	0	0
D)Inventory Cost	0	157,172	454,054
E)Minimun Order Quantity (1000 yard)	0	0	0
Total Cost	5,092,105	267,889	454,054
Saving Cost		4,824,217	4,638,051

Source: Author

Table 4.2 represents cost trading off of each situation.

Based on the Table 3.1 in Chapter 3, the current practice represents the loss of 5,092,105 USD for Men's category due to the delay of order fulfillment. The profit loss leaks out through fastest logistic service to keep customer's order delivery on-time, while delay penalty and order cancellations have a critical impact for the business in the long term.

The application of alternative one, finished greige fabric purchasing postponement could reduce the order fulfillment lead-time from 25 weeks to 21-22 weeks. To achieve a total of 21 weeks lead-time for all, there is extra cost of fabric air-freight transportation from the fabric mill to the manufacturer which represent 15% of the total cost of extra transportation expense of Men's category are a total amount of 110,717 USD. Inventory carrying cost of the finished yarn product cost 157,172 USD. The total trading off cost is 267,889 USD which saves up to 4,824,217 USD from the current practice process. The performance of target order fulfillment lead time is achieved.

The application of alternative two finished dying or printing fabric purchasing postponement could reduce the order fulfillment lead-time from 25 weeks to 18 weeks. Inventory carrying cost of the finished yarn product as the total trade off cost is 454,054 USD which saves up 4,638,051 USD from the current practice process, while it increases the effectiveness of order fulfillment lead time within 18 weeks. Inventory cost would be influenced by the accuracy of the November's demand forecast which is used for greige fabric commitment.

4.4 Summary

Designed order fulfillment processes, alternative one and alternative two, indicates that purchasing postponement strategy can support the order fulfillment lead-time reduction. The performance of order fulfillment lead time and cost reduction of both alternatives reflect the achievement of leagile supply chain strategy, at the same time.

The application of alternative one, finished greige fabric purchasing postponement represents the best practice supporting current SAS business goals. It balances the performance on optimal cost saving and 21 week's lead-time is achieved. The variety of yarn module is in small amounts and is easy to manage the sharing across the greige fabric families. Demand forecast as one month before actual order arrives is provides more accurate details as the time period is shorter and nearer to the real demand.

The application of alternative two, finished dying or printing fabric purchasing postponement can be considered further for the most efficient order fulfillment time consumption, but the cost trading off is necessary to be monitored closely . Enhancing the modularity and standardization concept could help to reduce the present weak point of this alternative. While the smaller amount of griege fabric type can be shared across the product designs, it will create the lower risk of carrying the wrong finished greige fabric items and reduce the time to the market of SAS product in the future.

CHAPTER V

SUMMARY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the findings, conclusions of the research results and provides recommendation.

5.1 Summary of the Findings

The discussion in Chapter 4 presents the benefits of purchasing postponement application in this case study. The results of both alternatives and new processes can improve the lead-time performance with effective cost saving that increases the company profit.

Alternative one is the best process since it achieves what was intended. The order fulfillment lead time is improved with plenty of cost saving.

Anyhow, the study explored an aspect of an opportunity gain for the company. While the alternative two processes presents the shortest lead time which is performance improvement to 18 weeks period, and short order fulfillment lead time plays the important role in the market today as key to support the emerging demand at the shortest time. The cost of inventory is the main operating cost trade off of alternative two. Enhancing the modularity and standardization concept can support the weak point of alternative two which has too many types of greige fabric constructions. The modularity and standardization in the greige fabric stage can avoid the liability from demand fluctuation, while it can be shared with the other finished fabrics in same greige construction. At the design point, greige fabric construction of each category, Men's, Women's, and Kyd's should be further studied for considering the modularity enhancement across the product categories. Furthermore, it is necessary to recognize the product value that the customer expects.

Balancing the product value and the modularity concept is a sensitive part that SAS Company should pay attention to.

5.2 Conclusions

The purpose of this study is to apply the findings to improve the business situation in reality. Based on the database and information analysis, the researcher recommends the application of short-term and long-term implementation.

Short term implementations: For the application of alternative one, finished fabric purchasing postponement is recommended.

A) Order fulfillment lead-time performance is improved, and the target of 21 weeks lead time, with the lesser cost expense is achieved.

B) The cost of cancellation and delay penalty can be eliminated by this new process implementation. Cost saving is up from the current practice by 4,824,217 USD.

C) Cost of inventory carrying cost and extra transportation cost as trade off is 267,889 USD

D) The implementation of alternative one process does not disturb the design portion much, and can keep the product value as it is.

E) Low risk of leftover stock as the small variety of the yarn type can be shared over the families in next product module.

Long term implementations: For the application of alternative two, dyed or printed fabric purchasing postponement is recommended, as it presents the most effectiveness of lead time performance reduction.

A) The achievement of 18 weeks lead-time represents a quick response concept which reduces time-to-market. This satisfies the SAS customers in future long term as the customers can place accurate order under the shorter period

of production lead time that SAS offers. This can make SAS more competitiveness for sell opportunity's increasing.

B) The cost of cancellation and delay penalty can be eliminated by this new process implementation. It saves up 4,638,051 USD, compared to the current practice.

C) Cost of inventory carrying cost as trading off is 454,054 USD

D) The implementation of optimal alternative two processes does need designers' team to be involved to enhance the modularity and standardization concept onto product development. It would create efficient low risk of leftover stock while the lesser variety of the greige fabric construction type can be shared over the families in next product module.

Anyway, the product value that the end customers expect is needed to be further studied, to ensure that the greige differentiation is necessarily required. During the development process, all fabric types which are picked from the designers in each category should be combined and analyzed the potential of its sharing utilization across the styles and categories.

SAS can consider creating a trial product line as well to run the finished dyed or printed fabric postponement to balance the capacity in fabric mill during the January buy, and gain the optimal quick response benefit in return.

5.3 Theoretical Implications

The study, following the postponement application framework by Yang et al. (2003), provides a chance to explore the wide range of aspects, linked to the decision of purchasing postponement applications.

To implement the purchasing postponement strategy, all the aspects need to be gathered and weighed for the pros and cons. The direct implementation without understanding the product and supply chain value would lead to the failure of postponement strategy applications.

5.4 Managerial Implications

The purpose of this study is to design the new order fulfillment process based on purchasing postponement strategy, in order to improve lead time performance.

The employment of the purchasing postponement model enhances the effectiveness of quick response for a SAS skiwear product, which is with forecast accuracy, is difficult to achieve. At the same time, it helps reducing the extra loses from delay penalty and cancellation by the previous practice which focuses only on the most effectiveness of logistics and transportation functions. The company management teams can gain more alternative solutions on the different perspective views, and can consider applying the study's model to the real situation.

Moreover, other companies in the fashion industry can use this study as one of techniques for developing leagile supply chain to improve the effectiveness of business movement.

5.5 Limitations and Recommendations for Future Research

The postponement strategy implementation requires identifying the stage of forecast accuracy. Ski apparel demand emerges, depending on the weather and snow situation which is difficult to predict, while the variety of greige fabric is still in wide range without efficient family concept. The situation creates difficulty to follow the methodology right away. To create the flexibility for forecast accuracy is to enhance the modularity in stage of generic material, at least to the greige fabric stage. Greige fabric is still in doubt for product value insight of customer. Questions occur "Does the customer consider the fabric gerige construction as one of product value?" or "Does the greige fabric involved with the finished product have value according to customers' expectation?"

Due to the limitation of time, instead of enhancing the product modularity to create room for more forecast accuracy, the researcher must move in the direction of the solution which can handle the risk and impact of forecast inaccuracy.

Thus, the researcher recommends further approach marketing research in order to weight the product value of each category. The potential of product development direction to create more modularity for the generic material must be analyzed. This can be a further step for order lead-time performance improvement at less cost for efficient inventory keeping

The focus of the study is on the lead time performance improvement under the postponement strategy application of men's category. It is highly recommended that the study be extended to the balanced product categories.

BIBLIOGRAPHY

Alderson, W., (1950). Marketing efficiency and the principle of postponement. *Cost and Profit Outlook,* (3), 15-18.

Aviv, Y. & Federgruen, A. (2001), Design for postponement: a comprehensive characterization of its benefits under unknown demand distributors, *Operations Research,* (49) 4, 578-98.

Baldwin, C. & Clark, K., (1997). Managing in an age of modularity. *Harvard Business Review,* 84-93.

Bowersox, D.J. & Morash, E.A. (1989), The integration of marketing flows in channels of distribution, *European Journal of Marketing,* (23) 2, 58-67.

Boyer, R. & Drache, D. (1996), States Against Markets: The Limits of Globalization,London: Routledge.

Bozarth C.C. & Handfield R.B, (2008).Introduction to Operations and Supply Chain Management, Prentice Hall. 2nd edition.

Christopher, M., (1992). *Logistics and supply chain management,* London: Pitmans. edition.

Christopher, M. (1998), *Logistics and Supply Chain Management,* London: Financial Times/Pitman. 2' edition.

Christopher, M. & Towill, I). R., (2000). Supply chain migration from lean and functional to agile and customised. *Supply Chain Management: An International Journal,* (5) 4, 206-213.

Conklin, J.M. (1994), *Extending capabilities through contract manufacturing, Proceedings of Electro International Conference,* 145-53.

Feitzinger, & Lee, II., (1997). Mass customization at HewlettPackard: the power of postponement. *Harvard Business Review,* 116-121.

Friedman, T.L.,(2006). *The World is Flat.* Farrar, Straus and Giroux.593.

Fujita, K., (2002). Product variety optimization under modular architecture. *Computer-Aided Design,* (34) 12, 953-965.

Keely L. C., (2003). *The Order Fulfillment Process, International Journal of Logistics Management,* (14) 1,19 -- 32.

Hopp, W. J., (2003). *Supply chain science.* Irwin : McGraw-Hill. 1 edition

Kinney, L.E., (1990). Material planning, *AT&T Technical Journal, July/August,* 19-32.

Lampel, J. & Mintzberg, H., (1996). Customizing Customization. *Sloan Management Review,* 21-30.

Lee, H. L., (1996). Effective management of inventory and service through product and process redesign. *Operations Research,* (44), 151-159.

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, 77-91.

Lee, H. L. & Tang, C. S., (1997). Modeling the costs and benefits of delayed product differentiation. *Management Science,* (43) 1, 40-53.

Lee, H. L., Billington, C. & Carter, 13., (1993). *Hewlett-Packard gains control of inventory and service through design for localization.* Interfaces, (23) 4, 1-11.

Mangan,J.. Lal wani,C., Butcher,T., & Javadp our , R. (2012). *Global Logistics and Supply Chain Management.* John Wiley & Sons. 2nd Edition.

Mason-Jones, R. & Towill, D., (1999). Using the information decoupling point to improve supply chain performance. *The International Journal of Logistics Management, (10)* 2, 13-26.

Naumann, E. & Korduplcski, R., (1995). *Customer Value Toolkit*. South-Western College Publishing. 1 t edition.

Naylor, J. B., Naim, M. M. & Berry, D., (1999). Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain. *International Journal of Production Economics,* (62), 107-118.

Olhager, *J.,* (2003). Strategic positioning of the order penetration point. *International Journal of Production Economics,* (85) 3, 319-329.

Silver, E. A., Pyke, D. F., & Peterson, R., (1998). *Inventory management and production planning and scheduling.* New York: *J.* Wiley. 3rd edition.

Swaminathan, J. M. & Lee, H. L., (2003). Design for postponement. *In Graves & de Kok, ed. Handbook of OR/MS on Supply Chain Management.*

Ulrich, K., (1995). The role of product architecture in the manufacturing firm. *Research Policy,* (24), 419-440.

Van Hoek, R. I., (2001). The rediscovery of postponement a literature review and directions for research. *Journal of Operations Management*, (19), 161-184.

Yang, B., Burns, N.D. and Backhouse, C.J. (2003), The management of uncertainty through postponement, *International Journal of Production Research,* (42) 6, 1049-64.

APPENDICE

APPENDIX 1

SAS Product Cycle

JAN				FEB				MAR				APR				MAY				JUN			
WI	W2	1W3	W4	W5	W6	W7	1W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21	W22	W23	W24

Design development kick off.

JUL				AUG				SEP				OCT				NOV				DEC			
W25	W26	W27	W28	W29	W30	W31	W32	W33	W34	W35	W36	W37	W38	1W39	W40	W41	W42	W43	W44	W45	W46	W47	W48

sage pen°

Sale meeting.

JAN					FEB				MAR				APR				MAY				JUN			
W49	W50	W51	\V52	W53	W54	W55	\V56	W57	I W58	W59	I W60	W61	W62	W63	W64	W65	W66	W67	W68	W69	W70	W71	W72

Trade shows.

JAN BUY
Order place

FEB BUY
Order place

MAR BUY
Order place

Jan buy production

Feb buy production

Mar buy production

JAN-ready to ship.

JUL				AUG				SEP				OCT				NOV				DEC			
W25	W26	W27	\V28	W29	W30	\V31	W32	W33	W34	W35	W36	W37	W38	W39	W40	W41	W42	W43	W44	W45	W46	W47	W48

FEB-ready to ship.

AJAR-ready to ship.

Source: SAS's database