

APPLYING POSTPONEMENT STRATEGY TO INVENTORY MANAGEMENT

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ABSTRACT

The purpose of this research is to improve inventory cost and turnover of a manufacturer of wooden furniture by applying manufacturing postponement strategy. This allows a firm to postpone the final manufacturing process until a customer's specific demand.

Documentary data, such as production process and lead times, sales data, customer behaviors, and delivery lead times, were collected and analyzed in order to develop a new production process. Excel worksheets were created for controlling overall inventory transactions and movements.

The results of the existing and postponement production processes were compared, to identify improvements. The findings were that the average inventory costs of the two pilot product categories could be reduced by 30.3% and 21.3%, and the average inventory turnovers could be improved by 43.4% and 27.1 %.

บทคัดย่อ

งานวิจัยนี้จัดทำขึ้นเพื่อแสดงถึงการลดต้นทุนสินค้าคงคลัง และเพิ่มอัตราการหมุนเวียนของสินค้าคงเหลือของผู้ผลิตเฟอร์นิเจอร์ไม้ โดยใช้กลยุทธ์การเลื่อนการผลิตในขั้นตอนสุดท้ายออกไป กลยุทธ์นี้สามารถช่วยให้ผู้ผลิตสามารถเลื่อนกระบวนการผลิตขั้นตอนสุดท้าย ไปจนกว่าจะรับรู้ความต้องการของลูกค้าที่แน่นอน

วิธีการผลิตแบบใหม่ที่น่าเสนอในงานวิจัยได้รับการพัฒนาจาก ข้อมูลหลายส่วน เช่น กระบวนการและระยะเวลาการผลิต ข้อมูลการขาย พฤติกรรมของลูกค้า และระยะเวลาการส่งสินค้า นอกจากนี้ผู้ผลิตได้ใช้โปรแกรม Excel ในการควบคุมรายการและความเคลื่อนไหวของสินค้าขายทั้งหมด

*This is a condensed version of Mr. Pattarachai's graduate project report. He was awarded MSc in Supply Chain Management by Assumption University in January 2012.

เพื่อชี้ให้เห็นถึงการเปลี่ยนแปลง งานวิจัยนี้จะมีการเปรียบเทียบผลลัพธ์ของกระบวนการผลิตแบบเดิม และแบบใหม่ โดยทดลองใช้กับสินค้าสองประเภท ผลสรุปคือ ต้นทุนสินค้าคงคลังเฉลี่ยของสินค้าทดลองทั้งสองประเภท ลดลงประมาณ 30.3% และ 21.3% และอัตราการหมุนเวียนของสินค้าคงคลังเพิ่มขึ้น 43.4% และ 27.1% ตามลำดับ

INTRODUCTION

In today's business, customer demand is more and more complex. Customers are changing their product preferences all the time, demanding that companies provide quick response to their requirements, with more concern about product quality rather than price. This fact leads business operators not only to enhance their product categories but also their operation management in order to serve the customers effectively. However the demand and supply should be balanced for if not, inventory handling problems will arise. Excessive inventory problem occurs when a company produces and stocks more products than are actually sold. Then surplus products need to be stored for a while. In contrast, if the inventory is insufficient, companies will not have enough products to serve all customers: customer dissatisfaction will occur as well as its consequences such as customer switching, lower loyalty, and intention not to buy. Both issues, inventory too high and too low, are critical logistics problems facing companies.

The furniture industry is one of the growing industries in Thailand. The furniture also plays an important role in the domestic economy, the total number of furniture manufacturers being more than 3,000 companies with 300,000 jobs. This industry was chosen to be 1 of 13 industries in the government's support campaign for exporters.

The industry is facing high competition from both domestic and international companies. China and Vietnam are major competitors in the international market, and their export values continuously increase. On the other hand, IKEA, a Swedish world-class furniture retailer, is launching three branches in Thailand. This benefits customers, but not domestic manufacturers. Therefore, any company who can respond effectively to customer needs would gain competitive advantage and survive.

Pearl Company is a family business that produces wooden furniture with inlaid pearl decoration. Pearl Company is a retailer and manufacturer producing various types of wooden furniture such as, dining table, conference table, wooden cabinet, and living room set. There are eleven product categories in total. In each category there are different designs and colors. For example, there are 15 designs of living room set, and each set has 3 to 4 different colors. Therefore, the company has more than 500 SKUs of inventory to manage.

Operating in a highly competitive market, the company differentiates its products by applying a unique Chinese traditional design in which pearl slivers are inlaid on the surfaces. Most are handmade. Due to demand complexity and variety of customer preferences, the company provides various product categories and designs in order to serve different demands. However, this causes major problems of high inventory cost and low inventory turnover.

As most products are handmade, average production lead time ranges from 32 to 63 days depending on category. Thus, the company keeps high inventory on hand to ensure that the products are sufficiently available to meet customer demand. The company normally stocks two to four units for the same SKU to prevent lost sales, and as it has more than 500 SKUs, and the average cost per SKU is approximately US\$1,500 there is a very high inventory cost.

When compared to the other furniture manufacturers, the imbalance of inventory cost and cost of goods sold by the company leads to a low inventory turnover of 1.7, whereas the turnover of other companies ranges from 4.7 to 7.1.

To solve the problems, postponement strategy is considered as a solution, as it is an effective strategy to manage the risks associated with demand uncertainty and high inventory cost. The concept is to delay the final production process as close to customers as possible, and to customize finished products based upon actual customer orders.

The three main objectives of the study are:

1. To identify the key postponement activities that appropriate for Pearl Company to improve its production process.
2. To plan for the implementation of postponement activities.
3. To illustrate possible improvements of the production process and inventory turnover from the implementation of postponement activities.

The scope of the study focuses on two main product categories: living room sets and dining tables. These two are selected because their values account for 80% of total inventory cost.

SELECTIVE REVIEW OF LITERATURE

According to Capkun et al. (2009), the total inventory performance is affected by raw materials, work-in-process, and finished goods. Inventory management is one of the most important functions in any industry, not only for retailers or manufacturers but governments also implement this concept (Ayad, 2008). Ineffective and inefficient management can result in some serious problems; such as excessive inventory, shortage inventory, unnecessary costs, lower customer service level, or obsolete cost (Lee & Kleiner, 2001).

A postponement strategy delays the production process until receiving a customer's order. The benefits are reduction in transportation cost, inventory cost, obsolescence and shrinkage cost, and warehousing cost (Boone, Craighead, & Hanna, 2007).

Graman and Magazine (2006) mentioned that customers now prefer products and services to be customized, and that their demands should be met with quick responsiveness. Postponement is a way of keeping inventory cost low while dealing with demand uncertainty (Huang & Li, 2009).

Manufacturing Postponement is the most common postponement technique. The standard products are produced and then wait for the customer order. Once a customer order is received, the final phases are performed. This postponement is most effective when it takes place in the last production process (Battezzati & Magnani, 2000). Manufacturing postponement is appropriate to firms that sell products with a high proportion of common raw materials.

Identifying the postponement point should be the first consideration. Pros and cons for all parties involved should be balanced. Thus, business operators should consider where the applicable delay point is in the supply chain.

There are other postponement strategies. For Pure postponement, the whole activities will not be performed until customers' orders are received. It is appropriate to the firms that require special product design and functions. This postponement type has the longest lead time. In contrast, for logistic postponement, the postponed activity is within the distribution network. Products already produced are shipped to the warehouses or distribution centers prior to customers' orders. This postponement type is the most responsive because the finished products are already stored close to the market. For manufacturing postponement, the delayed activities take place within the production processes. Then the component parts are postponed to the final manufacturing process, and then are customized to customer requirements. It has significant influence on inventory cost reduction since the company stores only semi-finished products (Yang et al., 2004).

The three important steps for formulating and implementing a management postponement strategy are: understanding the market requirements; considering and selecting the possible postponement points; and strategy selection and implementation (Yang et al. 2004).

Once the postponement points are selected, a company can start to re-design the products and processes for postponement (Johnson & Anderson, 2000). Some companies could achieve postponement by delaying operations or by re-sequencing processes, each of which is associated with a separate attribute (Lee & Tang, 1997). However, a postponement strategy effective for one company may not be effective in others: the internal operation and production processes of each business are important factors in selecting an appropriate postponement strategy.

METHODOLOGY & DATA ANALYSIS

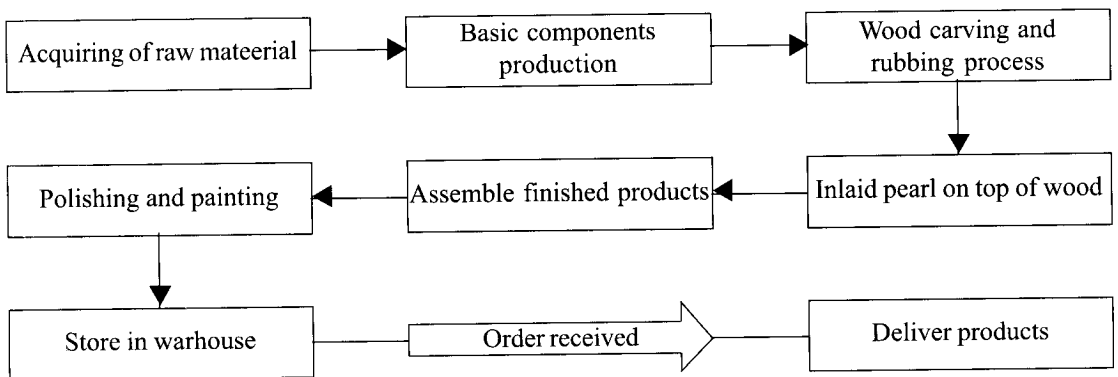
The methodology used relevant factors from company data, plus observation and interviews. The production and business process were identified, and then analyzed to gain deep understanding of the company's operation. After understanding the internal operation, the external factor, such as customer demands, were considered. Analysis of customer demands was made from customer behaviors and preferences in purchasing the company's products. The next step was consideration and selection of the possible postponement points and postponement strategy, after which the current and new processes were compared and analyzed.

The interviews gained intensive information, from the owner and sales manager of the company. Data included types of customer and customer preferred delivery times information about light and heavy buying customers, and customers' product preferences.

The Company's Production Process

In the company's production process, activities are separated into two main parts - operation and production processes. The operation process acquires raw materials and delivers the products. Once a customer decided to purchase a product, the production process starts to replenish inventory immediately. This is illustrated in the following Figure.

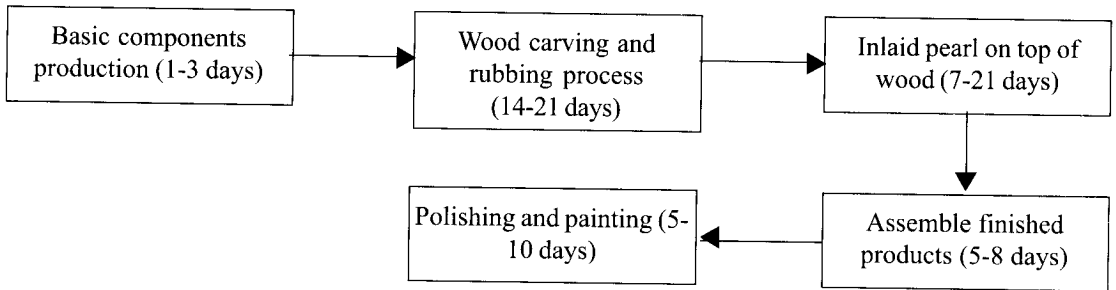
Figure 1: Production Process Flow



Source: Company data

The production division is the main business operation and source of cost. The production processes convert raw materials into finished products. The essential raw materials are wood, marble, pearl oyster shell, and wood coloring. The Figure below shows the current production process and production lead time for living room set and dining table. The mapping of this process later enabled the selection of possible postponement points.

Figure 2: Current Production Process and Lead Time



Source: Company production process

The first production process is the basic components production phase, in which all component parts are produced. Then, all components pass through wood carving and rubbing, according to each specific design. This step is very important because the products become differentiated from competitors through unique designs. Next is to inlay pearl on the wood surfaces. Skilled employees put pearl oyster shell on each component part. After that, component parts are combined into a finished model, such as a chair. The products then pass through the final production process, by being polished and dyed a color. As a result, the total production lead time for producing a finished product is from 32 to 63 days.

Finished products are stored in the warehouse, waiting for customer orders. High product varieties and high inventory cost of living room set and dining table (the two products studied) are the main causes of these inventory problems. Monthly sales volumes of living room sets and dining tables show that these are slow moving products, which cause low inventory movement. The monthly inventory cost was very high, and because of this, the turnover rate was only 1.7.

It became obvious that the company’s customers are different from other businesses. Their purchase decisions are based on what they actually see. They do not make any decisions without seeing the actual products. Sometimes customers’ preferences are more specific about design, material, and color, and the company may lose sales if it cannot fulfill these requirements.

As most customers are Thai-Chinese, when they purchase something, they select an auspicious day for delivery, and they often need time to remove their old furniture to create space

for the new. Thus the sold products have to be kept in store for a while. This makes delivery time important, and it ranges from eight to fourteen days depending on product category, but can be more than a month.

The company has 15 designs of living room sets and 12 designs of dining tables. Each design has a different cost depending on material and labor costs. In unique product design, the component parts are only produced for a specific finished product. So, it is difficult to produce component parts as basic units for all product designs. Moreover, due to customer preferred delivery lead times, half of all customers require delivery of the product within seven to fourteen days, while the total production lead time is 32 to 63 days. Thus, the only possible postponement point is the final phase, which is the polishing and painting phase. The production lead time of this phase is only five to ten days, and the process could enhance customer satisfaction by delaying whilst waiting for a customer's order so that dyeing the specific color accords with the customer's requirement.

PRESENTATION AND DISCUSSION OF RESULTS

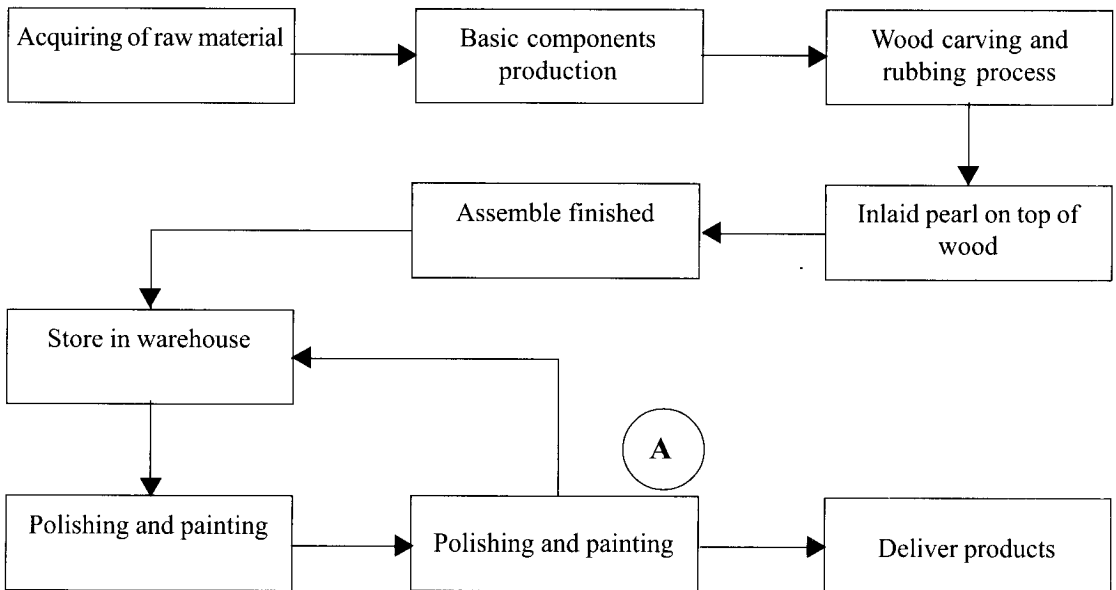
After analyzing the existing production process and related data, the proposed postponement production process was developed. The postponement point and postponement strategy were considered and selected. The postponement point is at the final production process, which is the polishing and painting process. The appropriate postponement strategy is manufacturing postponement because the products have to be produced and stored as semi-product forms which can be colored according to customer demands.

The difference between existing and new proposed production processes of the company is at the postponement of the polishing and painting process. Before postponement, the product is produced for a specific color. Then it is progressed through all production processes, and polished and dyed a color before being kept in the storage area. As a result, the Company has to store seven to fourteen units for the same SKU in order to offer customers various product designs. With the customer's Order, the product would be delivered.

On the other hand, after postponement, the semi-finished product would be kept in the storage area after passing through the assembly process. It is held until a customer's order is received. Then the polishing and painting process would be performed in order to dye a specific color. Thus, this postponement process could help the company to produce and store semi-finished products, which leads to reduced inventory cost.

An overview of the new production processes flow after implementing a postponement strategy is presented in Figure 3.

Figure 3: New Proposed Production Process



For the new proposed production process, the tasks of each step are not different from the existing production process except that at the postponement point A (the polishing and painting process) is postponed. After the assembly of finished products process is completed, semi-finished products would be stored in a warehouse in order to wait for customer orders. Then, once the company received orders, the postponement activity would be performed to replace the sold units. For example, if a customer orders one red color unit of product L001, then the postponement activity will dye the red color on a stored semi-finished product of L001 product to deliver to a customer or store in the warehouse, and the production processes would be started to make the inventory replenishment in order to make sure that the ending inventory is at the same level as at the beginning and sufficient to serve customer demand.

In order to ensure that the new proposed production process can improve company performance, the proposed production process was analyzed and implemented in a worksheet in order to highlight the improvements after postponement application. The analysis was based on actual sales volume in 2010.

The inventory records were contained in Excel worksheets. These were applied to clarify the movement of each product design, and also to identify the inventory units that the company has to carry at the end of each period.

The Excel sheet show the actual result of the current and proposed processes. An example is that in the old process, the actual beginning inventory of Product L001 in January, 2010 was

13 units, while the end-of-month inventory was 12 units. The total ending inventory on hand was US\$34,000.

For the new proposed process for Product L001, the proposed quantities of beginning inventory were 4 for finished products, and 1 unit for semi-finished products. At the end of the month, the ending inventory consisted of 4 units of finished product, 2 units of semi-finished product and 2 units of work in process. The total cost was US\$19,500.

Over a year, for the current process for Product L001, the monthly ending inventories are in the range of 11 to 13 units, about US\$31,000 to US\$37,000. This is higher than the proposed process, which has 8 units, about US\$12,000 to US\$16,000. It means that proposed process is able to reduce monthly inventory stock by 27% - 38% and also decrease monthly inventory cost by 37% - 44%. All designs of living room sets and dining tables were also examined and similar improvements found in the postponement process.

After completing the Excel worksheets, all results were summarized and compared to the existing data. The significant improvements of the research are focused on inventory cost reduction and inventory turnover improvement.

Looking at inventory cost reduction, the existing production process is focused on producing and storing sufficient amounts of finished products. However, the proposed postponement production process allows the company to reduce inventory cost by storing semi-finished products instead of finished items. As a result, the new production process is able to reduce inventory cost of living room set and dining tables comparing to existing process.

The company has to carry inventories of all designs of living room sets in the range of 121 to 132 units, which is a lot more than the proposed process. The postponement process allows the company to carry inventory of about 82 to 93 units. As a result, on average, the new proposed process is able to reduce inventory stock of living room sets by 31.85% and decrease inventory cost on hand by 30.27%.

For dining tables, in the old process the company had to carry inventories of all designs of dining table in the range of 73 to 87 units. However, the proposed process allows the company to carry lower inventory, in the range of 54 to 66 units. As a result, on average, the proposed process is able to reduce inventory stock of living room sets by 23.86% and decrease inventory cost on hand by 21.28%.

Inventory turnover is a major concern of the company, and one of the objectives of this research. Therefore, a comparison of inventory turnover between existing and new proposed production processes is presented in this Table, which reveals the improvements resulting from a postponement strategy.

Table : Comparison of Inventory Turnovers

	Living room set		Dining table	
	Existing process	New process	Existing process	New process
Inventory turnover	1.56	2.23	1.94	2.47
Difference		43.41%		27.03%

RECOMMENDATIONS & LIMITATIONS

These results show that postponement can solve the company problems. The inventory cost and inventory turnover are significant improvements. The company could extend the implementation to other product categories. The appropriate quantity of finished and semi-finished product inventories should be considered if the company would like to expand its business in the future. Business growth leads to higher sales volumes and more customer orders. In order to ensure that the products are sufficiently available for sales, the optimal quantity of inventory on hand should be clearly identified.

There are some research limitations. First, the results of this research are based on historical data and an assumption that the business operations are not changed. Further study may discover more appropriate plans that are suitable to changing environments. Second, this research studied only postponement strategy. Future research could study other strategies, such as lean manufacturing.

A further limitation is that, this study only concentrates on one company, so the result may not be generalized to other companies, or indeed to other industries. Also, this study does not emphasize other relevant costs, such as, transportation cost, storage cost, interest cost and warehousing cost. It concentrates only on production manufacturing costs.

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