LEAN AND AGILE PROCUREMENT STRATEGIES IN THE FLORAL INDUSTRY

Nalinthip Arunphan*
School of Management, Assumption University of Thailand

ABSTRACT

Lean and agile concepts originated in the manufacturing area, and in this graduate project are adapted and applied to the procurement task of a flower shop in Bangkok. The fluctuating amount of flowers causes two adverse situations: sometimes there are not enough flowers available for customers, and sometimes flowers remain unsold. This double problem leads to the question "How many flowers should be purchased in each period of time?" The quantitative data of purchased, sold, and unsold flowers was collected for one year. Other related data was obtained through observations, interviews, and documentary reviews. The answer to the project question was obtained by using a forecasting method which applied lean and agile concepts.

INTRODUCTION

Purchasing management is involved in the integration of supply chain activities for the purpose of ensuring uninterrupted flows of raw materials at lowest total cost and obtaining customer satisfaction (Wisner et al., 2005). In contrast, procurement or sourcing is viewed as a strategic activity such that the lowest price is not the objective but rather mutual agreement (Hakansson, 1982). This study adapts and applies lean and agile concepts to the procurement task. These two concepts were originally implemented in manufacturing processes, but were later extended to a wider business context. Agile focuses on market sensitivity and nimbleness (Nagel & Dove, 1991), whereas the lean concept focuses on elimination of waste (Christopher & Towill, 2000).

NA Florist (a pseudonym) is the flower shop in this case study. The shop began in 1965, and is located in downtown Bangkok, near a large department store, hotel, restaurant, and train station. The number of its competitors has significantly increased, and the recent economic crisis affects the floral business. Therefore, the shop tries its best to maintain a relationship with corporate customers but also provides good availability of flowers and service for walk-in customers.

---

*Ms Arunphan was awarded the degree of MSc in Supply Chain Management by Assumption University. This is a condensed version of her MSc project.

70% of the shop's flower supply is from within Thailand, and 30% from abroad. Flower prices in the market fluctuate daily. Purchasing orders are placed twice a week, but on different days to each supplier, and flowers are delivered to the shop the next day. After delivery, flowers are counted, and checked for quality. Budding flowers have their leaves removed and are placed in a nursery refrigerator.

The various designs of flower arrangement include wreath, basket, vase, and bouquet. Flower arrangement depends on design, color, creativity, and freshness. Being fresh means lasting longer when bought by a customer. The arrangement is customized into any design which the customer requests. A flower's life-time is normally not more than one week. Defective flowers are thrown away. Making flower arrangements for sale is irregular. NA Florist reduces the amount of unsold (for two days) flowers by arranging them in wreaths.

Flower assortment is based on the types, colors, and durability of each flower as flowers are perishable by nature. The market price fluctuates by seasonal demand for festivals and special days. The price per flower, and maintenance costs, vary and is usually high.

The two specific major problems are: (1) Flower shortage of lily, trumpet lily and rose (used in the main floral arrangement) leads to low customer satisfaction and loss of opportunity to sell at a higher price when they have to be substituted by other kinds of low price flowers; (2) Unsold lily, trumpet lily and rose are scrapped, which causes high operation costs as their price is rather high. Therefore, the focus question is: "How many flowers should be purchased in each period of time?"

Lean and agile procurement strategies, with Microsoft Excel software are used to answer the question. Lean procurement concentrates on cost reduction whereas agile procurement concentrates on service level. Lean procurement strategy provides supply chain responsiveness. Leanness is applied to eliminate waste in procurement i.e. excess inventory. Agile procurement strategy enhances efficiency in a supply chain. It is applied to introduce flexibility in the ordering and receiving of flowers, especially lily, trumpet lily and rose, to be able to have a quick response to customer demand. It is hard to state which strategy is better: both include quality of product as the major element. The objectives of the research are to find the appropriate number of main flowers to be purchased in each period. Also, the number of scrapped flowers is expected to be reduced and customer satisfaction increased. This research is a challenge, to adapt the benefits of lean and agile implementation found in manufacturing by applying them to the procurement task in a flower shop.

LITERATURE REVIEW

The literature first reviewed is about matching the right product to the appropriate supply

chain, followed by characteristics of the flower industry. Then, the concept of lean and agile strategies are discussed and linked to the actual situation of the procurement task in this case study. Finally, the background of NA Florist shop, procurement regulation, suppliers, flower life-time, and existing problems, are discussed.

Supply Chain and Types of Product

There are two types of product, which require different supply chains. The first is primarily a functional product, one of the common products that people use in daily life. Sales are stable and predictable in demand, and the product usually has a long life cycle. However, it offers a low profit margin and is highly price sensitive. The second type is primarily an innovative product: fashion apparel and, computers, the demand driven by customers keeping up with social trends. The life cycle tends to be short and demand fluctuates. However, the profit margin is high and price is not sensitive.

Though some products like flowers can be either functional or innovative, a company needs to be sure in which category its product is, so that it can be matched to the appropriate supply chain (Fisher, 1997). Flowers are a commodity product, not a necessity, but are costly, perishable and require good care to ensure freshness. The florist does not just sell flowers, but also provides service, skills, and artistic talent (Hunt, 1972).

A functional product matches an efficient supply chain, and an innovative one matches a responsive supply chain. The mismatch between product and supply chain is the root problem of this florist company. In refusing to make customers wait for a special product (innovative product), the responsive process (agile) will shorten the lead time of delivery. Then, the efficient process (lean) will eliminate waste in the supply chain of a functional product (Fisher, 1997).

The physically efficient and market-responsive supply chain require different action in terms of primary purpose, manufacturing focus, inventory strategy, lead-time focus, approach to choosing suppliers and product-design strategy. Whether an efficient or responsive supply chain is appropriate for the floral industry is now discussed.

All processes of the flower industry, represent hard work, high cost, and are time consuming. The labor cost of the shop is in the careful selection, maintenance, and arrangement of the blooms, then packing and deliver them to the customer. Not only skill is needed in arranging flowers - the florist must also have knowledge to order the numbers of various colors and species of flowers according to special occasions in the year, e.g. Graduation and New Year. It is harder to predict demand for personal occasions, such as, congratulations, birthday, and get-well-soon.

Mostly, a customer orders flowers for others, not for personal use, and the florist asks about details such as occasion, age, gender, favorite color and so on. The variety of customers includes walk-in, online, telephone, and business customers (corporations, government, hotel, restaurants, temple, church etc.). Those who are not walk-in customers usually have no interaction with the florist: the florist and the customer have to trust each other when ordering and arranging the flower product so that their promises and commitment are fulfilled (Yuwadee, 2003).

Lean and Agile Concepts

Lean concept works in eliminating all wastes by focusing on reducing waste but not cutting cost because waste reduction itself will lower cost. (Vitasek et al. 2005). The agile concept works with flexibility and responsiveness to changes in the supply chain (Christopher et al., 2002). The functional product is suited to applying the lean concept to its efficient supply chain as demand is predictable (Suzaki, 1987), and fashion products are suitable for application of the agile concept to its responsive supply chain as demand is unpredictable (Mason-Jones et al., 2000).

Lean thinking focuses on reduction and elimination of seven wastes, as described by Ohno (1998): overproduction, waiting time, transportation, inventory, motion, over-processing and defective units. Some activities, like maintenance, although not directly adding value, are necessary. Value is a starting point in lean thinking, as defined by the customer (Womack & Jones, 1996).

The agile concept focuses on fast response to volatile demand of customers, by using market knowledge to secure profitable opportunities for a product which is unpredictable and requires a short lead time (Christopher, 2000). Perishable products have stable demand but short shelf life that requires quick response (Childerhouse & Towill, 2000). Fast delivery enables a perishable product to have a longer shelf life in the store and eliminate returns (Kay, 2007).

Both agile and lean strategies focus on customer responsiveness, but the main principles of lean work only by what is pulled by customers. As lean implementation involves trade-offs between inventory and long lead time, inventory is viewed as waste. The trade-offs for time, information, and knowledge are the task of agility (Van Hoek, 2000). What is regarded as waste in lean production may be essential in agile production. In lean strategy, customers buy specific products, but in agile strategy, customers can be served in a short time (Mchugh et al., 1995). The difference of their total value is that cost is linked to leanness and service level is linked to agility (Christopher & Towill, 2000).

Table: Comparison of Attributes between Lean Supply and Agile Supply

DISTINGUISHING ATTRIBUTES	LEAN SUPPLY	AGILE SUPPLY
Typical Products	Commodities	Fashion Goods
Marketplace Demand	Predictable	Volatile
Product Variety	Low	High
Product Life Cycle	Long	Short
Customer Drivers	Cost	Availability
Profit Margin	Low	High
Dominant Costs	Physical Costs	Marketability Costs
Stockout Penalties	Long Term Contractual	Immediate and Volatile
Purchasing Policy	Buy Goods	Assign Capacity
Information Enrichment	Highly Desirable	Obligatory
Forecasting Mechanism	Algorithmic	Consultative

Source: Mason-Jones et al. (2000b)

Applying Lean in the Procurement Task

The objective of procurement is to acquire and obtain personnel, material, or services by mutual agreement with suppliers. The quality of flowers is viewed as a critical point as many flower suppliers are available. Flowers represent a leverage item that is high profit impact and low supply risk. The high profit impact depends on the quality. Non-fresh flowers lead to lost sales opportunities over more days, and give a bad impression to customers or recipients. As non-fresh flower cannot be sold like other products, the defective ones are thrown away, at a cost to the business. As many suppliers are available, a florist can use purchasing power and price negotiation.

In this study, there is a need to focus on major selling floral products. There are various flower types, species, and colors sold in floral shop. The main flowers in arrangements include white lily, pink lily, cream lily, trumpet lily, Chinese rose and Chiangmai rose. As in a Pareto analysis, 20 percent of all flowers generate 80 percent of the shop's income. The specific orders of main flowers tend to be more accurate than overall for flowers in the shop. More accurate numbers of ordering flowers would lead to a lower number of unsold flowers. The shop should be able to reduce the waste of unsold flowers.

No Inventory for Pre-order

JIT is a strategy for inventory management so that materials are delivered from a supplier immediately on receipt of a company's order. This creates faster delivery time with flexibility by reacting to real demand in order to eliminate excess inventory waste (Wisner et al., 2005). Flower pre-orders and immediate orders have different reactions to demand management. A

florist knows how many pre-order flowers to purchase, and can apply JIT such that an inventory is not necessary. The flowers are delivered at the requested time. Waste is reduced by having no inventory costs.

Applying Agile in the Procurement Task

The aim of the agile approach is flexibility, so the company should carry inventory in generic form in which semi-finished products await the final process due to the concept of postponement in which the final production operation is done only when the customer's requirement is known (Christopher, 2000). Thus, the company purchases less in order to have lower inventory and has fewer SKU variants. The company is also able to pursue mass-customization at higher level of variety with lower total cost (Van Hoek, 1998).

After receiving delivery of flowers, the processes of unpacking flowers, removing extra leaves, watering and then, putting them in the right place, produce semi-finished products in a state of postponement. These flowers are ready to be selected for flower arrangement once a customer orders. This shows flexibility and fast response to customer orders. These flowers provide not only for flexibility in flower arrangement but also a value added service for those who buy for self-arrangement.

Quick Response Operations versus Uncertainty

Quick response (QR) is defined as responsiveness and flexibility that provide a wide range of products in colors, styles, SKU and services to customers in the exact quantity, variety and quality for the purpose of meeting volatile demand (Lowson et al., 1999). Dealing with uncertainty is a major role of QR that counters the impacts of uncertainty of customer demand and supplier reliability. QR operations strategy provides speed, flexibility and responsiveness (Christopher et al. 2004).

The customer mostly demands specific fresh flowers to be delivered to a recipient at a requested time. Hence, the floral industry has to cope with uncertainty due to unexpected orders, seasonal shortages, and any accidents during delivery. The flexibility in QR can solve problems of delivery to the wrong place, and speed and responsiveness would provide immediate delivery.

Mass Customization

The combination of lean and agile processes enables mass-customization as it seeks demand-driven response and also retains the cost advantages of volume production (Christopher & Towill, 2007). The customized product is a special product that is required by customers to be designed for them exclusively. The customer is willing to pay a premium price for an individual product, and thus the company can realize a high profit margin even in low volume production (Barutcu, 2007).

Customers usually know which type of flower and arrangement they want to purchase, although the florist may offer some guidelines. Flowers are arranged according to a customers' design, aligned to the florist's capability. The demand of a customer does not end with low cost and high quality, but customized variety is also included (Fitzgerald, 1995). As Pine (1994) stated "customers do not want choice; they want what they want".

In summary, functional products match an efficient supply chain and innovative products match a responsive supply chain. Lean procurement strategy focuses on eliminating waste by using the concept of Kraljic's Supply Matrix, Pareto analysis and JIT, whereas agile procurement strategy focuses on flexibility in a supply chain by using postponement, quick response and mass customization. The existing problem of NA Florist is the customer's complaint of the shop using less fresh flowers for wreaths. So, a forecasting technique is proposed to find the number of purchased flowers in each period of time.

RESEARCH METHODOLOGY

Both qualitative and quantitative methods are used in this research. The required data include flower life time, delivery date of each supplier, purchasing and receiving procedures, numbers of unsold flowers, monthly purchased volume, and other related data (from August 2008) to July 2009). The data was collected through in-depth interviews, observations, and numerical records.

Several Time-Series Models, which use historic data to predict the future, are used in this case study. These are: simple averages, moving averages, weighted moving averages, and simple exponential smoothing (Render et al., 2006).

Three main suppliers provide flowers from China, Chiangmai and Netherlands. The order is placed one day in advance. Due to the flower life time, new delivered flowers are usually kept until the old ones are sold out. Then, the numbers of flowers that are currently available in the shop are considered when the new batch of flowers is ordered.

Sales volume was high while loss on unsold flowers was also high. Comparing January, February and March, the highest sales volume was in February due to Valentine's Day, and also, the number of unsold flowers was highest. However, in a comparison of percentages of unsold flower in these three months, February was found as the least, at 1.85 percent.

Data Generating and Analysis

Ordering large number of flowers may increase customer satisfaction but the floral shop may suffer from high operation cost when the flowers are unsold. In contrast, ordering small num-

bers of flowers may achieve the target of all flowers sold out but the customers may not be satisfied and switch to buy products from competitors. Not only are there lost selling opportunities, but also the customer may be dissatisfied, may not return in future, and may tell others.

The support of lean and agile procurement strategies in a virtual environment may enhance decision capability in terms of time saving, risk minimization and higher transparency of system (Aslanertik, 2005). Using modern Excel-spreadsheet provides an interactive modeling environment in which simulation technique can be utilized by applying quantitative management tools in order to develop models of system analysis (Khan, 1999).

Summary

First, the sources of data collection and flower information are from observations, interviews, and document reviews. Then, the sales volume is revealed when calculated by purchased volume and scrap flowers. The loss on unsold flower and shortage of flower are submitted to problem analysis. The Microsoft Excel Program is proposed as a tool to achieve the optimal number to be purchased.

FINDINGS AND DISCUSSION

Main Flowers at NA Florist

There are various kinds of flower, which are different in types, colors, and durability. The main flowers used in floral arrangement are lily, trumpet lily and rose. The prices of the three different colors are equal. Trumpet lily is the seasonal one, sold from November to March. The price of a trumpet lily is normally 10-29% lower than an ordinary lily, however, in some periods they are equal. More trumpet lilies are used in arrangements because they are a smaller size than a lily. Also Chinese rose and Chiangmai rose can be substituted for each other. The price of Chiangmai rose is normally 10% lower than Chinese rose but in some periods they are equal.

Total Amount of Purchased Main Flowers

The total amount of purchased lily, trumpet lily and rose were recorded on a weekly basis from August 2008 to July 2009. The highest numbers of purchased lily were in the second week of August (Mothers' Day) and in the second week of February (Valentine's Day). The purchased numbers of trumpet lily were also higher on these special days. The purchased numbers of roses were highest on Valentine's Day.

Actual Sales of the Main Flowers

The actual sales numbers of lily, trumpet lily and rose were collected on a weekly basis from August 2008 to July 2009. It was found that the highest numbers of lily and rose sold were in the second week of August and February - Mother's Day and Valentine's Day. The numbers sold of trumpet lily in five months were also higher during these two special days but not so significant as for lily and rose. As the sales were not equal in each period, the shop lost sales opportunities when these main flowers were in short supply. On the other hand, ordering more flowers was too risky, as it could result in a loss, as these flowers are then very expensive.

On special days, the shop may contract with suppliers to have expedited delivery by air freight for small quantities of lily and rose or other flowers according to customer demand. Of course, this involves extra cost, but customers are willing to pay more, and would be angry if their flower shop did not have these items on special days.

Wreath arrangements below 2,000 baht are arranged using the last two days left life of the flower's time, so customers sometimes complained about the lack of freshness. When flowers are unsold, scrapping them is the last choice. The shop replaced wreaths when customers requested this. Scrap flowers are sometimes more than enough for the number of wreaths ordered, and so scrapping flowers is the only option. When the shop experiences a shortage of flowers, it would buy them at the market or sometimes borrow them from a nearby flower shop, which incurred a transportation cost.

Applying Lean and Agile Concepts in Procurement Task

Minimum Purchased Amount

By applying the lean concept, the moving average is used to find the minimum amount. The minimum purchased amount ensures that there would be no shortage of main flowers. Then, root mean squared error is used to measure how many weeks in moving average are the most responsive to actual sales. When comparing the actual sales to moving average in each week, lily was found to have the least error in the three weeks moving average. Then, trumpet lily and rose were found to have least errors in the five weeks moving average.

Root Mean Squared Error for Moving Average Forecast

Flower	2 weeks MA	3 weeks MA	4 weeks MA	5 weeks MA
Lily	50.63	49.61	51.39	50.88
Trumpet lily	35.47	35.55	33.20	31.63
Rose	17.90	17.53	16.86	16.65

Source: Author

Remark: Excluded sales number of lily and rose in second week of August 08 and February 09.

Weighted moving average is another forecasting method used to find the minimum purchased amount of lily, trumpet lily and rose. The weighted numbers are ranked from 1 to 5. The gap between each week is 1, as shown in variable n-week numbers in the next Table.

Weighted Moving Average

Week	Weighted Number	
	Lily (3 Weeks MA)	Trumpet Lily & Rose (5 Weeks MA)
Week n-5		1
Week n-4		2
Week n-3	1	3
Week n-2	2	4
Week n-1	3	5
Sum	6	15

Source: Author

The forecasting results of weighted moving average obtained less error than the moving average forecast. When compared to previous RMSE, the error for lily is reduced by 44.5 percent. The errors of trumpet lily and rose and are reduced 28 percent and 33 percent respectively. The minimum purchased amount of lily, trumpet lily and rose are obtained in each period of time by using weighted moving average forecast. These purchased amounts ensure that there will be no shortage of flowers.

Root Mean Squared Error for Weighted Moving Average Forecast

Flower	3 weeks MA	5 weeks MA
Lily	27.53	
Trumpet lily		22.71
Rose		11.17

Source: Author

Flexible Purchased Amount

As NA Florist places order twice a week, the agile concept is applied to divide purchase amounts to be unequal for the first and second purchase in a week. This will provide flexibility to increase or reduce the purchased amount in the second time of the week since the actual

unsold flowers and market trend were revealed in the first purchase.

The purchased amount should be a 70:30% ratio that ensures no shortage of flowers sold in the first three days, as it is compared to the average three days actual sales and adds a spare amount of 10%. The first purchase of 70% is taken from moving average and the remaining 30% is obtained from the subtraction between minimum purchased amount and 70% of the first purchase.

The minimum purchased amounts of lily, trumpet lily and rose were identified. NA Florist can apply the lean concept to the minimum purchase in each week that will ensure no shortage of flowers. Moreover, it can apply the agile concept to have unequal purchased amounts in a week depending on the sales in the first purchase. As the lifetime of main flowers is about five to seven days, NA Florist would reduce the second purchased amount if the first purchase is still unsold.

Potential Consequences in Terms of Money

In applying lean and agile procurement strategies, NA Florist can save the cost of re-delivery and scrapped flowers, including lily, trumpet lily and rose. There would be no need for market sourcing of flowers, thus saving transportation cost. NA Florist does not need to pay the higher price of market sourced flowers. Also, there is the elimination of hidden costs, such as for workers who had to stop working to go to the market to buy specific flowers, customer dissatisfaction with non-fresh wreaths who move their custom to other shops, and the low quality of market sourced flowers.

Potential Consequences in Terms of Customer Satisfaction

In the data period, there were five re-deliveries of wreaths after customers complained. There could be more than these five customers: other customers might have realized they had a non-fresh wreath but rather than complain would purchase wreaths at other floral shops next time. Lean and agile procurement strategies are not only to eliminate waste of scrap flowers in order to reduce cost, but also they ensure that flowers at the shop are fresh all the time. Due to flexible ordering, the use of flowers is matched to the supplier's delivery, so, the flowers are always fresh and do not have any less lifetime. The recipients and/or customers will find that NA Florist's floral arrangements, including vase, basket, bouquet and wreath, last a long time because of the fresh flowers. Moreover, the availability of flowers at NA Florist would increase customer satisfaction.

CONCLUSION

The concepts of lean and agile were applied to the quantitative data, through the use of various statistical techniques. This enabled the (lean) identification of minimum purchased amounts which would not result in shortage of main flowers, including seasonal variations of demand and supply, and the (agile) flexibility to increase or reduce purchases, especially to avoid unsold perishable flowers. It would also mean that there would be no need to resort to the market to source emergency flowers at higher price and lower quality. Customer satisfaction would increase through regular availability of choice, and fresher wreaths. Savings would result, from the absence of re-delivery (and other expenses) and minimal amount of scrapped flowers.

BIBLIOGRAPHY

Aslanertik, B.E. (2005). Model-supported supply chains for cost-efficient intelligent enterprises. *Journal of Manufacturing Technology Management*. 16(1), 75-86.

Barutcu, S. (2007). Customized Products: The integrating relationship marketing, agile manufacturing and supply chain management for mass customization. *Ege Academic Review*, 7(2), 573-593.

Childerhouse, P., & Towill, D. (2000). Engineering supply chains to match customer requirements. *Logistics Information Management*, 13(6), 337-345.

Christopher, M. (2000). The agile supply chain: competing in volatile markets. *Industrial Marketing Management*, 29(1), 37-44.

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

Christopher, M., Van Hoek, R., & Harrison, A. (2001). Measuring the agile capabilities in the supply chain. *International Journal of Operations and Production Management*, 21(1/2), 126-147.

Christopher, M., Aitken, J., & Towill, D. (2002). Understanding, implementing and exploiting agility and leanness. *International Journal of Logistics Research & Application*, 5(1), 59-74.

Christopher, M., Lowson, R., & Peck, H. (2004). Creating agile supply chains in the fashion industry. *International Journal of Retail & Distribution Management*, 32(8), 367-376.

Christopher, M., & Towill, D. R. (2007). Don't lean too far-evidence from the first decade. *International Journal of Agile Systems & Management*, 2(4), 406-424.

Fisher, M.L. (1997). What is the right supply chain for your product? *Harvard Business Review*, March-April, 105-116.

Fitzgerald, B. (1995). Mass customization at a profit. *World Class Design to Manufacture*,

2 (1), 43-46.
Hakansson, H. (1982). *International marketing and purchasing of industrial goods: an interaction approach*. New York: John Wiley & Sons.
Hunt, A. (1972). The marketing of flowers in the United Kingdom. *European Journal of Marketing*, 6(2), 98-106.
Kay, M.J. (2007). Making mass customization happen: lessons for implementation. *Emerald Backfiles*, 14-18.
Khan, R. (1999). Simulation modeling of a garment production system using aspreadsheet to minimize production cost. *International Journal of Clothing Science and Technology*, 11, 287-299.
Kraljic P. (1983). Purchasing must become supply management. *Harvard Business Review*, September-October, 109-117.
Lowson, R.H., King, R. & Hunter, N.A. (1999). Quick response: Managing the supply chain to meet consumer demand. Chichester: John Wiley & Sons.
Lowson, R.H. (2002). *Strategic operations management: The new competitive advantage*. Routledge: London.
Mason-Jones, R., Towill, D.R. (1999a). Total cycle time compression and the agile supply chain. *International Journal of Production Economics*, 62, 61-73.
Mason-Jones, R., Towill, D.R. (1999b). Using the information de-coupling point to improve supply chain performance. *International Journal of Logistics Management*, 19(2), 13-36.
Mason-Jones, R., Naylor, J. B. & Towill, D.R. (2000a). Engineering the leagile supply chain. *International Journal of Agile Management Systems*, 2(1), 54-61.
Mason-Jones, R., Naylor, B., & Towill, D.R. (2000b). Lean, agile or leagile? Matching your supply chain to the market place. *International Journal of Production Research*, 38(17), 4061-4070.
Mchugh, P., Merli, G., & Wheeler III, W.A. (1995). *Beyond business process re-engineering towards the holonic enterprise*. New York: Wiley.
Mills, D. Quinn (1991). *Rebirth of the Corporation*. New York: Wiley.
Nagel, R. & Dove, R. (1991). *21st century manufacturing enterprise strategy*. Incocca Institute, Leigh University.
Ohno, T. (1998). *The Toyota Production System: Beyond Large Scale Production*. Portland, Oregon: Productivity Press.
Pine, B.J. (1994). Customers don't want choice. *Managers Journal*, *Wall Street Journal*, A14.
Render, B., Stair, R., & Hanna, M. (2006). *Quantitative Analysis for Management*. New Jersey: Pearson Education. 9th edition.
Suzaki, K. (1987). *The new manufacturing challenge*, New York: The Free Press.
Van Hoek, R. (1998). Reconfiguring the supply chain to implement postponed manufacturing. *International Journal of Logistics Management*, 9(1).
Van Hoek, R., (2000). The thesis of leagility revisited. *International Journal of Agile Man-*

agement Systems, 2(3), 196-201.
Vitasek, K., Manrodt, K.B. & Abbot, J. (2005). What makes a lean supply chain? *Supply Chain Management Review*, 9(7), 39-45.
Waters, C.D.J. (2002). *Inventory control and management*. Chichester: John Wiley & Sons.
Wisner, J., Keong, Leong G., & Tan, K. (2005). *Principles of supply chain management*. Ohio: South-Western.
Womack, J.P. & Jones, D.T. (1996). Lean Thinking. New York: Simon and Schuster.
Yuwadee, T. (2003). ใครๆ ก็อยากมีร้านดอกไม้. Bangkok: Viriya
www.oracle.com