Vendor managed inventory: a survey of the Taiwanese grocery industry

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Abstract

Recent research has shown the importance of improving the supply chain competitiveness by means of strategic alliances. This study considers the retailer–supplier partnership through a vendor managed inventory (VMI) system. The characteristics of a VMI system and a retailer–supplier power relationship are discussed in some detail with a case illustration to examine the practical implementations of the system in the Taiwanese grocery industry. VMI not only has the ability to reduce costs, but also to improve service levels and create business opportunities for both parties in the supply chain. Thus, it is considered as one of the main systems in a strategic alliance.

Keywords: Retailer–supplier partnership; Vendor managed inventory; Taiwan; Grocery; Supply chain management

1. Introduction

The core objective of supply chain management is to minimize system wide costs while satisfying service level requirements. A supply chain is a dynamic system; it includes all activities involved in delivering a product from the stage of raw material to the customer. These activities include manufacturing, inventory control, distribution, warehousing, and customer service. Supply chain management coordinates and integrates all of these activities into a seamless process. With increasing global competition and emergence of e-business, supply chain management is viewed as a major solution to cost reduction and profitability.

A strategic alliance is identified by Marien (2000) as one of the key supply chain enablers. Strategic alliances are concerned with how external companies (customers, suppliers, and logistic-service providers) are selected as business allies and how inter-company relationships are built and managed. A supply chain links all of the chain partners from departments within an organization to external partners such as suppliers and third-party logistics providers. A successful alliance motivates managers in the companies involved to take an interest in the success of other companies, and to work together to make the whole supply chain competitive. Strategic partnerships usually lead to long-term benefits for both partners.

Demand forecasting is one of the most difficult tasks for both retailers and suppliers in a supply chain. With the shortening of product life cycles, and the increasing request for customization of made-to-order products, forecasting is even more challenging. In addition, due to the “bullwhip effect”, the demand variation of the suppliers is much greater than the demand variation of the retailers. Thus, sharing of information in the retailer–supplier partnership (RSP) is critical to both parties.

Simchi-Livi et al. (2000) proposes the view that RSP is a continuum (see Fig. 1 for an example). The degree of partnership ranges from information sharing where the retailer helps the vendor to plan demand more efficiently, to consignment schemes where the vendor completely manages and owns the inventory until the retailer sells it. The latter type of partnership is referred to as the vendor managed inventory (VMI). Another perspective to examine in the RSP is the power
relationship between the retailer and the supplier. The successful selection of a RSP strategy has to consider the relative buyer and supplier power. Cooray and Ratnatunga (2001) further identify that power relationships are related to cultural differences between the retailer and the supplier.

2. Historical development of VMI

VMI, sometimes called vendor-managed replenishment, is a ‘pull’ replenishing practice designed to enable a Quick Response (QR) from the vendor to actual demand. VMI represents the highest level of partnership where the vendor is the primary decision-maker in order placement and inventory control. Under a VMI system, the supplier decides on the appropriate inventory levels of each of the products (within previously agreed upon bounds), and the appropriate inventory policies to maintain these levels (Simchi-Li et al., 2000).

The historical perspective of VMI can be traced back to the early development of QR for general merchandized retailers and their suppliers. Owing to the intense competition in the textile industry, leaders in the US apparel industry formed the “Crafted With Pride in the USA Council” in 1984 (Lummus and Vokurka, 1999). A supply chain analysis was conducted under this Council and the results showed that the delivery time for the apparel supply chain was 66 weeks from raw materials to consumer, and 40 weeks of which were spent in warehouse or in transit. In order to reduce the lead-time and inventory cost, a QR strategy was developed to address this issue. A QR strategy is a system where the retailers and the suppliers work together to serve consumer needs quickly by information sharing. Under this strategy, suppliers receive point of sale data from retailers and use this information to synchronize their production and inventory control with actual sales. The retailer makes decisions to generate orders. Using point of sale data, the supplier makes decisions to improve demand forecasting and production scheduling. A textile and chemicals company, Milliken and Company, was among the first companies to adopt QR resulting in lead-time reduction from 18 to 3 weeks (Schonberger, 1996).

Similar to the textile industry, a group of grocery industry leaders created a joint industry task force called the efficient consumer response (ECR) working group in 1992. Kurt Salmon and Associates (1993) were appointed under this group to examine the grocery supply chain in order to identify the competitive drivers in the supply chain. They identified set practices, which if implemented, could substantially improve overall performance of the supply chain. They further showed that by expediting the quick and accurate flow of information in the supply chain, ECR enables distributors and suppliers to forecast demand far more accurately than the current system. From ECR, the concept of continuous replenishment policy (CRP) is developed. CRP is a move from pushing products from inventory holding areas to pulling goods onto grocery shelves based on consumer demand (Lummus and Vokurka, 1999).

In a CRP strategy, vendors receive point of sale data and use this data to prepare shipments at previously agreed intervals to maintain specific inventory levels. In an advanced form of CRP, suppliers may gradually decrease inventory levels at the retail store or distribution centre as long as the service levels are met (Troyer and Denny, 1992). Vergin and Barr (1999) reported that the CRP had received positive attention by the US grocery industry. The surveyed grocery manufacturers achieved an average of 30% inventory reduction and a reduced average of 55% stock outs.

The implementation of RSP benefits the retailer and the supplier, as well as the consumer. The different RSP strategies are summarized in Table 1 (Simchi-Li et al., 2000). When RSP moves from one level to the next, a new set of skills has to be learned and employed by the vendor to implement that strategy. In the case of a VMI strategy, the vendor generates the point of order decision and holds the ultimate inventory ownership. In order to operate under the VMI scheme, the vendor must have the capability to perform demand forecasting, inventory management, and retail management.

The selection of a RSP strategy is highly dependent on the power structure of the retailer–supplier relationship. Duke (1998), who has done a comprehensive survey on power and conflict handling of buyer–suppliers in a variety of countries and industries, concluded that UK grocery retailing has moved away from short-term, transaction-based relationships towards long-term, collaboration and partnerships. Perdue et al. (1986) conducted a survey of North American buyers and identified that the collaborative approach was the dominant buyer–supplier relationship approach. Thus, most literature suggests a long-term collaborative approach based on trust and partnership towards supply chain management. Recently, Cox (2001) has argued that the collaborative approach may not be the ultimate solution for all supply chain scenarios. The buyer and
supplier relationships operate under a relative buyer and supplier power environment. The power exchange and shift between retailers and suppliers of RSP strategies can be explained by a retailer–supplier power structure as shown in Fig. 2. The power structure can then easily explain why VMI has been largely rejected in Europe and the US when a supply chain can operate in a collaborative environment.

3. Vendor managed inventory system

A VMI system has been widely adopted by many industries for years. The classical success story for VMI system is found in the partnership between Wal-Mart and Procter & Gamble (P&G). In 1985, the partnership has dramatically improved P&G’s on-time deliveries and Wal-Mart’s sales. Both of their inventory turns also increased (Buzzell and Ortmeyer, 1995). Kmart also followed suit. By 1992, Kmart had developed over 200 VMI partners (Schonberger, 1996). Besides retailing industries, VMI is adopted by leading chemical companies to increase supply chain efficiency and to enhance customer and supplier relationships (Challener, 2000).

High-tech industries such as Dell, HP and ST Microelectronics also operate efficient supply chains through VMI to reduce inventory levels and costs (Baljko, 1999; Shah, 2002). The benefits of the VMI program are normally evaluated against a set of performance measures such as shown in Table 2.

The motivation behind a VMI system is that both the retailer and supplier work together to maximize the competitiveness of the supply chain. The most obvious benefits of VMI are inventory cost reduction for the retailer and total cost reduction for the supplier. The productivity and service level improvement lead to a larger profit margin and an increase in sales. In spite of numerous benefits of VMI, some concerns have to be taken into account. Aichlmayr (2000) investigated the VMI implementation and reported that out of ten VMI implementations, only three or four achieved great success. Three or four reaped some benefits, but not as much as anticipated, and two or three did not result in any benefits. The confidentiality of information sharing between retailer and supplier, the risk of loss of control by the retailer, the increase of vendor’s administrative cost and minimal benefits for supplier are the major weaknesses of VMI.

The requirements for a retailer to implement a VMI program can be classified into three categories: organization infrastructure, information technology, and a decision support tool. The organization infrastructure refers to the change of the retailer’s power environment externally and internally. As indicated in Fig. 2, a VMI system shifts the relative power relationship from the retailer to the supplier. The supplier dominant relationship changes the fundamental way of doing business and top management commitment is the key to ensure success. A certain level of mutual trust and a regular review scheme has to be established to ensure the continuous success of the system. Internally, the supplier’s day-to-day contact with the retailer shifts from sales and marketing personnel to logistic personnel. This organizational change has to be addressed by re-structuring the organization and job responsibility. A new compensation scheme should also be implemented to promote morale and reduce resistance in the new organization structure.

<table>
<thead>
<tr>
<th>RSP strategy</th>
<th>Decision point of order generation</th>
<th>Inventory ownership</th>
<th>New skills employed by vendors</th>
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<tbody>
<tr>
<td>QR</td>
<td>Retailer</td>
<td>Retailer</td>
<td>Demand forecasting skills</td>
</tr>
<tr>
<td>CRP</td>
<td>Contractually agreed levels</td>
<td>Either party</td>
<td>Demand forecasting and inventory control</td>
</tr>
<tr>
<td>Advanced CRP</td>
<td>Contractually agreed to and continuously improved levels</td>
<td>Either party</td>
<td>Demand forecasting and inventory control</td>
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<tr>
<td>VMI</td>
<td>Vendor</td>
<td>Vendor</td>
<td>Demand forecasting, inventory control, and retail management</td>
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Table 1: Comparison of four major RSP strategies

Fig. 2. Retailer–supplier relationship power structure.
An effective information system is another important enabler for a VMI system. It can be broken down into two sub-categories: information technology and integrated production system. Bar coding and scanning are essential to maintain data accuracy and processing efficiency. In order to create a direct link between the retailer and the supplier, electronic data interchange or Internet is required for delivering point of sale data and other relevant information. Direct communication links also avoid entry error and cut down on data transfer time. Once this real time data is available, it requires an integrated system to incorporate planning, inventory, production, and distribution to take full advantage of the VMI system. An integration of a VMI system with an existing enterprise resource planning system is an effective solution for information system requirement (Holmstrom, 1998a).

Managing the power relationship between a retailer and a supplier is a critical success factor of a VMI program. Besides the organizational aspects of changing purchasing strategies and policies, the management of transparency in retailer–supplier relationships is an important focus to realize the benefits of a VMI program. The transparency in relationships includes the two-way exchange of sales, costs, inventories, information, and knowledge between the retailer and the supplier (Lamming et al., 2001). A regular review and negotiation mechanism between retailer and supplier are necessary to maintain the transparency in the relationship. Furthermore, a tactical decision support system (Achabal et al., 2000) can be developed to ensure data transparency and to assist in coordinating inventory management and transportation policies.

A systematic approach for VMI system implementation can be formulated into five progressive stages as shown in Fig. 3. The first stage is to highlight the benefits of VMI in order to gain top management’s commitment. The next stage is the design of the VMI system. Then, the system is tested and implemented. The last stage is the performance evaluation and system upgrade to achieve targets.

4. A survey of the Taiwanese grocery industry

In comparison with western countries, the grocery industry in Taiwan was slow to adopt a VMI system. The first adoption in Taiwan was not until 1997. The reasons for the slow application are attributed to business culture, complicated logistics flow, and complex distribution channels. Local products dominate Taiwan’s retail market and approximately 75% of goods are domestically made. Local top manufacturers still possess a “manufacturer superiority complex” with the perception that they have a monopoly over retailers and wholesalers. Furthermore, by operating in a protective environment with minimal competition from foreign companies, many local firms are doing very well. Thus, there is a tendency to remain in the status quo and resist change.

Secondly, Taiwan has a complicated supply chain with many different players in the traditional market. In
addition to manufacturers and retailers, there are many intermediate wholesalers (secondary and tertiary), distributors and import agents, present within the supply chain. These agents are usually very flexible and small in size. Another reason attributing to the slow adoption of VMI is because Taiwan has a multi-channel retail market, namely: traditional open market, government run welfare stores, and modern supermarkets, coexisting together in the ratio of 40%, 25%, and 35%, respectively.

The characteristics of the grocery industries in Taiwan result in high inventory across the supply chain. A study conducted by Coopers & Lybrand Management on Taiwan’s fast moving consumer goods in 1998 indicated that Taiwan has very high pipeline inventories when compared to the rest of the world (see Fig. 4 for example). High unnecessary inventory holding costs are incurred by manufacturers, distributors, and retailers, and they are ultimately passed to the consumers. The current trade practice is “pushing” products into inventory holding areas along the supply chain, rather than products being “pulled” onto retail shelves in response to actual consumer demand.

With the admission to the World Trade Organization (WTO), Taiwan has taken significant steps to open up its domestic market by allowing more imports and encouraging foreign competition in the retailer business sector. As a result of this, the grocery industry now faces unprecedented market competition. In order to improve the productivity and competitiveness of the local retail industry and consumer products industry, Taiwan government initiated a project in 1998 to facilitate the application of VMI in retail business. In order to examine further the process and effect of a VMI system, a grocery supply chain case study between P&G and Wellcome supermarket chains stores was selected to illustrate the introduction of a VMI program.

Wellcome, is part of the Diary Farm group, which is a regional supermarket chain store, operating in Australia, Hong Kong, Indonesia, Malaysia, Singapore, and Taiwan. In Taiwan, being a dominant supermarket player, Wellcome is currently operating more than 100 stores. P&G is a well-known global manufacturer of fast moving consumer goods. They are the market leader in product categories such as skin care and shampoo. In addition, P&G is the pioneer in adopting VMI throughout the world and in Taiwan. In responding to the growing competition in the market place, increasing consumer demand, and escalating operating costs, Wellcome is seeking to move to a RSP with its suppliers and towards VMI to take advantage of supply chain integration. As a key trading partner of Wellcome, P&G was selected to explore the VMI program initiative.

Wellcome identifies two major areas, Distribution Centre (DC) customer service level and inventory level as primary objectives of the VMI program. The adoption of a VMI system requires the vendor to deploy new skills such as demand forecasting, inventory control, and retail management. With their global experience, P&G seeks intra-company skills transfer to promote a VMI partnership in Taiwan. P&G internally developed software, Key Account Replenishment System (KARS), is used to facilitate the process.

The project is organized and executed in five stages. The associated supply chain is depicted in Fig. 5. In order to access the readiness of implementing the VMI system, the concept and benefits of VMI is aligned in the first stage of implementation. The top management commitment and staff acceptance are very high on both sides. In order to bring CRP expertise to this project, a third-party consultant, Price-Waterhouse-Coopers, is selected to join the steering committee to provide consultancy and training support.

\[1\] Taiwan Ministry of Economic Affairs (MOEA) appointed Coopers & Lybrand (C&L) Management Consultants to access Quick Response/Efficient Consumer Response (QR/ECR) applications of retail business in 1998. The ratio of channel distributions and pipeline inventory comparison are outlined in the Taiwan QR/ECR Executive Summary. For more information, see www.ec.org.tw.

\[2\] The project is sponsored by the MOEA to adopt QR/ECR concepts to retail business. The project consists of three phases: QR/ECR roadmap, education and training, and pilot implementation from 1998 to 1999. Wellcome and P&G are selected firms to participate the implementation phase for VMI system by Taiwan MOEA (1999). For more information, see www.ec.org.tw.

\[3\] Interviews with Yen Lee, Director, Human Resource; Grace Chung, Manager, Training; Tony Tsai, Manager, Retail Purchasing and Replenishment—Wellcome, Taiwan.
On reviewing the IT requirements of the VMI project, both companies have well-established information technology to pursue further system integration. The KARS is shown in Fig. 6 as a tool to implement the VMI system. The KARS consists of three major modules: demand projection, order calculation, and order generation; it can generate product replenishment from suppliers to retailers efficiently with minimal inventory and maximum customer satisfaction levels. A set of requirements and parameters such as customer level, safety stock, order frequency and lead time have to be fed into the KARS system. The inventory and replenishment information sharing is processed through standard electronic data interchange.

The project timeline was set to run from May 1998 to June 1999 in five progressive stages. The average retailer DC off-take in an 8 week period provided by Wellcome is used as baseline data. The performance index includes inventory days, DC in-stock %, line fill rate %, delivered on-time %, billed accurately %, order generation turnaround time, and order confirmation turnaround time. In order to measure the progress of the implementation, the project is further divided into three phases: May 1998 to August 1998 as phase I, September 1998 to February 1999 as phase II, and March 1999 to June 1999 as phase III.

5. Case study discussion

The two primary objectives of DC service level and inventory level, are measured by DC inventory days and DC in-stock %. The DC service level improves consistently from 92% in phase I to 98% in phase III; that is above the target of 95%. The result is shown in Fig. 7.

The inventory level in DC is 24 days before VMI implementation, and it drops to 13 days in phase II. The inventory level increases to 16 days in phase III as depicted in Fig. 8. Factors contributing to higher inventory levels in phase III are identified as cancellation of one planned promotion and the pipeline inventory for a new product. In order to reduce and stabilize the inventory level, P&G has tried hard to achieve forecast accuracy and provide one low price policy.

The principle of a VMI system is assumed that the vendor takes full responsibility for order generation and replenishment. However, Wellcome overrode 17% of orders generated by KARS in phase II. A root cause analysis is conducted to provide remedy for high override intervention. The joint diagnosis discovers the primary causes are data integrity, promotion items, and new product introduction. The data integrity issue, accounts for 75% of overall override occurrences, is identified as incomplete sales data provided to P&G from Wellcome and results in lower forecasts from KARS. In order to offset the difference, Wellcome adjusts the replenishment order manually. The data integrity issue is resolved in Phase III. Another anomaly was that the original KARS is developed in the US and is not able to handle special promotion and new product introduction from Wellcome. This resulted in manual input from Wellcome.

In order to reduce the order override and improve forecast accuracy, a decision support tool was developed to incorporate promotion handling to address another 20% of override occurrences. The promotion decision
Support tool (see Fig. 9 for example) is designed to include promotion information, link with Wellcome’s promotion schedule, and KARS’s order forecast. Since promotion is an important selling strategy, about 30% of Wellcome’s sales rely on promotion sale, Wellcome and P&G moved one step further to adopt collaborative planning, forecasting and replenishment (CPFR) principles in item promotions.

About 5% of override occurrences are caused by new product introduction. A similar collaborative procedure is developed to improve forecast accuracy of new product introductions. Three remedy actions of override occurrences were developed and carried out in phase II through teamwork. The number of overrides has reduced from 17% to 9% in phase III and is lower than the expected target of 10%. The greater percentage override reduction is contributed to a higher DC service level.

This project reports other improvements such as billing accuracy, reduction of order generation turnaround time and line fill rate. Beside the immediate tangible benefits, the VMI system also results in closer working partnerships, which increase the competitiveness of the retailer supply chain.

The previous section identified three requirements of VMI implementation: organization infrastructure, information technology, and decision support tool. The application of this case against these requirements is then discussed. Wellcome has realized the shifting of purchasing power structure towards supplier dominance and the commitment from high level management, supports the external aspect of organizational change. However, the new process created uncertainty among Wellcome’s purchasing personnel due to lack of VMI practice and knowledge. Unlike most western grocery chains that adopt VMI programs by transforming from QR or CRP, Wellcome has not acquired similar experience to facilitate the organizational change internally. The existing information infrastructure of both parties was recognized as a key enabler to this program. However, the manual interruption and adjustment from Wellcome has distorted the principle of VMI. A later developed promotion decision support tool resolved the issues and enabled the supplier to manage fully the order replenishment. Furthermore, some key lessons can be learned from this case:

- Hiring an external consultant—An experienced consultant is an ideal way to duplicate a VMI program by providing necessary assessment and training. The outside consultant also has the advantage of independence of interests to facilitate the change of the retailer–supplier power structure.
- Understanding the power relationship—Understanding and managing the power relationship internally and externally are key factors for any retailer in adopting a VMI program. It is also important to realize that the power structure may vary over time and under different circumstances. In other words, the selection of the best RSP approach is highly dependent on the retailer–supplier power relationship.
- Readiness of IT infrastructure—IT investment is a fundamental requirement of a VMI program and it may constitute major capital spending. If a retailer does not have necessary IT infrastructure, a detailed cost-benefit analysis should be conducted before applying the program.
- Regular review and negotiation mechanism—Any VMI system itself will not guarantee RSP and deliver values, unless it is carefully managed. A constant review and negotiation channel has to be designed before the program, and executed in closing gaps and resolving issues.

6. Conclusion and future development

This study discusses the RSP in a supply chain using VMI. From the discussion of historical development of RSP, we believe that a VMI system is one of the most effective partnership styles. Once both parties enter the strategic alliances, they can select a VMI system to maximize the competitiveness of the chain.

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4CPFR is initiated by Voluntary Inter-industry Commerce Standards (VICS) association. VICS found that supply chain processes such as a VMI system, when managed either completely by the distributor or completely by the supplier have inherent opportunities for improved efficiency. This is because both parties play an active role in creating and satisfying consumer demand. It is the premise of CPFR that increased efficiencies could be gained through creating co-managed business processes, and that to achieve these efficiencies, the operational systems and processes must be integrated through new methods of sharing information. For detail information, see www.cpfr.org.
The cited VMI applications reinforce the confidence of the supply chain players. The recommended VMI implementation approach provides an effective guideline to shorten the process and to maximize the VMI's benefits. One of the most critical aspects of such an alliance is to understand and manage the power relationships between the retailer and the supplier. The illustrated grocery case study in Taiwan provides practical guidelines for VMI implementation as well as insightful lessons learned.

A new development of VMI is to incorporate mutual collaboration in the system such as co-managed inventory (CMI) and CPFR. The CPFR is defined as a business process model for value chain partners to coordinate plans in order to reduce variance between supply and demand (Aichlymayr, 2000). Under a CPFR process, both parties mutually look at information and compare data. Retailers and suppliers share forecasts, including point of sale, and on-hand and delivery data. They review the data together and collaborate in working with discrepancies. Unlike VMI where suppliers have most of the responsibility, CPFR is a collaboration between both parties in their business dealings and problem solving. In order to improve the physical transportation section of the supply chain, the collaborative transportation management (Tyan et al., 2002) can be considered to enhance overall supply chain efficiency. Another area to enhance VMI application is to integrate on-line e-grocery with existing grocery chains (Smaros, 2000). The e-grocery business model through VMI has been widely adopted by major retail chains.

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