

Vendor Managed Inventory System Adaptability

A supply chain management analysis

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Abstract—The VMI (Vendor Managed Inventory) system has been used as a sophisticated logistics system to provide adequate assistance to some large retailers. Despite this, the VMI system is currently limited to the retail industry and does not have access to the VMI system in other industries. In order to make up for this gap, this paper analyzes the feasibility of the VMI system in other industries and companies, and further determines the VMI system as a boost for other industries through three conditions. This article provides sufficient evidence for the research method through case analysis to further determine the feasibility and correctness of the research method. As the results of the study show, companies that meet these three conditions can significantly improve the company's logistics efficiency and reduce the company's storage costs when using the VMI system.

Keywords—VMI system; logistics; company efficiency; condition

I. INTRODUCTION

For most companies with a physical business, the cost of logistics and warehousing often accounts for a large portion of the total cost. Therefore, how to reduce the expenditure of logistics and storage costs to achieve the goal of reducing total cost is a problem that the company management must solve. Some retail companies use the VMI system to share logistics information with upstream suppliers, reducing the bullwhip effect and ultimately improving efficiency and reducing costs. The bullwhip effect not only affects the deadweight losses of upstream suppliers but also prevents downstream retailers from obtaining products in time and reducing logistics efficiency. VMI system effectively reduces this phenomenon and is a win-win strategy for both partners. However, the current VMI system is only used by a large number of large retailers, and few companies in other industries can see the company using the VMI system. The theory proposed in this study establishes a general framework, expands the scope of application of VMI system theory and is more concise, convenient for users to quickly apply to the actual decision-making process. Through some case studies, the VMI system is not limited to the retail industry. Companies from other industry that have pressure on warehousing and logistics costs can also use the VMI system to increase efficiency when certain conditions are met. Therefore, this paper locates three conditions for judging whether a company can use the VMI system. However, the theory proposed in this study still has some limitations. The theory proposed in this study only considers the impact of objective

factors, that is, only considers the product dimension, the company dimension, and the supplier dimension, without taking into account the impact of other dimensions of the company's operations.

II. LITERATURE REVIEW

In the modern enterprise environment, the company competitive advantage of an enterprise is an integral part of its development, so improving the company competitive advantage has always been a topic of research. The effectiveness of the supply chain directly affects retail companies. We believe the core reason why China Carrefour was acquired in 2019 is that the supply chain is imperfect. This paper will analyze the case of Walmart to identify the improvement of company competitive advantage in the supply chain (SC) by vendor-managed inventory (VMI). VMI is recognized as a comprehensive tool in enhancing supply chain performance [1]. It refers to a theory in order to reduce the cost of the supply chain and to coordinate the whole steps in SC [2]. We can find more considerable attention to the benefit of VIM in a different area. First, VMI can be used in reducing the bullwhip effect in the level of society [3]. The bullwhip is a phenomenon that is gradually increasing swing of inventory further up the SC [4]. This negative social influence is caused by information opaque, so VMI's feature of information symmetry can fundamentally avoid the bullwhip effect. According to Langfield and Greenwood's research in the company of Toyota [5], the connection between suppliers and buyers in the industry, technologies, prior experience, and effective communications should be attached importance to. Moreover, as mentioned by Wadhwa et al. [6], the different levels of information transparency of the SC have the influence in the SC time service department and when SC is leaner, the advantage of the cooperation between buyer and suppliers will higher. Angulo, Nachtmann, and Waller research the effect of information accuracy on the VMI system [7]. Yang et al. propose an innovative VMI strategy with a physical internet [8]. But the fact of the using of the VIM system is not adopted in many industries. Bookbinder et al. state that the dispute of the benefit and reality is from the lack of quantitative analyses [9]. Niranjana, Wagner, and Nguyen determine that there are fifteen variables to identify the prerequisites to VMI; these variables can be categorized as three features product-, company-, and supplier-related [10]. According to Zimon and Domingues, SC management should be sustained by more simplified tools [11].

The three features from Niranjana, Wagner, and Nguyen’s categorization shall be the dimensions to identify the industry’s adaptability to VMI. Production dimension refers to the product standardization and demand of product inventory forecasting; Company dimension represents for the company’s current operations, information systems and acceptance of public inventory information; And the supplier-related dimension means trust relationship between a company with suppliers, supplier’s acceptance of VMI and ratio of major suppliers’ product offerings. These three aspects are refined to six variables in our research to a tool that is easier to analyse the industry or company’s adaptability of the vendor managed industry. Fewer variables can be used to analyze the practicality of the VMI system more conceptually. It also means more companies that can be applied to different industries. The gap in our research lies in the difference in focus, the theory proposed in this study focuses on conceptualization and simplicity, while the 15 variable theory focuses on practical. We believe the most suitable industry in using the VMI strategy is the hypermarket industry. After using the tool to analysis some case, we can determine the reason for the success of hypermarket using VMI. Then can find the VMI strategies characteristic and calculate the influence of the VMI under the different positions in society.

III. METHOD

The VMI system significantly reduces the warehousing and logistics costs of downstream retailers while reducing the uncertainty that upstream suppliers encounter when producing products. However, the scope of the VMI system is not for all companies. Through related research, this article categorizes three criteria or dimensions to determine whether a company can increase efficiency and reduce costs through the VMI system. According to the TABLE I, these three dimensions determine the conditions that a company needs to use a VMI system from its products, companies, and suppliers.

A. Product Dimension

At the beginning of the analysis, the product can be divided into two standards. They are product standardization and stable product demand. Firstly, the definition of product standardization is the unifying of products’ standard and services provided in a different marketplace [12]. In other words, product standardization refers to the homogenization of goods and sell them to consumers [13]. In addition, product standardization also means that the company will not produce customized products. The products manufactured by suppliers have uniform specifications and characteristics. Moreover, when the production line manufactures products of uniform specifications, the speed of delivery and replenishment of this product is breakneck. Therefore, when the products have uniform quality, and each order can deal with the same criteria. Those mature process of production and order dealing processing are more suitable for VMI to manage product inventory.

The second criteria which measure VMI can be taken is that the products have stable demand. It means the forecast of product demand is under control, which it should be posited in a reasonable range because advanced calculating system

contributes to accurate demand forecasting of the company. Stable demand has a positive impact on the supplier’s forecast replenishment frequency. For example, this standard can significantly reduce the uncertainty of upstream suppliers in the production of products, and prevent losses caused by excessive or too little product. In conclusion, the product type suitable for VMI needs two characteristics. One is product standardization; the other is that products need stable and predictable demand. As long as the product owns these two characteristics, it will lead to VMI to be more convenient for the industry.

B. Company Dimension

The second view is the corporate dimension. The first point is the company’s acceptance of information sharing. Because VMI mode need company share inventory information with supplier. And VMI mode can reduce the uncertainty of replenishment times. Therefore, the trust between supplier and company is vital. The second point is the relevant technologies. Both parties have very high requirements for information technology because the instant exchange of information is the key to the VMI system.

C. Supplier Dimension

The third view dimension is the supplier aspect. The number of significant suppliers is small, but the proportion of supply is relatively high, and it is easier to achieve VMI. Because the leading suppliers have a large number of goods, and the company is conveniently to share inventory data. By contrast, if the number of suppliers is large, it is challenging to achieve VMI, because it is not easy to trust too many supplier in a short period.

IV. CASE STUDY

A. Wal-Mart

Wal-Mart was organized by Sam Walton in 1962. During the more than 20 years later of operating, Wal-Mart became to combination grocery and goods collection center. With the growth of the retail industry, Wal-Mart supermarket had turned into one of the largest retail supermarkets chains in America [14]. In addition, Wal-Mart’s inventory management level is very high, which is also one of the most significant contributors to the thriving retail industry.

TABLE I. METHOD DIMENSIONS

Three dimensions of method		
<i>Product dimension</i>	<i>Company dimension</i>	<i>Supplier dimension</i>
First criteria: product standardization	First criteria: build trust with suppliers	First criteria: large size suppliers
Second criteria: stable product demand	Second criteria: Relevant technologies	Second criteria: a small number of suppliers

^a. (source: compiled by authors)

In the product aspect, Wal-Mart's products are divided into three aspects: food, daily necessities, and household appliances. These products are in high-volume production and have strict production standards. Moreover, Wal-Mart promised it would improve transparency for product quality and also contributes to society [15]. In addition, Wal-Mart also pays more attention on customer demand. For example, Wal-Mart focuses on customer desires and make an effort to cut down the cost through the advanced supply chain management and also decrease the price [16]. At the same time, Wal-Mart owned advanced and accurate demand forecasting method. It is a necessary way of company to control the replenish times. The standardization of Wal-Mart's products is extremely high. Products are repeatable and have auditable standards. Customers have little demand for the same product. These characteristics of products are all generated from the supermarket's mode. Therefore, large quantity of uniform standard products is more suitable for VMI system.

In the company aspect, Wal-Mart is in good shape, and its sales are staggering, which reached \$476.29 billion in 2014. It always at the forefront of the world's top 500. Internal staffs of Wal-Mart states they have innovated a strategy to predict data which cover 100,000 different products of and 4,700 Wal-Mart chains in America [17]. Therefore, the high level of Wal-Mart's data analysis system which promotes to Wal-Mart's use of VMI management.

In supplier aspect, Wal-Mart has a lot of vendors. However, Wal-Mart has convenient communication with vendors. The reason is that Wal-Mart shares inventory data with vendors. For example, Proctor and Gamble both of Wal-Mart's vendors. Wal-Mart puts share the inventory data and let the distributors take responsibility of vendors. Vendors receive the data of inventory and sales and are then will make the decision of the appropriate rate in order to replenish Wal-Mart's inventory [18]. Therefore, Wal-Mart increases its sales of VMI mode. Wal-Mart and its vendors own abundant source. For example, Plug Power, a Wal-Mart supplier, claims that they will enter into new partnerships with Wal-Mart. The cooperation between those two company aims to improve the fuel cell capabilities of Wal-Mart. After signing the agreement with Plug Power, Wal-Mart's distribution transactions will be promoted in the future [19]. Therefore, Wal-Mart and its vendor establishing a stable and mutual trust of each other.

B. RUAG

RUAG is a stable company to produce the components and service on space, aviation, and a heavy weapon in Switzerland. TABLE II shows the specific performances of RUAG in different three dimensions.

For the dimension of the product, RUAG's service and the product has three aspects: in space, air, and land. The products and services in RUAG's space part are specifically for the European space agency to provide components for launchers, satellites, and spacecraft. RUAG provides system services and component supply for different types of passenger aircraft and military aircraft in the air part, including A320, A330, Dornier 228, and so on. In the land part, RUAG produces heavy weapons and provides construction and maintenance services

for military communication systems [20]. Besides there are supporting tests and research services. These components require incredibly high technical requirements and special requirements. And these services and products are closely tied to the project, and the information is not suitable for disclosure. Their products are not universal and repeatable, and customized solutions account for a large portion of the production. Their products part shows low support to the VMI system.

In the company part, RUAG's operation is stable. RUAG's predecessor 20 years ago was a Swiss state-owned military reserver, and the reforms became a technology-led international company. Its headquarters locates on Bern, Switzerland, which is a joint-stock company. It is also a supplier and shareholder to Arianespace, with 0.82% of capital [21]. In 2017, RUAG's net sales were 1,955 million Swiss francs, of which 62% came from outside the Swiss domestic market. RUAG's R&D investment is high; about 9 percent of its revenue will be used for research and development [22]. At the company level, RUAG has an excellent information system, but it is still not suitable for sharing inventory information with suppliers due to the Swiss national background and technology standard.

The last dimension of the supplier-related aspect can be dividend as two different kinds: ordinary supplier and specification supplier. The most significant proportion of previous is white papers suppliers. Due to the frequent using of office products, RUAG is managed using the SAP system. When the level is lower than the set replenishment level, inventory will be automatically replenished. Also, another supplier of specialized material part needs several weeks to receive orders, product, and ship the inventory. This kind of products have characteristics in a low repetition rate and highly integrated with the project. The cycle is long, the product range has lots of types, and many components will be destroyed after the project. In general, RUAG is not suitable for VMI because the office system adopts SAP automation system and unique product features.

TABLE II. METHOD DIMENSIONS

Three dimensions of method		
<i>Product dimension</i>	<i>Company dimension</i>	<i>Supplier dimension</i>
First criteria: Low product standardization for the low repeatability	First criteria: Military products cause the information to be undisclosed	First criteria: Customized supplier
Second criteria: unstable product based on a different project	Second criteria: High technical requirements	Second criteria: Suppliers have higher requirements for specialization

^b. (source: compiled by authors)

V. CONCLUSION

According to the research results, the applicability of the VMI system is not limited to the retail industry. Companies that meet the three conditions or dimensions in the methodology can also use the VMI system to increase efficiency, regardless of the industry from which these

companies come from. The first dimension is the product side. The company has a large number of highly standardized and fixed-cycle requirements, and the VMI system can provide information to suppliers to start production promptly. However, products with special needs cannot save production time because suppliers need to carry out particular research and development and production of these products. The second dimension comes from the company level, and the company's management maintains sufficient trust in the suppliers that work with them. A company's logistics information can reflect the company's internal decision-making and the latest market sales, and competitors in the same industry know that this information can lead to severe consequences. So the establishment of the VMI system is based on the trust between the company and the supplier. The last dimension is the supplier; the company wants to use the VMI system must have a small number of large-scale suppliers, in order to successfully implement the VMI system. The reason for this requirement is that large suppliers have sufficient quantities and types of goods to supply, as well as relatively advanced logistics and warehousing technology to facilitate the implementation of the VMI system. On the other hand, a large number of suppliers with small companies are likely to create a crisis of trust. In general, companies with logistics and warehousing pressures can meet these three conditions to reduce costs and improve efficiency through the VMI system. The main limitation of the theory proposed in this paper is that it only considers the main influencing factors of the objective dimension in order to pursue practicality and simplicity, and does not pay attention to the influence brought by other dimensions. Research for specific industries or specific companies is also necessary. Therefore, the introduction of specific industry constraints is strongly recommended in subsequent studies.

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