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An Analysis of The Effectiveness "Term of Consumption" System Implementation in PT XYZ

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***Abstract*—As one of the largest retail company in Indonesia, PT XYZ is relying on their operational activities through a complex supply chain management system. To be able to survive and become a leading company, PT XYZ understands the importance to improve the competitive advantage of its supply chain by means of strategic alliances. VMI is one of the most popular strategic alliance's concepts in the retail industry. For the retailer, VMI is transferring their responsibility of inventory management to the supplier. VMI partnership enables the supplier to decide regarding inventory replenishment for the retailer. To be able to adjust to the needs of the supplier, PT XYZ adapts the VMI system to a system called Term of Consumption (TOC).**

***Index Terms*—Supply Chain, Retail, Term of Consumption, Vendor Managed Inventory.**

I. Introduction

Retail is selling a piece of a larger commodity to the consumer. Retailing is all activities involved in the marketing of goods and services directly to consumers. According to Lucas, Bush dan Graham (1994), retailer is an organization that received their profit through retailing.

Nowadays, retail has developed to many models, from a traditional model to the modern model that uses the latest technology. The transformation from traditional retail to modern retail is indicated by how the retailer is making changes in marketing, sales, services, etc. Retail is an important element for supplier growth. The bigger the market means bigger cost and control that supplier needs to allocate for marketing and selling their products. With the emergence of retail, this role is moved to the retailer. Not only that, according to Simchi, Kaminsky and Simchi [1], retail can also give extra value such as break down of the products into smaller parts, i.e. become an inventory place, provide products variety, and give extra service.

Traditional retails in Indonesia emerged on 1962, and developed to modern retails with supermarket concept in 1970. With the development of modern retail industry, in 1990, the concept of minimarket is introduced in Indonesia and keep developing to hypermarket concept in 2000. Today, retail industry become one of the most important sectors for Indonesian economy, it contributes to 15.24% of Indonesian GDP. Based on the latest data, Indonesia has around 29,045 modern retail which 28,610 of it is minimarket.

PT XYZ is one the pioneer of minimarket concept with their first store opened in 1988. At first, PT XYZ set up their store around residential areas and provides various basic needs. As the time goes and demand increases, PT XYZ started to set their store in office, commercial, tourist and apartment areas. Based on the data from PT XYZ, in 2017 PT XYZ has more than 13,600 store throughout Indonesia that consists of 40% franchised store and 60% company-owned store. In order to meet the needs of 13,600 stores, PT XYZ has 27 distribution centers (DC) throughout Indonesia. Distribution centers (DC) play an important role on managing PT XYZ inventory.

To maintain the position as the leading company in retail industry, PT XYZ needs to gain a competitive advantage. Logistic and supply chain management becomes the most popular solution for a retail company to achieve their competitive advantage. Mentzer et al., [2] stated that management of supply chain is a system, strategy, and coordination from a traditional business function and a tactic that is used in the business activity of an organization and its supply chain, that aimed to increase their long-term performance. The main objective for a company implementing supply chain management is to reduce the cost of their operational activities and increasing their service level target. The supply chain is a system that covers every stage in a product lifecycle, from the first stage of raw material up until it is received by the customer. Supply chain management coordinates and integrates all the stages into a continuous process. These stages include manufacture, inventory control, distribution, warehouse to customer service. Ramanathan and Gunasekara [3] said that supply chain management encourages the organization to implement an open partnership with their partner. The open partnership usually will lead to collaboration between organizations in a supply chain network to do planning, forecasting, replenishment, information sharing, resource sharing, and incentive sharing.

As a retail company, PT XYZ also needs to improve their inventory management. Inventory management always tried to look for answers regarding the correct time to order, how many to order and how much the inventory level needs to be kept. Therefore, sharing of information that usually exists in a collaboration partnership become one of the main solutions for this challenge. Sharing information is often lead the partnership to vendor managed inventory (VMI) system, a system that has been one of the most often applied collaboration forms in various markets all over the world.

There are some factor that affects PT XYZ inventory level

TABLE I
PT XYZ DISTRIBUTION CENTER CAPACITY

DC Location	Store Coverage	Σ Cell Storage	Storage Capacity (in store)
PARUNG	525	3.17	265
MAKASSAR	592	10.422	736

which is demand, replenishment lead time, the change of demand and the change on replenishment lead time. Each factor will affect the other one and create a bullwhip effect. At first, PT XYZ used a forecasting system based on DSI (Day Sales Inventory) data and DSO (Day Stock Out) data. Based on DSI and DSO data, PT XYZ calculated their order to the supplier. However, this system is not effective because stock out cases in the distribution center (DC) and the store is still high. To solve this problem, PT XYZ tried to adapt the VMI system in their company. The adapted system is called Term of Consumption (TOC) system, this system is implemented with the objective to reduce the stock out problem in PT XYZ distribution center.

Before TOC becomes a standard inventory management system for all PT XYZ DCs, at first the system will be implemented in two different DCs which is DC Parung and DC Makassar. DC Parung is a representative for DCs that based on Java island which usually has bigger store coverage than their storage capacity while DC Makassar is considered to be a representative for DCs that is based outside Java island which usually has bigger storage capacity than their store coverage.

II. LITERATURE REVIEW

A. Supply Chain

Chopra and Meindl [4] said that supply chain management is a process to move a product or information from manufacturer or service in a firm. The main idea from supply chain management is to implement a system that can manage the flow of information, products, and services from raw material to end customer. The element of supply chain consists of the supplier, manufacturer, distributor, retailer, and consumer. The focus of supply chain is the customer, because the main idea is how to gain customer satisfaction and gain revenue from the process.

In order to accomplish the effective supply chain, firms need to work on the collaboration over the firm's boundaries. According to Frankel, Robert, Thomas, and Judith [5], the successful collaboration factors tested on grocery industry are: (1) willing to innovate and change; (2) understanding the other's business; (3) common goals and objectives; (4) appropriate measures and incentives; and (5) information sharing.

As Simchi-Levi said, the retailer-supplier partnership (RSP) is a continuum. That means, in RSP system, two or more chain partners work together to create competitive advantage through sharing of information, collaboration and sharing of benefits. Simchi, Kaminsky, and Simchi, [1] elaborate 4 major RSP strategies. First, quick response (QR), in this system retailer and supplier will work together to fulfill customer needs by information exchange. Second, continuous replenishment (CRP), in which the supplier will receive sales data and use that to make shipment schedule based on the interval that agreed before to maintain specific inventory level. In advance CRP, the supplier will decrease the inventory level in DC or store as long the service level is fulfilled. And the last one is VMI, in the supplier has the authority to decide the order number and manage the inventory.

B. Vendor Managed Inventory

In a VMI partnership, the supplier, usually the manufacturer but sometimes a reseller or distributor, makes the main inventory replenishment decisions for the consuming organization. This means that the vendor monitors the buyer's inventory levels and makes periodic replenishment decisions regarding order quantities, shipping, and timing. The main objectives from VMI system implementation are to increase the partnership between retailer and supplier in order to gain competitiveness of the supply chain.

Implementation of VMI in the retailer-supplier partnership will give competitive advantages to both parties. Firstly, is cost reduction, after the implementation of VMI, the most visible reduction is on shipment cost. Angulo, Heather, and Mathew [6] said that with VMI the shipment schedule would become stable, so the supplier can create an effective schedule and reduce the number of trips, use fewer trucks or at least reduce the number of trips with half-loaded trucks. Secondly, inventory level reduction. According to Sui, Abhijit, and Li [7] under VMI, the supplier will have access to retailer inventory database. Therefore it can coordinate its own inventory and retailer inventory level from being excessive. The third advantage is to improve service level. If the VMI successfully implemented then supplier wouldn't have to worry for not fulfilling retailer order, instead they can arrange the order by minimum as long retailer inventory is on a safety level. In addition to the mentioned advantages, VMI also can create a long-term relationship. In the long run, supplier will experience retailer loyalty and retailer will have a reliable partner who able to ensure high service level.

Fawcett et al. [8] stated that despite numerous advantages of VMI, many companies have failed to implement this strategy successfully. In order to implement VMI successfully, researchers agree that companies must firstly understand the nature of VMI strategy. Secondly, efficient information sharing is considered as the main cause in the VMI strategy. Finally, VMI can't be implemented successfully without trust between partners.

Over the years, VMI strategy has been adopted in numerous industries which resulted in the appearance of different VMI models and designs. The vendor and its customer must

reach an agreement on various details in order to make this relationship work out. Researchers have proposed different dimensions of the agreement which they see as necessary ones for successful VMI implementation. The dimensions can be clustered to inventory-related dimensions, information-related dimensions, and decision-making related dimensions.

In inventory-related dimensions, there are inventory ownership and inventory location. Simchi, Kaminsky, and Simchi [1] claim that agreement on this dimension is crucial to the success of any strategic collaboration effort, especially VMI. Originally, ownership is transferred to the retailer as soon as goods are received, and payment is placed. In this case, it is considered that inventory is owned by the retailer. Another type of inventory ownership is called consignment-inventory system. Besides that, retailer and supplier should also agree where goods will be placed. Zammori et al. (2009) notice that both retailer and supplier have certain responsibilities concerning inventory location. Retailer assures that inventory will be stored in suitable conditions and will be separated from non-VMI items. Supplier obliges that goods are properly marked and packaged. The next dimensions are information-related dimensions. This dimension highlight is about demand visibility and access to information. According to Angulo et al. [6], demand visibility is a key success factor of VMI as it reduces the amount of inaccurate information which then allows making better replenishment decisions.

The last one is decision-making related dimensions which include replenishment monitoring and ordering; control limits; and replenishment decisions. Replenishment monitoring and ordering refer to the means which are used by the supplier to monitor inventory levels and define replenishment frequency. There are three methods suggested: (1) inventory is continuously reviewed and replenished when needed; (2) inventory is reviewed periodically and replenished when needed; (3) inventory is reviewed periodically and replenished irrespective to inventory levels until it does not exceed defined maximum limits. Control limits, show how much freedom the supplier have while calculating the quantities of goods to be replenished. There are four possible scenarios in this case: the retailer defines (1) both maximum and minimum levels, (2) only maximum levels, (3) only minimum levels, (4) no levels are defined. Replenishment decision refers to the supplier freedom to make decisions about the quantity and frequency of replenishment. There are four possibilities suggested in the literature: (1) retailer confirms order suggested by supplier; (2) supplier has the right to decide either quantity or frequency; (3) supplier is free to decide both quantity and frequency until retailer's demand is met; (4) retailer gives order proposals which can be changed under certain circumstances by the supplier. The first alternative is considered by Simchi, Kaminsky, and Simchi [1] as being not a VMI solution because the supplier does not possess the right to make replenishment decisions on its own. However, this method is possible in the transition period when traditional ordering system is being replaced by VMI.

C. Term of Consumption

The term of Consumption or TOC is an adaptation of the VMI model that is used by PT XYZ. In this model, supplier possesses to create replenishment time and norm that will be implemented in TOC. Before, the time needed for ordering until the product arrived in the warehouse took a long time. Therefore, it increases the chance of stock out. Before TOC is implemented, the time required to process an order is 3 days, followed by production time of 7 days and ended with delivery to the distribution center which takes 2 days. So, the replenishment time will take 12 days. However, by using the TOC system, the time required to process order will be 1 day, and production time can be eliminated because of PT ABC has prepared the product for replenishment in its warehouse before. It means the replenishment time needed by PT ABC will only take three days; this is 9 days ahead of time

The first step of TOC is to determine the norm. The objective of determining the norm is to maintain the safety level of inventory in PT XYZ by managing the buffer stock. The formula to determine the norm or inventory level in TOC partnership is:

Norm = Maximum consumption for 3 days x 100% = inventory for 6 days.

The second step is to determine how the information will be delivered. In this case, the consumption data is delivered by email every day from PT.XYZ. The final stage is ordered replenishment by PT.ABC. With this implemented it will create stability in ordering and production.

III. Research Methodology

To analyze the differences before and after TOC implementation in PT XYZ DCs, this research will focus on comparing the inventory (stock out) and sales data. The final hypothesis that will be used is:

$$H_0 \quad : X = X_2$$
$$H_1 \quad : X \neq X_2$$

Where X is the data of stock out and sales before TOC implemented. X_2 is the data after the TOC system is implemented. Thus, the answer based on the hypothesis is, if Ho is accepted then it means TOC system did not give any significant impact. Otherwise, if Ho is rejected or Hi is accepted, then it means TOC system is giving significant impact. The hypotheses that will be tested in this research are:

- Hypothesis 1 – There are significant differences on the stock out the level before and after TOC system is implemented in DC Parung
- Hypothesis 2 – There are significant differences on the stock out the level before and after TOC system is implemented in DC Makassar
- Hypothesis 3 – There are significant differences in sales before and after the TOC system is implemented in DC Parung

TABLE II
DECREASING PERCENTAGE OF STOCK OUT BEFORE AND AFTER TOC IMPLEMENTATION

DC	2015 - 2016 BEFORE	2016 - 2017 AFTER	%
DC PARUNG	204	159	22%
DC MAKASSAR	350	130	63%

TABLE III
INCREASING PERCENTAGE OF SALES BEFORE AND AFTER TOC IMPLEMENTATION

DC	2015 - 2016 BEFORE	2016 - 2017 AFTER	%
DC PARUNG	Rp 30.432.312.655,43	Rp 32.871.181.746,75	8%
DC MAKASSAR	Rp 19.464.085.905,91	Rp 29.981.419.607,96	54%

- Hypothesis 4 – There are significant differences in sales before and after the TOC system is implemented in DC Makassar The final impact can be positive or negative; it will be positive if the stock out cases is decreasing, and sales are increasing after implementation. Also, it will be negative if the stock cases are increasing and sales are decreasing.

The tools that will be used for analysis in this research is ABC analysis and statistical test using SPSS. Thus, the data that will be used is inventory data, which is cover stock out data and sales data. The data timeframe will be one year before TOC is implemented (2015 — 2016) and one year after TOC is implemented (2016 -– 2017).

The data that will be used in this research is gathered from PT XYZ and researcher observation. The data is provided from PT XYZ Distribution Center where TOC system is implemented, which is DC Makassar and DC Parung. The products that will become the population is the products from PT ABC that distribute in Makassar and Parung.

IV. RESULT

The hypotheses are tested and analyzed by using paired sample t-test, and Wilcoxon signed ranked test. The results for the hypotheses would be:

Hypothesis 1, there are significant differences on the stock out the level before and after the TOC system is implemented in DC Parung. After being tested by using paired sample t-test, the value of t statistic is 1.108 with the significance of 0.283. It means hypothesis 1 is rejected; there are no significant differences on the stock out the level before and after the TOC system implemented in DC Parung.

Hypothesis 2, there are significant differences on the stock out the level before and after the TOC system is implemented in DC Makassar. After being tested by using paired sample t-test, the value of t statistic is 2.537 with the significance of 0.021. It means hypothesis 2 is accepted; there are significant differences on the stock out the level before and after the TOC system is implemented in DC Makassar.

Hypothesis 3, there are significant differences in sales before and after the TOC system is implemented in DC Parung. After being tested by using Wilcoxon signed ranked test, the value of t statistic is -1.167b with the significance of 0.243. It means hypothesis 3 is rejected; there are no significant differences in sales before and after the TOC system is implemented in DC Parung.

Hypothesis 4, there are significant differences in sales before and after the TOC system is implemented in DC Makassar. After being tested by using Wilcoxon signed ranked test, the value of t statistic is -2.722b with the significance of 0.006. It means hypothesis 4 is accepted; there are significant differences in sales before and after the TOC system is implemented in DC Makassar.

V. DISCUSSION

After the TOC system is implemented for about 1.5 years, general calculation showed that the stock out the case is decreasing, and sales are increasing.

Based on the general percentage the case of stock out after TOC implemented for 1.5 years are decreasing. DC Parung stock out case decreased by about 22 % and DC Makassar stock out case decreased by 63%. As for the sales, DC Makassar has their sales increase by 54.03% and DC Parung only by 8.01%. However, based on the test results, the decrease of stock out cases and sales increase in DC Parung is not significant, but significant in DC Makassar.

From this research, the researcher creates an assumption that TOC system is more effective if implemented in DC with the storage capacity bigger than the store coverage. This is because the TOC system emphasizes buffer stock management, so with bigger storage capacity supplier can replenish according to the norm that has been decided. This assumption is based on the comparison between DC Parung and DC Makassar. DC Parung is one of the busiest and efficient from 27 DC of PT.XYZ, DC Parung should cover 525 stores with a maximum capacity of 265 stores. Because of that, DC Parung can't store or receive buffer with high quantity because they have limited capacity. This condition is upside down with DC Makassar where the can store or receive buffer without any constraint because of the high capacity. DC Makassar has a maximum capacity for 736 stores and by this research made they only have to cover 596 stores. Thus, even if the hypothesis is rejected and the difference is not significant, but there is a positive trend in DC Parung. As for DC Makassar, the implementation of TOC system for 1.5 years is proven to be effective because it can

decrease the stock out rate to more than 50% and increase sales for more than 50%.

Based on Angulo, Heather, and Mathew [6], the adoption of VMI system will result in reduced stock level, accelerated the goods lifecycle and reduced cost for ordering and other administration, increased in sales and reduced the stock out cases. Therefore, the implementation of TOC system in PT. XYZ was successful to reduce ordering and administration cost, increase sales and reduce stock out cases.

VI. Conclusion

In conclusion, TOC as an adaptation from the VMI system is proven to increase the efficiency and give positive results on the stock out level and sales value. The adaptation is successful to reduce the cost from ordering and another administration process such as forecasting. From the research, it can be said that the TOC system will be more effective if implemented in DC with higher capacity than their coverage area. This is because the DC with bigger capacity can increase and maximize their buffer stock level to fulfill the decided norm.

Based on the research, TOC is already implemented effectively, but it will need more adjustment and improvement before it can be implemented in all DCs of PT.XYZ. One of the things that can be upgraded is the norm formula and buffer management. The supplier should think to adjust the buffer management and make the inventory level as low as it can be. With lower inventory, it will reduce the inventory cost. The supplier cannot keeps depending on the maximum inventory level; supplier should try to do more complex forecast to create a lower inventory level. If the TOC system is implemented in any DC without any changes, it will be better to implement in DC with high capacity in order the be more effective.

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