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ANALYSIS OF INFORMATION SHARING IMPACT IN TWO LEVEL SUPPLY CHAIN WITH MULTIPLE RETAILERS (CASE STUDY IN TWO MANUFACTURING COMPANIES, PT XY AND PT YZ)

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ABSTRACT

The development of information technology in manufacturing accelerates business globalization in the last two decades. Modern business competition brings the impact of changes in the current competitive strategy. Along with the development of information technology, many problems in the supply chain can be resolved. It is known that the main problem is the uncertainty in the supply chain. Uncertainty in the two sides of demand and supply. This of course can lead to the buildup of inventory and increased costs.

Previous studies explain that it is necessary to deal with the uncertainty of information sharing between supply chain actors. Information sharing is certainly supported by the Internet technology. Effect of information sharing is often more focused on the manufacturer side. So this study does not only focus on the benefits of information sharing in manufacturer but also in retail with three types of information-sharing scenarios are provided. The benefits of information sharing on inventory cost reduction and shortage cost reduction.

This research found that information sharing influence the expected cost reduction of PT YZ. But it does not give a significant influence to the expected cost reduction of PT XY. It also provides mechanism of information sharing strategy.

***Keywords**: Information Sharing, Inventory Reduction, and Expected Cost Reduction.*

1. INTRODUCTION

In previous time, the company used the traditional way in determining their inventory. The Company determines their supplies in accordance with the order quantity from the downstream supply chain actors (Cheng and Wu, 2005). Effective inventory policy needs to be used to identify the factors the uncertainty. This uncertainty causes an excess amount of saved inventory, improve logistics costs and inefficient use of resources (Yu, 2001). Sufficient availability of products are factors that ensure a flow of production process. But too much inventory is not necessarily profitable for companies, too much inventories can increase the cost of supplies and maintenance during storage in the warehouse. While a small amount of inventory possible to lost sale or inability of the company in fulfill all requests (Assauri, 2003). The problems most frequently encountered is the bullwhip effect (accumulation of inventories). Bullwhip effect is due to the distortion of information. Distortion of information requests showed that manufacturer observe the data request in a hurry will be misled by the high demand patterns. This gives a serious impact on the cost of which will appear (Lee, Padmanabhan, and Whang, 1997). Lee et al (1997) suggest to share information on ordering and inventory status to reduce the bullwhip effect.

According to the problems, supply chain required a coordination and integration between supply chain actors. To strenghten collaboration, it needs information sharing. The merger between effective supply chain practices with effective information sharing to be the development of supply chain performance (Chopra and Meindl, 2001). So that is the necessary strategic policies to manage information as well as in the

implementation of information sharing. The objective will be achieved through strategic step is to get the benefits that can be shared between supply chain actors (suppliers and retailers). The benefits of information sharing on supply chain actors are not always the same. It depends on the structure of the supply chain and operational characteristics (demand patterns and associated costs).

Information sharing on supply chain and the affect of information sharing in a two-level supply chain have been discussed in several previous studies such as the journal Lee, So, and Tang (2000) implementation of information sharing in a two-level supply chain. Then the next study discusses about the affect of information sharing on two-level supply chain is the research from Cheng and Wu (2005) and Helper, Davis, and Wui (2010), discusses the flow of information that is divided into three: no information sharing, information sharing and complete partial information sharing with multiple retailers later on Additional research is by Lee, So and Tang (2000) aims to see how the effect of two levels of information sharing on supply chain in terms of the expected cost reduction and inventory reduction. These studies do not provide a mathematical test against the model or its application in the company. The present study sought to entering a gap. So the present study wants to analyze the effect of information sharing with three scenarios with the aim of determining inventory cost reduction and shortage cost reduction in suppliers. The author would like to test and compare the implementation of information sharing strategies for assigned the expected benefits in two different types of characteristics of the company products. Ding and Liu (2010), said that the benefits obtained by retail on the implementation of information sharing is very little compared to other supply chain actors. The benefits obtained by the supplier that is holding shortage cost reduction and cost reduction for high to avoid increased costs The Goals to be achieved from this study was to evaluate the best case scenario of no information sharing (level 1), partial information sharing (level 2), and full information sharing (level 3) in its influence on the holding cost reduction and shortage cost reduction.

2. METHODE

Cheng and Wu's research (2005) assumed that the cost of shortage in the retail and suppliers as well as cost savings on retail and constant supplier. But in this study assumes that shortage costs and holding costs in the retail store and the supplier are not constant. Cost depends on the number of units.

The following are the variables that will be used in the modeling to resolve the issues raised in this study:

s_t^i : the retailer's order-up-to level at time period t, t=- 1, 2,... t, i = 1, 2, …, n
p : unit shortage cost for the retailers
h : unit holding cost for the retailers
P : unit shortage cost for the supplier
H : unit holding cost for the supplier

As considered in Lee et al, external demand occurring at each retailer is assumed to be a simple autocorrelated AR (1) process. Let dt, t= 1,2, ...,i= 1,2, ...,n be the AR (1) demand process at retailer i at time period t, that is,

$$d_t^i = d + pd_{t-1}^i + \varepsilon_t^i \qquad (1)$$

where d>0 and -1 <p<, 1 are constant, and ε_t^i is independent and identically (i.i.d.) normally distributed with mean 0 and variance σ_i^2. Like in Lee et al,5 it is further assumed that σ_i^2 is significantly smaller than d so that the probability of a negative demand is negligible. It assumes that the retailer faces nonstationary demand over time and demand forecasts are updated based on observed demand.

In this model, retailers review their inventory level and place orders y_t^i to the manufacturer to fulfill their demands. The orders will come at time periode t + 1 + 1. We know that

$$y_t^i = d_t^i + \left(s_t^i - s_{t-1}^i\right) \ldots\ldots \quad (2).$$

The optimal order-up-to level s_t^{*i} is decided to minimize total cost at time periode t + l + 1. We denote the total demands during the lead time from retailer i. From (3), we have

$$\sum_{j=1}^{l+1} d_{t+j}^i = d\sum_{j=1}^{l+1}\frac{1-\rho^j}{1-\rho} + \frac{\rho(1-\rho^{l+1})}{1-\rho}d_t^i + \frac{1}{1-\rho}\sum_{j=1}^{l+1}(1-\rho^j)\varepsilon_{t+l+2-i}^i$$

Where

$m_t^i = d\sum_{j=1}^{l+1}\frac{1-\rho^j}{1-\rho} + \frac{\rho(1-\rho^{l+1}),}{1-\rho}d_t^l$ (3)

and

$$v_t^i = v\sigma_i^2$$

where known is :

$$v = \frac{1}{(1-\rho)^2}\left(\sum_{j=1}^{l+1}(1-\rho^j)^2\right)$$

Optimal order at retail level i at the time period t is

$$s_t^{*i} = m_t^i + k\sigma_i\sqrt{v} \quad (4)$$

$k = \emptyset^{-1}[p/(p+h)]$, and $\emptyset^{-1}$ are inverse function from normal distribution.

Size reservations at retail in time period t is the demand on manufacturer. When retailers put their reservations to manufacturer, and then manufacturer review its inventory. If there is not enough supply, the manufacturer firm hold of the outsourced inventory replenishment. So that manufacturer receives their orders on time, period *t* + L. D_t characterized as a measure of retail orders. So that from equation (1) - (4), owned,

$$\begin{aligned} D_t &= \sum_{i=1}^{n} y_t^i \\ &= \sum_{i=1}^{n}\left[d_t^i + \left(s_t^{*i} - s_{t-1}^{*i}\right)\right] \\ &= \sum_{i=1}^{n}\left[d_t^i + \left(m_t^i - m_{t-1}^i\right)\right] \\ &= \sum_{i=1}^{n}\left[d_t^i + \frac{\rho(1-\rho^{l+1})}{1-\rho}\left(d_t^i - d_{t-1}^i\right)\right] \quad (5) \end{aligned}$$

From (1) – (4) consider D_{t+1} . We denote,

$$\begin{aligned} D_{t+1} &= \sum_{i=1}^{n} y_{t+1}^i \\ &= \sum_{i=1}^{n} d_{t+1}^i + \left(s_{t+1}^{*i} - s_t^{*1}\right) \\ &= \sum_{i=1}^{n}\left[d_{t+1}^i + \left(m_{t+1}^i - m_t^i\right)\right] \\ &= \sum_{i=1}^{n}\left[d_{t+1}^i + \frac{\rho\left(1-\rho^{l+1}\right)}{1-\rho}\left(d_{t+1}^i - d_t^i\right)\right] \\ &= \sum_{i=1}^{n}\left[d + \rho d_t^i + \varepsilon_{t+1}^i + \frac{\rho\left(1-\rho^{l+1}\right)}{1-\rho}\left(\left(d_t^i - d_{t-1}^i\right) + \left(\varepsilon_{t+1}^i - \varepsilon_t^i\right)\right)\right] \\ &= nd + \rho\sum_{i-1}^{n}\left[d_{t+1}^i + \frac{\rho\left(1-\rho^{l+1}\right)}{1-\rho}\left(d_t^i - d_{t-1}^i\right)\right] + \sum_{i=1}^{n}\left[\frac{\rho\left(1-\rho^{l+1}\right)+(1-\rho)}{1-\rho}\varepsilon_{t+1}^i - \frac{\rho\left(1-\rho^{l+1}\right)}{1-\rho}\varepsilon_t^i\right] \\ &= nd + \rho D_t + \sum_{i=1}^{n}\left[\frac{\rho\left(1-\rho^{l+2}\right)+(1-\rho)}{1-\rho}\varepsilon_{t+1}^i - \frac{\rho\left(1-\rho^{l+1}\right)}{1-\rho}\varepsilon_t^i\right] \end{aligned}$$

The total shipment quantity over the lead time *L* from manufacturer to retailer is

$$\begin{aligned} \sum_{j=1}^{L+1} D_{t+j} &= \left[L+1-\frac{\rho(1-\rho^{L+1})}{1-\rho}\right]\frac{nd}{1-\rho} + \frac{\rho(1-\rho^{L+1})}{1-\rho}D_t \\ &+ \frac{1-\rho^{l+2}}{1-\rho}\left(\sum_{i=1}^{n}\varepsilon_{t+L+1}^i\right) + \frac{1}{1-\rho}\sum_{j=1}^{L}(1 - \rho^{L+l+3-j})\left(\sum_{i=1}^{n}\varepsilon_{t+j}^i\right) \\ &- \frac{\rho(1-\rho^{L+1})(1-\rho^{l+1})}{(1-\rho)^2}\left(\sum_{i=1}^{n}\varepsilon_t^i\right) \end{aligned}$$

Level 1: Manufacturer decides optimal order-up-to level $S_{t|1}^*$ to minimize total holding cost and shortage cost over the lead time L. Known variable is shipment quantity D_t and $\varepsilon_{t+j}^i (i = 1,2,\dots,n, j = 0,1,\dots,L+1)$ as stochastic variabel. Then manufacturer

divide $\sum_{j=1}^{L+1} D_{t+j}$ as normal distribution and $V_t|_1(\sum_{i=1}^{n} \sigma_1^2)$ as variance, where

$$V_t|_1 = \frac{1}{(1-\rho)^2}\left[(1-\rho^{l+2})^2 + \sum_{j=1}^{L}(1-\rho^{L+l+3-j})^2 + \frac{\rho^2(1-\rho^{L+1})^2(1-\rho^{l+1})^2}{(1-\rho)^2}\right]$$

By Lee, et al (2000) we denote that the optimal order-up-to level of the manufacturer $S_{t|1}^*$ at level 1 information sharing is

$$S_{t|1}^* = M_t|_1 + K\sqrt{\sum_{i=1}^{n}\sigma_i^2\sqrt{V|_1}}, t = 1,2\ldots$$

Where $K = \emptyset^{-1}[P/(P+H)]$.

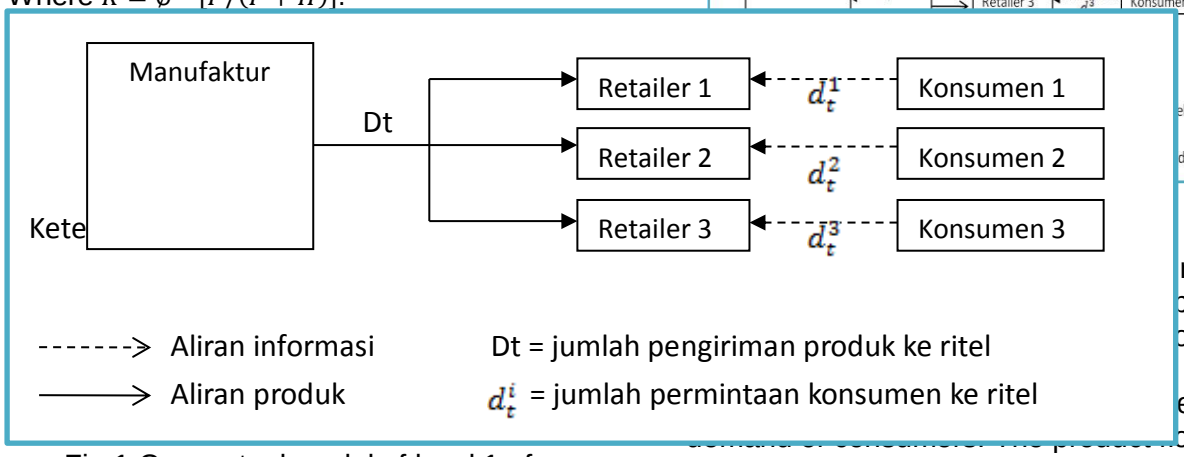

Fig.1 Conceptual model of level 1 of information sharing

At this level, there is no flow of information between the retail and manufacturer so there is no coordination relationship between the retail and manufacturer. The flow of information and product flow at level 1 information sharing can be seen in Figure 1. Conceptual model of level 1 information sharing. Index period shown at t = 1,2, ...,While the retail index is shown i = 1,2, ..., n.

Level 2: In this conditon, manufacturers knows not only the total size of retailer's order but also total customer's demand. Known variabels are shipmnet quantity D_t and $\varepsilon_t^i(i = 1,2,\ldots,n)$. $\varepsilon_{t+j}^i(i = 1,2,\ldots,n, j = 0,1,\ldots,L+1)$ is stochastic variable. Then manufacturer denote $\sum_{j=1}^{L+1} D_{t+j}$ as normal distribution and $V_t|_2(\sum_{i=1}^{n} \sigma_1^2)$as variance.

$$V_t|_2 = \frac{1}{(1-\rho)^2}\left[\left(1-\rho^{l+2}\right)^2 + \sum_{j=1}^{L}\left(1-\rho^{L+l+3-j}\right)^2\right]$$

Order-up-to level of manufacturer at level 2 of information sharing $S_t^*|_2$ is

$$S_{t|2}^* = M_t|_2 + K\sqrt{\sum_{i=1}^{n}\sigma_i^2\sqrt{V|_2}}, t = 1,2\ldots$$

Where K is defined as above.

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information flow on information sharing level 2 is shown in Fig.2 Conceptual model of level 2 information sharing. Index period shown at t = 1,2, ..., while the retail index is shown i = 1,2, ..., n.

Level 3: With EDI, manufacturer obtain information about consumer demand directly. Received requests received by manufacturer is the total number of deliveries to retail quantities. Manufacturer send Dt units of an item which is added to the retail inventory in period t. Total Dt should meet demand d_t^i of all consumers, not just retail dri. Thus, it can be concluded that relationship between $\sum_{j=1}^{L+1} D_{t+j}$ and d_t^i, not the relationship between $\sum_{j=1}^{L+1} D_{t+j}$ and *Dt*. As level 1 and level 2. the total units required for lead time L is

$$\sum_{j=1}^{L+1} D_{t+j} = \sum_{j=1}^{L+1}\left[\sum_{j=1}^{n}\left[d_{t+j}^{i}\frac{\rho\left(1-\rho^{l+1}\right)}{1-\rho}\left(d_{t+j}^{i} - d_{t+j-1}^{i}\right)\right]\right]$$

$$= \sum_{i=1}^{n}\left[\sum_{j=1}^{L+1}\left[d_{t+j}^{i}\frac{\rho\left(1-\rho^{l+1}\right)}{1-\rho}\left(d_{t+j}^{i} - d_{t+j-1}^{i}\right)\right]\right]$$

$$= \sum_{i=1}^{n}\left[\sum_{j=1}^{L+1}\left[d_{t+j}^{i}\frac{\rho\left(1-\rho^{l+1}\right)}{1-\rho}\left(d_{t+L+1}^{i} - d_{t}^{i}\right)\right]\right]$$

$$= nd\left[\sum_{j=1}^{L+1}\left[\frac{1-\rho^{j}}{1-\rho} + \frac{\rho\left(1-\rho^{l+1}\right)\left(1-\rho^{L+1}\right)}{(1-\rho)^{2}}\right]\right] + \sum_{i=1}^{n}\left[\frac{\rho^{l+2}\left(1-\rho^{L+1}\right)}{1-\rho}d_{t}^{i} + \frac{1}{1-\rho}\sum_{j=1}^{L+1}\left(1 - \rho^{l+1+j}\right)\varepsilon_{t+L+2-j}^{i}\right]$$

At this level, $\mathrm{d_t^i(i = 1,2, \dots, n)}$ is known as known variable and $\varepsilon_{t+j}^{i}\,(i = 1,2, \dots, n, j = 1,2, \dots, L+1)$ is stochastic. Variance $M_t|_3\left(\sum_{i=1}^{n}\sigma_i^2\right)$ from normal distribution $\sum_{j=1}^{L+1} D_{t+j}$

$$V_t|_3 = \frac{1}{(1-\rho)^2}\left(\sum_{j=1}^{L+1}\left(1-\rho^{l+1+j}\right)\varepsilon_{t+L+2-j}^{i}\right)$$

At this level, $\mathrm{d_t^i(i = 1,2, \dots, n)}$ is known as known variable and $\varepsilon_{t+j}^{i}\,(i = 1,2, \dots, n, j = 1,2, \dots, L+1)$ is stochastic. Variance $M_t|_3\left(\sum_{i=1}^{n}\sigma_i^2\right)$ from normal distribution $\sum_{j=1}^{L+1} D_{t+j}$.

$V_t|_3 = \frac{1}{(1-\rho)^2}\left(\sum_{j=1}^{L+1}\left(1-\rho^{l+1+j}\right)\varepsilon_{t+L+2-j}^{i}\right)$ The optimal level order of manufacturer S_t^*3 at level 3 information sharing is

$$S_{t|3}^{*} = M_t|_3 + K\sqrt{\sum_{i=1}^{n}\sigma_i^2}\,\sqrt{V|_3}, t = 1,2 \dots$$

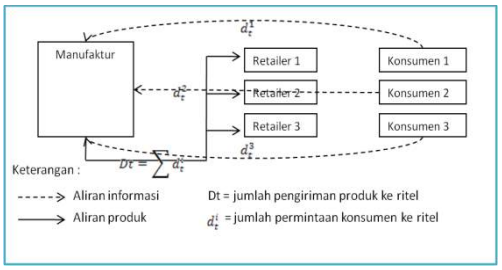

Fig.3 Conceptual model of level 3 of information sharing

Manufacturer directly obtain information on consumer demand d_t^i indexes are shown in period t = 1,2, ..., while the retail index is shown i = 1,2, ..., n. So the demand which to be met by manufacturing is the total of the number of consumer demand $Dt = \sum d_t^i$. The flow of information and product flow can be seen in Figure 3 Conceptual Model of Level 3 of information sharing.

3. EFFECT OF INFORMATION SHARING

This section discusses the influence of informaton sharing on manufacturing, which is the expected cost reduction which is revealed to be holding cost reduction. This model did not discuss about the influence exerted by information sharing to retail. Expected Cost Reduction $L(x)$ an appropriate loss function for a standard normal distribution, where

$$L(x)\int_{\times}^{\infty}(z-x)d\emptyset(z)$$

And $\emptyset(z)$ is standard normal probability distribution.

$S_t = M_t + K\sqrt{\sum_{i=1}^{n}\sigma_i^2\,\sqrt{V}}$is assumed as an order-up-to level of the manufacturer, where $V(\sum_{i=1}^{n}\sigma_1^2)$as variance from $\sum_{j=1}^{L+1} D_{t+j}$, and F_t is normal distribution function with mean M_t and variance $\left(\sum_{i=1}^{n}\sigma_i^2\right)$. By Lee, et al (2000), we define expected cost reduction of manufacturer at periode $t + L + 1$ is

$$C_t = E\left(\rho\int_{S_t}^{\infty}(x - S_t)\,dF_t(x) + H\int_{-\infty}^{-S_t}(S_t - x)\,d\,F_t(x)\right)$$

$$= \sqrt{\sum_{i=1}^{n}\sigma_i^2}\,\sqrt{V}[(H+P)L(K) + HK)]$$

C_t is not depend on t so it can be characterized as C. The expected holding cost occurring in manufacturer is divided into three levels according to the level of information sharing. So that these costs are divided into C1, C2, and C3. So its value can be determined by the following equation

$$C_1 = \sqrt{V|_1}[(H+P)L(K) + HK)]\sqrt{\sum_{i=1}^{n}\sigma_i^2}\,C_2$$

$$= \sqrt{V|_2}[(H+P)L(K) + HK)]\sqrt{\sum_{i=1}^{n}\sigma_i^2}$$

$$C_3 = \sqrt{V|_3}[(H+P)L(K) + HK)]\sqrt{\sum_{i=1}^{n}\sigma_i^2}$$

In this study, the holding cost reduction will be obtained from the equation expexted cost reduction. Expected holding cost is the cost savings expected by the company. C_{it} is not depend on t that can be characterized as C_i. The value can be determined by the following equation

$$C_{i1} = \sqrt{\sum_{i=1}^{n}\sigma_i^2\sqrt{V|_1}\ (HL(K) + HK)C_{i2}}$$

$$= \sqrt{\sum_{i=1}^{n}\sigma_i^2\sqrt{V|_2}\ (HL(K) + HK)}$$

$$C_{i3} = \sqrt{\sum_{i=1}^{n}\sigma_i^2\sqrt{V|_3}\ (HL(K) + HK)}$$

C_{st} is a minimum cost of shortage that is expected by the company. C_{st} also does not depend on t that can be characterized as C_s. Its value can be determined by the following equation

$$C_{s1} = \sqrt{\sum_{i=1}^{n}\sigma_i^2\sqrt{V|_1}\,(PL(K))}$$

$$C_{s2} = \sqrt{\sum_{i=1}^{n}\sigma_i^2\sqrt{V|_2}\ (PL(K))}$$

$$C_{s3} = \sqrt{\sum_{i=1}^{n}\sigma_i^2\sqrt{V|_3}\ (HL(K))}$$

To get the value of the calculation cost reduction $C_1 - C_2$ for level 2 information sharing and $C_1 - C_3$ for level 3 information sharing. So that the total cost can be saved by the company can be seen from the results of these calculations.

4. CASE STUDY OF PT EEASTERN PEARL FLOUR MILLS

PT Eastern Pearl Flour Mills (EPFM) is a miling wheat company. The company established several warehouses in multiple delivery locations to serve requests in a timely manner and also to increase sales. This experiment examined the effect of information sharing on cost reduction PT EPFM in East Java and East Java. The calculation of cost reduction using a mathematical model of Cheng and Wu (2005) described by the author into inventory shortage cost reduction and cost reduction. Table 1 below shows the results of the calculation of the expected cost of PT EPFM.

Tabel 1. *Expectedcost* PT EPFM

L = 2	
Holding Cost Level 1	Rp.113173512
Holding Cost Level 2	Rp.112114637
Holding Cost Level 3	Rp.108876242
L = 3	
Holding Cost Level 1	Rp.138867985
Holding Cost Level 2	Rp.136675190
Holding Cost Level 3	Rp.129874860
L = 2	
Shortage Cost Level 1	Rp.168719142
Shortage Cost Level 2	Rp.167140571
Shortage Cost Level 3	Rp.162312769
L = 3	
Shortage Cost Level 1	Rp.216606889
Shortage Cost Level 2	Rp.213186559
Shortage Cost Level 3	Rp.202579374

After getting the expected cost at each level of information sharing scenario, do the calculations to find the difference of the expected cost between level 1 and level 2, and between level 1 and level 3.
Cost reduction is a case study of PT EPFM. Indicates that the current cost reduction of lead time 3, the value is smaller than when lead time 2. This study uses sensitivity analysis to overcome the lead time variance that occurs in the process of delivery. The calculation result can be seen in Table 3.

Table 3. Total *Expected cost reduction*

Shortage Cost Reduction	L = 2	Cp1 - Cp2	Rp.1.578.571	0.83	Rp.1.310.214
	L = 3	Cp1 - Cp2	Rp.3.420.330	0.17	Rp.581.456
	Total		Rp.4.998.901	Rp.1.891.670	
	L = 2	Cp1 - Cp3	Rp.6.406.373	0.83	Rp.5.317.290
	L = 3	Cp1 - Cp3	Rp.14.027.515	0.17	Rp.2.384.678
	Total		Rp.20.433.888	Rp.7.701.967	
Holding Cost Reduction	L = 2	Ch1 - Ch2	Rp.1.058.875	0.83	Rp.878.866
	L = 3	Ch1 - Ch2	Rp.2.192.795	0.17	Rp.1.931.826
	Total		Rp.16.794.619	Rp.2.810.692	
	L = 2	Ch1 - Ch3	Rp.4.297.270	0.83	Rp.3.566.734
	L = 3	Ch1 - Ch3	Rp.8.993.125	0.17	Rp.1.528.831
	Total		Rp.13.290.395	Rp.5.095.565	

The calculation result shows that the percentage of cost reduction are at level 2 information sharing (partial information sharing) and at level 3 information sharing (full information sharing) is very small. It is caused by a small variance request. So it is easier to forecast demand. This is certainly affect the supply company that also will affect directly to save costs and shortage. Low percentage of cost reduction shows that demand information sharing does not affect significantly to cost reduction. From the research, the shorter lead time, the greater the holding cost reduction. So the company is able to save costs more.

The value percentage cost reduction in PT XY low. So that the application of information sharing and information technology depending on company policy. It certainly should consider the cost of application of information technology in an expensive enterprise.

5. CASE STUDY OF PT YZ

PT YZ is one of the largest agri-food company in Indonesia. PT YZ was established on the stairs January 18, 1971 with the main production of copra pellets. This study discusses in the Poultry Division on livestock feed unit. Known Poultry Division has three units, namely units fodder, chicken breeding units and units of commercial farms. Animal feed unit currently has a total of 12 feed mills located in Sidoarjo (2 mills), Cirebon, Lampung, Tangerang, Makassar, Sragen, Medan, Padang, Bati-Bati, Cikande, and Surabaya.Seluruh factory has implemented a Quality Management System (QMS) ISO 9001.Unit animal feed business have provided the largest contribution to total sales. This study discusses fodder units located in Makassar.

The main sales area is spread in Palu, Sidrap, Makassar, Kendari, West Sulawesi and differentiated consumer. Jenis of needs. Consumers who only need one type of product is categorized into homogeneous consumers. This homogeneous consumers are direct users such as chicken farms. As for the consumer with the needs of a wide range of products categorized as heterogeneous consumers. This heterogeneous consumer retailers usually are fodder. Total production per month of 14000-17000 tons for all produk.Total production per month for broiler chicken products as 8400-10200 tons. Supporting data to perform inventory that sales forecasts are obtained from the field and the data for the purchasing of raw materials as well. Inventories of raw materials handled by the Purchasing Department. The Company has not implemented such as VMI or EDI technology to communications or transactions with suppliers and retailer them. Transactions between suppliers, manufacturer and retailer is done by telephone. That is to say that the company PT Japfa Comfeed Indonesia Tbk has not implemented an integrated information system centered with suppliers and retailers or their end-customer.

The calculation of cost reduction using a mathematical model of Cheng and Wu (2005) described by the author into inventory shortage cost reduction and cost reduction. Table 2 below shows the results of the calculation of the expected cost of PT YZ.

Tabel 2. Expected Cost of PT YZ

L = 1	
Holding Cost Level 1	Rp.51.682.050
Holding Cost Level 2	Rp.40.240.018
Holding Cost Level 3	Rp.40.240.018
L = 2	
Holding Cost Level 1	Rp.56.887.255
Holding Cost Level 2	Rp.48.471.948
Holding Cost Level 3	Rp.48.471.948
L = 3	
Holding Cost Level 1	Rp.63.711.064
Holding Cost Level 2	Rp.55.350.509
Holding Cost Level 3	Rp.55.350.509
L = 1	
Shortage Cost Level 1	Rp.49.590.356
Shortage Cost Level 2	Rp.38.611.410
Shortage Cost Level 3	Rp.38.611.410
L = 2	
Shortage Cost Level 1	Rp.54.584.894
Shortage Cost Level 2	Rp.46.510.175
Shortage Cost Level 3	Rp.46.510.175
L = 3	
Shortage Cost Level 1	Rp.61.132.528
Shortage Cost Level 2	Rp.53.110.344
Shortage Cost Level 3	Rp.53.110.344

After getting the expected cost savings in costs and shortage costs in each scenario level of information sharing, do the calculations to find the difference in the cost of the expected cost savings and shortage costs between level 1 and level 2, and between level 1 and level 3. Table 3. Expected cost reduction case studies PT YZ shows the difference in cost between level 1 and level 2, and between level 1 and level 3.

Shortage Cost Reduction	L = 1	Cp1 - Cp2	Rp.2.504.128	0.7	Rp.1.752.890
	L = 2	Cp1 - Cp2	Rp.1.168.293	0.2	Rp.233.659
	L = 3	Cp1 - Cp2	Rp.926.227	0.1	Rp.92.623
	Total		Rp.4.598.648	Rp.2.079.171	
	L = 1	Cp1 - Cp3	Rp.10.978.945	0.7	Rp.7.685.262
	L = 2	Cp1 - Cp3	Rp.8.074.720	0.2	Rp.1.614.944
	L = 3	Cp1 - Cp3	Rp.8.022.183	0.1	Rp.802.218
	Total		Rp.27.075.848	Rp.10.102.424	
Holding Cost Reduction	L = 1	Ch1 - Ch2	Rp.2.609.752	0.7	Rp.1.826.826
	L = 2	Ch1 - Ch2	Rp.1.217.571	0.2	Rp.243.514
	L = 3	Ch1 - Ch2	Rp.965.295	0.1	Rp.96.530
	Total		Rp.4.792.618	Rp.2.166.870	
	L = 2	Ch1 - Ch3	Rp.11.442.033	0.7	Rp.8.009.423
	L = 2	Ch1 - Ch3	Rp.8.415.307	0.2	Rp.1.683.061
	L = 3	Ch1 - Ch3	Rp.8.360.555	0.1	Rp.836.056
	Total		Rp.28.217.895	Rp.10.528.540	

The results show the value of the percentage cost reduction at level 3 (full information sharing) are great. This is caused because the variance value and a great loss function. Value of variance showed a pattern of consumer demand, consumer demand patterns of PT YZ vary due to the number of requests is not only based on the season but also the condition of the chicken farm consumers. Sizable percentage value indicates information sharing significantly affect the cost reduction. Beside that, the short range of lead time made the probability of bullwhip effect increase. It increased the inventory and also the cost.

6. CONCLUSION

Reference model of this study is from research Cheng and Wang (2005) is adapted from the study, Lee et al (2000). This study examines the effect of information sharing on the holding cost reduction by considering the lead time in the field is not fixed in two manufacturing companies, PT XY and PT YZ. There are three information sharing scenarios used are no information sharing, partial information sharing, and full information sharing. The result of this study shows that information sharing is not significantly affect to the cost reduction at PT XY but have a great value of total cost reduction at PT YZ. The results showed that the shorter lead time, the greater the cost reduction obtained companies.

7. SUGGESTION

Further research can be done by developing a model of the effect of three levels of information sharing in supply chain by considering the varying lead time for implementation in a manufacturing company. In addition, research the influence of information sharing in the three levels of the supply chain can also be done by considering the variance of the product. So the research will able to get a wider view of system of supply chain.

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