IDENTIFICATION EXISTENCE OF BULLWHIP EFFECT ON SUPPLY CHAIN PT. ABC

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ABSTRACT

Bullwhip effect is the main evidence of inefficiency in the supply chain of a company. Bullwhip effect describes the tendency of increasing the number of purchases of raw material supply chain as a result of the inability to predict the increase in the number of requests. This study is the high level of inventory, whether as a result of the bullwhip effect or was due to an increase in demand. The purpose of this study was to determine the contribution of each factor causes of the bullwhip effect, identify the factors that provide the greatest impact on supply chain performance and find solutions to reduce the impact caused. The approach of this research is done by collecting data for inventory movement in the period 2003-2007, analyzing the interaction between members in the supply chain. Theory - the theory was used to create a research model. Data analysis is done by analyzing graphs and statistical analysis for the right to draw conclusions from this research. Results from this study that the coordination of "end to end" supply chain to reduce the impact of bullwhip effect in supply chain.

Keywords: *BWE, demand forecast updating, price variations, supply available.*

INTRODUCTION

According to Said et al. (2006), the future will be more and more companies are implementing Supply Chain Management (SCM). Especially the distribution of its product manufacturing company covers a vast territory, the application of SCM is not negotiable for the sake of winning the competition or even just to maintain existence. By Indrajit and Djokopranoto (2005) percentage of the cost of purchasing goods and services into most large compared with the cost of production, personnel, and other expenses. Thus, the benefits to the level of management if the purchase can be handled properly. Based on the above definition, we can conclude that the way an organization should be regular and expected that all human resources (HR) involved know their roles in these complex networks. But we also know that the dynamics of the work is not static. Relationships between employees can be a problem because each wants a standard system and little change. If there are problems in one area to another consequence companies will also face problems and can eventually weaken the overall supply chain. Each section is also likely to secure a share of excess. As a result, the organization began not flexible and there was the phenomenon of bullwhip effect (BWE). This happens because every element in the network tends to add a safety factor that resulted in more and more to the tip of the greater amount. Therefore, supply chain involves a lot of human resources, policies, and practices specifically, the dynamics and the level of uncertainty in the supply chain becomes increasingly high. Supply Chain that both must always follow the changes in consumer demand (consumer demand). However, companies need to be careful of BWE (artificial demand). Companies must respond to consumer needs, not responding to BWE.

According to Said et al. (2006), BWE is a serious problem to be solved. BWE may occur due to mistakes or lack of knowledge organization. Perhaps also because the incentive system is wrong. For example at the end of the month sales target must be reached so that the goods must be moved to the distributor. If it is done then the request as if the rise drastically when this happens because the sales person strategy to achieve sales targets. BWE is the magnitude of the effect of changes in demand (consumer demand) and changes in purchase (company orders) against the company's supply chain. For that the author wanted to examine and analyze the system from end to end supply chain in PT ABC, one of the largest foreign investment (PMA) based in Thailand which was granted permission to operate a feed mill in Indonesia ungas in an area of 2.4 hectares. ABC has also successfully expanded its business to Surabaya and Medan. Up to now, ABC has been operating in Indonesia for about 30 years and is one of the largest animal feed producer with annual production capacity of 650 thousand tons per year. As a market leader in the animal feed industry, the ABC must continue to innovate due to the continuous innovation will create new competitive advantage and will be easier to create opportunities for growth. And one of the strategies that made the ABC to be able to continue to be market leader is to implement SCM. But whether the SCM is applied by ABC managed productively, efficiently and involve the organization as a whole? To be able to find out, researchers developed an analysis to see the existence of BWE in the dynamics of the ABC job, especially in the SCM.

Based on literature studies conducted, researchers identified is 10 (ten) activity or factors that can lead BWE. Due to time constraints the study, researchers only examine the 3 (three) than 10 (ten)

the activity or the factors that encourage the emergence of BWE on PT ABC. Based on this, then the researcher formulate research questions are as follows:

1. Does the variation affect the purchase price Variations?
2. Is the demand forecast updating affect variations purchase?
3. What is the availability of supply variations affect the purchase?
4. Of the three factors mentioned above the factors which has the largest contribution (dominant) on the purchase of variation
4. Does the combination of price Variations, updating demand forecasts and supply availability can affect the variations of purchase?
5. Is demand amended from time to time?
6. How does the movement of demand from time to time?
7. What recommendations can be given to reduce the effects of BWE?

In connection with the subject-matter of the above, the objectives of the discussion of this thesis is:

1. Testing the impact of all activities of the SCM to the variability of orders in supply chain.
2. Determining the contribution of each SCM activity against variability in supply chain ordering.
3. Identifying the factors which provide a relatively significant impact on the variability of orders in supply chain.
4. Formulate appropriate recommendations to the manager of supply chain in order to reduce the variability ordering.
5. Test the effect of demand variability of BWE.

Research is expected to be useful to animal feed companies, especially ABC.

Limitations in this study is the first, because of the limited time of research, scientists have only been doing research on the 3 (three) than 10 (ten) possible causes of BWE. Second, the sample used only the data within 5 (five) years.

THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

Everyone will want a supply chain that are implemented in the company to provide maximum results. For that they made a lot of large and small investments in the field of SCM, for example by buying a variety of software supply chain and formed a unit within the company's supply chain, to conduct the election of members of marketing channels. According Sutardi and Budiasih (2002), the concept of SCM is known a "member" or supply chain of goods distributors - wholesalers (wholesalers) and retailers (retail). Kotler (1997) also revealed the reasons that made producers willing to delegate some duties to intermediaries selling is because among other things:

1. Many producers lack the financial resources to carry out direct marketing
2. The use of marketing channels to improve efficiency, producers do not need to build small shops to close market

3. Refunds are obtained by using marketing channels becomes greater

4. By using the marketing channels, functions such as collecting information on customer needs in a measure of the quality and quantity, promotion and negotiation can be transferred.

In undergoing its activities, supply chain involving 4 (four) different physical flows are not yet interconnected. Physical flows, among others, materials, information, ownership and payment activity (Paik and Bagchi, 2007). In his book, Miranda and Sole (2005) reveals the main activities in the SCM include: (1) Customer Service, (2) Demand Forecasting, (3) Inventory Management, (4) Logistic Communications, (5) Material Handling, (6) Order Processing. Packaging, (7) Warehousing and Location Selection, (8) Purchasing, (9) Reverse Logistics, (10) Transportation Liker (2005) says that the key that makes a superior company instead of each element, but the important thing is to unite all the elements these elements into one system. And integrated condition is achieved through communication links between the chains (chain) that exist. This must be done every day in a way that is consistent (not accelerated).

Gaspersz (2007) revealed that in order to develop a lean six sigma supply chain management company must perform an analysis of the total supply chain process, not just in certain parts only or partially. The success of the concept of SCM is still in a continuous flow of goods with minimum cost. No activity is inhibited and no accumulation of goods. According to Cohen and Rousel (2005) there are 4 (four) criteria for successful SCM is: in accordance with business strategies (cost and quality), able to meet consumer desires, are able to understand its position in the network and adaptive. Warburton (2004) revealed that Lee et al. (1997 2000) has popularized the BWE conditions since 1960, where the number of orders from retailers to suppliers tend to have greater variation than the actual consumer demand. According to Leishman et al. (2005) BWE is the magnification of demand fluctuations, not the magnification of demand. This effect causes the demand for components is more variable than the demand for finished goods are carried by retailers / distributors (Paolo Brandimarte and Giulio Zotteri, 2007.p.324).

Lee et al. (1997) suggested 4 (four) major factors that contribute in improving the variety and methods that can be done to reduce these variations, namely: (a) Demand Forecasting. (b) Inventory rationing (shortage gaming), (c) Order batching, (d) Price Variations. Diana and Katok (2005) noted that 4 (four) conditions above involve the role of members of the supply chain in responding to every activity of the SCM, this is what is called behavioral causes are usually studied in the laboratory and continue to be studied to eliminate the causes operational. Paik and Bagchi (2006) added a few factors that can increase the level of variation in the supply chain, namely the material and Information's delay (lead time), supply variability from machine breakdown, capacity limits, and the number of echelons.

Production System. According to Nasution (2006), production systems can be divided into four types, namely: Engineering To Order (ETO), that is, if the buyer asks the manufacturers to create products that started the process of design (engineering). Assembly To Order (ATO), which is when manufacturers make a standard design, standard operating modules previously and assemble a specific combination of the modules in accordance with customer orders Make To Order (MTO), ie when producers finally completed the item if and only if it has received a customer order for the item.

Make To Stock (MTS), ie when producers make the items that were completed and placed in inventory prior to a customer order is received.

Problems Order Sudden (Rush - Orders). Specific approach to address the problem of special order:

1. Coordinate the activities of sales, production, and purchasing.
2. Sales person (user) must confirm in writing their needs and give them to the executive and approved by top management executives. Only then can be given to the production.
3. For identification purposes in the production, emergency requests can be printed with a different form than normal booking or given a sticker or stamp "emergency."
4. Wear a service charge at the request of a sudden the users of the goods department.

Small Order Problem. The things that can be done to reduce the purchasing activities of raw materials and production in small quantities are as follows:

1. To appoint a special manager who handles customers -customers who have a record of an order goods in small quantities.
2. Setting the ATO system as a production system, so that the purchasing department to make plans to store raw materials, but the production of finished goods made after orders from customers.
3. Establish system of blanket orders or contracts to bind the company and customers in an effort to meet the needs.

Russell and Taylor (2005) argues that the above conditions also contribute to uncertainty and variability in the supply chain. According Wilck BWE is not likely eliminate completely from the supply chain (at least a realistic supply chain) but the company can minimize it by creating an effective information system among the members of the supply chain. By minimizing the variation and fluctuation of each level of intermediaries, the impact can be minimized BWE. Based on previous studies of the BWE, conducted by Lee et al. (1997a), Diana and Katok (2005), Paik and Bagchi (2006) framework was made from this study as shown in Figure 1 below.

Figure 1: Conceptual Framework
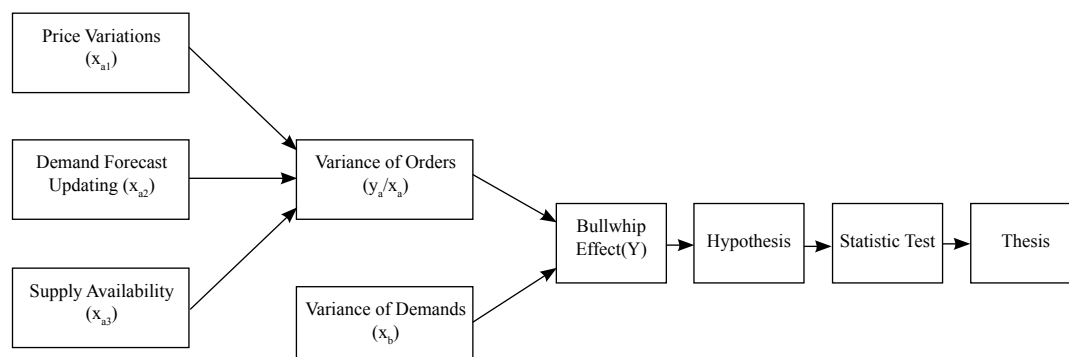
Based on some opinions above hypothesis was made as follows :

H1:   BWE influenced by variations in the purchase of corn at PTABC as a partial result of the

existence of conditions such as price Variations, updating demand forecasts and supply is partially available.

H2:   *BWE influenced by variations in the purchase of corn at PTABC as a result of a combination of price factor Variations, updating demand forecasts and supply available together.*

H3:   *BWE influenced by variations in demand as a function of time.*

METHODS

Operational Objectives Research. become independent variable "independent variables" of this research is the value of the variable causes of the BWE, the variation amount of requests from time to time and vary the number of orders caused by the price variations updating demand forecasts and supply available. Selection of Research Methods. The research method is a statistical analysis to measure the impact of 3 (three) and to test the operational causes a causal relationship between each of the causes of the BWE. Population and Sample. Population is taken from the movement of maize within the last 5 years on ABC. The sample taken was the purchase of data (quantity and price), sales data, inventory data, and forecasting data within 5 (five) years. Sampling method used in this study was purposive sampling based on an assessment of the characteristics of the sample, adjusted for the purpose of research.

Instrumentation and Data Collection. Primary data collected through interviews is data about the activities of each department involved in the supply chain, while other secondary data is data about existence of the ABC in the competition for the animal feed industry. Data collected through the collection of data forecasting, purchasing data, sales data, inventory data and other data that will be used as one consideration in assessing the performance of supply chain ABC. Data from the JSE is the data about the company's financial position and results of audits by independent auditors. Data from the BPS is the data about the supply in Indonesia position corn available for feed industry. Data. Method Analysis Method of analysis used are statistical analysis and trend method (Santoso, 2003) and Multiple Regression.

RESULTS AND DISCUSSION

Hypothesis #1 to test the influence of each variable price Variations, demand forecast updating, and shortage gaming(supply availability) against the decision to purchase supplies. Hypothesis # 2 tested the effect of simultaneously (combination) between the price Variations, demand forecast updating and shortage gaming (supply availability) against the decision to purchase supplies. To test hypothesis # 1 devices using a simple linear regression analysis. Regression coefficient obtained when tested with t-test. If the value of significance (p) $<\alpha / 2$ or the value t count> t table means that the research hypothesis accepted the research hypothesis accepted. To see the effect of variations in the partial purchase of raw materials used in the period of 2003-2007 corn partial coefficient of

determination (r2) of each variable. The greater r2 an independent variable showed that the more dominant influence of independent variables on the dependent variable.

Table 1: Analysis of Simple Regression

Variable	Coefficient Regression	t Counts	Significant (p)	r^2 partial	t Table (α=0.025)	DW
Price Variations (x_{a1})	371.142	137.872	0.000	0.997	2.0025	2.258
Demand Forecast Updating (x_{a2})	0.738	124.653	0.000	0.996	2.0025	2.43
Supply Availability (x_{a3})	1.389	90.317	0.000	0.993	2.0025	1.26

To test hypothesis # 2 devices using multiple linear regression analysis. Regression coefficient obtained when tested with a test-F. If the value of significance (P) <α or calculated F value> F table, the research hypothesis accepted. To see the effect of the partial purchase of raw material variation of 2003-2007 corn multiple determination coefficient (R2) The greater the R2 an independent variable showed that the more dominant influence of independent variables on the dependent variable. From the regression test results of regression analysis can be seen in table 2 below :

Table 2: Analysis of Multiple Regression

Variable	Coefficient Regression	t-Counts	Significant	r^2 partial	VIF
Price Variations (x_{a1})	296.274	3.928	0.000	0.997	817.455
Demand Forecast Updating (x_{a2})	0.241	1.904	0.062	0.996	580.683
Supply Availability (x_{a3})	-0.173	-0.99	0.327	0.993	312.227
Multiple R	0.999		DW	2.478	
R Square	0.997		F Count	6598.904	
Adjusted R	0.997		F Table	2.896	
Standard Error	11451.036		Significant	0.000	
Observations	58		Constanta	9.279	

Hypothesis #3 examine the relationship between time with variations in demand. To test the hypothesis #3 the analysis presented in graphical form that links the amount of demand for raw materials of corn on a quarterly basis during the period 2003-2007.From the available data comparing the R2 by using 4 (four) types of existing trends, namely linear, quadratic and exponential logarithmic, such that in Table 3 below:

Table 3: Result of Analysis Demand Graph Function Based on Time

Three	R^2			
Months	Linear	Logarithm	Quadratic	Exponential
I	0.9311	0.8283	0.9626	0.9628
II	0.3287	0.1776	0.521	0.3069
III	0.6571	0.5191	0.7083	0.6578

From Table 3 the results obtained showed that value is always bigger than t tables and significance value price Variations (xa1), demand forecast updating (xa2) and shortage gaming or supply availability (xa3) equal to 0000 or less than 0025 then research hypothesis can be accepted, which means there is influence between the decision to buy stocks with price variables Variations, demand forecast updating, and shortage gaming (supply availability) partially. Based on the value of r2, Variations price variable is a variable that provides the most significant impact on the variability of orders in supply chain. This variable affects the variability of 99.7% reservation.
Regression resulted from hypothesis 1 is:

Price Variation (y) = 8.565 + 371.142x   …(1)
Demand Forecast Updating (y) = 69.015 + 0.738x   …(2)
Supply Avaialbility (y) = 185.568 + 1.389x   …(3)
ya = 9.279 + 296.274 xa$_1$ + 0.241xa2 – 0.173 xa3   … (4)

Constant value of 9279 states that if prices do not be fluctuation, correction of forecasting is not done, and inventories that exist at the amount of supplies needed, then what happens is the purchase of 9.279 kg. Coefficient value, amounting to 296 274 xa1 states that any difference in price of U.S. $ 1 then the number of purchases will increase by 296.274 kg. Coefficient, xa2 of 0241 states that every happened correction forecasting the price difference as much as 1,000 kg, the total purchase would increase by 241 kg. Coefficient value, amounting 0173 xa3 states that every available corn as much as 1,000 kg at the warehouse then the amount of purchases will decrease by 173 kg. Based on the calculated F value greater than F table and significance value equal to 0000 is less than 0.05, meaning there is influence between the decision to buy stocks with price variables. Variation demand forecast updating, and shortage gaming(supply availability) simultaneously. Based on the value of R2, the variable price Variations, demand forecast updating, and shortage gaming (supply availability) simultaneously provide a significant impact on the variability of orders in supply chain. This variable affects the variability of 99.7% reservation. Partial testing on the results of multiple regression analysis, the t value for the variable shortage gaming (supply availability) is the value of -0.99 is greater than -2.0025, it can be concluded that this variable did not significantly affect the variability of demand. Based on chart analysis conducted, a trend that produced the highest R2 is to use a quadratic trend (polynomial), as shown in Table 3 above and described in Figure 2, 3 and 4 below. In the first quarter, demand has increased due to a few big days like New Year, Lunar New Year, and Eid al-Fitr in the month - January,February and March and began to decline in April, as illustrated in Figure 2 below.
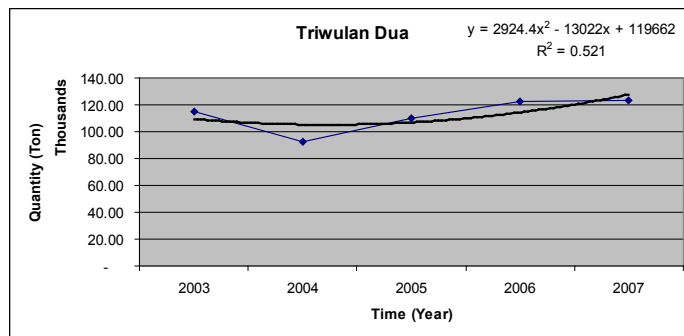
Figure 2: Corn Demand Graph of January-April 2003-2007

**Triwulan Satu** $y = 2749.2x^2 + 1187.6x + 75520$
$R^2 = 0.9626$
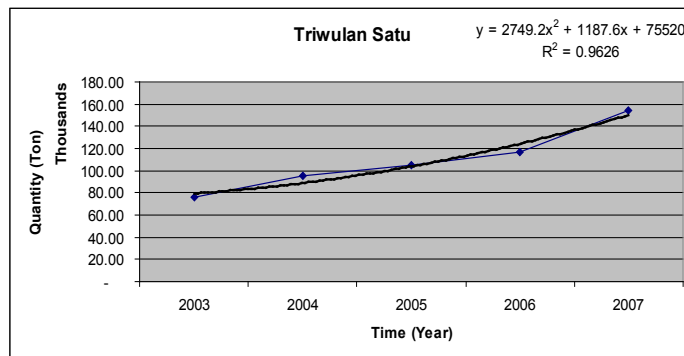
In the second quarter, demand in the month of May is not too much initially and then increased due to school holidays in June and July, as illustrated in Figure 3, below.

Figure 3: Corn Demand Graph of May-August 2003-2007

Triwulan Dua $y = 2924.4x^2 - 13022x + 119662$
$R^2 = 0.521$

In the third quarter, demand has increased because of the feast of Christmas and Eid al-Fitr in September, October and December, as illustrated in Figure 4 below.

Figure 4: Corn Demand Graph of September-December 2003-2007

Triwulan Tiga $y = 1724.6x^2 - 3042.6x + 111824$
$R^2 = 0.7083$
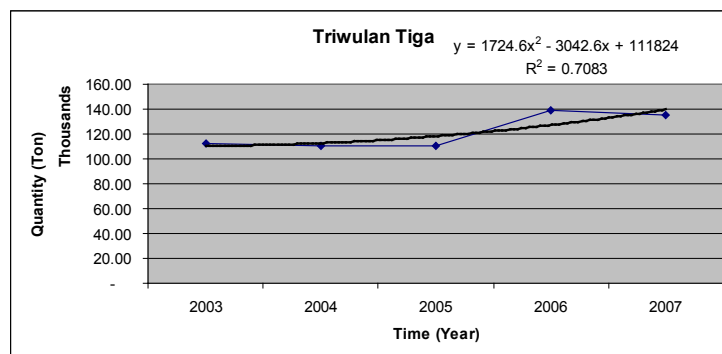
On this basis it can be concluded that the variability of demand is influenced by a quadratic time. At any given time demand will experience the culmination until eventually decline.

CONCLUSION

Based on testing using regression analysis tools to study the problem, it can be concluded that the price Variations, updating demand forecasts and supply availability, all three have a positive influence on the variability of the purchase of a partial but not simultaneously. Price Variations have the highest contribution to the variability of the purchase when compared with demand forecast updating and supply availability. And on the other hand the variability of demand affect the BWE as a function of time. Means that if the price Variations and frequency can be reduced demand forecast updating and maintaining the supply availability at an optimum level, the variability of purchase can be reduced. Furthermore, if the variability of the purchase could be reduced then the possibility of BWE can also be reduced.

Based on the above conclusions, the results of this study should be used by manufacturing companies in managing the total supply. Some things that should be focused on include:

1. Keeping the price of corn is not too varied from time to time by making a contract with corn farmers over the agricultural land so that farmers can obtain sufficient working capital that ultimately they could grow corn better

2. Make corrections to reduce the frequency of forecasting for the cancellation or the addition of the purchases that are still outstanding can be reduced. In this way purchasing departments to maintain number of available raw material corn better. According to Heizer and Barry (2004) multiple forecasting can be done by creating a centralized control that can be done by: retailers who understand the pattern of demand, which is able to process persedia istributor to certain areas of distribution, the manufacturer who has a regular distribution system properly. It is expected that in subsequent studies for:

    a. Examining the impact of 7 (seven) other factors to the variability of demand in supply chain and examine the impact of a combination of variables - those variables.

    b. Examining the influence of past events that can contribute to variations of purchase.

    c. Examining the differences from depreciation of the local corn and corn imports.

    d. Seeing the effect of variation of production track record of purchase,

    e. Researching BWE in a wider scope with activities involving marketing channels - wholesalers and retailers.

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