

# Comparing Performance of Centralized and Non-Centralized Safety Stock Case Study: Retail Clothing Business

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## Abstract

This research aims to develop a model of safety stock for retail clothing business between centralized and non-centralized system. Currently, in a case company that used non-centralized system to control their inventory. The company's central warehouse, when supplier delivered finished goods to the warehouse, warehouse staff will check the products and proceed the inventory information to the company database system. After that, all inventory will be sorting out and distributing to retail stores without stocking inventory in the warehouse. There are some company problems with the inventory such as imbalance among retail stores and transferring inventory between retail stores, which have been taken long time. Moreover, waiting period for ordering new products on next period if the retail store can't transfer the inventory to another store. Which may lead to opportunity lost. In this paper, the researcher emphasizes on the efficiency improvement for safety stock system by modifying the safety stock system to a centralized, the majority of inventory stored at company central's warehouse and small lot stored at the retail stores. As a result, the centralized safety stock system can reduce the quantity of safety stock to 1,344 pieces from 2,224 pieces or reduced 39.57% that compared with non-centralized safety stock system and can reduce production costs down to THB 102,960. In addition, the reshuffle of safety stock system has reduced lead time to 1 week from at least 2 weeks for replenishing the inventory to retail stores. This helps to increase the company's commercial opportunities.

**Keywords:** Safety Stock, Centralized, Non-centralized, Retail business

## 1. Introduction

From the current business situation, there is high level of competition and has new entrants to the business in a growing proportion. Each entrepreneur will develop and implement the new strategies that aims to increase market share than other operators in the same business. For the retail clothing business, based on the economic situation analysis [1] prepared by department of business development, Ministry of commerce on December 2015, the retail clothing business that higher the growth rate to register for start-up company. This is opposed to other type of businesses that trend to decrease.

Due to circumstance, there are many business competitors in retail clothing business. The entrepreneurs need to adapt the business plan following current world economic situation. One of the key factors that entrepreneurs must prioritize is the effective planning, implementation and management of their resources. For the trading business, the important resources to the performance of an organization are the production and stock keeping. The optimal of production and storage of materials are important to the profitability of the business.

For the retail clothing business, the inventory management is an important because there are many competitors. If prepared the inventory less than demand, the trade opportunities will be lost. In the other hand if prepare the inventory level to high, the entrepreneur must spend a lot of money to investment and risk of loss from sales.

In this paper, the researcher emphasizes on the efficiency improvement for safety stock system in case study of retail clothing business by modifying the safety stock system to a centralized, the majority of inventory is stored at company central's warehouse and small lot stored at the retail stores instead of non-centralized, all the inventory stored at each retail stores without stocking the inventory at the company's central warehouse. For the research objective as,

1. To study and develop the safety stock model for retail clothing business.
2. Testing results from the model development to compare performance between the current model (Non-centralized safety stock) and the new model (Centralized safety stock)

The researcher has reviewed about the theories and reviewed of the literature as following;

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The inventory control system [2], the criteria used to select the inventory control system to suitable the organization's operating strategy. The inventory control system is classified as two types;

Type 1 Continuous inventory system is a system to track the movement of the inventory at all times. This is a system that records the input-output inventory data and represents the current balance of the inventory level on the monitor screen. For a continuous inventory system that is suitable for the high value product and important to the organization to be handled regularly.

Type 2 Periodic inventory system is a system of inventory in which updates are made on period basis, with a set period of the inventory balance check such as weekly, monthly, Quarterly or annual. This system is suitable for the common product and consistent usage product.

For the safety stock inventory system, the product that the organization has calculated for backup stock in cases the product has a higher volume to use than expected, or other unexpected situation. The key factors in determining the quantity of the safety stock inventory that consist of the accuracy forecast, the service level target of the organization, the frequency of replenishment, lead time and other variability.

Service level [4] is an important factor for determining amount of inventories that an organization will reserve to prevent lose any opportunity to sell. However, if the organization has set a high service level, the cost will be high following target level. Therefore, the organizations must be carefully about data analyze and plan strategies.

The concept of risk pooling [5] is an important concept for the supply chain management process. The concept of risk pooling as demand fluctuation will be lower level if aggregate demand from different sources are combined. By reducing such fluctuate, the amount of safety stock inventory of the organization will be reduce. This will be beneficial to the organization in terms of reducing inventory cost. Risk pooling can be accomplished in several methods including consolidating of inventory storage locations to the center warehouse, product integration, consolidation of distribution points.

The research of Sri Krishna Kumar and M.K Tiwari [6] has designed the supply chain system by using the risk pooling technique. In case study is a comparison between the performances of the retailer that independent of each other and retailer work with distribution center. This research method using mix integer nonlinear programming as an implementation tool. The result of the research concluded that the retailer work with distribution center can reduce the total operating cost up to 8.25%

The research of Peter L. Jackson, John A and Muckstadt [7] has studied the impact of inventory system between several retailers and warehouse. The researcher has set the retailer's order cycle twice time by using the risk pooling model. The results of the research showed that the impact on the second order of the product. The effect that the researchers has developed to determine the optimal of the demand for each product in the store. In additional, this research also aims to develop a computer system for the operation of controlling distribution system to retailers.

The research of Z. Kevin Weng [8] has studied the impact of risk pooling which is caused by demand uncertainty. This research study the layout of warehouse and n retail stores. The inventories at the warehouse are include many products of retailers and studied the impact of operation costs, opportunity cost, cost of inventory and ordering cost. The results of the research showed that many retailers use the safety stock inventory to reduce the cost of their products.

## 2. Materials and methods

For company information, in case study is fashion clothing company under their own brand. The company has fashion designers to design product including men's clothing, women's clothing and accessories. There are 10 branches in Bangkok. Target customers of this brand are during adolescence and working age. The highlight of company case study that there are a variety of clothing styles and accessories for the customers to view and select products, so it is attracting a large number of customers to shopping at stores.

In the first step, researcher study of the company's business model. The product that the researcher interested is a T-shirt for men in black and white colour. For the T-shirt for men is available product throughout the year and generates revenue for the company. In product details; each color is available in 5 size as XS, S, M, L, XL. For the production order period of the T-shirt. The company has set an order cycle every four months; the company takes about 1 month to analyze the sales data before ordering and the factory will take 3 months to order production.

**Table 1** The period of T-shirt production and delivery

Month in which the company ordered to factory production	January	May	September
Month at the factory delivery finish goods to company center warehouse	March	July	November

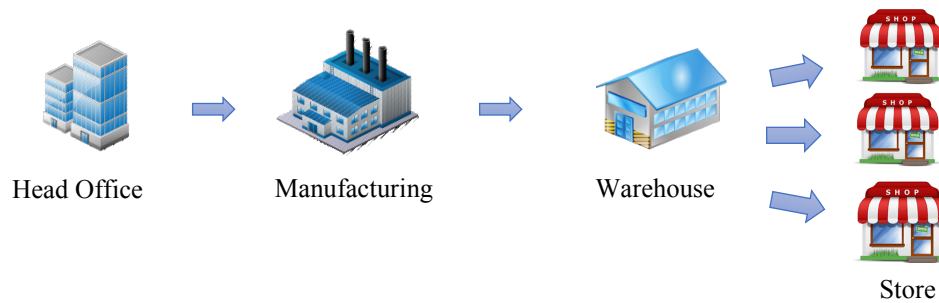
After the factory delivers the finish goods to company central warehouse and warehouse staff will be check the order, counting products and data entry into the warehouse inventory system. Then all the stock are sorting by the number assigned by sales department in each branch and shipping all the product to the store without stock keeping at the warehouse. In case of any branch store requires additional product, they will need to contact other branches to transfer stock and the warehouse will be the operator to transfer the stock between the stores.

For each production order cycle, the sales department will record the sales report in each period of each branch stores and analyze the data and decide the order quantity to production.

For the data analysis consist of 2 parts as

Part 1 Analysis of sales quantity for next period sales forecast data.

Part 2 Analysis for the safety stock volume in each color, size to storage in each branch store.



**Figure 1** Process flow of ordering and shipping information

Based on the operating model of the case study company can be encountered the problem as follow;

For the product distribution method of the company’s case study to all branch stores without some stock backups stored at the company central warehouse. If any branch stores need to transfer the stocks between Branch stores will take a minimum of two week to complete process. Due to the company central warehouse will begin to transfer from one branch and back to warehouse to carry out the paperwork before shipping to other branches. In the other hand, if any branch store do not transfer the products to another store. The branch store will have to wait for the order in the next cycle order, which will take a long time.

From this issues, the researcher is interested to improve the safety stock model in a new format by adjusting the safety stock system from the currently method as non-centralized safety stock to the new method as centralized safety stock system by using risk pooling concept, is to store safety stock inventory at the company central warehouse.

The research process as follow;

Step 1 Determining the amount of safety stock level to reserve in various places with lead time. Lead time is the deciding factor. For the new safety stock model will be stored in two locations as

- One part of safety stock inventory will be stored at company central warehouse, by the time taken for calculating the safety stock inventory a total 4 months or 16 weeks as current operation.

- One part of safety stock inventory will be stored at branch stores. The researcher has added the condition about replenish stock at branch store, each branch stores can request to fill the stock from the company central warehouse on time per week. After company central warehouse received the request they will deliver the products to the branch store at the same day in the week later. So, lest time to calculate for the safety stock level of and branch store is one week.

For the both stock locations use the method of safety stock calculating from the formula.

$$(\sqrt{L} \times \sigma) \times z \tag{1}$$

The explanation of the variable in equations;

L = Lead time for products delivery from source location to destination

Z = Customer service level, the organization is set at 97%

$\sigma$  = Standard deviation of weekly sales report that separate by branch stores, color, size

Standard deviation calculated from the formula as

$$\sigma = \sqrt{\frac{\sum(x-\bar{x})^2}{N}} \tag{2}$$

x = T-shirt’s weekly sales report

$\bar{x}$  = Average sales of all T-shirt

N = Amount of week

Step 2 Calculate the summary of safety stock by using centralized inventory concept; the result obtained from the calculation of safety stock that stored at the company central warehouse and the amount of safety stock that stored at each branch stores.

**Table 2** Total amount of safety stock on the period of sales from December 2015 to March 2016 (Period 1) by using centralized inventory concept

Color	Size	Safety Stock		
		At Warehouse	At Store	Total
Black	XS	19	5	24
	S	65	17	82
	M	72	18	90
	L	24	6	30
	XL	17	5	22
White	XS	21	6	27
	S	99	25	124
	M	67	17	84
	L	31	8	39
	XL	13	4	17
<b>Grand Total</b>		<b>428</b>	<b>111</b>	<b>539</b>

**Table 3** Total amount of safety stock on the period of sales from April to July 2016 (Period 2) by using centralized inventory concept

Color	Size	Safety Stock		
		At Warehouse	At Store	Total
Black	XS	29	8	37
	S	63	16	79
	M	51	13	64
	L	28	7	35
	XL	14	4	18
White	XS	35	9	44
	S	57	15	72
	M	55	14	69
	L	39	10	49
	XL	16	4	20
<b>Grand Total</b>		<b>387</b>	<b>100</b>	<b>487</b>

**Table 4** Total amount of safety stock on the period of sales from August to November 2016 (Period 3) by using centralized inventory concept

Color	Size	Safety Stock		
		At Warehouse	At Store	Total
Black	XS	15	4	19
	S	29	8	37
	M	28	7	35
	L	22	6	28
	XL	12	3	15
White	XS	23	6	29
	S	44	11	55
	M	41	11	52

Color	Size	Safety Stock		
		At Warehouse	At Store	Total
	L	27	7	34
	XL	11	3	14
<b>Grand Total</b>		<b>252</b>	<b>66</b>	<b>318</b>

### 3. Results and discussion

The researcher compared the efficiency of safety stock level between the current pattern as non-centralized and new concept as centralized concept the store main safety stock of T-shirt at company central warehouse, the result are as follow

**Table 5** Total amount of safety stock based on sales report from December 2015 to March 2016 (Period 1)

Color	Pattern	Safety Stock						No. Diff	% Diff
		XS	S	M	L	XL	Total		
Black	As-is of period 1	40	111	113	54	39	357	-109	-30.53
	To be of period 1	24	82	90	30	22	248		
White	As-is of period 1	56	138	112	69	27	402	-111	-27.61
	To be of period 1	27	124	84	39	17	291		

**Table 6** Total amount of safety stock based on sales report from April to July 2016 (Period 2)

Color	Pattern	Safety Stock						No. Diff	% Diff
		XS	S	M	L	XL	Total		
Black	As-is of period 2	57	111	106	85	32	391	-158	-40.41
	To be of period 2	37	79	64	35	18	233		
White	As-is of period 2	61	144	131	87	34	457	-203	-44.42
	To be of period 2	44	72	69	49	20	254		

**Table 7** Total amount of safety stock based on sales report from August to November 2016 (Period 3)

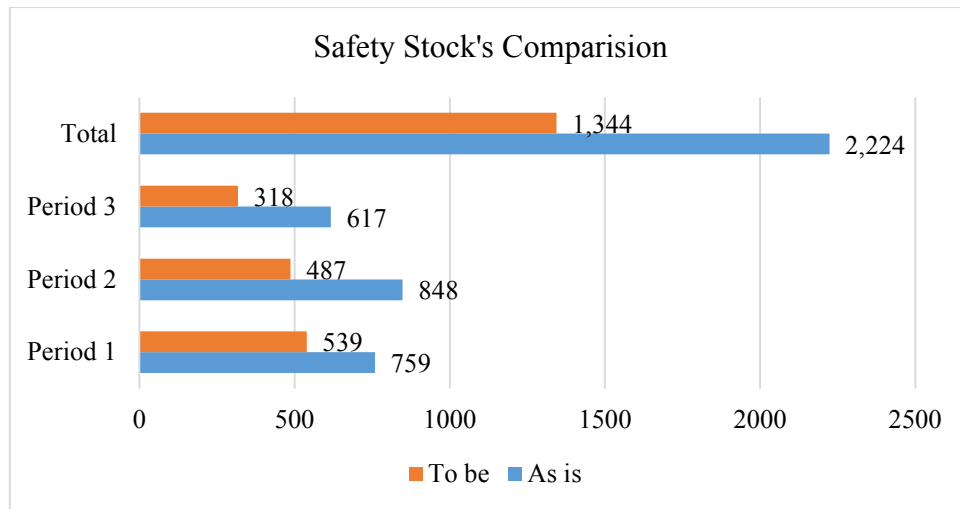
Color	Pattern	Safety Stock						No. Diff	% Diff
		XS	S	M	L	XL	Total		
Black	As-is of period 3	44	79	84	52	26	285	-151	-52.98
	To be of period 3	19	37	35	28	15	134		
White	As-is of period 3	69	86	91	72	14	332	-148	-44.58
	To be of period 3	29	55	52	34	14	184		

Based on the analysis from sales report of three period that can show the safety stock comparison between non-centralized and centralized concept as follow

**Table 8** The result of safety stock based on three period of sales report

Color	Pattern	Safety Stock						No. Diff	% Diff
		XS	S	M	L	XL	Total		
Black & White	As is	327	669	637	419	172	2,224	-880	-39.57
	To be	180	449	394	215	106	1,344		

And can be summarized as a chart



**Figure 2** Result of safety stock’s comparison between non-centralized and centralized concept

By the improvement of safety stock model, the centralized concept can reduce the total of production cost by comparing as follows

**Table 9** The result of production cost

Period	Reduce (/pcs.)	Cost (baht/pcs.)	Cost saving(baht)
Period 1	220	117	25,740
Period 2	361	117	42,237
Period 3	299	117	34,983
Total	880	117	102,960

In additional, from the improvement of safety stock concept to the centralized model. This approach can reduce the waiting time for replenishment of a branch store in case the product is sold out and the branch store requires additional stock, which takes time to synchronize with other stores, and centralized warehouse reduce to one week instead of 2 week for coordinate shipping between branch stores and the company central warehouse

**4. Conclusions**

From this research, Comparing Performance of Centralized and Non-Centralized Safety Stock Case Study: Retail Clothing Business can be summarized that the method of safety stock in a centralized concept has decrease in the total amount of safety stock inventory up to 39.57%. Moreover, the new safety stock pattern will also help the replenishment process in branch store that take time on processing less than current approach at the same time it also increased the company’s business opportunities.

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