

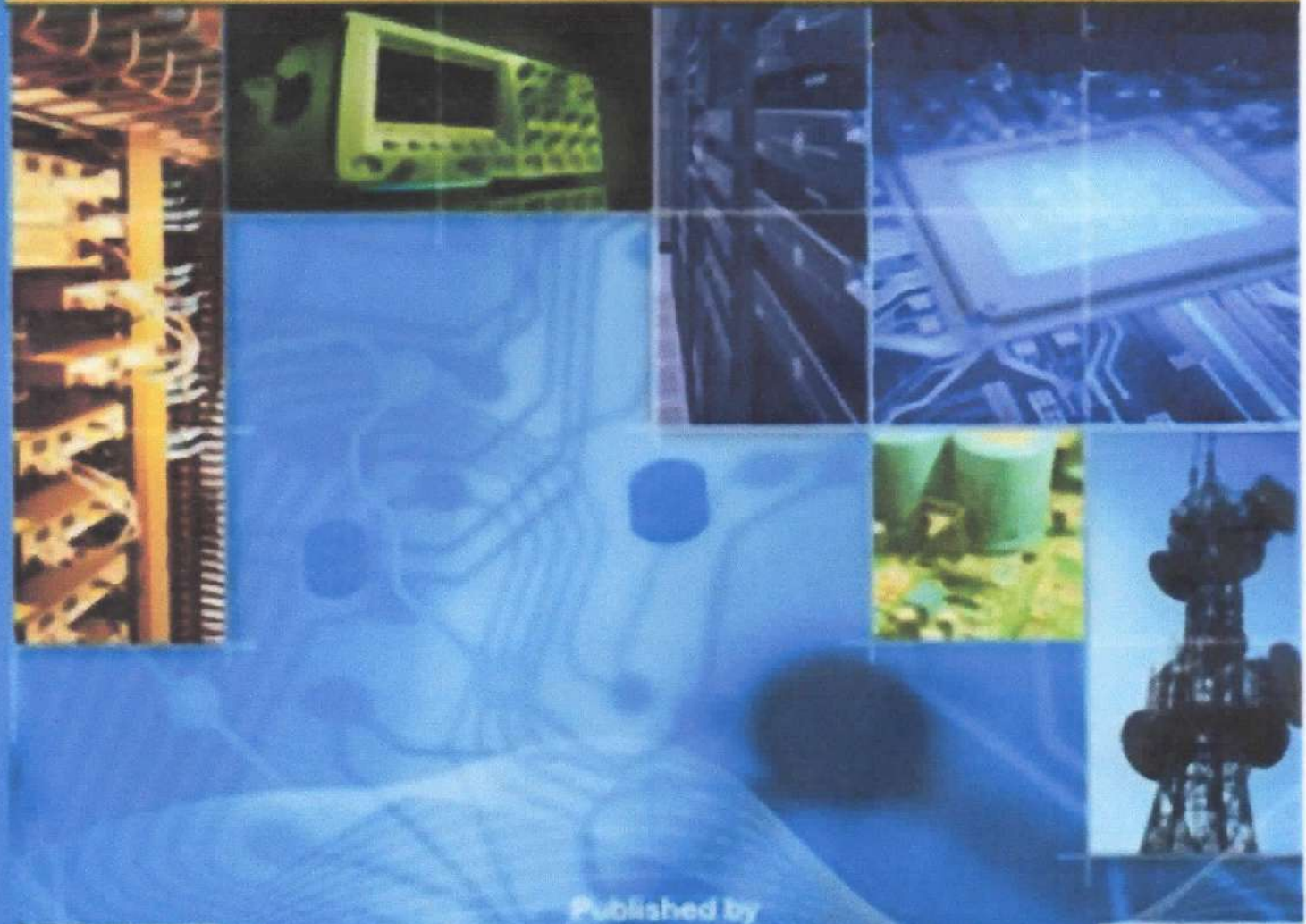
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Auto purchase order system between retailer and distributor

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Abstract

Uncertainty of goods inventory often triggers the occurrence of Bullwhip Effect, where there is accumulation of goods on a stage or lack of goods at another stage in the supply chain. Bullwhip Effect is caused by an error in ordering the amount of goods, error in the time of ordering or delivery of goods. The problem can be solved using information sharing. This research utilizing information sharing between two retailers and one distributors used for the ordering process of goods. The process of ordering goods retailers to distributors is done automatically based on sales data retailers. The order quantity is calculated based on the final stock and the maximum stock value of the goods.

Keywords: *information sharing, supply chain management, pull system*

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1. Introduction

Supply Chain Management (SCM) is an efficient and integrated use of relationships between suppliers, manufacturers, warehouses and stores, where goods are produced and distributed in the right amount, location and time to minimize costs [1]. In SCM, the need often fluctuates. Each stage in the supply chain is often difficult to determine the amount of product needs or the number of products to be produced. This leads to the uncertainty of supply demand in the supply chain [2]. Uncertainty of inventory goods often triggers the occurrence of Bullwhip Effect, where there is accumulation of goods on a stage or lack of goods at another stage. Bullwhip Effect is caused by an error in ordering the amount of goods, errors in the time of ordering or delivery of goods. Errors in time and shipping amount will also increase storage costs. Goods that should be directly distributed to consumers are stuck in the warehouse because they are not in accordance with consumer demand. The old unsold goods will increase the life of the goods and storage costs, thereby reducing the company's profits. Bullwhip effect will also increase manufacturing costs, storage costs, replenishment lead time, transportation costs, shipping and reception workers costs [3].

To solve the problems of Bullwhip Effect one of the ways used is to apply information sharing [4-7]. Information sharing positively affects the commitment between wholesalers, distributors and retailers [8]. Information sharing is done using a reliable Information Communication Technology (ICT). The use of ICT in Supply Chain could be developed a resilient supply chain [9-12] and will decrease the delivery delay so that it not only reduces costs [13] but also increases client fulfillment level so that it will help the organization [14-16]. The example of using ICT are RFID [17] usage the warehouse management system [18] and internet of things to tracking pallets and containers [19], food control [20], virtualization of floricultural [21]. ICT is also very influential in the process of supply chain integration [22, 23]. One way to reduce inventory costs is by applying an Inventory Replenishment Expert System (IRES) based on periodic review inventory control and time series forecasting technique [24].

Thats problems are also experienced by supply chains that implement distribution center (DC) systems. In this research there is one DC warehouse that serves the demand for two retailers. DC make order to suppliers and retailers make order to DC. This research will design and build a replenishment system of goods on retailers through sharing information between retailers and DC.

2. Research Method

2.1. Supply Chain Management

Supply chain management is an approach used to effectively integrate between suppliers, manufactures, warehouses and stores, so that goods are produced and distributed in the right quantities, exact locations, and timing to minimize costs [1]. Supply Chain Management aims to streamline overall costs, from transport and distribution of raw materials to finished goods.

In a supply chain, raw materials are used to be manufactured by one or more factories, then delivered to storage warehouses, then distributed to retailers or consumers. To reduce costs and increase the service level of an effective supply chain strategy it must be used the right strategy. Supply chain which is also called logistics network consists of suppliers, factories, warehouses, distribution centers and retailers can be seen in Figure 1.

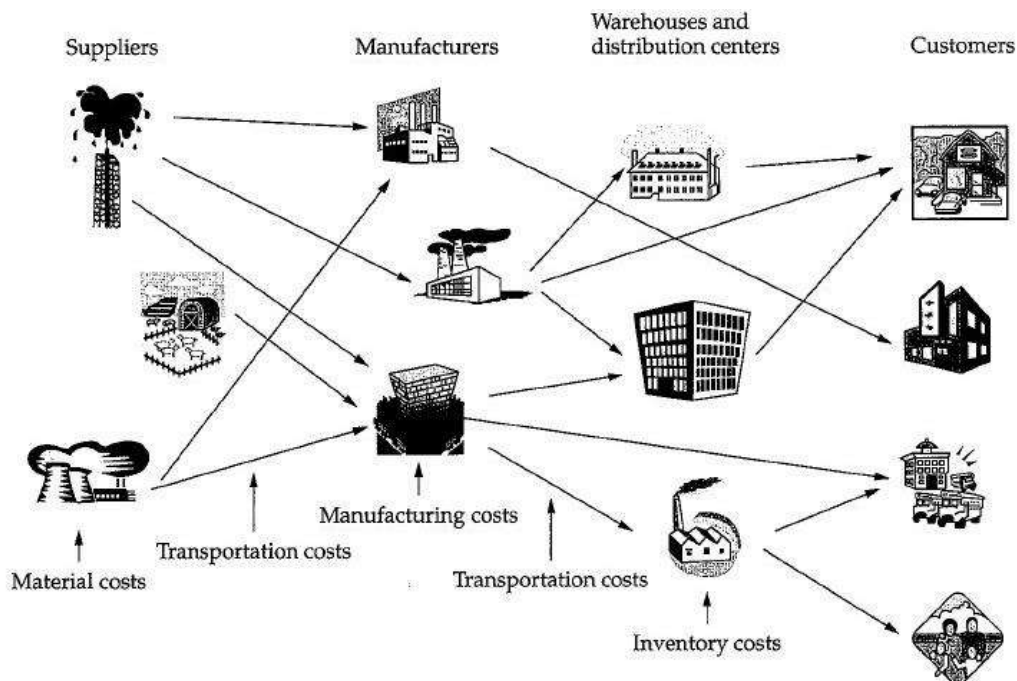


Figure 1. Logistics network [1]

2.2 Inventory Control

An inventory control carried out by a company to keep inventory levels at an optimal level so as to obtain savings for the inventory [25]. It is important to calculate the inventory so that it can show the level of inventory in accordance with the needs and maintain the sustainability of products with economical cost expenditure.

Thus the definition of inventory management is the activity in estimating the exact amount of inventory, with a number that is not too large and not too little compared with the needs or demand [22]. From this definition, the objectives of inventory management are as follows:

- 1) To be able to meet the needs or consumer demand quickly.
- 2) To maintain the sustainability of production so that the company does not run out of inventory resulting in cessation of production due to:
 - a) The possibility of goods (raw materials and auxiliaries) to be scarce so difficult to obtain.
 - b) Probably late supplier sending the ordered goods.
- 3) To maintain and where possible increase sales and profits.
- 4) Keeping small purchases can be avoided, as it can lead to large ordering costs.
- 5) Keeping the storage in the emplacement is not excessive, because it will cause the cost to be large.

2.3. Pull-Based System Supply Chain

In pull-based supply chain production and distribution are managed on a need basis so that production and distribution are more determined based on customer demand than demand forecast [1]. Therefore, the company does not need to store a lot of inventory and only serve a special order. This is possible through a rapid information flow mechanism to deliver customer needs information to multiple suppliers in the supply chain. The pull-based supply chain system has several advantages:

- 1) Reduce lead time so that it can better anticipate orders coming from retailers.
- 2) Reduce the amount of inventory on retail by increasing inventory level.
- 3) Reduced variability in the system due to lead time reduction.
- 4) Reduce manufacturer inventory due to reduced variability.

In other words pull-based systems are usually difficult to apply when lead time is too long. Pull-based supply-chains also require considerable future time planning if they want to benefit in manufacturing and transportation.

3. Results and Analysis

3.1. Architecture Design

The SIM data inventory architecture uses a distributed database architecture. Therefore every retailer has its own database server. It aims to process transaction, especially sales transaction on retailer is not disturbed or depend on distributor. Because the inventory SIM application is built using a php programming language then it takes a web server on every server. Data communication between retailers and distributors is done using internet media. There is a server distributor that is used to accommodate the order of goods from each retailer. Architecture design of auto purchase order system can be seen in Figure 2. Purchase order from retailer send to distributor automatically become sales order.

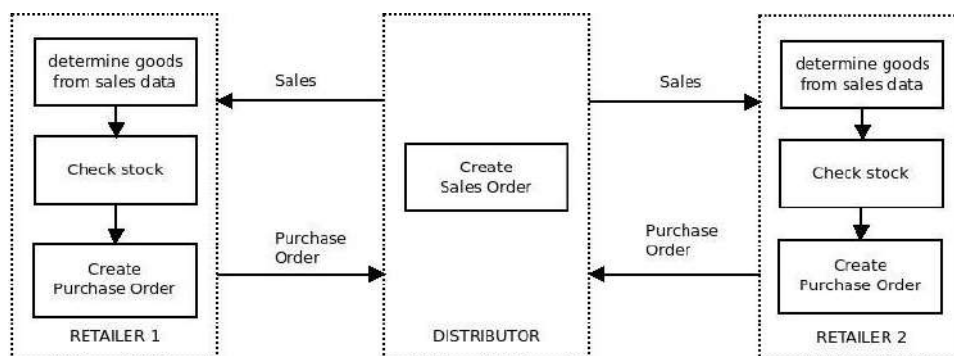


Figure 2. Architecture design

3.2. Process Design

In this research pull-based supply chain system is used through information sharing between retailers and distributors. Such information is data items ordered by retailers to distributors who do automatically every closing store or called the Auto Purchase Order (Auto PO). The Auto PO flowchart can be seen in Figure 3. The following is the Auto PO retail algorithm:

- 1) Each item is set minimum and maximum amount.
- 2) Every period of time is checked the stock balance of goods sold.
- 3) If the stock balance is less than or equal to the minimum amount, a purchase order will be made
- 4) The amount of goods ordered is the difference between the stock balance and the maximum value of stock
- 5) The next purchase order is sent to the distributor automatically

The distributor then checks the retailer's PO list and prepares the goods to be sent to the retailers. At the time the goods come, the retailer will make the purchase process so that the

stock will increase. If the goods have not been received by the retailer then the stock balance status is under minimum stock and automatically at the end of the closing store will be made Auto PO to the distributor.

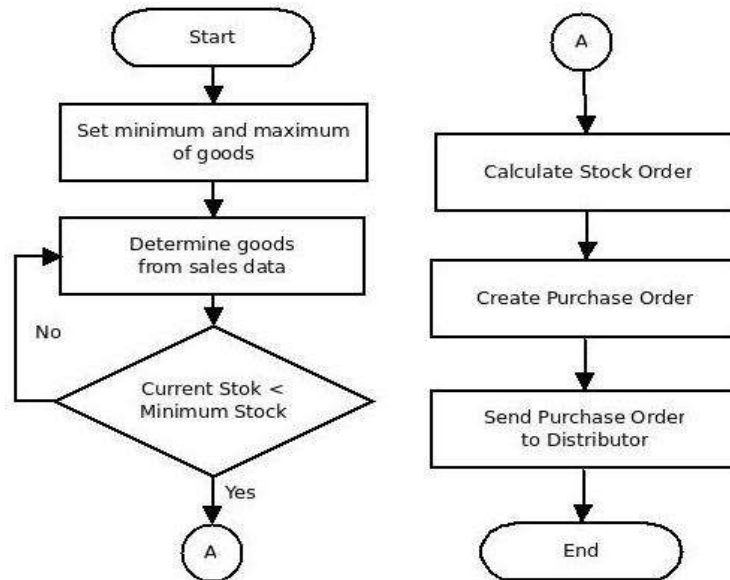


Figure 3. The auto PO flowchart

3.3. Hardware and Software

This research uses one distributor prototype and two retailers. On the distributor and each retailer there is a web server and database server. Inter server is connected with internet connection. On the distributor server using Virtual Private Server (VPS) with specification Ubuntu Linux 14.04, 512 MB RAM, Nginx web server, MySql database. In retail 1 using linux operating system Ubuntu 14.04, 2 GB RAM, Apache web server and MySql database. While on retail 2 using Windows 7 operating system, 2 GB RAM, Apache web server and MySql database. The inventory management system application is a web-based application. The programming language used in the application is php.

3.4. Auto PO on Retailer 1

Auto PO on Retail 1 begins with stock analysis process. The process is done automatically at a certain time after the store closes. Auto PO process is divided into 2 that is generate PO and upload PO. The Auto PO process on Retailer 1 uses the cronjob task on the server. The task cronjob executes the php file using the Command Line Interface (CLI). The advantage of using CLI is that there is no time limit for execution. Different if execution is done through browser which is limited by execution time according to the php setting. To run php via CLI then on server Retailer 1 must be installed php CLI. The cronjob Auto PO Retail 1 script is shown in Figure 4.

```

30 22 * * * php /var/www/html/posmart/z_auto_po.php
00 23 * * * php /var/www/html/posmart/z_upload_po.php
  
```

Figure 4. Conjob task auto PO on retailer 1

In Figure 3 it can be seen that the file execution process `z_auto_po.php` is excute every day at 22.30. The `z_auto_po.php` file contains the PO process by analyzing the sales data for the day. Every item sold will be checked ending stock balance. If the stock balance is less than

or equal to the minimum value of stock that has been set in the master item data then the item will be entered in Auto PO data. The ordered amount is the difference between the maximum value of stock that has been set in the master item data and stock balance. Next at 23.00 the server will execute the file `z_upload_po.php`. The file contains a command to access the distributor's server database to upload the generated PO.

3.5. Auto PO pada Retail 2

The Auto PO process on Retailer 2 is almost the same as Retailer 1. Auto PO on Retail 2 begins with a stock analysis process automatically at a certain time after the store closes. The Auto PO process is divided into 2, ie the PO generating process and the PO upload process. The PO automatic process on Retailer 2 uses the Windows Task Scheduler (WTS) setting that is done at 23.30. In WTS execute a bat file. The bat file script in Retailer 2 is shown in Figure 5.

```
ECHO OFF
ECHO Proses Create PO. DON'T CLOSE !!!
cd D:\xampp\php
php D:\xampp\htdocs\posmartz_auto_po.php
ECHO
ECHO Proses Upload PO. DON'T CLOSE !!!
php D:\xampp\htdocs\posmartz_upload_po.php
```

Figure 5. Script file bat Auto PO on Retailer 2

The contents and processes in the file `z_auto_po.php` and `z_upload_po.php` on Retailer 2 are the same as those in Retailer 1. The time of upload of PO Retailer 2 is done later than Retail 1. This is because the PO upload process is done by accessing the distributor database remotely from server retailers. If the time of PO upload simultaneously then the process of one of the retailer's PO will queue up until the previous upload process is complete. Besides that the server load of distributors will become heavier.

3.6. List of Sales Order Distributor

Distributors automatically receive PO data from retailers that turn into Sales Order (SO). The list view of SO retailers is shown in Figure 6. Every morning the distributor checks the SO data and prepares the items on the SO. The items are then shipped to retailers. With the existence of Auto SO on distributors then the distributor can know with certainty the real needs of customers. This will reduce the bullwhip effect in the supply chain. The content of the PO retailer (SO distributor) is shown in Figure 7.







	Tgl	No.PO	
	17-05-2018	SO/00/18050000414	Misykat Mart Lirboyo
	16-05-2018	SO/00/18050000411	Misykat Mart Lirboyo
	16-05-2018	SO/00/18050000407	Misykat Mart Ngampel
	15-05-2018	SO/00/18050000406	Misykat Mart Lirboyo
	15-05-2018	SO/00/18050000404	Misykat Mart Ngampel
	14-05-2018	SO/00/18050000401	Misykat Mart Ngampel
	13-05-2018	SO/00/18050000400	Misykat Mart Lirboyo
	13-05-2018	SO/00/18050000397	Misykat Mart Ngampel
	12-05-2018	SO/00/18050000394	Misykat Mart Lirboyo
	12-05-2018	SO/00/18050000392	Misykat Mart Ngampel

Figure 6. List of sales order distributor

Distribution Center Kediri			Hal 1/1	
SO/00/18050000397			Cust: Misykat Mart Ngampel	
No. Group	Barcode	Item	Jml	Sat
1. BISCUIT	8886015428136	Tim tam bisc chocolate 120gr	1	PCS
2. FACIAL FOAM	8992304039607	Garnier acno wasabi foam 50ml	2	PCS
3. ROKOK	8999909096004	Sampoerna mild 16x10	1	PAK
4. SHAMPO	8999999048167	Sunsilk black shine 10ml	12	SCH
5. SHAMPO	8999999048242	Sunsilk soft&s 10ml	12	PCS
Tgl. 13-05-2018			PO By system, _____	

Figure 7. Sales order distributor

3.7. Replenishment System

With the sharing of information between retailers and distributors then the stock of goods can be easily controlled. Stock of goods that have reached the minimum stock automatically direct orders to distributors without involving humans. Likewise with distributors, the process of receiving orders from retailers is done automatically. The process allows retailers without having an inventory storehouse because the quantity of items ordered automatically matches the capacity of the store.

System replenishment of goods can be done effectively and efficiently. To support the replenishment system through a pull-based supply chain technology support and reliable transportation is required. The process of uploading PO from retailers to distributors is done using internet media. So that internet connection has a vital role. If the internet connection is disconnected then the PO retailers can not be sent so that replenishment lead time of goods increases. Likewise with the transportation used to deliver goods by the distributor must be adequate. Inadequate transportation will cause long delivery time so it will add replenishment lead time.

4. Conclusion

Auto purchase order system between retailers and distributors is possible retailers to not have storage warehouse because the goods ordered in accordance with the capacity of retailers. Besides, distributors can directly know the customer needs so as to reduce bullwhip effect in the supply chain. In the future research can be developed method for the process of determining the quantity of goods ordered more effectively and efficiently with forecasting method or artificial intelligence.

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