Sistem Information Implementation With Supply Chain Management Approach at SIS Company

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ABSTRACT

SIS company is a company that located in Citeureup Tasikmalaya. This company is engaged in the production of snacks such as “mie lidi”. This company organizes the activities from upstream into downstream. It was found some problems that happened in this company such as purchasing department have a problem to determine the number of raw material requirements to the supplier. It happened because of the uncertain demands from the distributors. Besides a problem in the upstream, there was some problem in the downstream that was shipping department was difficult to make schedule of product shipping. Based on the problems, so the company needs the development of the system with using supply chain management approach. A strategy that used in the production process is make to stock. The method that used is forecasting method single moving average based on sales data. The inventory calculation of the safe limits of raw materials and products use safety stock method. After testing has done, then it gets the conclusion from the result that this information system is making easy purchasing department to determine the number of raw materials for procurement process to a supplier and it is making easy shipping department to make schedule of product shipping for distributors.

Keywords : *supply chain management, safety stock, make to stock, single moving average, forecasting.*.

1. INTRODUCTION

SIS Company is one of the companies engaged in the production of snack such as mie kidi. Products produced are mie lidi mentah, mie lidi matang rasa original, mie lidi matang rasa spicy, mie lidi matang rasa pedas jeruk, mie lidi matang rasa rumput laut and mie lidi matang rasa pedas jeruk. The SIS Company regulates all sequences of activities from upstream into downstream.

After do an interview with the head of the purchasing department, he explained that currently the upstream activities are in the procurement of raw materials to the supplier based on the previous month's sales report. Then on the production activities in the company, he explained that the company made the production process before the request of the distributor (customer).

However, the company encountered problems when there was uncertain demand from distributors. If the demand rises, then the vacancy for some raw materials. Conversely, if the demand falls, it results in buildup for some raw materials. Known in April 2017 there was an increase in product demand by 31% from the previous month. At that time, product demand from distributors was 10076 packs of mie lidi. However, the company experienced a shortage of raw material stocks in which the stock of raw materials owned by the company is only able to meet the demand from distributors as much as 7155 packets of mie lidi. Meanwhile, in May 2017 there was a decrease of product demand from distributors by 29% from the previous month. When the product demand from distributors is 7460 packs of mie lidi, the company has a stockpile of raw materials in which the raw material stock owned by the company is able to fulfill the demand of the products from the distributors of 10433 packs of mie lidi. So the problems that occur in the upstream purchasing department has difficulty to determine the amount of procurement of raw materials to suppliers.

Furthermore, after conducting an interview with the head of the shipping department, he explained that the downstream activities are receiving product order and then sending it to the distributor. Distributors order products through the marketing department, then the product will be delivered to the distributor by the shipping department using the company's private vehicle. The delivery department often has difficulties in determining the capacity of the vehicle to be used for the shipping process as well as the difficulty in conducting the monitoring process during delivery as there is no system that can monitor the delivery process.

In line with that, previous results of research conducted by Haryanto Tanuwijaya related to

drug planning in hospitals indicate that the procurement of drugs is still not optimal and the absence of drug supply forecasting system. From research 61,9% RS drug have pattern of data is stationer so more precise use method of Single Moving Average [1]. Later research conducted by Ricky Effendi, Johan Oscar Ong and Arief Samuel Gunawan related to the problem in Naga bookstore that does not have enough stock on inventory. Researchers use the method of Single Moving Average forecasting, because the data is stationary [2]. The results of this study provide a picture that based on the problems that occur can be concluded that the company needs a system that can manage supply chain information. From the results of data processing sales from February to July 2017, indicating that this company has stationary data. So the development of Supply Chain Management information system with Single Moving Average forecasting method is expected to facilitate the purchasing department in determining the amount of raw material procurement to suppliers and facilitate the shipping department to make schedule of product shipping to distributors.

2. RESEARCH CONTENTS

2.1 Theoretical Basis

Theoretical basis aims to provide an overview of the sources and theories relating to research.

2.1.2 System

According Kusrini, defines the system as a set of interrelated or integrated elements that are intended to achieve a goal [1]. Meanwhile, according to Hanif Al Fatta, simply the system can be defined as a collection or set of elements of variables that are mutually organized, interacting, and interdependent with each other [2].

2.1.3 Information

According to Turban et al [3] in Eko and Angga's research [4] information is data that organized to give meaning and value to the recipients. Meanwhile, according to Ladjmudin, said that information is data that has been processed into a more meaningful form for the recipient [5].

2.1.4 Supply Chain Management

According to I Nyoman and Mahendrawathi, the term SCM were first put forward by Oliver and Weber in 1982 (cf. Oliver & Weber, 1982; Lambert et al., 1998). If the supply chain is the physical network, the companies involved in supplying the raw materials, producing the goods, or sending them to the final supplier, SCM is the method, tool, or management approach. It should be emphasized, however, that SCM requires an integrated approach or method based on the spirit of collaboration. So, Supply Chain Management is not only oriented to the internal affairs of a company, but also an external affair involving relationships with partner companies [6].

2.1.5 Safety Stock

Safety stock serves to protect errors in predicting demand during lead time. Lead time is the time required between the raw materials ordered to arrive at the company. The amount of safety stock value depends on supply and demand uncertainty [6]. The formula for calculating safety stock is as follows..

$Safety\ Stock = \text{Z x Sdl}$ .....(1)

Information:

Z = *Service Level*

S_{dl} = Uncertainty of Demand and Lead Time

Reorder point is when the inventory reaches the point where ordering is required. The formula in determining the reorder point is as follows.

$\text{Sdl} = \sqrt{(d^2 \text{ x } sl^2 + l \text{ x } sd^2)}$ .....(2)

Information:

d = Average Usage

sl = Standard Deviation *Lead Time*

l = *Lead Time*

sd = Standard Deviation of Average Usage

2.1.6 Forecasting

Forecasting is forecasting what happens in the future. While the plan is a determination of what will be done in the future. By itself, there is a difference between forecast and plan. A forecast is forecasting what will happen, but not necessarily can be implemented by the company.

Forecasting aims to obtain forecasts or predictions that minimize errors in forecasts that are usually measured by mean square error, mean absolute error [7].

2.1.7 Single Moving Average

The single moving average method uses a number of actual data of new requests to generate prediction value for future demand. This method will be effectively applied if we can assume that the market demand for the product will remain stable over time. This method has two special properties that is to make forecasts require historical data within a certain time period, the longer the moving average will result in a smoother moving average. The moving average system can be calculated by equation [8].

$S_{t+1} = \frac{x_t + x_t - 1 + \cdots + x_t - n + 1}{n}$ .....(3)

Information:
St + 1 = Forecast for period t + 1.
Xt = Data in period t.
n = Time Moving Averages

2.1.8 Measurement of Forecasting Error

Measurement of forecasting errors can use mean absolute error, mean square error, mean absolute percentage error. Here is an explanation of forecasting errors [8].

1. Mean Absolute Error (MAE)

Mean absolute error (MAE) is the average absolute error value of predictor error (positive and negative values are not seen) can be seen in the following equation.

$$MAE = \frac{\sum |x_t - F_t|}{n} \quad \text{.....(4)}$$

2. Mean Square Error (MSE)

Mean square error (MSE) is the mean forecasting error squared. Can be seen in the following equation.

$$MSE = \frac{\sum (X_t - F_t)}{n} \quad \text{.....(5)}$$

3. Mean Absolute Percentage Error

MAPE is a relative error measure. MAPE specifies the percentage of error forecasting results against actual demand over a given period which will give the error percentage information too high or too low. Systematically, MAPE can be seen in the following equation.

$$MAPE = \frac{100}{n} \sum |A_t \frac{F_t}{A}| \quad \text{.....(6)}$$

2.1.9 Problem Analysis

Problem analysis is a process to learn some system problem that have identified in an identifying process. Problem analysis from this running system are:

1. The purchasing department has difficulties in determining the exact amount of raw material to the supplier due to the number of requests from the erratic distributors. If the demand from distributors increases, then the company experienced a shortage of raw materials in the warehouse. Conversely, if the demand from distributors decreased, then the company experienced a buildup of raw materials in the warehouse.
2. Shipping department difficulties in scheduling delivery of products due to frequent delays in delivery due to lack of product stock.

2.2 Supply Chain Management Analysis

Supply chain management analysis was used to apply supply chain management approach at the information system that will be built in company.

2.2.1 Supply Chain Management Model

The supply chain management model explains the range of activities that occur in the company from upstream into downstream. In carrying out its activities, the company not only establish relationships with the internal part of the company, but the company also establish relationships with several partners outside the company. As for which included into the internal part of the company that is part purchasing, warehouse, production, finance, marketing, and delivery. Meanwhile, the external relations that the company does is with suppliers and distributors. Figure 1 is a supply chain management model. Further explanation can be seen in figure 1.

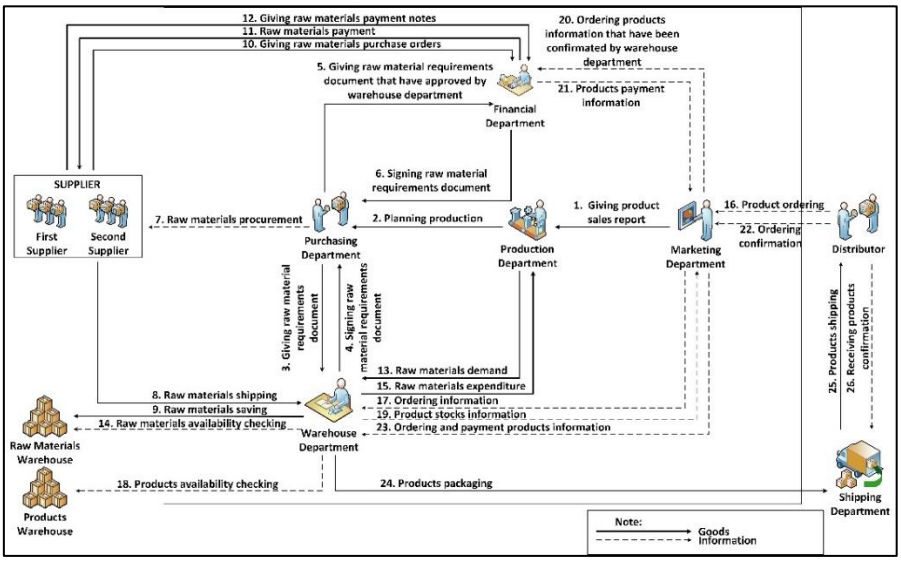


Figure 1. Supply Chain Management Model at SIS Company

Furthermore about the production activities that occur in the company that is using make to stock strategy which means the production process before the ordering of the distributor. Currently the company is doing large production or commonly called mass product. This is done to create sufficient product stock to anticipate the product shortage due to the increasing demand from an erratic distributor. Therefore, there needs to be planning of ordering raw materials in order to avoid void of raw materials at the time of production process and does not happen the accumulation of raw materials in case of decrease in demand from distributors that can cause losses for the company.

2.2.2 Supply Chain Analysis at SIS Company

Supply chain analysis were done to describe information system of supply chain management that will be built at the SIS company. Steps of supply chain analysis that will be doing are.

1. The amount of raw materials order analysis.
2. Inventory (monitoring) analysis.
3. Production analysis.
4. Procurement of raw materials analysis.
5. Shipping products analysis.

1. The Amount of Raw Materials Orders Analysis

The determining the number of raw materials that must be ordered to a supplier, at the first step is purchasing department must be forecasting of product sales. Then the result of it will be used to forecasting the amount of raw material requirements to be knowing the number of raw materials that must be ordered to supplier. So, when the distributor has ordered, the amount of product that have ordered by the distributor can be completed because there were doing certain determine the number of raw materials in a procurement process to a supplier.

Forecast method that be used is a quantitative forecast method with time series model analysis. It was chosen based on histories data and projecting it to the future [9]. Forecast method that is used a single moving average based on comparison with single exponential smoothing and weighted moving average method. Based on the data pattern found that the pattern of horizontal or stationary data means the data series that fluctuate around the average value that is not changed all the time [10]. The data to be sampled is the sales data of mie lidi mentah product And the sample data were used is mie lidi mentah because it was best seller in February until July 2017 than another product. Table 1 is a sales data of mie lidi mentah. The detail description can be seen on table 1.

Tabel 1. Data Penjualan Mie Lidi Mentah

No	Period	Product Sales Data Mie Lidi Mentah
1	February	3.032 packs
2	March	2.286 packs
3	April	3.010 packs
4	May	2.112 packs
5	June	2.356 packs
6	July	2.365 packs

From the data, it can be made a graphic to determining method will be used on forecasting with the pattern of data. Figure 2 is a graphic of sales data mie lidi mentah. The detail description can be seen on figure 2 above.

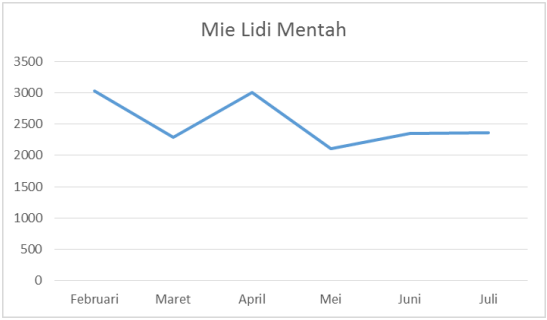


Figure 1. Product Sales Data Mie Lidi Mentah

Based on the pattern of data above, so the next step was forecasting with single moving average method.

2. Inventory Monitoring Analysis

Things done after determining the amount of raw materials to be ordered, the next step is to monitor the inventory of raw materials and products using safety stock method.

Monitoring of raw material inventory is conducted in order to determine the safe limits of raw material inventory that must be available in the warehouse and to know when the raw materials must be ordered to the supplier immediately. In addition, it also aims to avoid the void of raw materials in the warehouse. Similar to monitoring raw material inventory, the purpose of monitoring product inventory is to determine the safe limits of product availability in order to avoid the occurrence of void or lack of products. Table 2 is an example of monitoring product inventories and raw materials. Further explanation can be seen in table 2 below.

Table 2. Product Inventory Monitoring

Product	Stock	*Safety Stock*	Status
Mie Lidi Mentah	1.080	77 packs	Safety

After monitoring the product inventory, then it will be monitored raw material inventory. Table 8 is an example of monitoring raw material inventory. A more detailed explanation can be seen in table 3 below.

Table 3. Raw Materials Inventory Monitoring

Raw Materials	Stock	*Safety Stock*	Status
Wheat	150 kg	77 kg	Safety
Cooking Oil	125 lt	10 lt	Safety
Salt	50 kg	3 kg	Safety
Food Coloring	289 ml	308 ml	Not Safety
Red Onion	2 kg	4 kg	Not Safety
White Onion	4 kg	3 kg	Safety

If the status of the raw material is not safe, it will be procured to the supplier by the company.

3. Production Analysis

In this step, production department does planning production process to determining the amount of product that will be produced every day based on the result of forecasting calculation divided with the amount of the workday on month.

4. Procurement of Raw Materials Analysis

At this stage, the purchasing department procures raw materials based on raw material requirements documents. The procurement of raw materials is done by the purchasing department the suppliers and the raw materials that have been ordered are sent by the supplier and will be received by the warehouse when the raw material reaches the company. Based on the monitoring of raw material inventory, if the raw material stock has unsafe status, then the company must make procurement with the amount of raw materials ordered based on forecasting results plus safety stock and reduced stock warehouse. The procurement process is done with suppliers who have established cooperation with the company. Cooperation is done in the form of investment. For the main suppliers with the highest amount of investment have percentage of raw material purchase by 70%. Meanwhile, 30% of raw material purchases are met by second suppliers.

5. Shipping Product Analysis

Shipping products analysis has proposed for determine the amount of transportation capacity on shipping product and it will be doing monitoring process while shipping happened. So, the company can be knowing a product that is ordered by distributor have arrived or not to them.

2.3 *Data Flow Diagram*

DFD level 1 on information system with using supply chain management approach at the SIS company describes on general about all process that is happened on the system. Figure 3 is a DFD Level 1 information system supply chain management at SIS company. A more explanation can be seen in figure 3.

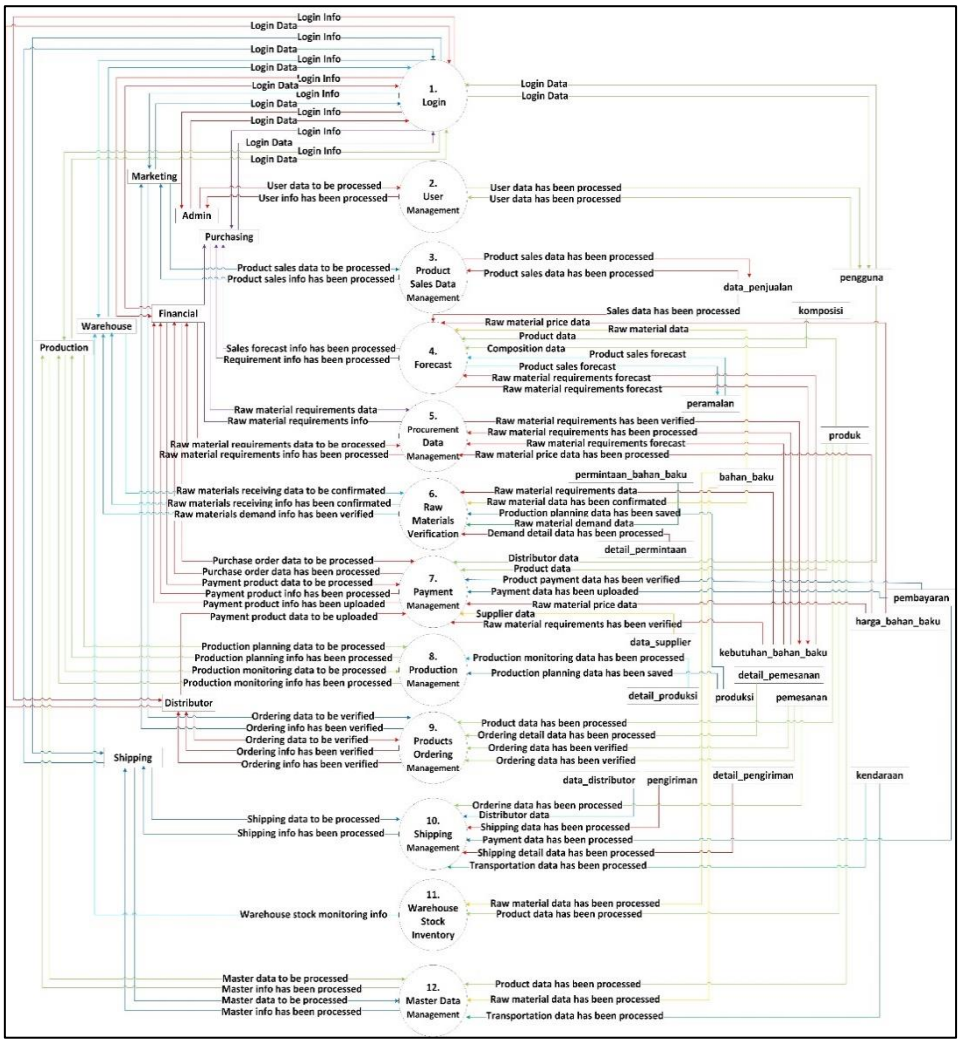


Figure 2. DFD level 1 Information System Supply Chain Management at SIS Company

2.4 Interface Design

Interface design is designed to provide an overview of the program display that will be used by the user to interact with the system. Figure 4 is one example of interface design of purchasing section can be seen in Figure 4 below.

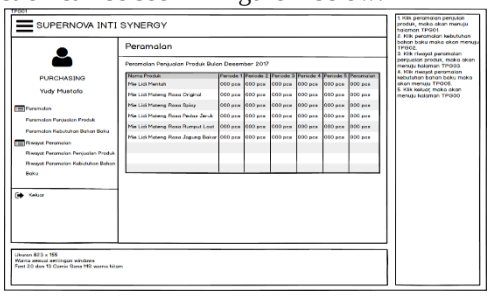


Figure 3. Purchasing Interface Design

2.5 System Implementation

System implementation is a step to apply the results analysis and designing system. This step aims to do confirmation design. So, a user on the system can give suggestions for developing the system.

2.5.1 Software Implementation

Software implementation describes the specification of software that will be used for information system implementation with using supply chain management approach at the PQR's company. Table 9 is a software implementation on information system supply chain management at SIS company. A more explanation can be seen in table 4 above.

Table 4. Software Implementation

No	Software	Specification
1	Operation System	Operation System Windows 8.1
2	Web Server	XAMPP Server
3	Web Browser	Google Chrome
4	Database Server	MySql
5	Code Editor	Sublime Text 3

2.5.2 Hardware Implementation

Hardware implementation describes the specification of hardware that will be used for information system implementation with using supply chain management approach at SIS company. Table 5 is a hardware implementation of information system supply chain management at PQR's company. A more explanation can be seen in table 5 above.

Table 5. Hardware Implementation

No	Hardware	Specification
1	Processor	Intel Core 2 Duo 2-Ghz
2	Memory	2 Gb
3	Storage	250 Gb
4	VGA	Intel HD Grapichs
5	Monitor	14"
6	Mouse	*Optical Mouse*
7	Keyboard	*Standard*

2.5.3 Database Implementation

Database design is done by using MySQL DBMS. Table 6 is one example of database implementation in SQL to store raw material data on the system. More detailed explanation can be seen in table 6 below.

Table 6. Table of Raw Materials

No	SQL
1 2 3 4 5 6	CREATE TABLE bahan_baku (kode_bahanbaku varchar (15) PRIMARY KEY, nama_bahanbaku varchar (40) NOT NULL, stok_bahanbaku int (8) NOT NULL, satuan varchar (15) NOT NULL)

2.6 System Testing

System testing aims to found error or deficiency on an information system that will be tested. It is doing to know what does the development of this information system has completed a performance with the purpose of design or not. The testing that used to test a system is black box testing method and beta.

2.6.1 Functional Testing

Black box testing is focused to functional requirement software will be built. After do testing to several samples, so it can take the conclusion that functional system has been shown the output which is expected.

2.6.2 User Acceptance Test (UAT) Testing

Testing User Acceptance Test (UAT) is to confirm that the system being tested can meet the needs and can work correctly before it is given to the end user. After testing User Acceptance Test (UAT) with some test sample case, it can be concluded that all the process can be run properly and can be used.

2.6.3 Beta Testing

Beta testing is done with the aim to determine the extent to which the quality of software that has been built, whether it is in accordance with the goal or not. The technique chosen in doing beta testing is the interview technique.

Interviews were conducted for users of the system such as admin, head purchasing, head of marketing, head of warehouse, head of production, head of shipment and head of finance. After beta testing is done by interview technique to each user, hence can be drawn conclusion for something that is as follows:

1. The system has facilitated the purchasing part in determining the amount of raw material procurement to the supplier because the information has been presented automatically in the system.
2. The system has facilitated the delivery part in monitoring during shipment.
3. This system has also helped admin, part production, warehouse, marketing, and finance in carrying out their respective jobs.
4. Information provided by the system is complete enough. However, it is still considered incomplete for some users.
5. The built system has a simple and easy to understand interface.

3. CLOSING

The conclusions and suggestions obtained from the results of this study are:

3.1 Conclusion

Based on the results of testing the development of information systems with supply chain management approach, it can be concluded as follows:

1. Development of information systems using supply chain management approaches can facilitate the purchasing department to determine the amount of procurement of raw materials to suppliers because the determination of the amount of raw material procurement has been provided in the system automatically.

2. Development of information systems using supply chain management approaches can provide convenience to the shipping department to monitor during the delivery is in progress.

3.2 Suggestion

Based on the results of testing the development of information systems with supply chain management approach, it can be obtained suggestions for system development is the addition of password change function in the menu of each user to facilitate users to change the password.

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