DEVELOPMENT OF INFORMATION SYSTEMS IN CV. DUTA NIAGA SUKSES USING SUPPLY CHAIN MANAGEMENT

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ABSTRACT

CV. Duta Niaga Sukses is a company engaged in the production of Tea. Tea products produced by CV. Duta Niaga Sukses to date there are 11 types of tea. The problems that often occur in CV. Duta Niaga Sukses is a problem in determining the supplier for the needs of tea raw materials to be produced. The problem in providing tea stock that will be sold in the next month so that resulted in the purchase of raw materials to suppliers. If the purchase of tea raw material is too much then the raw materials of tea will be stored in the warehouse and when the tea raw material is stored too long then the quality of tea raw materials to be used for production will decline. Problems that occur in the distribution is in determining the type of vehicle and how many vehicles to be hired to meet the capacity of tea products to be shipped to the buyer. Based on the problems that occurred in the CV. Duta Niaga Sukses, it needs an information system development with supply chain management approach. This system is built from the upstream to the downstream. For the upstream part of the selection of suppliers, the selection based on the best grade and cheapest price of raw materials. To provide tea stock, the forecasting method used is to use the method of double moving average. Calculation prediction availability of raw materials in the warehouse using the method of security inventory (safety stock). For the downstream selection of vehicles based on capacity that meets from the number of buyer reservations and the cheapest rental price. Based on the test results it can be concluded that this system has helped the production department to choose the best supplier, planning the next month's production and purchasing section in determining the raw material planning for the production process and choose the vehicle according to capacity that meets the number of buyer orders.

Keywords : supply chain management, push supply chain, make-to-stock, double moving average, safety stock.

1. INTRODUCTION

CV. Duta Niaga Sukses is a company engaged in the production of Tea. Tea products produced by CV Duta Niaga Succes to date there are 11 types of tea. This company uses a make-to-stock strategy that is the production process before the order for the type of tea. Mass production is done by the company to make enough tea stock to anticipate purchasing tea product by buyer.

Activities contained in the upstream section of the ordering of raw materials to suppliers. Until now CV. Duta Niaga Sukses has 23 suppliers. The supplier is a co-worker from the beginning the company was built. According to Mr. Dede Suhendar, in determining which supplier should be selected at this time the company still chooses suppliers based on close relatives of the company. As a result of the selection of suppliers the company is difficult to determine if there is the best grade and raw material prices are cheaper than the raw materials of these close relatives. So this results in the expenditure of expenditures incurred for the purchase of raw materials for tea production.

According to Mr. Agus, the problem found in the production process is in providing tea stock that will be sold in the next month. Currently the company in meeting these needs does not yet have a sales plan that can predict the sales of tea for each subsequent month. This will result in the purchase of raw materials to suppliers. If the purchase of tea raw materials is too much then the raw materials of tea will be stored in the warehouse and when the tea raw material is stored too long then the quality of tea raw materials to be used for production will decline. Vice versa, if the purchase of tea raw material is too little and the shortage to be produced then resulted in not meeting the demand for tea

production. This can disrupt service to buyers as it takes more time in tea delivery.

Activities that are in downstream CV. Duta Niaga Sukses is accepting ordering of tea product from buyer, and then doing the distribution of product with vehicle hired company. According to Mr. Eka, the current problem with distribution is in determining the type of vehicle and how many vehicles to hire to meet the capacity of the tea product to be shipped to the buyer. This results in the cost to be incurred by the company to lease the vehicle. So the company is still difficult in determining the type of vehicle and how many vehicles to rent.

Based on the problems that have been presented, CV. Duta Niaga Sukses currently requires an information system development that can choose the best supplier for the company, predicting production for next month's sales by using Double Moving Average method and determining the type of vehicle and how many vehicles must be leased for tea distribution. Information systems to be built web-based to facilitate Warehouse Manager and Purchase, Production Manager, and Marketing Manager in processing data in various places during the computer connected to the Internet network. Therefore, it is done Information System Development In CV. Duta Niaga Succes With Approaching Supply Chain Management.

Based on the problems that have been described, then the problems that occur in the CV. Duta Niaga Sukses is how to build Information System at CV. Duta Niaga Sukses by approaching Supply chain management.

While the objectives to be achieved in this research are:

1. Simplify Warehouse and Purchase Managers to choose the best supplier for tea raw materials to be produced by the company.
2. Facilitate Production Manager in estimating stock of tea stock to be sold next month and determine the amount of raw material to be ordered to supplier for production process.
3. Facilitate the Marketing Manager to determine the type of vehicle and how many vehicles to hire to meet the capacity in the distribution of tea.

2. CONTENTS RESEARCH

2.1 Theoretical Basis

Theoretical basis on the writing of this thesis will explain the theories associated with the application of Information Systems In CV. Duta Niaga Success Approaching Supply Chain Management.

2.1.1 Supply chain Management

Supply chain management is a system for applying a total approach to managing the entire flow of information, materials, and services from raw materials through factories and warehouses to final consumers. [1]

Supply chain management is an integrative method or approach for managing an integrated flow of products, information, and money involving parties from upstream to downstream consisting of suppliers, factories, distribution networks and logistics services.

Supply chain management is a method or approach to managing an integrated flow of products, information, and money that involve parties from upstream to downstream. Supply chain management activities include product development, material and component procurement, production planning and inventory control, production, and distribution / transportation. The principle of Supply Chain Management is the transparency of information and collaboration between the internal functions of the company and with the parties in the company along the supply chain. Supply chain is a network of companies that work together to create and deliver a product into the hands of the end user. These companies usually include suppliers, manufacturers, distributors, stores or retailers, as well as support companies such as logistics services.

A Supply chain usually there are 3 kinds of flow that must be managed. Three types of flow that must be managed in the supply chain are as follows: [2]

1. The first is a stream of goods flowing from upstream (upstream) to downstream (downstream).
2. The second is the flow of money and the like flowing from downstream to upstream.
3. The third is the flow of information that can occur from upstream to downstream or vice versa.

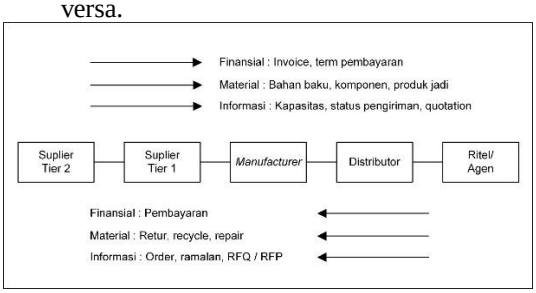


Figure 1. Simplification supply chain model and 3 kinds of stream [2]

2.1.2 Push and Pull Supply Chain

The pull process is based on customer orders, while the Push process is initiated and done in anticipation of customer orders. [3]

Pull supply chain is a "make-to-order" production strategy whose main benefit is to avoid inventory waste or a company strategy, especially a manufacturing company where new production is done always after market demand and is actually done on customer demand.

Push Supply chain is a Make-to-Stock production strategy. This strategy is the opposite of the Pull strategy in which the pull appeals, the push strategy is more popular because the production system is based on forecasting and produces a large amount of output that will later enter into the inventory before it is channeled to the customer.

This strategy focuses on activity efficiency and standardization. Push strategy can be connoted with lean supply. The more companies have a little variety of products then this strategy is right. However, for products with a fluctuating market situation, the use of push systems will result in some losses, such as:

1. Inability to meet changing market demands.
2. The buildup of inventory that will bring in a lot of waste and requires a lot of storage space.
3. Large production batch.
4. The risk of large obsolete product.

2.1.3 Procurement

Procurement of goods is an important activity in maintaining the viability of the company, especially in the manufacturing industry.

Procurement is the acquisition of goods or services. It is advantageous that the goods or services are right and that they are purchased at the best cost to meet buyers' needs in terms of quality and quantity, time and location. [4]

Procurement is an activity to obtain goods or services in a transparent, effective and efficient in accordance with the needs and desires of its users. [5]

Procurement is divided into 2 parts, namely the procurement of simple and more complex procurement. Simple procurement is nothing but repetitive purchases or requests, whereas more complex procurement can include long-term supplier searches or fundamentally fixed commitments with an organization.

2.1.4 Inventory

Inventory along Supply Chain has major implications for a company's financial performance.

Inventory of goods as the main element of working capital is an asset that is always in a state of rotation and constantly changing. [6]

Understanding of goods inventory in general terms of inventory of goods used to show the goods owned for resale or used to produce goods to be sold. [7]

2.1.5 Safety Stock

Based on the inventory classification previously described the author uses Safety stock technique to accommodate demand uncertainty that affect the inventory.

Security inventory or Safety stock serves to protect errors in predicting demand during Lead Time. Lead Time is the time required between raw materials ordered to arrive at the company. The amount of Safety stock value depends on supply and demand uncertainty. Here is the formula in determining Safety stock can be seen in equation 1. [2]

$$SS = Paverage\ usage\ previous\ period \times LT \quad (1)$$

Where:

SS = Safety Stock
LT = Lead Time

The reorder point or point of reorder is when the inventory reaches the point where ordering is required. Here is the formula in determining the reoder point can be seen in equation 2.

$$Reorder\ Point = (LD \times AU) + SS \quad (2)$$

Where:

LD = Lead Time
AU = Average usage
SS = Safety Stock

2.1.6 Double Moving Average Forcasting Method

Moving Average is a method of forecasting the value of a value by taking a group of observed values which are then searched average, then using the aforementioned average as a forecast for the next period. The term moving average is used, because every time new observation data is available, the new averages are calculated and used as forecasts. [8]

Double Moving Average is one of time series forecasting by looking at trend data is forecasting with method of double moving average. The first moving average is then done again the moving average for the data that was already in the first moving average.

The steps to calculate the double moving average are as follows:

1. First moving average

$$M_t = \hat{Y}_{t+1} = \frac{Y_t + Y_{t-1} + \cdots + Y_{t-k+1}}{K} \quad (3)$$

2. Second moving average

$$M'_t = \frac{M_t + M_{t-1} + \cdots + M_{t-k+1}}{K} \quad (4)$$

3. Intercept

$$a_t = M_t + (M_t - M'_t) \quad (5)$$

$$a_t = 2\,M_t - M'_t \quad (6)$$

4. Slope

$$b_t = \frac{2}{k-1}\,(M_t - M'_t) \quad (7)$$

5. Forecast Value

$$\hat{Y}_{t+p} = a_t + (b_t \times p) \quad (8)$$

Where:

Mt = Moving Average period t
Yt + p = Forecast period t + p
Yt = The Real Value of period t
k = Number of limits in moving average
p = Number of periods to be predicted

2.1.7 Measuring Forecasting Errors

Measurement of forecasting errors can use Mean Absolute Error, Mean Square Error, Mean Absolute Precentage Error.

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:

$$MAE = \frac{\sum |x_t - F_t|}{n} \quad (9)$$

2. Mean Absolute Deviation (MAD)

Mean Absolute Deviation (MAD) measures the accuracy of the prediction by averaging the alleged error (the absolute value of each error). MAD is useful when measuring forecast errors in the same unit as the original series. The value of MAD can be seen in the following equation:

$$MAD = \frac{\sum(Absolut\ dari\ Forecast\ Error)}{n} \quad (10)$$

3. Mean Squares Error (MSE)

Mean Squared Error (MSE) is the average of forecasting error squared and can be seen in the following equation:

$$MSE = \frac{\sum(X_t - F_t)}{n} \quad (11)$$

Where:

Xt = Actual data in period t
Ft = Forecast data of the model used in period t
n = Many predicted data

4. Mean Absolute Precentage Error (MAPE)

MAPE is a relative error measure. MAPE is usually more meaningful than MAD because MAPE declares the percentage of error forecasting results against actual demand over a given period that will give the error percentage information too high or too low. Mathematically, MAPE can be seen in the following equation:

$$MAPE = \frac{100}{n} \sum |A_t \frac{F_t}{A} \quad (12)$$

5. Tracking Signal

Tracking Signals are a measure of how well a forecasting estimates actual values. Mathematically the value of Tracking Signal can be seen in the following equation:

$$Traking\ Signal = \frac{RSFE}{MAD} \quad (13)$$

Where:

RSFE = Cumulative Error
MAD = Mean Absolute Deviation

2.2 Supply chain management analysis

CV. Duta Niaga Sukses is a company engaged in the production of Tea. Tea products produced by CV company. Duta Niaga Success to date there are 11 types of tea. This company uses a make-to-stock strategy that is the production process before the order for the type of tea. Mass production is done by the company to make enough tea stock to anticipate purchasing tea product by buyer.

2.2.1 Supply chain management model in CV. Duta Niaga Sukses

Supply chain model contained in CV. Successful Sales Ambassadors can be seen in Figure 2.

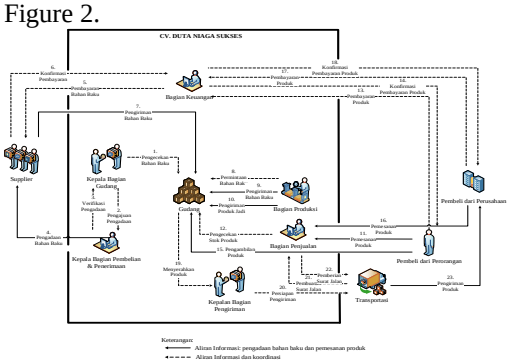


Figure 2. Supply Chain Management model in CV. Duta Niaga Sukses

2.2.2 Supply chain management analysis in CV. Duta Niaga Sukses

Supply chain analysis is done to illustrate supply chain management process built in CV. Duta Niaga Success based on supply chain model. So that supply chain analysis in CV. Duta Niaga Sukses can be seen in Figure 3 as follows:

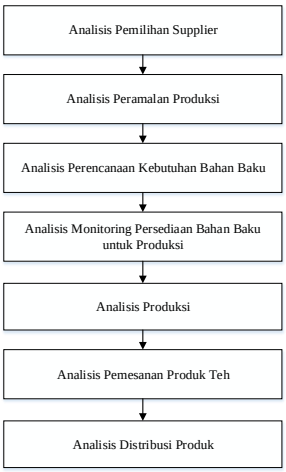


Figure 3. Supply Chain Management analysist in CV. Duta Niaga Sukses

1. Supplier Selection Analysis

Supplier selection is done by CV. Duta Niaga Success by way of procurement of raw materials to suppliers that are based on the best grade and price of each of the cheapest raw materials.

2. Production Forecasting Analysis

Forecasting demand for raw materials based on previous ordering request. The results of forecasting obtained used to determine the amount of procurement to be done and as a basis for consideration to make purchases of raw materials to suppliers. Forecasting needs of raw materials aims to meet production needs for the next month where when product demand is available. The forecasting technique used is a quantitative forecasting technique, due to the availability of sufficient past data. Forecasting method used is Double Moving Average because the result of comparison method that is method of Single Moving Average, Weight Moving Average, and Double Moving Average.

Table 1. Order Forecasting Results Tea PF II B

No	Period	Order Data	Forcasting Period	Forecasting Results
1	January	50350	-	-
2	February	15650	-	-
3	March	25850	-	-
4	April	31800	-	-
5	May	17500	-	-
6	June	26975	-	-
7	July	35500	-	-
8	August	24600	1	29898
9	September	14050	1	27085
10	October	6000	1	23709
Forecasting for November			1	12015

3. Planning Analysis of Total Raw Material Needs

Here is the stages of planning analysis of the amount of raw material needs on the CV. Duta Niaga Sukses. The part responsible for planning the amount of raw material needs is the production part.

Table 2. Planning of Raw Materials Needs Tea PF II B

Forecasting Results	Raw Materials	Calculations	Material Requirements
12015 Kg	VN 3309	12015 x 10%	1202 Kg
	VN 350	12015 x 5%	601 Kg
	Dust	12015 x 12%	1442 Kg
	BM	12015 x 7%	841 Kg
	Bohea Bulu	12015 x 13%	1562 Kg
	BTL	12015 x 13%	1562 Kg
	Fanning	12015 x 10%	1202 Kg
	Pluff	12015 x 7%	841 Kg
	Waste	12015 x 7%	841 Kg
	Sweeping	12015 x 4%	481 Kg
	Parol Giling	12015 x 7%	841 Kg

4. Analysis of Raw Material Inventory Monitoring for Production

After doing the forecasting stage, the next step is to monitor raw material inventory and determine the safe boundary of raw materials that must be in the warehouse of raw materials intended to avoid the occurrence of deficiencies or void raw materials using safety stock method.

Table 3. Raw Material Inventory Monitoring Tea PF II B

Forecasting Results	Raw Materials	Safety Stock	Reorder Point
12015 Kg	VN 3309	273 Kg	546 Kg
	VN 350	137 Kg	273 Kg
	Dust	328 Kg	655 Kg
	BM	191 Kg	382 Kg
	Bohea Bulu	355 Kg	710 Kg
	BTL	355 Kg	710 Kg
	Fanning	273 Kg	546 Kg
	Pluff	191 Kg	382 Kg
	Waste	191 Kg	382 Kg
	Sweeping	109 Kg	218 Kg
	Parol Giling	191 Kg	382 Kg

5. Production Analysis

In production analysis, the production department scheduling the production plan to fulfill the order. The number of products to be produced is calculated based on forecasting results divided by the number of working days in a month.

Table 4. Raw Material Inventory Monitoring Tea PF II B

Production Plan	Raw Materials	Calculations	Number of Raw Materials
546 Kg	VN 3309	546 x 10 %	55 Kg
	VN 350	546 x 5 %	27 Kg
	Dust	546 x 12 %	66 Kg
	BM	546 x 7 %	38 Kg
	Bohea Bulu	546 x 13 %	71 Kg
	BTL	546 x 13 %	71 Kg
	Fanning	546 x 10 %	55 Kg
	Pluff	546 x 7 %	38 Kg
	Waste	546 x 7 %	38 Kg
	Sweeping	546 x 4%	22 Kg
	Parol Giling	546 x 7 %	38 Kg

6. Analysis of Tea Products Ordering

At this stage the sales department conducts a product ordering transaction with a potential buyer. The part responsible for this stage is the marketing department. The marketing department can know directly about monitoring the tea products available in the company.

Table 5. Tea Product Order List March 2016

Purchase Date	Customers	Types of Products	Total Ordering	Total (Rp)
02/03/16	PD CHA	PF II A	7100	182.100.000
		PF II B	6900	
14/03/16	PRP	BAV	26000	318.500.000
17/03/16	PD CHA	PF I	2600	188.600.000
		PF II A	4500	
		PF II B	6900	
18/03/16	Ali / Nico	Dust 2	10020	107.214.000
18/03/16	Asep Ely	BOP	450	8.550.000

7. Product Distribution Analysis

Based on data ordering Teh Teh next stage is the delivery of tea products to buyers. Activities at this stage is the determination of the amount of transport capacity of product delivery and monitoring so that companies know with certainty what products have reached the buyers. The part responsible for this stage is the sales section. The sales department provides the amount of carrying capacity that can be used for delivery.

Table 6. Product Distribution

Customers	Types of Products	Total Ordering	Total (Rp)	Transportation type
PD CHA	PF II A	7100	182.100.000	1 x Fuso
	PF II B	6900		
PRP	BAV	26000	318.500.000	2 x Fuso
PD CHA	PF I	2600	188.600.000	1 x Fuso
	PF II A	4500		
	PF II B	6900		
Ali / Nico	Dust 2	10020	107.214.000	1 x Truck 1 x Box
Asep Ely	BOP	450	8.550.000	1 x Box

2.3 Database Analysis

Database analysis on information system in CV. Duta Niaga Sukses using a supply chain management approach will be built using Entity Relationship Diagram (ERD). The Entity Relationship Diagram (ERD) is depicted in Figure 4.

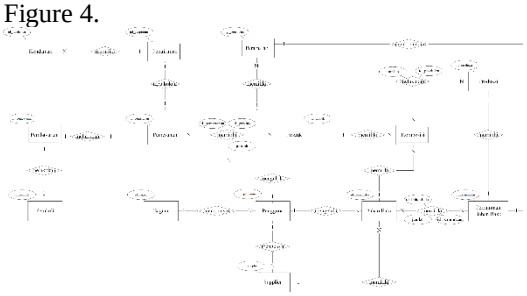


Figure 4. Entity relationship diagram
CV. Duta Niaga Sukses

2.4 Diagram Konteks

Context diagram for information systems in CV. Duta Niaga Sukses using supply chain management approach can be seen in Figure 5.

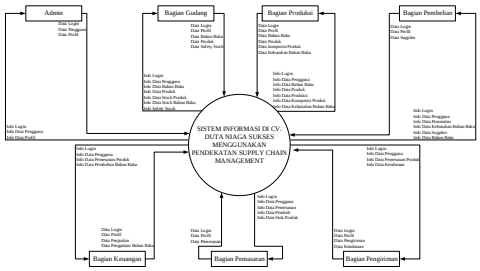


Figure 5. Diagram konteks
CV. Duta Niaga Sukses

2.5 Data Flow Diagram (DFD)

Data Flow Diagram for information system in CV. Duta Niaga Sukses using supply chain management approach can be seen in Figure 6. DFD shows how the data flow describes the processes that occur in the system until the process more detail.

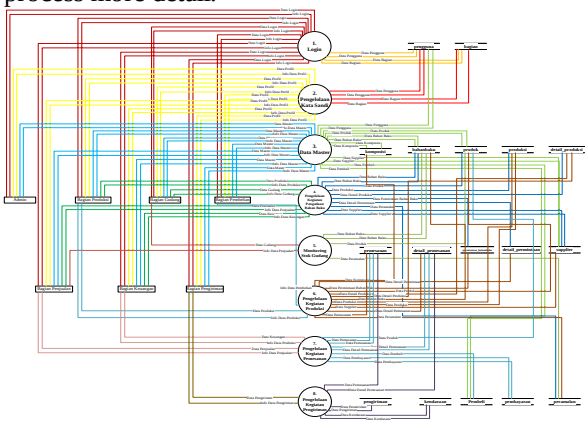


Figure 6. DFD Level 1
CV. Duta Niaga Sukses

2.6 Relation Scheme

Relation scheme of Information System at CV. Duta Niaga Sukses Using Approach Supply chain management can be seen in Figure 7.

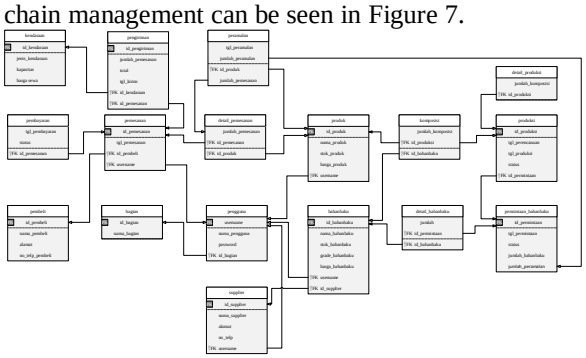


Figure 7. Relation Scheme
CV. Duta Niaga Sukses

2.7 Interface Design

The design is made based on the interface of both input and output that will be generated when the application is implemented.

Interface design for information systems in CV. Duta Niaga Sukses using supply chain management approach can be seen in Figure 8.

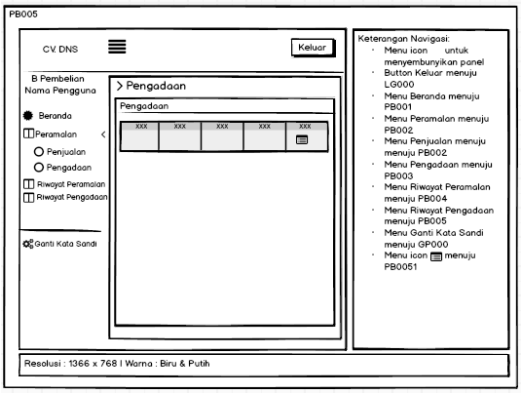


Figure 8. Designing Procurement Uses

2.8 System Testing

System testing is the most important thing that aims to find faults or flaws in the supply chain management system being tested. Testing intends to know the supply chain management system that has been made to meet the performance in accordance with the design objectives.

The test used to test the new system is the Black Box testing method. Black box testing focused on testing the functional requirements of information systems.

Test plan to be done is to test the system built in Black Box and Beta. Testing Information Development At CV. Duta Niaga Sukses With Approach Supply chain management uses test data based on given data.

1. Functional Testing

Black box testing is focused on the functional requirements of built software.

Testing is done by testing each process for possible errors that occur.

Kelas Uji	Jenis Pengujian
Login	Black Box
Mengganti Kata Sandi	
Menambah Data Pengguna	
Mengubah Data Pengguna	
Menghapus Data Pengguna	
Menambah Data Bahan Baku	
Mengubah Data Bahan Baku	
Menghapus Data Bahan Baku	Black Box
Menambah Data Produk	
Mengubah Data Produk	
Menghapus Data Produk	
Menambah Data Supplier	
Mengubah Data Supplier	
Menghapus Data Supplier	
Menambah Data Pembeli	
Mengubah Data Pembeli	
Menghapus Data Pembeli	
Melakaukan Konfirmasi Permintaan	
Melihat Detil Permintaan	
Melakukan Verifikasi Pengadaan	
Melihat Detil Pengadaan	
Melakukan Monitoring Stok Gudang	
Melakukan Pengecekan Stok Gudang	
Melakukan Pengelolaan Produk	
Melakukan Permintaan Produksi	
Melakukan Peramalan Penjualan	
Melakukan Pengadaan	
Melakukan Pengelolaan Pemesanan	
Melihat Detil Pemesanan	
Menghapus Pemesanan	
Melakukan Konfirmasi Pembayaran	
Jadwal Pengiriman	
Menambah Data Kendaraan	
Mengubah Data Kendaraan	
Menghapus Data Kendaraan	

Based on the test results with the case of test samples that have been done to give the conclusion that the process is correct, it has been able to facilitate Warehouse Manager and Purchase to choose the best supplier for tea raw materials to be produced by the company, it can facilitate the Production Manager in estimating the stock inventory will be sold in the next month as well as determine the amount of raw materials to be ordered to the supplier for the production process, and has been able to facilitate the Marketing Manager to determine the type of vehicle and how many vehicles to hire to meet the capacity in the distribution of tea. Filtering process errors in the form of landing page view messages is quite maximal. Functionally the system is able to produce the expected output.

2. Beta Testing

Beta testing is a direct test of the real environment. Users make an assessment of the software using interview methods. From the results of these interviews it can be concluded whether the software built in accordance with the purpose or not.

Interviews are conducted for users of systems consisting of admin, parts of purchases, parts of delivery, sales, finance, warehouse and parts of production.

Based on the above beta test, it can be concluded that:

1. This system helps the admin, the purchasing department, the shipping department, the sales department, the finance department, the warehouse and the production section in running their respective jobs.
2. The built system is easy enough to use.
3. The built system has a simple and easy to understand interface.

4. The use of language in the system is good and quite easy to understand.

3. CLOSING

This section will explain the conclusions that contain the results obtained after the analysis, design, and implementation of the design of built and developed software and suggestions that will provide important records and possible improvements that need to be made to the previous software development .

3.1 Conclution

Based on the results obtained in the writing of this thesis, it can be concluded as follows:

1. The information system using the supply chain management approach built can facilitate Warehouse and Purchase Managers to select the best supplier for tea raw materials to be produced by the company. From the analysis results obtained supplier selection is based on the price of the cheapest raw materials and also a good grade of tea raw materials.
2. The information system using the built-in supply chain management approach enables the Production Manager to estimate the supply of tea stock to be sold in the next month and to determine the amount of raw materials to be ordered to the supplier for the production process. To estimate the stock of tea stock is then done forecasting process using the method of Double Moving Average which will be used to estimate the purchase of raw materials to suppliers. But to determine the amount of tea raw materials that must be purchased to the supplier system is still fixed to the forecasting results, so if there is purchases of excessive tea raw materials or less than forecasting the system is still not able to produce the desired results.
3. The information system using this built-in supply chain management approach enables the Marketing Manager to determine the type of vehicle and how many vehicles to hire to meet the capacity in the distribution of tea.

3.2 Suggestios

Suggestions for the development of this supply chain system are some suggestions that can be done, among others:

1. Addition Management User data will be better if there is a special system such as human resource information system that can manage employee data so that users can be selected directly from the system.
2. Forecasting used should not only to know 1 month to come, but can for month next month.
3. Integration with existing financial system with existing budget data management on supply chain management system that has been built.

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