DEVELOPMENT INFORMATION SYSTEM INDUSTRI HILIR TEH PT. PERKEBUNAN NUSANTARA VIII BANDUNG USING THE SUPPLY CHAIN MANAGEMENT

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ABSTRACT

PT. Perkebunan Nusantara VIII has a tea packing factory known as Industri Hilir Teh (IHT). Industri Hilir Teh (IHT) is a company that produces tea under the brand Walini with twenty seven types of variant flavors. Production on a scale big (Mass product) conducted by the IHT. Tea material is the main raw material in the production process.The problems that often occur in the Industri Hilir Teh PT. Perkebunan Nusantara VIII Bandung is a shortage or excess raw materials, scheduling the distribution of products to customers often do not match. Pursuant to the problems that exist today in the Industri Hilir Teh PT. Perkebunan Nusantara VIII Bandung, then it needs development information system using the Supply Chain Management. The development objective of this information system facilitates the procurement section chief in determining the number of raw materials to be used and facilitates the head of the warehouse in the distribution process by scheduling delivery of the product.

Supply Chain strategy used is Push Supply Chain, since it is based on the suitability of that happening in companies today is using a strategy make-to-stock. This information system is built on the upstream (upstream) to the downstream (downstream). Forecasting method of ordering products used are Single Moving Average. Calculation predicted availability of raw materials in the warehouse using the method of securing supply (Safety Stock). The booking process raw materials using a direct booking system

Based on the result of black box functional testing, UAT and end user acceptance testing after the system was applied at the company can be conclude that this system helped the head of procurement in determining the large number of raw materials to be used and allows the head of the warehouse in the distribution process by scheduling the distribution.

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

1. INTRODUCTION

PT. Perkebunan Nusantara VIII have a tea packaging factory known as the Industri Hilir Teh (IHT). The downstream Industri Hilir Teh (IHT) is a company producing tea with Walini brand with twenty-seven types of variant such as Walini Black Teabag, Teabag Black Tea Bags, Apple Walini Black Walini Green Teabag jasmine, Walini, and so on to meet the domestic market. IHT has a supply chain management activities from the upper reaches to the lower reaches of the upper part is done by the IHT is doing the process of procurement of raw materials to suppliers, receiving raw materials, and performing the processing of raw materials into products of tea Walini. IHT uses the strategy of make-to-stock production process namely prior to booking. Great production (Mass product) was done to make the IHT party enough stock in anticipation of ordering the purchase of the product by the buyer Walini. IHT is working with twenty suppliers include Garden IHT Malabar, PT. Argapura Trading Company, PT. Shoots Alfin, and others who have product standards include standards of quality tea and packaging. IHT has eight categories of suppliers of raw materials, among others, the supplier of the raw material supplier, tea master cartons, packaging suppliers, supplier of paper cartons asmofilter, food grade yarn suppliers, supplier of duct tape, a supplier of flavour, and a supplier of plastic. The purchase of the raw material by the IHT carried out in cash. IHT has 28 engine in the production process which every day produce an average of 600 master carton. While the lower part is conducted by the IHT with distributors are receiving bookings Walini and distributing products to distributors. The purchase of the product by the distributor made in cash.

Based on the results of the interview with Mr. Miroslav Ferry as the head of the field Procurement stated that the raw material procurement conducted by field Procurement against suppliers currently conducted every month. as a result there was a problem when demand high booking number shortage of raw materials in the warehouse which resulted in the production process is not running so

that when there is a tea Walini products purchase booking reservations cannot be made. Vice versa when booking request down excess products and raw materials often occur and result in the buildup of the number of products and raw materials in the warehouse.

Based on the results of the interview with Mr. Satrio Password as the head of the field Warehouse stated that scheduling distribution of products to the customers are often not appropriate, due to the amount of finished product inventory in the warehouse. The booking took place on April 1, 2016, is a transaction with the greatest number of queries such as Puskopkar to order as much as master carton of 2046 the booking is the product of a black Teabag Walini. As a result there is a delay in the process of delivery to the customer. The products will be delivered to the customer is done directly by the parties based on the data warehouse ordering given by the marketing field. IHT use third party in terms of distributing the product. Therefore, when there are delivery delays of the party aggrieved i.e. distributors and buyers. This gives a negative effect on the company's.

Based on the problems that exist today in the downstream Industry of tea plantations of PT Nusantara VIII, hence the need for a development of information systems that can manage the procurement of raw materials management, production planning and inventory management as well as coordination with distributors in shipping using the method of approach to Supply Chain Management.

Based on problems occurred, then the intent and purpose of this research is to build an industrial information system Downstream of the tea plantations of PT Nusantara VIII using Supply Chain Management Approach.

The purpose of the construction of the information system of the State of Teh Idustri PT. Perkebunanan Nusantara VIII using Supply Chain Management Approach are as follows :

1. Facilitate the head of procurement in determining a large number of raw materials will be ordered.
2. Make it easy for the head of the shed in the process of distributing the existence of scheduling the delivery of the finished product.

2. CONTENTS RESEARCH

2.1 Theoretical Basis

The theoretical basis on this thesis will explain the theories relating to the application of Supply Chain Systems Products Industri Hilir Teh PT. Perkebunan Nusantara VIII Bandung.

2.1.1 Sistem

According Jogiyanto "The system is a collection of elements that interact to achieve a certain goal." (Jogiyanto, 2005)

Meanwhile, according to Jacob, "The system is a network of related procedures, gathered together to perform an activity or a specific purpose." (Jacob, 2012)

Based on the two opinions above authors conclude that the system is the system is a collection of elements or networks of procedures that interact and relate to accomplish an activity or a particular purpose.

2.1.2 Supply Chain

According to I Nyoman Pujawan "Supply Chain is a network of companies that together work to create and deliver a product into the hands of end users." (Pujawan & ER 2010)

Meanwhile, according According to Simchi-Levi et. al "Supply Chain (SC) is a network of independent organizations and interconnected that work together in a cooperative and mutually beneficial in controlling, regulating and improving the flow of materials and information from supplier to consumer. (Simchi-Levi, Kaminsky, Simchi-Levi, & Bishop, 2003)

Based on the two opinions above authors conclude supply chain is a network that can be a network of companies and network of independent organizations that work together and are connected to create the cooperation of mutual benefit in controlling, regulating and improving the flow of material and information of a product from suppliers to end users.

2.1.3 Supply Chain System

Based on expert opinion about the system and supply chain authors conclude supply chain system is a system in the supply chain which has the objective of creating mutually beneficial cooperation in controlling, regulating and improving the flow of material and information of a product from the supplier to the end user. Construction supply chain system in PT. Sinkona Indonesia Lestari author in the development of supply chain management approach.

2.1.4 Supply Chain Management (SCM)

According to James A. and Mona J. Fitzsimmons "Supply Chain Management is a total system approach to deliver the products to the end users by using information technology to coordinate all elements of the supply chain from suppliers to retailers start, then reach the next level which is a competitive advantage that is not available in traditional logistics system. "(Fitzsimmons & Fitzsimmons, 2004)

Meanwhile, according to Jacobs and Chase "Supply Chain Management is a system for

implementing a total approach to managing the entire flow of information, materials, and services from raw materials through factories and warehouses to the final consumer." (Jacobs and Chase, 2008)

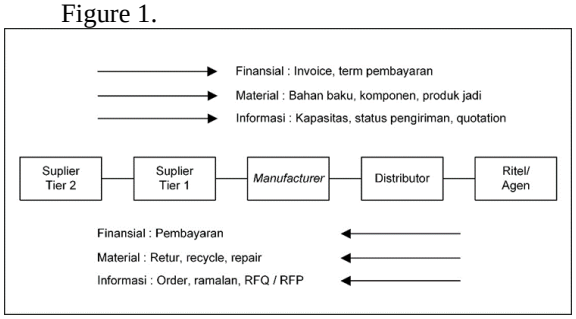
Meanwhile, according to Simchi-Levi et. al "Supply chain management is defined as a series of approaches used to integrate suppliers, manufacturers, warehouses and stores to effectively so that supplies can be manufactured and distribution at the right amount, to the right location, and at the right time so that the cost of the overall system can minimized while trying to satisfy the needs and services. "(Simchi-levi, Kaminsky, Simchi-levi, & Bishop, 2003)

Meanwhile, according to I Nyoman Pujawan and Mahendrawati "Supply Chain Management (SCM) is a method or an integrative approach to manage the flow of products, information, and money in an integrated manner involving parties from upstream to downstream consisting of suppliers, factories, distribution networks and services logistics-services. "(Pujawan & ER 2010)

According to I Nyoman and Mahendrawati in the supply chain there are usually three kinds of streams that must be managed. Three kinds of streams that must be managed pad supply chain is as follows (Pujawan & ER, 2010):

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.

Here is a model of supply chain simplification and 3 kinds of managed flow can be seen in Figure 1.



Gambar 1. Simplifikasi model *supply chain* model abd 3 kinds of stream

2.1.5 Push and Pull Supply Chain

According to Chopra and Meindel "pull process based on the customer orders, while the push process initiated and conducted in a way to anticipate the customer's order." (Chopra & Meindel, 2007)

Pull supply chain is the production strategy of "make-to-order" the main benefit is to avoid waste inventory or a corporate strategy mainly manufacturing companies where new production is done always after the market demand and actually performed at the request of customers.

Push Supply Chain is a production strategy Make-to-Stock. This strategy is the opposite of Pull strategy where in the appeal pull, push the strategy is more popular due to its production system based forecasting and produce output in a large number of which will go into inventory prior to distribution to the customer.

This strategy has a focus on efficiency and standardization activities. Push strategy can be connoted with lean supply. Increasingly, companies have little variation, the products that fit this strategy. However, for products with market conditions change, the use of the push system will bring some disadvantages, as:

1. Inability to meet the demands of a changing market.
2. Inventory buildup that will bring a lot of waste and need a lot of storage space.
3. Large production batches.
4. The risk of major product obsolete.

2.1.6 Inventory

Inventory throughout the supply chain has major implications for the financial performance of a company.

According Riyanto "inventory or inventories as the main elements of working capital is an asset that is always in a state of rotating and constantly changing." (Riyanto, 2001)

Meanwhile, according to Zaki Baridwan "Definition of inventory is generally the term used to indicate the inventory of goods held for resale or used to produce goods for sale." (Baridwan, 2000)

2.1.7 Safety Stock Tecnique

Safety stock inventory or security functions to protect the error in predicting demand during Lead Time. Lead time is the time it takes between the raw materials ordered to arrive at the company. The amount of safety stock depends on the uncertainty of supply and demand. Here is the formula in determining Safety stock is shown in Equation 1

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

Where:

Z = *Service Level*

Sdl = *Lead Time*

2.1.8 Single Moving Average Forecasting Method

Method of moving average single-use amount of actual data to generate new demand forecast values for future demand. This method will be effectively implemented if we can assume that the market demand for the product will remain stable over time. This method has two special properties, namely to make a forecast requires data.

Historically within a certain period, the longer the moving averages will produce a moving average

that is more subtle, systematically moving average can be calculated by equation 3.

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

Informatioan:

S_{t+1} = *Forecast* for period *t+1*.
Xt = Data in period t.
n = Time period Moving Averages

2.1.9 Mean Absolute Error (MAE)

Mean Absolute Error (MAE) is the average absolute error of error foresee (positive and negative values are not seen) is shown in Equation 4.

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

2.1.10 Mean Absolute Deviatioan (MAD)

Mean Absolute Deviation (MAD) to measure forecast accuracy by averaging the alleged error (absolute value of each error). MAD useful when measuring forecast error in the same units as the original series. MAD value can be seen in Equation 5.

$$MAD = \frac{\sum(Absolut\ dari\ Forecast\ Error)}{n} \quad (5)$$

2.1.11 Mean Squares Error (MSE)

Mean Squared Error (MSE) is the average of the squared forecasting error and can be seen in Equation 6.

$$MSE = \frac{\sum(X_t - F_t)}{n} \quad (6)$$

2.1.12 Mean Absolute Percentage Error

MAPE is a measure of the relative error. MAPE is usually more significant than MAD as stated percentage error MAPE forecasting results against the actual demand for a certain period that will provide information on the percentage of errors is too high or too low. Mathematically, MAPE can be seen in Equation 7

$$MAPE = \frac{100}{n} \sum |A_t \frac{F_t}{A}| \quad (7)$$

2.2. Analysis of the problem

Problem analysis is an assumption of the problems will be described in the procedures of data processing in program development Supply Chain Systems Industri Hilir Teh PT. Perkebunan Nusantara VIII using the approach of Supply Chain Management. Analysis of the problems of the current system at this time is:

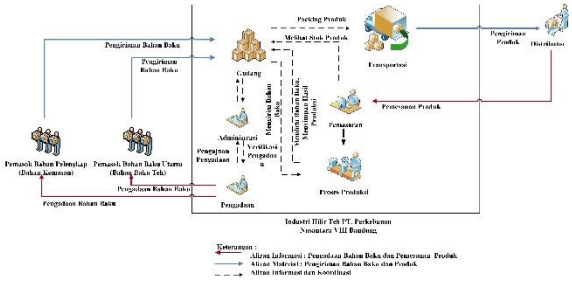
1. Head of procurement difficulties in determining the amount of raw material that will be ordered.
2. Head of warehouse distribution scheduling in planning difficulties that have not been run well due to the delay in the delivery of the finished product.

2.3 Analisis *Supply Chain Management (SCM)*

Analysis of supply chain management is used to implement a supply chain management approach to the supply chain system to be built. Supply chain management has a framework which is a component for the construction of the system.

2.3.1 Model Supply Chain Management (SCM) Industri Hilir Teh PT. Perkebunan Nusantara VIII

SCM is based on the analysis presented in the previous section, while the supply chain model contained in the PT. Sinkona Indonesia Lestari can be seen in Figure 2.



Gambar 2. Model *supply chain* Industri Hilir Teh PT. Perkebunan Nusantara VIII

2.3.2 Analisis *Supply Chain* di Industri Hilir Teh PT. Perkebunan Nusantara VIII

Supply chain analysis conducted to describe the supply chain management process that will be built in Indonesia, PT Sinkona Lestari (SIL) based on the supply chain model in Figure 2. As for the analysis of the supply chain in pt. SIL can be seen in Figure 3.



Gambar 3. Supply Chain Management Industri Hilir Teh PT. Perkebunan Nusantara VIII

1. Analysis of forecasting the amount of procurement of Products

Demand forecasting needs raw materials based on actual data request prior reservation. Forecasting results obtained are used to determine the amount of procurement will be done and as the basis of the

consideration for the purchase of raw materials on supplier. Fields that charge in this stage is the field procurement.

2. Analysis Monitoring Product Inventory and inventory of raw materials

After a stage of forecasting, the next step is to conduct monitoring of raw material supplies and determine the limits of safe raw materials which must be digudang the raw material that aims to prevent the occurrence of shortages of raw material using the vacuum or the method of Safety Stock.

3. Analysis Procurement Of Raw Materials

On the analysis of procurement this raw, the field procurement of booking based on the submission of raw materials. Reservations against the supplier of Tea, among others, Master Cartons, packaging Box, paper Asmofilter, duct tape, Twine, plastic.

The procurement process is carried out by means of the agreed cooperation. When the raw materials have been ordered to come will be handled by the procurement. Checking the raw materials procurement meets the standards of the company. When goods come meet the standards of the company then will go into the warehouse inventory of raw materials and if it does not comply will be returned to the supplier.

After knowing the number of raw materials have to be booked so companies need to conduct procurement of raw materials to the supplier that has been doing the same work previously, raw materials which should not be less than the amount of raw materials that must be reserved and must not be more than 100.

The supplier will receive pengajuaan the procurement of raw materials are submitted by the field of the industrial production of Downstream Tea plantations of PT Nusantara VIII. Suppliers will bid price to the Downstream Industry of tea plantations of PT Nusantara VIII. The lowest price suppliers and can meet the needs of companies will be selected as suppliers of raw materials.

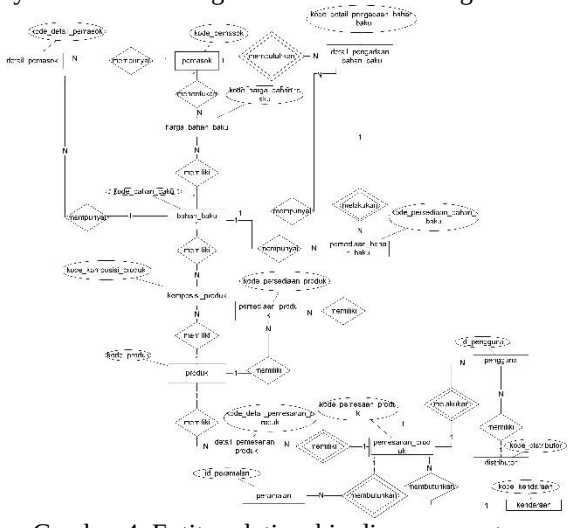
The next stage is to make a list of filing of procurement of raw materials against a supplier was selected based on the criteria defined by the company.

4. Analysis Distribution Of Products

On the analysis of the distribution of these products is the determination of the amount of the charge transport and product delivery done monitoring process so that companies know for certain products already ordered up to the customer. The part that is responsible for this is the realm of the warehouse along with a third party. The warehouse field provides the number of that item that's transported and determine the type of transport to be used. The charge transport available is a type with a capacity of a minimum capacity of Puso 1200 master cartons and a maximum of 1300 master cartons, for the kind of Colt Diesel Double with a capacity of at least 600 master cartons and a maximum capacity of 650 master cartons, for the kind of Colt Diesel Engkel with a minimum capacity of 100 master cartons and a maximum capacity of 550 master carton, to kind of Pick ups with a maximum capacity of 100 master carton.

2.4 Analysis Database

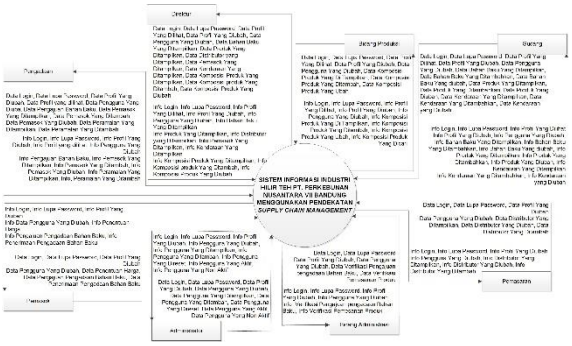
Analysis of the data on the basis of supply chain systems quinine salt products in PT. Sinkona Indonesia Lestari (SIL), which will be built using the Entity Relationship Diagram (ERD). ERD is a data model that uses some notation to describe the data in the context of the entities and relationships described by the data. The diagram is illustrated in Figure 4.



Gambar 4. Entity relationship diagrams system information Industri Hilir Teh PT. Perkebunan Nusantara VIII

2.5 Diagram Context

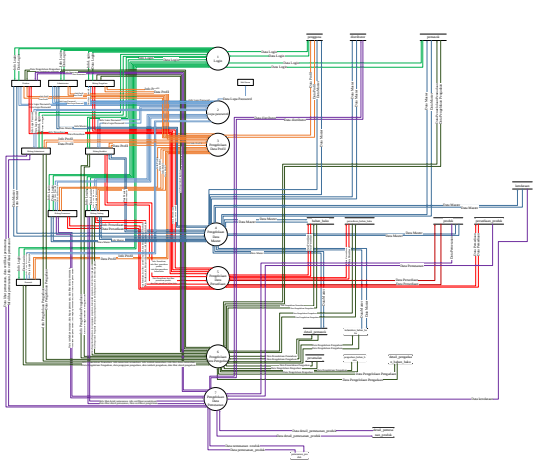
Diagram context is a global model to explain how the data is used and transformed to process or describe the flow of data into and out of the system. In the context of the system diagram shown in Figure 5.



Gambar 5. Diagram of the context of system information Industri Hilir Teh PT. Perkebunan Nusantara VIII

2.6 Data Flow Diagram (DFD)

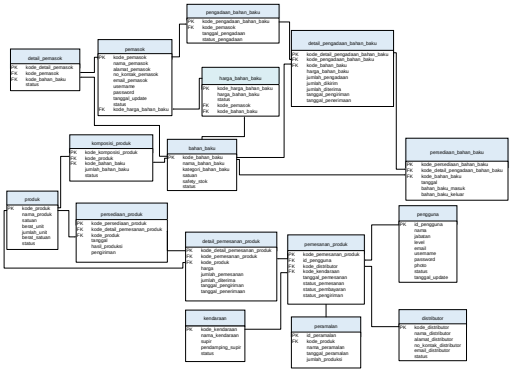
Data flow diagrams show how to decipher the data flow processes that occur in the system to process more detail. In the context diagram as shown in Figure 5. can be broken down into several DFD.



Gambar 6. DFD Level 1 system information Industri Hilir Teh PT. Perkebunan Nusantara VIII

2.7 Table Relationships

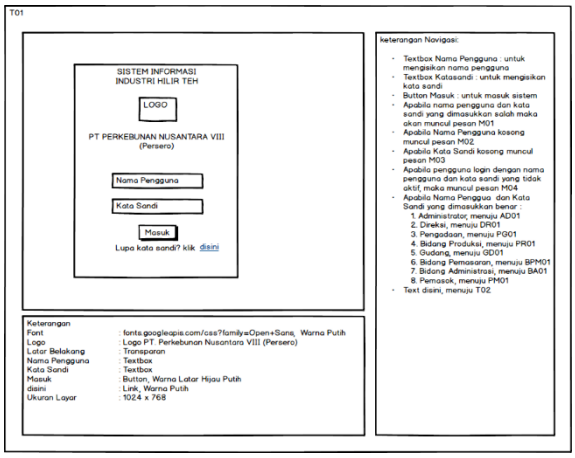
Table relationships describe the relationship between the data, meaning the data and limitations. The process of relationships between attributes is a combination between the attributes that have the same primary key, so that these attributes into a single unit that is connected by the key fields. Table relationships are described in Figure 7.



Gambar 7. Tabel relationships system information Industri Hilir Teh PT. Perkebunan Nusantara VIII

2.8 Interface Design

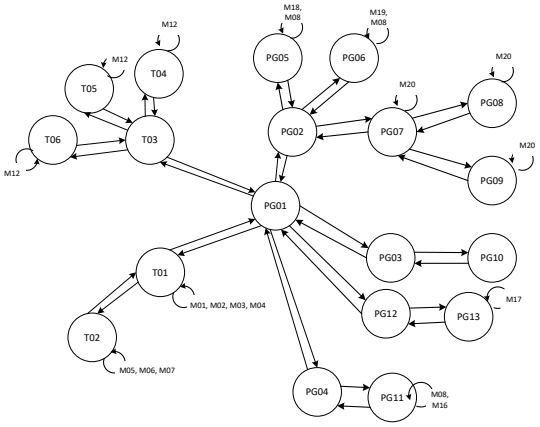
Interface design created to describe the look of the program that will be used by the user to interact with the system to be built. The design of the user interface is based on both input and output to be generated when the application is implemented. Here is a sample login interface design that can be seen in Figure 8.



Gambar 8. Interface Design T01 *Login*

2.9 Network Design Semantics

Semantic network design is a representation of the design interface that shows where each interface is connected. Here is an example design of the semantic network operators in the provision of system information in Industri Hilir Teh PT. Perkebunan Nusantara VIII approach to supply chain management can be seen in Figure 9.



Gambar 9. Designing User Semantic Network Procurement

2.10 Testing Systems

System testing is the most important thing that aims to find the mistakes or shortcomings in the system that was tested. Testing is intended to find out which system is made meets the performance according to the purpose of design.

The first test used to test the new system is a method of testing a black box test, both of which focused on the acceptance of the user (end user) using the UAT (User Acceptance Testing), the third test which focused on the acceptance of the user (end user).

1. Black Box Testing

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

Testing conducted by testing each process for possible errors that occurred.

Based on the test results to the case sample test has been done gives the conclusion that the process is correct. Error filtering process in the form of landing page views message is sufficient. Functionally the system can already produce the expected output.

2. User Acceptance Testing (UAT) Testing

The testing focused on the acceptance of the user (end user) using the UAT (User Acceptance Testing) that aims to find new defects (defects) that are not found by the developer and in the software testing process involves prospective users in the company that is selected by the developer as well as chaperoned when done.

3. End User testing

The testing focused on the acceptance of the user (end user) that the end user acceptance testing after the system is implemented in an enterprise environment by using the interview to end users who use the software.

Interview conducted for the users of the system consisting of the administrator, the field of administration, the Director, the field of procurement, warehouse areas, areas of procurement, marketing, manufacturing and suppliers. This research was conducted at the Downstream of the tea plantations of PT Nusantara VIII in order to find out the extent to which the system is built can be a solution and the resolution of problems that have been described earlier.

Based on testing of the end user, it can be concluded that:

1. The system helps administrators, field administration, warehouse areas, areas of procurement, marketing, manufacturing, and the Director in carrying out the work of each.
2. System built is pretty easy to use after there is a guide.
3. The system has less understandable interface.
4. Use of language that is present in the system is quite easy to dimengert.

3. CLOSING

In this section, describes the conclusions contains the results obtained after the analysis, design, and implementation of the design of software built and have been developed as well as suggestions that will provide an important record of and possible improvements that need to be done for previous software development.

3.1 CONCLUSION

Based on the results obtained in the writing of this final task, then a conclusion can be drawn as follows:

1. Information systems are built it can make it easier for the head of the procurement process in the procurement of raw materials.
2. Information systems are built it can ease the head of warehouse distribution scheduling in walini products to customers who have been booking the product walini.

3.2 SUGGESTION

Suggestions for the development of this supply chain system there are some suggestions that may be made, among other things:

1. The need for the development of information systems such as the look to make it more attractive and easy to use.
2. The need for the development of information systems in order to make the system more understandable by the user.
3. The need for the construction of information systems such as E-commerce is to make it easier to do transaction booking

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