DEVELOPMENT SUPPLY CHAIN SYSTEM OF QUININE SALT PRODUCTS AT PT. SINKONA INDONESIA LESTARI (SIL) USING THE SUPPLY CHAIN MANAGEMENT

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ABSTRACT

PT. Sinkona Indonesia Lestari (SIL) is a manufacturing company that produces quinine salts and derivatives for various industries. Production on a scale big (Mass product) conducted by the PT. SIL. Quinine bark material is the main raw material in the production process. The problems that often occur in the PT. SIL is a shortage or excess raw materials, lack of coordination between the production sector resulted in the production process does not go well that resulted in the frequent occurrence of cancellation of bookings quinine product made by prospective buyers. Pursuant to the problems that exist in PT. Sinkona Indonesia Lestari (SIL), then it needs development supply chain System using the Supply Chain Management. The development objective of this supply chain system facilitates planning raw material requirements for the determination of the amount of production in order to avoid any lack of product when ordering by prospective buyers do as well as the production sector in order to coordinate every production run properly.

Supply Chain strategy used is a push supply chain, since it is based on the suitability of the supply chain in the company Thar using strategy of make-to-stock. Supply chain system is built on the upstream (upstream) to the downstream (downstream). Method of forecasting demand of raw materials used are single moving average. Calculations predicted availability of raw materials in the warehouse using the method of securing supply (safety stock). The booking process raw materials using an auction system (tender) and direct booking.

Based on the test results it can be concluded that the system is already helping production planning and control part in determining the production of raw material requirements planning and coordinating all production sectors in the use of raw materials as well as avoid the blanks product.

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

1. INTRODUCTION

PT. Sinkona Indonesia Lestari (SIL) is a manufacturing company that produces quinine salts and derivatives for a variety of industries, particularly the pharmaceutical industry, beverage industry and chemical industry. PT. SIL uses the strategy of make-to-stock namely the production process prior to booking. Production on a large (Mass product) conducted by PT. SIL to create sufficient stock to anticipate the purchase order quinine salt product by the buyer. PT. SIL has four categories of raw material suppliers, among others, quinine bark raw material suppliers, suppliers of chemical, suppliers of packaging materials and fuel suppliers. Quinine bark material is the main raw material in the production process.

Based on the interview with Mr. Slamet Suwantoro, S.Sos as Assistant Procurement Manager at the Department of Procurement. Procurement of raw materials are carried out by the procurement department of the supplier is currently done on a regular basis. This becomes a problem when demand is high booking shortage of raw materials in the warehouse, which resulted in the production process is not running so that when there is a purchase order quinine products reservation can not be done. Likewise when demand fell excess raw materials are common and result in a buildup of raw materials.

Based on the interview with Mr. Agus Tarsono as Assistant Manager of Planning and Production Control. Problems found in the production process is the lack of coordination between each sector of production. Production sectors involved include the extraction section tasked with quinine bark grinding into powder bark quinine rubble. Processing section in charge of processing the results of quinine bark extract to be the salt of quinine and its derivatives. Part alkaloid assigned to conduct the process of making sinkonin from the rest of the extraction and processing. Charge of engineering parts, repair and maintenance of machinery and process waste disposal. When one production sector to do its job unfinished task will be a delay for other production sectors. This resulted in the production process does not go well, such as the buildup of semi-finished

products and affect the use of raw materials that are not used efficiently.

Process bookings made by buyers sometimes can not be done, because the finished product inventory in the warehouse is less or even non-existent. This is because the lack of production planning goes well done by the department of production and inventory control. Due to the production process is often delayed due to a shortage of raw materials resulted in delayed delivery to the buyer. Preparation products that will be sent to the customer is done directly by the warehouse based on booking data provided by the marketing department. PT. SIL using a third party in terms of product distribution. Therefore, when there is delay in delivery there are two losers, namely distributors and buyers. This gives a negative effect on the company.

Pursuant to the problems that exist at present in PT. Sinkona Indonesia Lestari (SIL), hence the need for a development system that can regulate the supply chain management of raw material procurement, coordination between the production sector, production planning and inventory management as well as coordination with distributors in using the delivery method approach to *Supply Chain Management*.

Based on the problems studied, the purpose of this thesis is to build a supply chain system quinine salt products in PT. Sinkona Indonesia Lestari (SIL) using the approach of *Supply Chain Management*.

While the objectives to be achieved in this study are:

a. Facilitate the procurement part in determining the estimated total reserve of raw materials to suppliers based on raw material requirements planning done by the production planning and control and to avoid any lack of raw material inventory.
b. Facilitate coordination between the production sector with production and inventory control department as a bridge of coordination between the production sector, relating to the internal supply chain relationships that exist in the system. So the production process went well in order to avoid delay in shipping products.
c. Avoid the occurrence of the vacancy inventory quinine salt products in the warehouse so that the cancellation of reservations is not often the case.

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 Salt Kina PT. Sinkona Indonesia Lestari (SIL).

2.1.1 System

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.

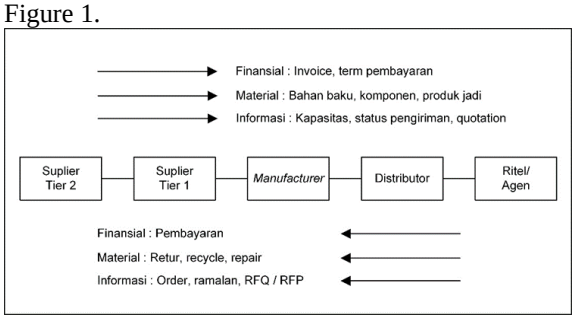


Figure 1. Simplification supply chain model and 3 kinds of stream

2.1.5 *Push* dan *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

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

Where:

SS = *Safety Stock*

LT = *Lead Time*

Reorder point or reorder point is when the inventory reaches a point where the necessary reordering. Here is the formula to determine 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*

2.1.8 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.

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

Keterangan:
S_{t+1} = Forecast for *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 Products Salt Kina PT. Sinkona Indonesia Lestari (SIL) using the approach of Supply Chain Management. Analysis of the problems of the current system at this time is:

1. The absence of raw material requirements planning efficiently so often happens in the blanks and stacking the raw material.
2. Lack of coordination between the production sector in the use of raw materials and the realization of production, resulting in a delay of the task to other production sectors. This resulted in the production process does not go well, such as the buildup of semi-finished products and affect the use of raw materials that are not used efficiently.
3. Often there is vacuum salt products quinine production due to shortages of raw materials resulting in canceled reservations quinine salt product by the buyer.

2.3 Analysis *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)* di PT. Sinkona Indonesia Lestari (SIL)

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.

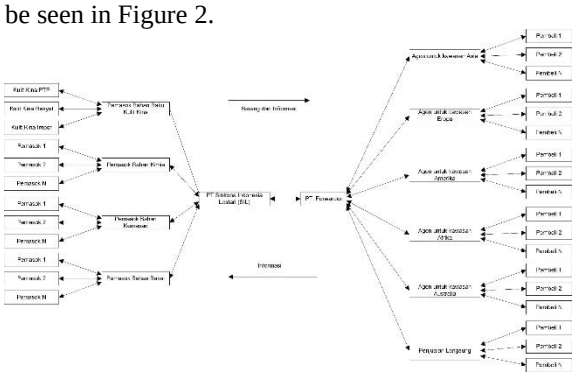


Figure 2. Model *supply chain* di PT. Sinkona Indonesia Lestari (SIL)

2.3.2 Analisis *Supply Chain* di PT. Sinkona Indonesia Lestari (SIL)

Supply chain analysis done to describe the process of supply chain management which will be built at PT. Sinkona Indonesia Lestari (SIL) based supply chain model in Figure 2. The analysis of the supply chain in PT. SIL can be seen in Figure 3.



Figure 3. Supply Chain Management di PT. Sinkona Indonesia Lestari (SIL)

1. Raw Material Requirements Planning

Raw material requirements planning process, done by forecasting demand for raw materials based on actual data request before ordering raw materials. Forecasting results obtained are used to determine the amount of production that will be performed and as a basis for consideration for purchase of raw materials to suppliers. Departments responsible in this stage is part of the planning and production control.

2. Determination of Total Production Products Kina Based Raw Material Requirements Planning

At this stage, the determination of the amount of raw materials based on raw material requirements planning. Department responsible at this stage is part of the planning and production control.

3. Purchase of Raw Materials at the Supplier

At this stage of the procurement department of an order of raw materials based on the submission of raw materials made by the planning and control. Booking on suppliers include quinine leather raw materials, chemicals, packaging materials, and fuel.

While doing the filing of the raw material is no comparison process availability of raw materials with the filing of a plan of raw materials to be purchased.

The procurement process is done by conducting a tender offer for the supplier. The selected tender will be the supplier of raw materials for the company. The raw materials come in the company will be handled directly by the warehouse. The warehouse to check the goods if the goods are fit to be done at the storage warehouse, where the goods are not in accordance returned to the supplier. Suppliers are given time to perform retransmission of goods.

Tender will be accepting submissions filed by the raw material procurement part PT. Sinkona Indonesia Lestari (SIL). Tender will memberika price quote to the PT. SIL. Tender with the lowest price into consideration the PT. SIL to be selected as a supplier of raw materials. Filing of raw materials every month. Therefore there will be no supplier companies fixed each month. Depending on the offer price given by potential suppliers of raw materials.

4. Monitoring Use of Raw Materials and Actual Production

At this stage, the process of monitoring the use of raw materials in the warehouse as well as monitoring the results of the products have been successfully realized. The indicator used is the amount of raw material consumption in the previous period. Inventory control of raw materials using techniques Safety stock, when the raw materials have run out, made reservations back to the supplier. Department responsible for monitoring the use of raw materials and the realization of the products is part of the planning and controlling.

5. Ordering Products Salt Kina

At this stage of sales transactions with a prospective buyer ordering products. Departments responsible in this stage is the marketing department sales unit. Unit sales can know directly monitoring quinine products available in the company.

6. Product Delivery Quinine Salts

The activities at this stage is the determination of the amount of cargo transportation and shipping products do the monitoring process so that the company knows exactly what products are already up to the buyer. Delivery using a third-party assistance in the delivery. Departments responsible in this stage is the marketing department sales unit. Unit sales only provide the amount of charge transport that can be used to make deliveries. The remaining third party as a distributor will deliver the products to the buyers of quinine.

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.

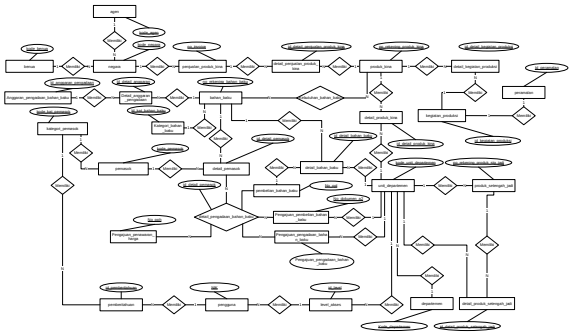


Figure 4. Entity relationship diagrams supply chain system quinine salt products in PT. Sinkona Indonesia Lestari (SIL)

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.

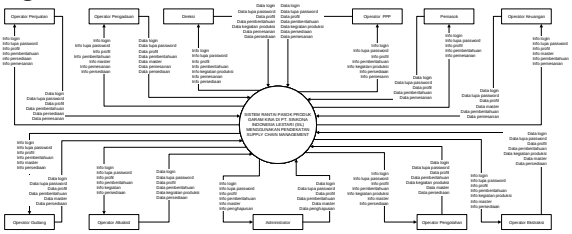


Figure 5. Diagram of the context of supply chain systems PT. Sinkona Indonesia Lestari (SIL)

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.

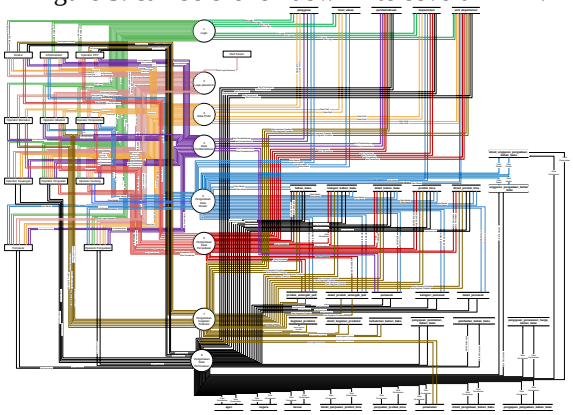


Figure 6. DFD Level 1 system supply chain PT. Sinkona Indonesia Lestari (SIL)

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.

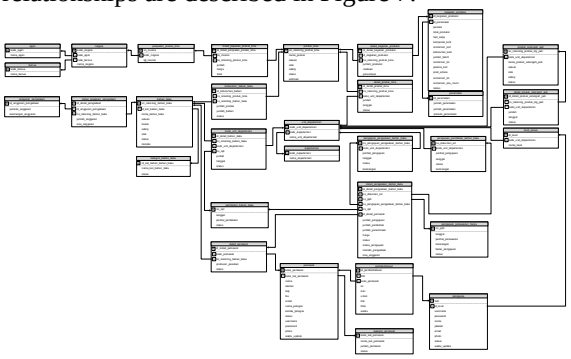


Figure 7. Table relationships PT supply chain system. Sinkona Indonesia Lestari (SIL)

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.

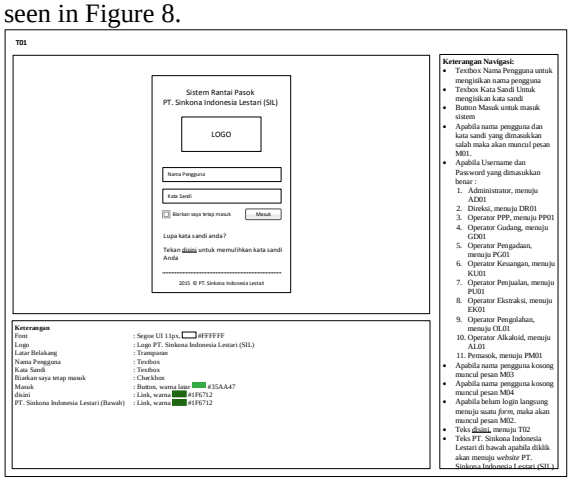


Figure 8. Interface Design T01 Login

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 supply chain systems quinine salt products in PT. Sinkona Indonesia Lestari (SIL) approach to supply chain management can be seen in Figure 9.

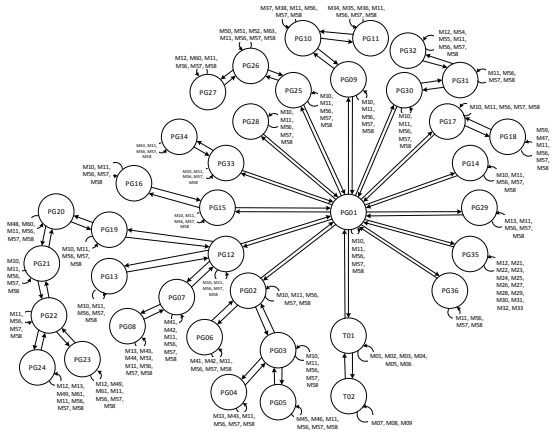


Figure 9. Designing User Semantic Network Operator Procurement

2.9 testing Systems

Testing of the system is the cornerstone that aims to find errors or shortcomings in the supply chain system under test. Testing intended to determine the supply chain system has met performance made in accordance with the design objectives.

Tests are used to test the new system is a black box testing methods. Black box testing focuses on testing the functional requirements of information systems.

Plan testing to be performed is to test the system built by Black Box and beta. Testing of the construction supply chain system in PT. Sinkona Indonesia Lestari (SIL) using test data based on data provided from some of the data that has been given.

1. Black Box Testing

Black box testing focuses on functional requirements of software that is built.

Testing is done by testing each process for possible mistakes.

Based on test results with sample test cases that have been done to give the conclusion that the process is correct. Filtering processing errors in the form of landing page view messages is fairly maximum. Functionally the system is able to produce the expected output.

2. Beta Testing

Beta testing is testing that is directly within the truth. Users undertake an assessment of the software using interviews. From the interviews, it can be deduced whether the software is built in accordance with the purpose or not.

Interviews conducted for the users of the system consisting of administrators, part warehouse, part of production planning and control, procurement, finance, sales, parts extraction, part alkaloids, parts processing and directors. This research was conducted at PT. Sinkona Indonesia Lestari (SIL) in order to determine the extent to which the system is built to be a solution and settlement of issues that have been described previously.

Based on beta testing, it can be concluded that:

1. The supply chain system to help administrators, part warehouse, part of production planning and control, procurement, finance, sales, parts extraction, part alkaloids, parts processing and directors in carrying out their respective jobs.
2. The supply chain system that is built quite easy to use.
3 The supply chain system has a user interface that is quite easy to understand.
4. The use of language in the system is quite easy to understand.

1. CLOSING

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

3.1 CONCLUSION

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

1. The supply chain system that is built to facilitate planning and production control to determine raw material requirements planning production which are used in determining the amount of production to avoid any lack of product.
2. The supply chain system that is built to facilitate procurement in the procurement process of raw materials.
3. The supply chain system that is built to facilitate coordination between the production sector with production and inventory control department as a bridge of coordination between the production sector.
4. The supply chain system that is built to facilitate sales in the booking confirmation quinine products to prospective buyers.
5. System built supply chain is easier for the directors and the financial section in the verification of raw material procurement.

3.2 Suggestion

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

1. The addition of user data management would be better if there is a special system such as the human resources information system that can manage employee data so that users can be selected directly from the system.

2. Penintegrasian the financial system has been running with the existing budget data management in the supply chain system that has been built.

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