SYSTEM DEVELOPMENT SUPPLY CHAIN USING THE APPROACH SUPPLY CHAIN MANAGEMENT AT PD. ANEKA BINTANG CEMERLANG

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ABSTRACT

PD. Aneka Bintang Cemerlang is a company located in Kelurahan Ciporang, Kuningan. The company is engaged in the production of food. The problems that often occur in the company is the difficulty in determining the amount of raw materials to be purchased to meet the production process because during this process the purchase of raw materials only use estimates by looking directly at the availability of raw materials in the warehouse. As a result of the improper estimation of raw materials can lead to a shortage of raw materials, so that if the shortage of raw materials will lead to shortages and even a void stock of products that impact on the late distribution to consumers. Based on existing problems in PD. Aneka Bintang Cemerlang, it needs a supply chain system using supply chain management approach. The purpose of building this system is to facilitate the warehouse in planning the purchase of raw materials in order to avoid shortage of raw material stock.

Supply chain strategy used is push supply chain, because it is based on suitability of supply chain that happened in company at this time that is using make-to-stock strategy. This supply chain system is built from upstream to downstream. Forecasting method of raw material requirement used is linear regression. Calculation of the prediction of availability of raw materials in the warehouse using safety stock method. Based on the results of the forecasting process, the company must purchase raw materials to produce Jelly Monas as much as 10802 boxes in August 2017 and safety stock of 275 boxes.

Based on the test results can be concluded that this system has assisted the warehouse in determining the planning needs of raw materials for the production process and avoid the void stock of raw materials and void stock of the product.

Keywords: supply chain management, push supply chain, make-to-stock, linear regression, safety stock.

1. INTRODUCTION

PD. Aneka Bintang Cemerlang is a company that produce various kinds of food and beverage especially for children. Starting from jelly food products named Jelly Monas, from the company's products are growing and continue to innovate until now there are 9 kinds of products divided into 3 types have been made by the company. This company uses make to stock strategy that is the production process before the order. Large production is done by the company to make enough stock to anticipate purchasing of product by buyer. Activities contained in the upstream section of the company is to order raw materials to suppliers, acceptance of raw materials from suppliers, and processing of raw materials into finished products. While the activities contained downstream that is receiving product orders, and make delivery to consumers who have ordered.

Based on the interview with Mr. Dudung as Warehouse Manager & Bookkeeper of PD. Aneka Bintang Cemerlang, stated that currently there are activities upstream that is ordering raw materials to suppliers. According to him, in determining the amount of raw materials to be ordered to suppliers are still using estimates by looking directly at the availability of raw materials in the warehouse. The ordering of raw materials will be made if the amount of raw materials in the warehouse has reached the minimum amount. The consequences of determining improper material estimates may result in a shortage of raw materials. In the applicable SOPs in the company, the purchase of raw materials is done once a month. The shortage of raw material for production process during this one month can be seen on raw material purchase data. Based on the recap of raw material purchases, the company purchased jelly, sodium, pottasium cytrate twice a month

due to the company's lack of raw materials to produce Jelly Monas.

Activities located downstream of PD. Aneka Bintang Cemerlang is accepting ordering of product from consumer, and then doing the delivery of product with freight car company available. According to Mr. Dudung, companies often have constraints in determining the supply of products that must be provided in order to meet the needs of consumers. The constraint is due to the vacancy of raw materials in the warehouse that can hamper the production process. If the product inventory is too little, it can cause a lack of product inventory so that it can not meet the needs of consumers or there is a delay in delivery to the consumer. Jelly Monas product data in July 2017, the number of finished products produced from the production process for a month as many as 7148 boxes, while the demand in the same month is 8858 boxes.

Supply Chain Management (SCM) is a complete chain management cycle from suppliers, operational activities in the company, continues to delivery to consumers, so that the above problems can be solved by using Supply Chain Management system. In inventory or inventory systems, regression methods are generally predicted variables such as sales or demand for a product, expressed as a dependent variable, this variable is influenced by the amount of independent variables (independent variable). The relationship between the independent variables and the variables sought is the function [1]. Meanwhile, to supervise the raw materials in order to avoid vacuum, then used the calculation of Safety Stock. Safety Stock is a minimum inventory that should always be there. [2]

Based on the description of the problem contained in PD. Aneka Bintang Cemerlang, it needs a development of supply chain system using supply chain management approach in PD. Aneka Bintang Cemerlang.

While the objectives to be achieved in this research are:

1. Assisting the Warehouse Section in determining the amount of raw materials to be ordered to suppliers to meet production needs.
2. Avoid the occurrence of product inventory void in order to avoid delays of distribution to consumers.

2. RESEARCH CONTENTS

2.1 Theoretical Basis

Theoretical foundation on the writing of this thesis will explain the theories associated with the application of Supply Chain System Using Supply Chain Management Approach in PD. Aneka Bintang Cemerlang.

2.1.1 Information System

A system is a network of interconnected procedures, gathered together to perform an activity or to accomplish a particular goal.

Information is data that is processed into a form that is more useful and more meaningful for those who receive it.

Information system is a system within an organization that brings daily transaction processing needs, support operations, managerial and strategic activities of an organization and provide certain outside parties with the necessary reports. [3]

2.1.2 Supply Chain Management

Supply Chain Management is a total approach system to deliver products to end consumers using information technology to coordinate all supply chain elements from supplier start to retailer, then reach the next level which is a competitive advantage not available in traditional logistics systems. [4]

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. [5]

Supply Chain Management (SCM) is an integrative method or approach to managing an integrated flow of products, information, and money involving parties from upstream to downstream consisting of suppliers, factories, distribution networks and logistics services. [6]

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. An important principle in SCM 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 the physical network, ie companies involved in supplying raw materials, producing goods, or sending it to end users. These companies usually include suppliers, manufacturers, distributors, retailers as well as support companies such as logistics services companies.

According to I Nyoman and Mahendrawati on supply chain there are usually 3 kinds of flow that must be managed. Three kinds of flow that must be managed on the supply chain are as follows: [6]

1. Flow of goods flowing from upstream to downstream.
2. The flow of money and the like that flows from downstream to upstream.
3. The flow of information flowing from upstream to downstream and vice versa.

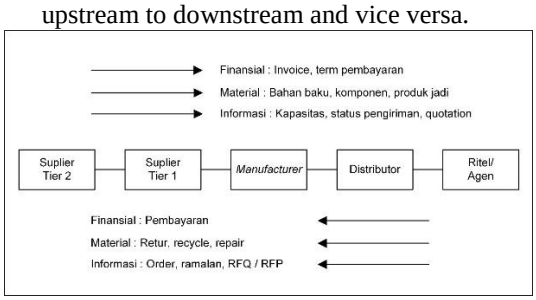


Figure 1. Flows of Supply Chain Management

2.1.3 Push and Pull Supply Chain

According to Chopra and Meindel "The pull process is based on customer orders, while the push process is initiated and done in anticipation of customer orders." [7]

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 always done 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 generates a large amount of output that will then enter into 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.

2.1.4 Inventory

Supply along the supply chain has major implications for a company's financial performance.

Inventory or inventory of goods as the main element of working capital is an asset that is always in a state of rotation and constantly changing. [8]

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. [9]

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

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

Information:

Z : Service Level

S_{dl} : Uncertainty of demand and Lead Time uncertainty

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

$$Sdl = \sqrt{(d^2 \times sl^2 + l \times sd^2)} \quad (2)$$

Information:

d : Average Usage

sl : Standard Lead Time Deviation

l : Lead Time

sd : Standard Deviation Usage Average

2.1.6 Linear Regression Method

Linear regression is a statistical analysis modeling the relationship of several variables according to the form of the relationship of an explicit linear equation. The linear equation of the explicit form is a linear equation which places a single variable on one of the equations. In the regression method the statistical analysis technique used describes the relationship between one response variable with one or more explanatory variables. The dependent varible (response variable) is a variable to be estimated in value, usually in the plot on the vertical axis (y-axis). The independent variable (independent variable or explanatory variable) is the variable that is assumed to affect the dependent variable, usually plot on the flat axis (x axis).

An important technical difference needs to be established among linear regression models with non-linear regression. All regression models are always written as equations that connect the dependent and independent variables. For example, Y = 1.5 + 2.5X is an equation that states Y (the independent variable)

as a function of X (independent variable) and involves two coefficients of 1.5 and 2.5. If this equation is written in the general form Y = a + bX where a and b are coefficients we can make two statements about the equation. First, Y is a linear function of X because if Y we plot against X will form a straight line and second, the equation is linear in its coefficients.

The reason for making the difference between linear and non-linear regression in terms of its coefficients is computational considerations. It is relatively easy to solve the coefficient of the regression equation if the coefficient of the equation is linear or non-linear is less important. Next stage, the forecaster must decide the number of variables encountered, which variable should be defined as the dependent variable and which are the independent variables as well as what functional form to choose. If the data is measured by time, the functional form is called period series regression, but if there is no time index then the functional form is called cross-sectional regression. Although cross-sectional regression is not explicitly related to time factor, but some important decisions affecting the future can be drawn from the review of the regression. [10]

Linear regression calculation can be seen in the equation below:

$$a = \frac{\sum Y(t)}{} - \frac{b.\sum t}{} \quad (3)$$

$$b = \frac{t.\sum^{n} tY(t) - \sum^{n} Y(t).\sum t}{t.\sum t^2 - (\sum t)^2} \quad (4)$$

Information:

t : Forecasting Period

Y(t) : Real sales data

n : Number of Periods

To determine the forecast in the next period used the formula

$$a + b.t \quad (5)$$

2.2 Problem Analysis

Problem Analysis is an assumption of the problem that will be described in data processing procedures in the Information System development program using the Supply Chain Management approach in PD. Aneka Bintang Cemerlang. Problem analysis of the current system is:

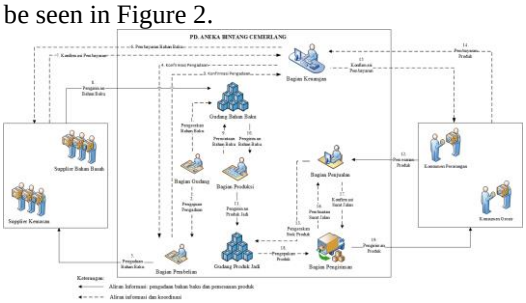
1. Warehouse Section difficulties in determining the amount of raw materials that must be in the message to the supplier to meet production needs. If the ordering of raw materials is not appropriate, it will cause a void of raw material stock or cause the accumulation of raw materials.
2. Delivery Section difficulties in scheduling the distribution due to the late production process caused by the empty supply of raw materials in the warehouse.

2.3 Supply Chain Management Analysis

Supply chain management analysis is used to apply supply chain management approach to the system to be built.

2.3.1 Supply Chain Management Model in PD. Aneka Bintang Cemerlang

Based on the SCM analysis described in the previous section, as for the supply chain model contained in PD. Aneka Bintang Cemerlang can be seen in Figure 2.



igure 2. SCM model in PD. Aneka Bintang Cemerlang

2.3.2 Analysis of Supply Chain Management in PD. Aneka Bintang Cemerlang

Supply chain analysis is done to describe supply chain management process to be built in PD. Aneka Bintang Cemerlang based on supply chain model in Figure 2. The supply chain analysis in PD. Aneka Bintang Cemerlang can be seen in Figure 3

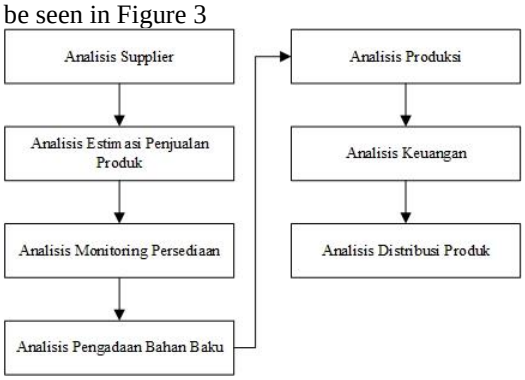


Figure 3. SCM Analysis PD. Aneka Bintang Cemerlang

1. Supplier Selection Analysis

Supplier selection is done by PD. Aneka Bintang Cemerlang by way of procurement of raw materials to suppliers based on the most frequent transactions made by the company to suppliers.

2. Product Sales Estimation Analysis

Forecasting demand for raw materials based on actual data of 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. Analysis of the forecasting stage that will be done is to predict the need for raw materials for the procurement process. Forecasting the needs of raw materials aims to meet the needs of production where when the demand for Jelly Monas products have been available, due to appropriate raw material planning to be used in the production process.

The forecasting technique used is a quantitative forecasting technique, due to the availability of sufficient past data. Forecasting method used is Linear Regression because obtained from the comparison of two other methods namely Single Moving Average method, and Double Exponential Smoothing. Based on the data pattern found that is Horizontal or Stationer pattern that shows the fluctuative regularly with the average value that does not change all the time.

3. Analysis of Inventory Monitoring of Products and Raw Materials

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 raw material that aims to avoid the occurrence of deficiencies or void raw materials using the method of Safety Stock.

4. Procurement of Raw Materials Analysis

In the analysis of raw material procurement, Purchasing Department made an order based on the production plan document created by the Warehouse. Booking against suppliers include Jelly Flour, Salt, Benzoat, Sodium Cyclamate, Potassium, Aspartame, Pasta, Cup, and Kardus. The procurement process is done in an agreed way of cooperation. When the raw materials that have been ordered come will be handled by the Warehouse. The Warehouse section checks that the raw material meets the standards. If the goods that come meet the standards, it will enter into the warehouse inventory of raw materials and if not meet the standards will be directly informed to the supplier.

5. Production Analysis

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

6. Financial Analysis

In this financial analysis is the process of checking the financial outgoing for the procurement of raw materials. This data is the last raw material purchase data for each supplier, if the payment status paid off then the company can make repurchase to the supplier.

7. Product Distribution Analysis

In the analysis of the delivery of this product is the determination of the quantity of freight transport products and conducted monitoring process so that the company knows with certainty the ordered product has reached the customer. The available transportation loads are large box cars and small box cars.

2.4 Database Analysis

Database analysis on information systems using supply chain management approach in PD. Aneka Bintang Cemerlan will be built using Entity Relationship Diagram (ERD). The diagram is illustrated in Figure 4.

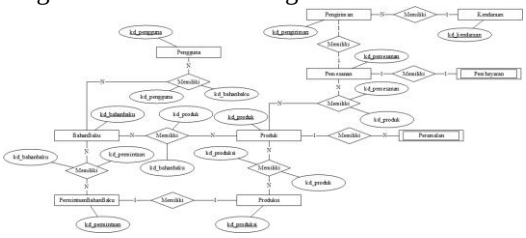


Figure 4. Entity relationship diagram

2.5 Context Diagram

Context diagram explains how data is used and transformed to process in the form of data flow into and out of information systems using supply chain management approach in PD. Aneka Bintang Cemerlang globally. Context diagram on the system can be seen in Figure 5.

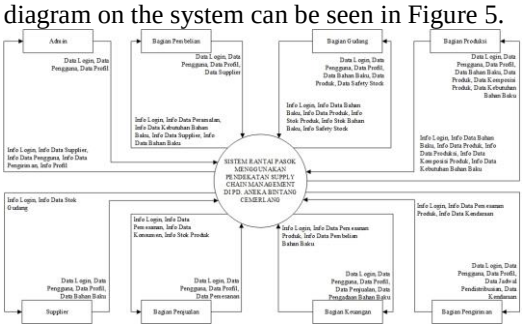


Figure 5. Context Diagram

2.6 Data Flow Diagram (DFD)

Data flow diagram shows how the data flow describes the processes that occur in the system until the process more detail. In the context diagram like Figure 5. can be decomposed into several DFD.

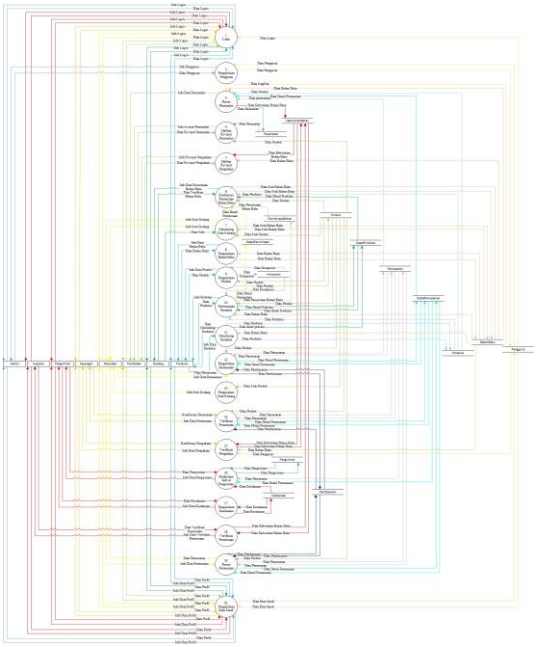


Figure 6. DFD Level 1

2.7 Relation Scheme

The relation scheme describes the relationship between data, the meaning of the data and its boundaries. The process of relations between attributes is a combination of attributes that have the same primary key, so that these attributes into a single unit that is linked by the key field. Relation scheme of Information Systems Using Supply Chain Management Approach in PD. Aneka Bintang Cemerlang. Table relation is described in Figure 7.

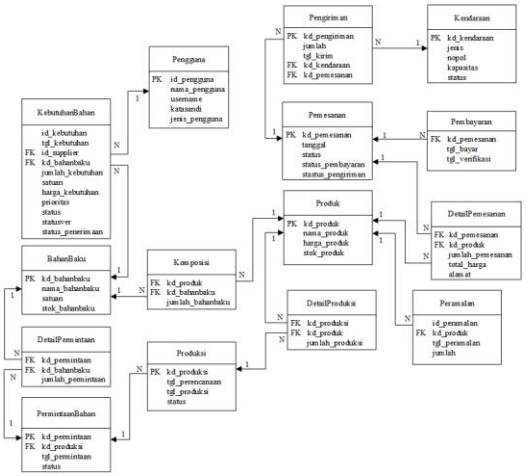


Figure 7 Relation Scheme

2.8 Interface Design

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

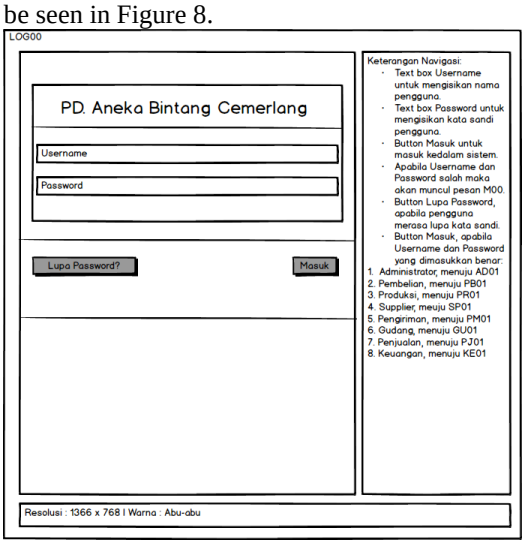


Figure 8. Interface Design Login

2.9 Semantic Network Design

Semantic network design is a representation of interface design that shows where each interface is connected. Semantic network planning in information systems using supply chain management approach can be seen in Figure 9.

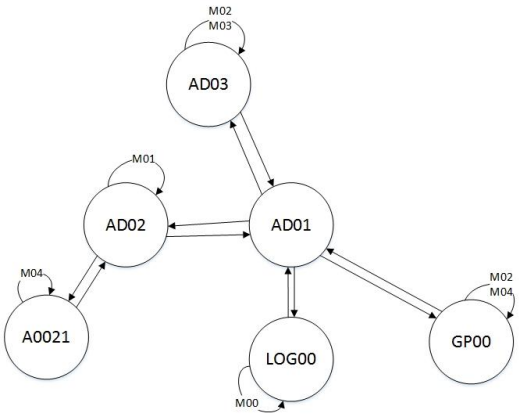


Figure 9. Designing Semantic Network Admin Users

2.10 Procedural Design

Procedural design transforms the structural elements of the program architecture into a procedural description of the software components. Here is an example of procedural login design that can be seen in Figure 10.

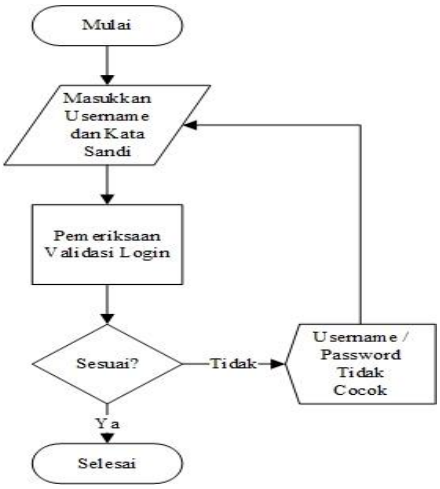


Figure 10. Procedural Logging Design

2.11 System Testing

Testing the system is the most important thing that aims to find errors or deficiencies in the supply chain system tested. Testing intends to know the supply chain 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 of supply chain system development in PD. Aneka Bintang Cemerlang uses test data based on given data from some data that has been given.

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.

Based on the test results with the test sample case that has been done to give the conclusion that the process is correct. 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 the system consisting of admin, parts of purchase, parts of delivery, sales, finance, warehouse and parts production. Based on beta testing, 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 easy and easy to understand.

3. CLOSING

In this section, describes 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 for software development previous.

3.1 Conclusions

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

1. Supply chain system in PD. Aneka Bintang Cemerlang using Supply Chain Management approach can facilitate Purchasing Section in determining the amount of raw material requirement to fulfill the production process.
2. Supply chain system in PD. Aneka Bintang Cemerlang using Supply Chain Management approach can facilitate Section Warehouse to monitor stock so that there is no shortage of product stock which will result in delays in delivery process to the consumer.

3.2 Suggestions

Supply chain system built with supply chain management approach in PD. Various Star Stars can still be developed further with higher system specifications and better performance.

Suggestions for information system developers using this supply chain management approach there are several suggestions that can be done, among others:

1. The process of adding new users will be better if there is a special system that can be directly accessed by potential users, without going through the admin.
2. Integration of management of incoming financial data or finance out of the company with the management of existing financial data on the supply chain system that has been built.
3. Management of user suppliers with the availability of goods in each supplier so that when ordering raw materials, the company immediately get the info the goods are available or not.

4. Need for better development and maintenance of the system that has been built, so the system can be used in accordance with the needs in the future.

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