INFORMATION SYSTEM DEVELOPMENT *SUPPLY CHAIN MANAGEMENT* AT SAMI RASA MILO

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ABSTRACT

Sami Rasa Milo is one of the companies engaged in trading, The products produced to date is Tempe Sweet, Tempe Asin, Tempe Spicy and Oncom

Sami Rasa Milo in the procurement of raw materials. Another problem that arises is that there is no schedule to send products to retail can be tried information, supply chain strategy used is supply chain, because the product whose product is already before there is order made to make the product in the warehouse or can be called make. For inventory Forecasting method used to estimate the number of product requests by method. Exponential Smoothing. Calculation of the prediction of raw materials and products in the warehouse uses the method of security. and
the calculation of the purchase of raw materials is not a stock using Just In Time. Schedule product d elivery method using Travelling Salesman Problem to
determine which retailers will send first seen from a distance of companies the nearest.

Based on the results of testing the blackbox, and interviews on each section in the company it can be concluded that the system has already helped the company in itsestimate the amount of raw material to be bought to the supplier and helps in determining the schedule for delivery to each retail.

Keywords: Supply Chain Management, Single Exponential Smoothing, Push Supply Chain, Safety Stock, Travelling Salesman Problem

1. PREFACE

Sami Rasa Milo is a company which engaged in snack trade. In determining the amount of raw materials that must be purchased by the procurement department to suppliers, there are still found difficulties, because the purchasement of raw materials to suppliers is still using intuition. By this condition causes conditon, if the raw material excess, the company will suffer losses due to raw materials in stock is quickly run to stale and if the shortage in warehouse happened then the production has to stopped.

1.1 Formulation of Problems

Based on the formulation of problem put forward, the problem happened at Sami Rasa Milo is how to develop an information system using *Supply Chain* Mangement at Sami Rasa Milo.

1.2 Purposes and Objectives

Purpose of this study is for develop an Information System using *Supply Chain* Management at Sami Rasa Milo. The Objecives to be achieved in this study are:

1. Ease head of procurement department to detrming the amount of purchases and inventories of raw materials contained in warehouse, in order to avoid raw materials out of stock, production process hampered, and late of disribution process.
2. Ease head of distribution department to make in time delivery product schedule to retail and the demand order from retail can be well- fulfilled.

1.3 Scope of Problems

Scope of problem this developement is to be more directed and achieve the objectives that have been determined are as follow :

1. Web-built system.
2. Data manged, are as follow :
    a. Products ordering data
    b. Materials data
    c. Material puchasements data
    d. Material Stocks data
    e. Transaction data
    f. Product deliveries data
    g. Supplier data
    h. Transportation data
3. Managed data is about product selling transaction from September 2016 untill January 2017.
4. The main type of product is sweet tempe, because the product is the most ordered.
5. The raw materials used in producing sweet tempe are startch, rice flour, seasoning for tempe as stocked material, salt, sugar, flavoring, MSG and eggs as unstocked material.
6. *Push-based supply chain* used as a strategy, because process of production in this company at this time influenced by the meterial supplies in warehouse and company determines first-processed products before there are orders which

made to make product stocks in warehouse, or in other words can be named with *make to stock*.

7. Doing control stock of product in order to avoid lack stock of product in warehoue. When Stock controling done and stocks are less then from safe limit, the company will order raw materials to fill the supply up in warehouse using *Safety Stock* method.
8. Using product data forecasting from last period to procure raw materials for next period by using *Sngle Exponential Smoothing* because the movement of data pattern indicate irregulary fluctuation dat pattern (unstable).
9. Determining route using TSP which technically always adding shotest range store or retail based on last retail that recently has been visited.
10. Using *Just In Time (JIT)* method for count non stocked raw materials purchasement cost.
11. Based on structural analysis, using *ERD (Entity Relationship Diagram)* as the method for this system development and using *DFD(Data Flow Diagram)* to describe its functional modeling.
12. Information System at Sami Rasa Milo will be build by using PHP as programming language and MySQL as Database Management System (DBMS).

1.4 Research Methodology

A brief description of research methodlogy is a process to study, comprehend, analyze, and solve based on an exist phenomenon and also a long systematic processes series and related siystematically. The method is descriptive, which mean a method examining status of a group of people, an object, a set of conditions, thought system, or a class of system by this time, in present. Wherease, there are some purpose of descriptive method, such as make a description, describe an idea systematicaly, factual and acurately about facts, kind of characters and connection of phenomenon which is being investigated.

Phase of steps which taken of this research described by plot as shown as figure 1 below.

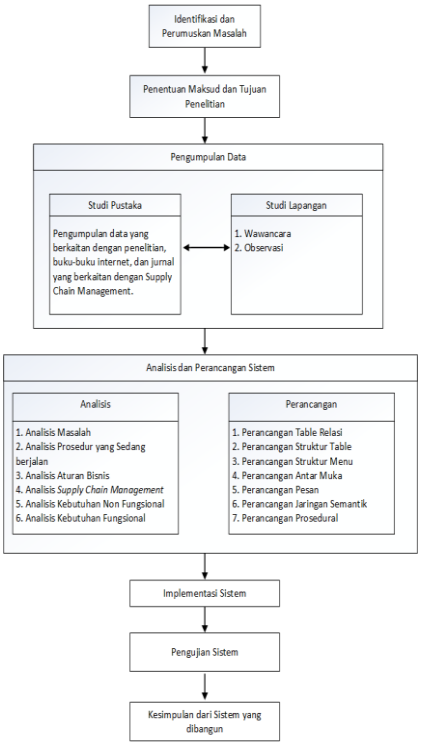


Figure 1 Phases of Research Methodology

The following are descriptions of research phases shown in figure 1 above :

1. Identification and Problems Formulation
   An early phase of research methodology, wherease, seeking input to the problem under observation. Researchers doing formulation againts encountered problems, how a process of production happened, handling of raw materials in the warehouse, handling and procurement of stocked-raw materials and non stocked-raw materials, make a relation between *supplier* whose deliver raw materials and retails whose order the product to the company.
2. The purpose and objective of the study
   In this phase is for the establishment of some purposes and ojectives which focusing to final result of problem, As final report. And the main objection from this study might be helpful and useful for Sami Rasa Milo Company.
3. Collecting Data
   Based on phases that has been done before, The phase of collecting data is doing by following steps below:
   a. Literature Review
      A phase for study, researches, and reviewing some literature from books, texts, and readings that relate to the research of topic.
   b. Field Study
      Observe the place of study at Sami Rasa Milo Company and collect some data that needed to solve the problem encountered by the company.

4. System Analysis
   The analysis system phase substains to a problem encountered by Sami Rasa Milo Company, analisis *Supply Chain Managament* yang terdapat di Sami Rasa Milo (by using forecasting analysis *Single Exponential Smoothing*, monitoring analysis towards stock of raw material and product available in warehouse), analysis of safe stock using *Safety Stock* dan for raw material purchasement non stock using *JIT (Just In Time)*, analisis distribution analysis using TSP (*Travelling Salesman Problem*) method, and functional analysis and non fungsional anlysis.
5. System Design and Coding
   The system design stage is the stage for designing software programming, including data structure, software architecture, interface representation (user interface) and coding procedure. System design made by structure analysis model with data model which made using ERD diagram (*Entity Relationshop Diagram)* and to describe process using DFD (*Data Flow Diagram)*. Tools used for database design is SQLyog and for interface design using Microsoft Visio 2016 application..
6. System Implementation
   After designing and coding process has completely done, next is implementation stage. At this process is about implementing design into *source code*. In process of development system, The system built using PHP (*HyperText Preprocessor*), a script that can be inserted into HTML (*Hyper Text Markup Language*), *MySQL* for the database and *Macromedia Dreamweaver 8* used for text editor tools.
7. System Testing
   System testing phase is taken to determine whether the system or software that has been created can solve problem that occured or not. This phase is taken also in order to reduce error and ensure output as expected. This phase taken as follow way below:
   a. *Black Box* test, this test performed to find out functional requirements of the software. This test performed by to find out the following errors as:
      1) Malfunction such as missing functions, etc.
      2) *Interface* error.
      3) Data structure error.
      4) Performance or process error.
   b. After user backend test implemented in company environtment, the test performed by interview with direct questions to system user at Sami Rasa Milo.
8. Built-System Conclusion

This stage is the final stage in which the researcher will withdraw the conclusion of development softwarethat contains about softwar development was successful andwhether the software created has overcome the problems that exist in the formulation of the problem.

2. CONTENT OF RESEARCH

2.1 Theoritical Basis

The cornerstone of the theory is a collection of definitions and concepts from a variety of sources. The cornerstone of this theory became a solid foundation is a foundation of research, then some theories that explained the theory of support is the Foundation for the construction of information system in supply chain management with the use of Sami Rasa Milo. The theory will be discussed regarding the theory of information system, BPMN (Business Process Modeling Notation), Supply Chain Management, control (monitoring), inventory (inventory), safety inventory (safety stock),forecasti ng (forecasting), purchase of raw materials is not in stock (Just In Time) and distribution (Traveling Salesman Problem).

2.1.1 Information System

Defines the system there are two groups of systems approach, i.e. a system that put more emphasis on procedures and relationships. The procedure is defined as a sequence of stages of instructions that describes what must be done, who is working on,when to do and how to do it. Based on the approach of an element is the system asparts of interlinked operating together to achieve some goal or intentions. [2]

2.1.2 BPMN (Business Process Modeling Notation)

BPMN stands for Business Process Modeling Notation, a new methodology was developed by Business Process Modeling Initiative as a new standard on business process modeling, and also as a design tool in complex systems such as e-Business system based message (message based).
The main objective of BPMN is a notation that provides easy to use and understandable by everyone involved in the business,including business analysts to model a business process, the developer of the technique that builds systems that carry out business, and many levels of management should be able to read and understand the process diagrams quickly so that it can help in decision-making. [3]

2.1.3 *Supply Chain Management*

.Supply Chain Management is the method or integrative approach to managing the flow of products, information, and integrated money involving parties ranging from up stream to downstream. Important principle in SCM is the transparency of information and collaboration among internal corporate functions as well as with the parties concerned with throughout the supply chain. Supply Chain is a physical network

i.e. the companies involved in the supply of raw materials, manufacture goods, or deliver it to the end user. Thesecompanies usually include suppliers, manufacturers, distributors, agents and supporting companies such as logistics service company [4]

2.1.4 Inventory

Based on coverage *supply chain management* that shows controlling process of raw material or finished goods, so then every company always requires availability of stock, to meet consumer demands.

Inventory constitute the number of materials, parts supplied and materials for production process, as well as finished goods or products provided to meet the demand from consumer or retail all the times. [5]

2.1.5 Forecasting Theory

Forecasting has many varies in time of forecasting horizon, factor determine the actual result, the pattern type and various other aspects. To deal with such widespread use, several techniques has been developed. One of them is *Smoothing* Method. [7]

2.1.5.1 Smoothing Method

Used where, one the weight of data different from previous data period and config *Exponential function* called *Exponential Smoothing*. [8]

By smoothing these historical values, kesalahan random fault averaged to generate "smooth" forecast which seems to work well under certain circumstances.

$$F_{t+1} = aX_t + (1 - a)\,F_t \qquad (2.1)$$

Keterangan :

F_{t+1} = Forecast result for t +1 period
a = Smoothing Constanta
X_t = Data actual demand for t period
F_t = Forecast in t period

In the *exponential smoothing* method, value of α can be determine freely , it means there is no definite way to obtain an optima α vlaue. Then, the selection of α value is taken by perform *trial* and *error*. Value of α lay between 0 and 1. [7]

2.1.5.2 Calculating Forecasting Error

Accuration or precision is a kriteria for test performance of forecasting method. To test performance of forecasting method, will be used require forecasting error size. The best forecast method is that gives the least error rate compared to other methods. There are many models for calculating forecasting errors.

Mean Squared Error (MSE) is average value from squared-error forecasting and detailed by equation 2.3 below.

$$MSE = \frac{\sum(|X_t - F_t|)^2}{n} \qquad (2.3)$$

Keterangan :

MSE = *Mean Square Error* value
X_t = Actual data in t period
F_t = Forecasting data from used model in t period
n = Many data forecasting result

2.1.6 Just In Time *(JIT)*

Just In Time (JIT) methode was developed first by Taiichi Ohno as an attempt by Toyota Motor Corporation to increase profits. The efforst have been made, Toyota Motor Corporation is to increase productivity and reduce cost and eliminate varios waste that does not give value to production process. (Mulyadi, 2001:26). [9]

2.1.6.1 Application of JUST IN TIME (JIT) Method

According to sofyan, step of implementing *just in time* method focused lies in *waste elimination* and *contionous process improvement*. [15]

Step of implement *just in time* method in stock; according Hustanto

1. Create new plan for raw materials
   The definition of formulation of new plan for raw material can be seen in formulation 2.15
   Rencana Kebutuhan Bahan Baku = *Rencana produksi perusahaan x kebutuhan bahan baku* (2.15)
2. Calculate the cost of purchasing raw material
   The definition of formulation of purchasing raw material can be seen in formulation 2.16

Cost purchasement raw material = *Cost raw material x raw material needed* (2.16)

3. Calculate and set order cost
   Formulation cost order in formualation 2.17
   Cost order (JIT) = *Company cost order x raw material purchasement needed by company* (2.17)
4. Calculate storage cost
   Storage cost consist of warehouse fee, electricity, and sanitation.
5. Total invetory cost
   Inventory cost = *Purcasement cost + order cost + storage cost* (2.18)

2.1.7 Route Determination and Delivery Schedule

Traveling Salesman Problem (TSP) described by Era Madona (2013) that TSP put forward in 1800 by Irish mathematician, William Rowan Hamilton and British mathematician, Thomas Penyngton. TSP known as a classic-type problem optimation and Non-Deterministik Pilynominal-time Complete (NPC), wherease, no optimal settlement unless try awhole possibility.

The Method of Traveling Salesman Problem is a method that used to reduce distribution costs by finding the shortest distance and route, fastest time and minimal cost (Utomo, et. Al.2011). As known as a classic-type and Non Deterministic Polynimial-time Complete(NPC), Traveling Salesman Problem , involves a traveling salesman who have to make a

visit all cities before returns to starting point. The problem of shortest route is about to found shortest route between start point (initial node) to final node in a road network. There are several method of completion of research in Travelling Salesman Problem (TSP) method are as follow: 1. Metode Nearest Neighbor 1. Metode Branch and Bound 3. Simulated Annealing

2.2 System Analysis

System analysis is a phase contains explanation from studied system which is focused on Sami Rasa Milo Supply Chain Management. In order to to identify and evaluate problems and demands needed to draft out possible solution.

2.2.1 Supply Chain Model At Sami Rasa Milo

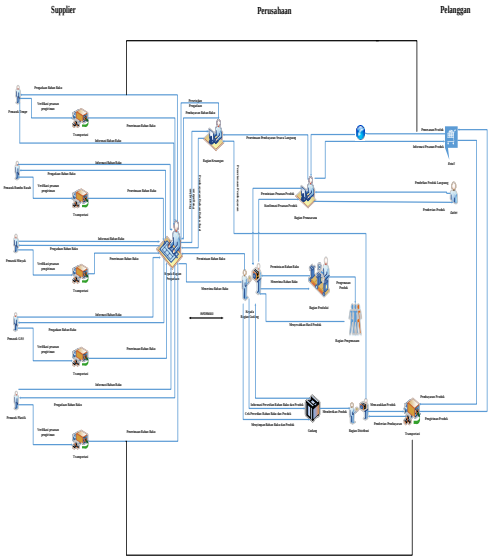


Figure 2 Supply Chain Management Model At Sami Rasa Milo

Informations contain on *Supply Chain* diagrams explained below:

Sami Rasa Milo has five categories suppliers, and these the are the categories:

a. Raw Tempe Supplier

In this category, there are three suppliers which are Ibu Ayu as first supplier, Mas Ujo as second supplier, and Bapak Isak as thrid supplier from pasar andir.

b. Raw Bamboo Supplier

In this category there are three suppliers from pasar kosambi which are Abah Yana as first supplier from, Ibu Yani as second supplier, and Bapak Odik as third supplier.

c. Supplier for coconut oil, flour, and etc.

In this category there are three suppliers from pasar kosambi which are CV Sunjana as first supplier, Toko Murni as second supplier, and Toko Bebeng as third supplier.

d. Gas supplier

In this category there are three suppliers from pasar kosambi which are Toko Ade as first supplier, Toko Abang as second supplier, and Bapak Peri as thrid supplier.

e. Bag and plastic supplier

In this category there are three suppliers from pasar kosambi which are Toko Romi as first supplier, Toko Makmur as second supplier, and Toko Botram as third supplier.

Sami Rasa Milo using *make-to-stock* strategy menagement which is determine primary products to make instead making a product based on demands from outlets and retails, therfore buying supplies in advance is needed to keep productions works without problems. Drafting suppliers order could be done by estimated how much supplies needed in the future.

2.2.2 Sami Rasa Milo *Supply Chain* Analysis

In order to map out the *supply chain* management process, an analysis is needed based on diagram on figure 3.5. Further explanation could be seen on figure 3.

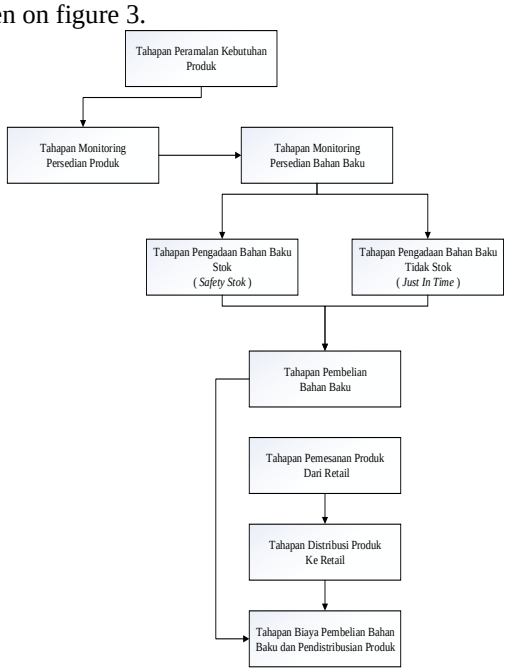


Figure 3 Sami Rasa Milo *Supply Chain* diagram

Make-to-stock strategy used by Sami Rasa Milo tends to affected by how much raw supplies stored and thus Sami Rasa Milo determined which raw supplies needed used in productions before a new demand published. In supply chain management information system applied phases as follows:

1. Product Demand Forecast

   Based on diagram on figure 3, subject involved on this phase is internal company comitee, including supply head officer. Supply head officer is responsible for forecasting raw supplies needed on future productions. Previous demands data are needed to make a supply forecasting. In this case, sweet tempe productions data from productions period September-January 2007 would be suited as sample data. Sweet tempe recapitulation data explained on table 1 below:

Table 1 Recapitulation of needs of sweet tempe product period September – Januari 2017

No	Periode	Kebutuhan
1	September	995 kg
2	Oktober	805 kg
3	November	875 kg
4	Desember	830 kg
5	Januari	895 kg

From data process phase resulted a demand patter graph. From this graph a methid could be determined to resolve future demands. Graph viewed on diagram figure 4.

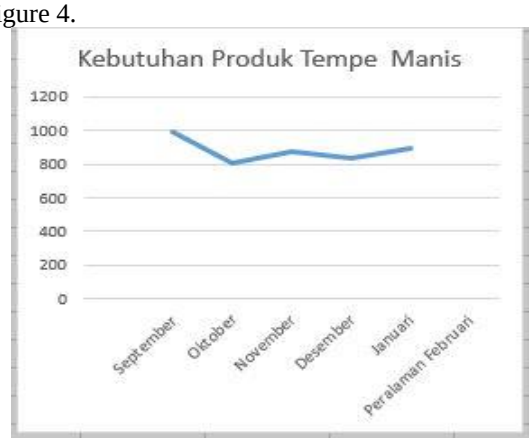


Figure 4 Graph Needs Sweet Tempe Product

2. Monitoring Product Store Analysis
   Subjects involved in this phase are company owner and store head officer. After product demand forecast has been determined by supply head officer, a safety product store could be determined. This process could preventing loss products supply using *Safety Stock* method. *Safety Stock* used to protect productions and demands on lead time. *Safety Stock* used when demand forecast on future demand has determined.
3. Raw Material Supply Phase
   Based on diagram figure 3, subjects involved on this phase are company owner and store head office. In this phase there are stocked raw materials and non stocked raw materials. Store section will determined which materials stocked and how much its safety stock. Store section also determined how much materials will be stocked in order to prevent less stocked materials. Failed to determined safety stock could resulted over cost on supply storing and to avoid over cost we could use *Just-In-Time.* Controlling stock supplies happens when stock on store less than its safety stock. When this happens, company will provide more stock supplies.
4. Raw Supply Stock
   Subject involved in this phase is purchasing head officer. Purchasing head officer will make a purchasing just when supply stock get near to its minimum safety stock.
5. Stock Purchasement Phase
   Subject Involved in this phase is purchasing head officer. Purchasing head officer will make a purchasing based on store supply demands with *Just In Time.*
6. Raw Supply Purchasement
   Subject involved in this phase is purchasing head officer which part of internal company comitee Sami Rasa Milo. Raw supply divided by raw stock and raw non stock. Supply purchasing made based on result on forecast demand analysis, safety stock and available stock on store. On this analysis, purchasing head officer make a pruchasement based on demand by store head office. Purchasing in raw supply consist of tempe, raw spices, oil, flour, kanji flour, and etc.
7. Retail Product Order
   Company can make purchasment of product order by phone or direct order in store marketing manager. Retail marketing manager will recieve order inquiry consist of value and amount.
8. Retail Distribution Product
   Subject involved in this phase is distribution head officer. Distribution head officer will make an distribution date appointment. Appointment arranged by calculating time, distance and vehicle maximum capacity as transport.
9. Raw Supplies Cost and Product Distribution
   Subject involved in this phase is marketing manager. Marketing manager will recieve an invoice based on purchasement made by purchasing head officer. Marketing manager will provide funds for purchasing. Subject involved on distribution process is also marketing manager. This is because marketing manager will provide new invoice to distribution officer.

2.3 Coding Analysis

Code is a data presentation with classificated data in order to maintain data input smoothly. Usually each code contain different meaning. In every process contains data, a code symbol is used. In this case there several codes used. Those are:

1. Product Code
   There are five digits code format used. Further explanation on diagram figure 5.

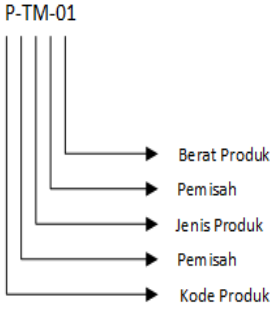


Figure 5 Product Code Format

2. Product Code

There are five digits code format used. Further explanation on diagram figure 6.

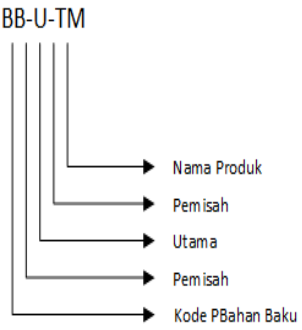


Figure 6 Raw Material Code Format

2.4 Database Analysis

In this system information, database analysis will be executed by ERD (*Entity Relationship Diagram*). ERD is a data model which using several note for presenting data in entity context and its relation based on data description. Further explanation on diagram figure 7

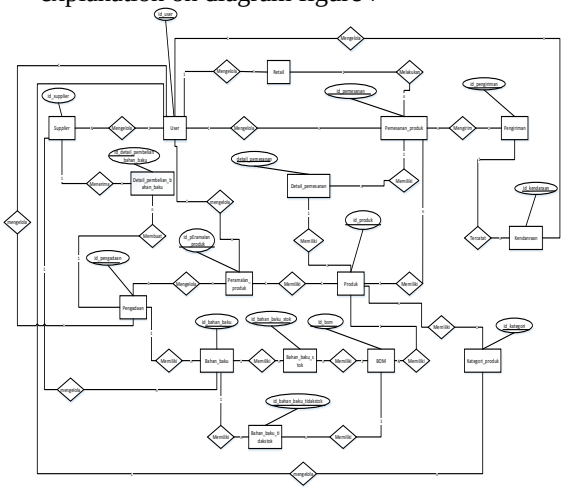


Figure 7 ERD Sistem Informasi Supply Chain Management di Sami Rasa Milo

2.5 Context Diagram

Context diagram is a model used to presenting how data is used and changed for process or showing in/out data stream globally. Further explanation in diagram figure 8.

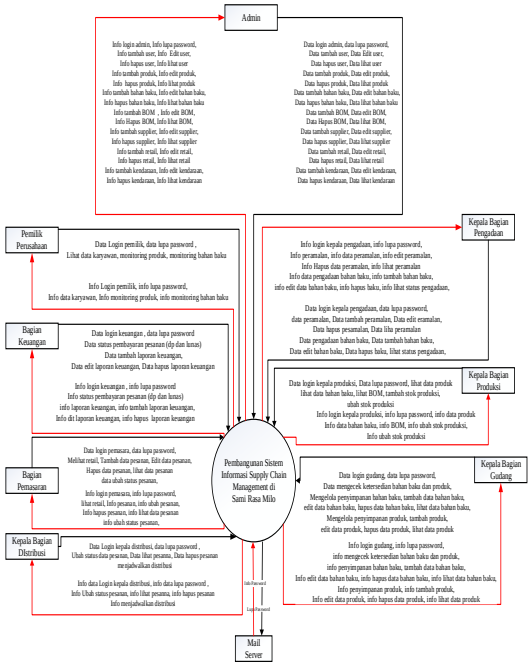


Figure 8 Context Diagram

2.6 DFD Level 1 SCM at Sami Rasa Milo

DFD level 1 *supply chain* management at Sami Rasa Milo presented on diagram figure 9 shows how many process this system could handle.

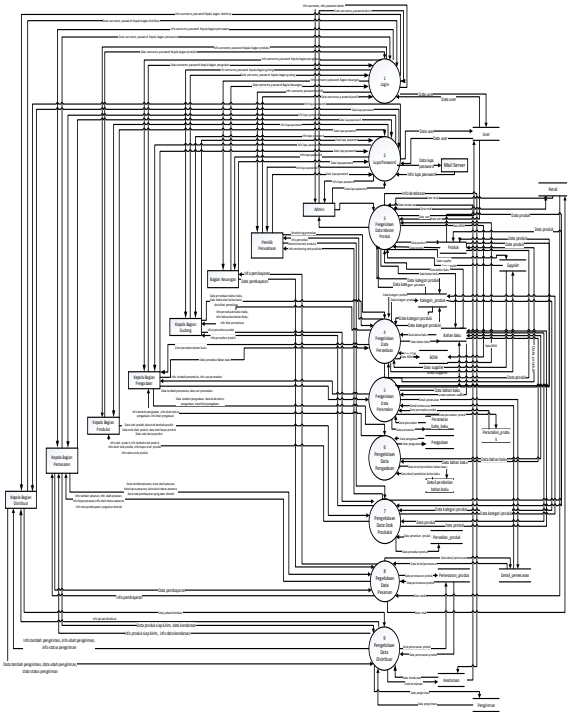


Figure 9 DFD Level 1 SCM at Sami Rasa Milo

2.7 Login Page Interface Design

Login interface designed for admin, owner, finance, marketing, warehouse head department, production head department, procurement head department, and distribution head department, further explanation on diagram figure 10.

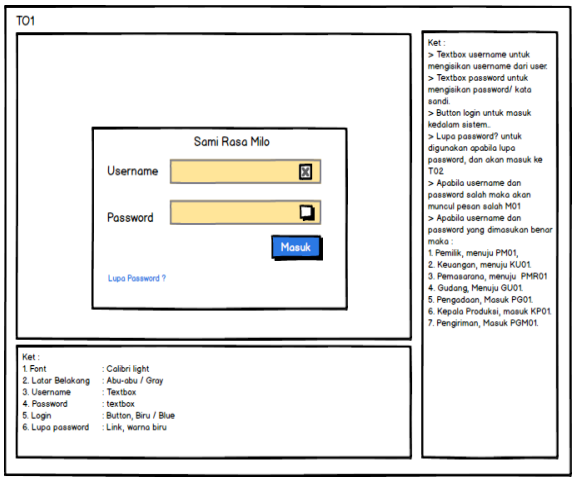


Figure 10 Login Interface Design

2.8 Forgot Password Interface Design

Forget password interface designed for those who forgot their password. Explanation on figure 11.

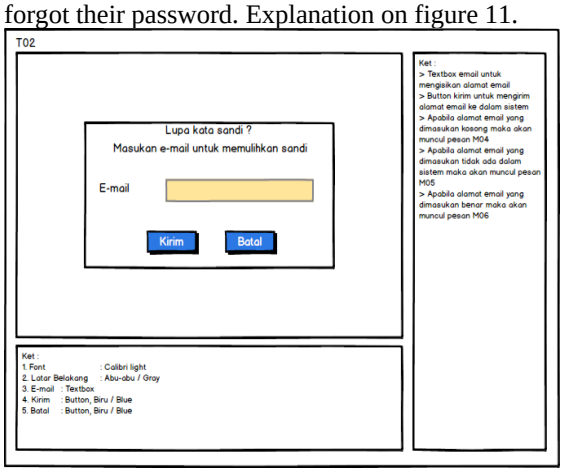


Figure 11 Forgot Password Interface Design

2.9 Admin Page Interface Design

Admin page interface design used by employee which had grant access level as administrator whose in charge managing master data. Admin page interface design detail on figure 12.

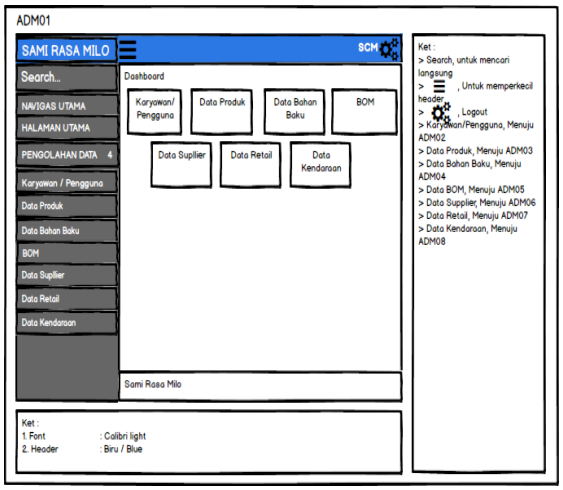


Figure 12 Admin Page Interface Design

2.10 Login Page Interface Implementation

Login page interface design implementation used by admin, owner, warehouse head department, production head department, procurement head department, and distribution head department meanwhile accessing into Sami Rasa Milo Supply Chain Management, detailed on figure 13 below.



Figure 13 Login Interface Implementation

2.11 Forgot Password Interface Design

Forgot password interface design implementation describe a condition of forgot password, if cannot access into system because forgot password can be directly head to forgot password interface implementation which can be seen on figure 14.

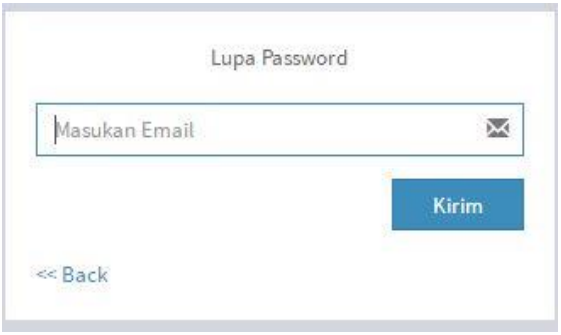


Figure 14 Forgot Password Interface Implementation

2.12 Admin Page Interface Implementation

Admin page interface implementation used for employee which has grant access level as administrator whose in charge managing master data, user data. Admin page interface implementation can be seen on figure 15.

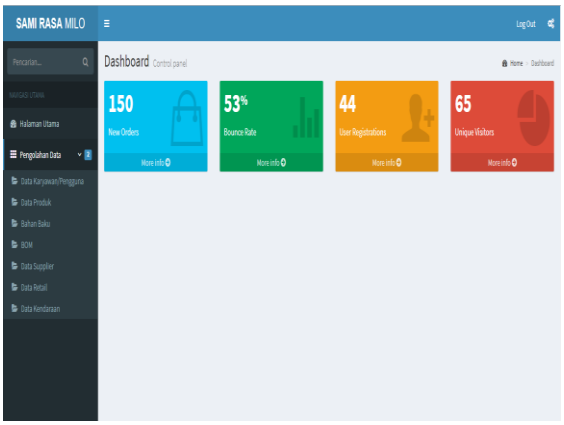


Figure 15 Admin Page Interface Implementation

2.13 Beta-tester Conclusion

Based on interview result conducted on each part consisting of admin, owner, finance department, marketing department, procurement head department, warehouse head, production head department and head distribution department said that supply chain management information system built about raw material purhcasement calculation quite correct and in accordance with the required. For disribution the product itself helpful in making the product delivery schedule to retail. As for display system that has been built is quite interesting and as an advice for next developing system, should be added more additional features.

3 CLOSING

This chapter will explain about conclusion contain results after doing analysis, design, and implementation from software developing that has been developed. as well as advices will provide important records and possible improvements that needed to make a developer software.

3.1 Conclusions

Based on *black box test* result, *user acceptance test result*, and *user backend acceptance test result*, after system applied, that can be concluded:

1. *Supply chain managemet* Information System at Sami Rasa Milo can help procurement head department in determining the amount of raw material purchasement for product activities to continue and work properly.
2. *Supply chain managemet* Information System at Sami Rasa Milo can help distribution head department in delivery process by scheduling delivery product to retail.

3.2 Advices

There are several suggestions for development of this information system :

1. In order to manage relationship with retails, Research expected that can be combined between *supply chain management* with *customer relationship management* information system dalam mengelola hubungan dengan para Retail.
2. Online order by every retails or outlets can be added as new fiture in this information system.

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