INFORMATION SYSTEM DEVELOPMENT OF PRODUCT DISTRIBUTION USING SUPPLY CHAIN MANAGEMENT CASE STUDY CV. MUTIARA TIMUR

Amma Bernard1, Irfan Maliki2

[1.2]Information Engineering - University Computer Indonesia
Jl. Dipatiukur No. 112-116, Jl. Dago No. 160-162, Bandung, West Java 40132
E-mail: benbernard34@gmail.com1, irfan.maliki@email.unikom.ac.id2

ABSTRACT

CV.Mutiara Timur is an industrial company that specializes in traditional food in packaging. CV.Mutiara Timur founded by Mr. JAMAL MUHAMMAD FARAY Ubaidi in 2008. The type of products manufactured by CV.Mutiara Timur is rendang in packaging, yellow rice and rice liwet in packaging in the packaging. The flagship product of the CV. Pearl of the Orient is rendang in packaging. CV.Mutiara Timur has a series of working system from upstream to downstream, from the upper reaches of CV.Mutiara Timur ordering process raw materials to suppliers, receiving raw materials have been ordered from suppliers, to process raw materials into products. While the downstream part of CV.Mutiara Timur do the admission process product orders from customers to CV.Mutiara Timur and the process of distributing the product from CV. Mutiara Timur of the to the customer. CV. Mutiara Timur implement systems make to stock.

In the process of product distribution rendang saving matrix method and the nearest neighbor is to determine the route and which ones will be sent in advance by calculating the cost of distribution, distance and capacity of the vehicle.

Based on test results, it can be concluded that this system has helped the head of the warehouse in planning the procurement of products to suppliers and facilitates the head of marketing in determining the current delivery schedule distribution process.

Keywords :*Supply Chain Management, nearest neighbor, Saving matrix*, Make to stock, Information Systems.

1. PRELIMINARY

1.1 Background

In the industrialized world, especially concerning the distribution of the product is still often an imbalance between the existing inventory with demand. This is because the consumer demands on product quality, price, delivery accuracy and availability of products on the market is getting higher and erratic. With this imbalance causes frequent scarcity or accumulation of stock in a company.

It is also that which is experienced by CV. Pearl of the Orient that is one of the companies engaged in the traditional food in the packaging industry in Cianjur, with the type of products manufactured include rendang in packs of 250 grams, and rice liwet and yellow rice in packs of 225 grams.

CV.Mutiara Timur has a series of working system from upstream to downstream, from the upper reaches of CV.Mutiara Timur ordering process raw materials to suppliers, receiving raw materials have been ordered from suppliers, to process raw materials into products. The process of ordering raw materials to suppliers conducted by telephone, to process payments to suppliers from CV.Mutiara Timur done when the goods have been received and made in cash or transfer in accordance with the policies of each supplier. While the downstream part of CV.Mutiara Timur do the admission process product orders from customers to the CV.Mutiara Timur and distribution process of products from CV.Mutiara Timur to customers. Process payments from customers to CV. Mutiara Timur is done in cash to customers who have long and as lightening made due payments for new customers. Supply Chain Management Strategies used in the CV. Mutiara Timur is a push supply chain, because in accordance with the reservation process occurring product that is make to stock, which means production is carried out prior to the booking of customers.

Based on the results of interviews with the father General as head of the warehouse and procurement, he explained that the process of ordering raw materials made the head of the warehouse and procurement to the supplier at the time this is done every 1 month for the same amount, it results in a problem when demand reservations from customers is high, resulting in raw material shortage in the barn which affects the inhibition of the production process and product orders from customers can not be met. Likewise, when a reservation request from the customer declines, they can lead to accumulation of raw materials in the warehouse. Advantages and disadvantages of raw materials in the warehouse affect the ordering process back to the supplier that is the difficulty in determining the amount to be ordered so that customer demand is met.

Based on the interview with Mr. Anshory Ahmad as head of marketing, he explained that the products ordered by customers in units of fruit, each region has a minimum limit order customers are different, these provisions have been established by the CV.Mutiara Timur. Ordering products from customers reach the marketing, the customer can place an order by telephone or in person to the office, all of the customer ordering process will be recorded in a memorandum and order book. The process of product distribution to customers is done every working day in accordance with the number of requests from customers. The company has one single box car unit, two units of the pickup box, and 4 units of motor tub to distribute the product to the customer. The vehicles have different capacities.

Based on the description of the problems that exist in the CV. Pearl of the Orient, it takes a Product Distribution Information System using the approach of Supply Chain Management (SCM) to manage information from upstream to downstream.

1.2 Purpose and objectives

The purpose of this research is to develop an information system product distribution in CV.Mutiara Timur approach Supply Chain Management (SCM).

The objectives of the development of this system are:

1. Assist the head of the procurement process to determine and plan the amount of raw materials to be ordered to the supplier for the production process can be run well so the demand of the customer product orders are fulfilled.
2. Head of marketing help in determining the type of vehicle and route distribution to customers so they can get to quickly, accurately and effectively.

2. RESEARCH

2.1 Supply Chain Management

Supply Chain Management is a method or an integrative approach to managing the flow of products, information, and money in an integrated manner involving parties from upstream to downstream. An important principle in the supply chain management is transparency of information and collaboration between the company's internal functions as well as with the parties in the company along the supply chain. In supply chain management activities include product development and component material control, planning of products, inventory control, production, and distribution / transport [1].

2.1.1 Component Supply Chain Management

Supply Chain Management has three main components that support the passage of a business process as follows [1]:

1. *Upstream Supply Chain*

Overall activity manufacturing company with distribution or distributor relationship may be extended to the multiple levels. The main activity in the Upstream Supply Chain is the procurement of goods.

2. *Internal Supply Chain*

Internal Supply Chain This is the process of shipping goods to the warehouse. The main activity in the Internal Supply Chain is a production management, manufacturing, and inventory control.

3. *Downstream Supply Chain*

Activity in the downstream supply chain involves the delivery process to the end consumer. The main activity in the downstream supply chain is the distribution of goods, warehousing, transportation.

2.1.2 Types of Supply Chain Management

The following are the types of common supply chain management [2]:

1. *Integrated make-to-stock*

*supply chain*These models may explore customer demand for a time, so that the production process can procure supplies efficiently. This can be overcome by using an integrated information system. By using the integrated information system, the company can find out information about customer demand in a timely manner, so that the information can be used to develop and modify the planning and production schedules.

2. *continuous Replesnishment*

*supply chain*This model, made the procurement of supplies on an ongoing basis. This type is suitable for enterprise environments stable customer demand patterns.

3. *Build-to-order*

supply chain this model, the assembly of the finished goods is done when the customer has made a request or order to such articles.

4. *Channel Assembly*

*Channel assembly*a modification of the model of build-to-order. Supply chain model, the assembly process of goods occurs when the movement of goods in the distribution line.

2.2 Transportation and Distribution Management

One very important operational decisions in the management of distribution is the determination of the schedule and route delivery from a single location to multiple locations of interest. This decision is very important for the delivery of products from the site to a variety of stores spread across a city. Saving matrix method is a method to minimize the distance or time or costs taking into account the constraints that exist. The steps that must be done in saving matrix method is as follows [2]:

a. Identifying the distance matrix

In this step we need the distance between warehouses to each store and distance antartoko. To simplify the problem, we use these so nearby

main routes. Then, after knowing the route we can use the following formula to calculate a route antarpelanggan. And the formula is as follows:

$$J(1,2) = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

If the route is already known, better known route of wear on the wearing theoretical.

b. Identifying matrix saving (saving matrix)

Aiming to save in the delivery process to be more efficient and not waste time to waste in the delivery process.

The formula is as follows:

$$S(x,y) = J(G,x) + J(G,y) - J(x,y)$$

With S (x, y) is the distance saving (saving) obtained by combining the x and y into one.

c. Allocate to store vehicles or routes

After knowing the distance saving on a route that will target the third stage that is allocated to the vehicle or the store, it aims to minimize the number of vehicles in transit.

To minimize shipping distances do with the delivery goal sequencing closest distance. There are several methods to sequence the closest distance that is [2]:

1. Nearest method Insert
   The method uses the principle of selecting the insert nearest store when inserted into an existing route generate additional minimum distance. At first only have a trip from warehouse to warehouse with a distance of zero. Next will be the distance that occurs when adding the distance of each store [2].
2. Nearest methods Neighboard
   Nearest neighbor method is also quite simple, principle, we are always adding stores that were located closest to the store that we visited last [2]. Nearest Neighboard algorithm is easy to implement and easy to execute, but it does not guarantee optimal solutions produced. Nearest neighbor method procedure is as follows [3]:
   a. Beginning with the starting point (depot), proceed to step b.
   b. Looking for the nearest point from the starting point, and then connect that point, go to step c.
   c. B Repeat procedure until all Visited the point, and go to step d.
   d. Connecting the first point to the last to complete the tour, the procedure is complete.

2.3 Analysis of Supply Chain Management

Analysis of Supply Chain Management is used to apply the approach to Supply Chain Management in the supply chain system to be built. On Supply Chain Management, there are three kinds of flows are maintained. The first is the flow of goods, the second is the flow of money, and the third is the flow of information.

The flow of goods that occur among the flow of raw materials delivered from the supplier to the CV.Mutiara Timur and products shipped from CV.Mutiara Timur to customers. The flow of money that occurs among the flow of money for the payment of the purchase of raw materials and payment for ordering products. The information flow that occur include raw material procurement information to suppliers, raw material delivery information from the supplier to the CV.Mutiara Timur, ordering information from the customer to the CV.Mutiara Timur, information on the product delivery to customers CV.Mutiara Timur.

The Model of Supply Chain Management in CV.Mutiara Timur can be seen in Figure 3.7.

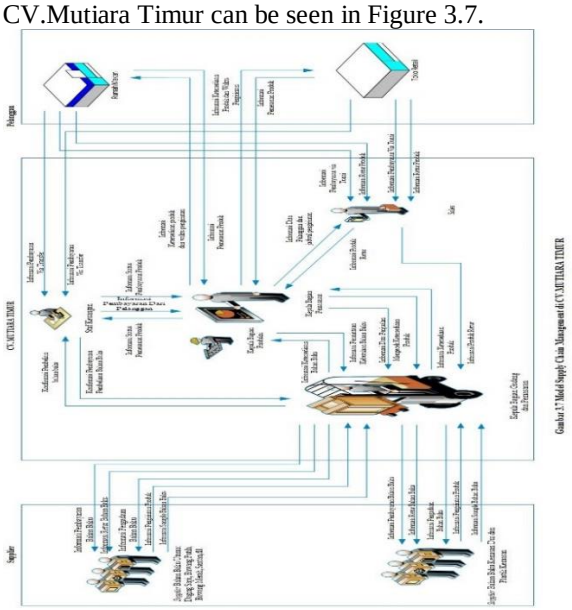


Figure 2.1 Supply Chain Management Model

Based on the figure 2.1 several actors involved in the activities of Supply Chain Management are as follows:

1. Supplier
   East CV.Mutiara has two categories of suppliers of raw materials, among others:
   a. Supplier of key raw materials consisting of beef, milk, sugar, salt, cayenne pepper, onion, herbs and spices.
   b. suppliers of raw materials such as carton packaging and plastic packaging.
2. East CV.Mutiara
   East CV.Mutiara is a manufacturer of rendang, the following is a process that is in the company's business, among others: the procurement process, production process, the process of ordering, and marketing processes.
3. Customer
   East CV.Mutiara distribute the product to the customer after the customer placing an order. Customers who have teamed up with East CV.Mutiara include retail stores and restaurants.

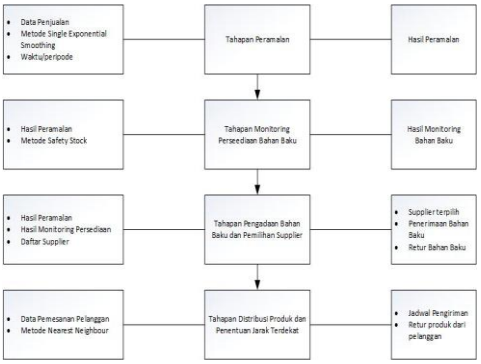


Figure 2.2 Stages of Supply Chain Management

1. stage Forecasting
   The Company manages sales data of products sold to customers and the company foresees for the next period of product procurement product sales data from the previous period which requires product sales data, forecasting methods with Single Exponential Smoothing and time / period specified.
2. Stage monitoring inventories of raw materials
   After doing the forecasting stage, the company conducts monitoring in warehouse inventories of raw materials and products to determine how safe limits which should be available in warehouse using methods Safety Stock.
3. Stage Raw Material Procurement
   After the process of forecasting and monitoring Secondly raw materials companies conduct the procurement process to suppliers. Companies see in advance the number of safe limits in warehouse inventories of raw materials and the procurement of raw materials to the amount of procurement of the prediction later reduced the remaining stock of available raw materials warehouse.
4. Phase delivery to the customer.
   The Company determines the type of vehicle and the officer who sent it and adjust the booking of customers who will be sent to the closest distance, to the end customer receives the product in accordance with the reservation.

2.5 Analysis of Product Distribution Rendang

There are activities in the supply chain of distribution / delivery. Scope of activities such as monitoring the status of delivery, delivery scheduling with the closest distance determination and capacity of the vehicle taking into account the cost of distribution to be used in pendistribuisan. Monitoring the distribution is done so that these products reach the end user at the right time and place and know the delivery status. Delivery schedules to customers is done on a schedule that has been agreed between CV.MUTIARA EAST with customers, while for the determination of distance, route, time or cost of using the Saving Matrix. The vehicles used to distribute the product, namely cars Pick Up Box, Engkel Box and Motor Bak. Car Capacity Pick Up Box for distribution of products up to 4000 pcs, 8000 pcs Engkel box, and for a maximum of 800 pcs Motor Bak. Here is the explanation unutuk vehicle data distribution process of products in Table 2.1.

No.	Plat	Vehicle Type	Dimension	Max Weight	Capacity
1.	F 5324 ZN	Pick Up Box	200x130x130	1000 kg	4000 pcs
2.	F 1337 WT	Pick Up Box	200x130x130	1000 kg	4000 pcs
3.	F 1239 ZN	Engkel Box	300x160x160	2000 kg	8000 pcs
4.	F 3741 XY	Motor Bak	180x123x30	400 kg	800 pcs
5.	F 7190 XW	Motor Bak	180x123x30	400 kg	800 pcs
6.	F 7758 WA	Motor Bak	180x123x30	400 kg	800 pcs
7.	F 6367 YZ	Motor Bak	180x123x30	400 kg	800 pcs

Table 2.1 Data Vehicle

In the distribution process also requires an analysis of the ordering process of the customer to determine customer data so that it can determine the distribution schedule. Below is the product ordering data rendang,

No Faktur	Customer	Customer Address	Quantity	Price	Total
MT/00000321/AG/1216	Priangan Sari Oleh-Oleh	Jln. Raya Puncak-Cianjur No.53, Bogor	400	Rp 32,000	Rp 12,800,000
MT/00000322/AG/1216	Toko Sakinah	Jln. Sitti Jenab, Cianjur	600	Rp 32,000	Rp 19,200,000
MT/00000323/AG/1216	Talubi Pusat Oleh-Oleh	Jln. Raya Puncak-Cianjur No.11 Bogor	400	Rp 32,000	Rp 12,800,000
MT/00000324/AG/1216	Asinan Gedung Dalam	Jln. Siliwangi No.27C,Sukasari,Bogor	200	Rp 32,000	Rp 6,400,000
MT/00000325/AG/1216	Sentra Oleh-Oleh Kita	Jln. Pulo Empang, Paledang, Bogor Tengah	500	Rp 32,000	Rp 16,000,000
MT/00000326/AG/1216	Lapis Bogor Sangkuriang	Ruko Bantar Kemang No.20i,Bogor	300	Rp 32,000	Rp 9,600,000

Table 2.2 Data Product Order Rendang

Packing used to package the product to be delivered to the customer is cardboard. 1 carton contains 20 pcs rendang, can be seen in Table 2.3.

Customer Name	Product Quantity	Packing
Priangan Sari Oleh-Oleh	400	20 kardus
Toko Sakinah	600	30 kardus
Talubi Pusat Oleh-Oleh	400	20 kardus
Asinan Gedung Dalam	200	10 kardus
Sentra Oleh-Oleh Kita	500	25 kardus
Lapis Bogor Sangkuriang	300	15 kardus
Toko Oleh-Oleh Hanada	200	10 kardus
Oleh-Oleh Cita Rasa	400	20 kardus

Table 2.3 Determination of Packing

After looking at the data ordering and menentuan type of packing, it is necessary to do an analysis of the initial route data and the distance between the warehouse-customer-warehouse. These companies amounted to 8 s beginning. The total distance is generated at the beginning of this service is as much km. The distance at the beginning of the route is too long and should be cut in order to avoid long delivery times and high transport costs. Average data along with product delivery routes beginning distance data on each route can be seen in Table 2.4.

No.	Customer	Distance (Km)
1.	Gudang – Priangan - Gudang	38
2.	Gudang - Toko Sakinah - Gudang	34
3.	Gudang – Talubi – Gudang	36
4.	Gudang - Asinan Gedung Dalam – Gudang	88
5.	Gudang - Sentra Oleh2 Kita – Gudang	86
6.	Gudang – Lapis Bogor Sangkuriang – Gudang	86
7.	Gudang – Oleh2 Hanada – Gudang	104
8.	Gudang – Oleh2 Cita Rasa - Gudang	96
Distance Total		568

Table 2.4 Initial Distance These

After looking at the data elements of the cost, it is necessary to do the analysis of the initial transport costs are calculated based on the initial company. The calculations use data elements of the cost. The results of the initial calculation of transport costs on each route can be explained in Table 2.5.

On the table is served the transportation costs of products in each route. The total cost incurred by the company in the process of distribution based on the initial route is Rp. 3,813,500. It turned out that these costs can be regarded as too large. Therefore, the cost of transportation on the route beginning should be minimized.

No.	Customer	Distance (Km)	Maintainance	BBM, Retribution	Total
1.	Gudang – Priangan - Gudang	38	Rp 300,000	315,000	Rp 928,000
2.	Gudang - Toko Sakinah - Gudang	34		313,000	
3.	Gudang – Talubi – Gudang	36	Rp 300,000	313,500	Rp 946,500
4.	Gudang - Asinan Gedung Dalam – Gudang	88		333,000	
5.	Gudang - Sentra Oleh2 Kita – Gudang	86	Rp 300,000	332,000	Rp 964,000
6.	Gudang – Lapis Bogor Sangkuriang – Gudang	86		332,000	
7.	Gudang – Oleh2 Hanada – Gudang	104	Rp 300,000	339,000	Rp 975,000
8.	Gudang – Oleh2 Cita Rasa - Gudang	96		336,000	
Total		568	Rp 3,813,500		

Table 2.5 Initial Costs These

Furthermore, identifying the matrix saving (saving matrix). Saving matrix obtained by combining two or more customer service simultaneously. The merger was adjusted by the amount of customer demand. Total incorporation of customer demand may not exceed the capacity of the vehicle.

The allocation of customers into the same route is based on the calculation matrix savings:

$S (x, y) = J (g, x) + J (G, y) - J (x, y)$

Where S (x, y) is the distance savings are obtained by combining the x and y into one. By using the formula above, the matrix distance can be calculated savings for all the shops and the result can be seen in Table 2.6.

	Gdg	Priangan Sari Oleh2	Toko Sakinah	Talubi Pusat Oleh2	Asinan Gedung Dalam	Sentra oleh2 Kita	Lapis Bogor	Oleh-Oleh Hanada	Oleh2 Cita Rasa
Priangan	Rute 1	0,0							
Toko Sakinah	Rute 2	31	0,0						
Talubi Oleh2	Rute 3	3	43	0,0					
Asinan Gedung Dalam	Rute 4	14	60	19	0,0				
Sentra Oleh2	Rute 5	13	60	18	4	0,0			
Lapis Bogor	Rute 6	13	60	17	1	4	0,0		
Oleh2 Hanada	Rute 7	23	70	27	20	15	19	0,0	
Oleh2 Cita Rasa	Rute 8	8	65	22	15	10	14	5	0,0
Order		400	600	400	200	500	300	200	400

Table 2.6 Savings Distance

Judging from the total demand of customers in the amount of 3000 pcs which means it could do the distribution process uses only one vehicle pickup box alone, it can be concluded that there is only one route that formed then being sorted from the largest value to the smallest savings. Distribution data allocation request can be seen in Table 2.7.

No.	Rute	Customer	Quantity Total	Vehicle Capacity	Status
1.	Rute 1	Cita Rasa, Hanada, Asinan, Sentra, Lapis Bogor, Priangan, Talubi, Sakinah	3000 Pcs	4000 Pcs	OK

Table 2.7 Data Distribution Allocation Request

The next step is to determine the sequence of visits to minimize the distance distribution. The method used to determine the order of the visit is the Nearest Neighbor method. The principle of this method is always adding stores that were located closest to the store last visited. The following data Nearest Neighbor method of analysis results are presented in Table 2.8.

No.	Rute	Delivery Schedule	Distance Total (Km)	BBM, Retribution	Maintainance	Cost Total
1.	Rute 1	Gudang – Sakinah – Talubi Oleh2 – Lapis Bogor – Cita Rasa – Hanada – Sentra Oleh2 – Asinan Bogor – Priangan Oleh2 - Gudang	148	Rp 355,300	Rp 300,000	Rp 655,300

Table 2.8 Results of Nearest Neighbor

2.6 System planning

Designing systems to be built using Entity Relationship Diagram (ERD). ERD is one way to process the database so that the data can be known relationships between data, ERD is used to solve the data redundancy or the like. Can be described in Figure 2.3.

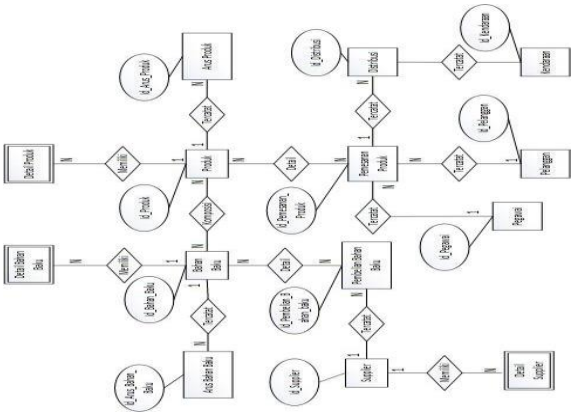


Figure 2.3 Entity Relationship Diagram

2.7 Data Flow Diagram

Data Flow Diagrams (DFD) is a medium that is used to describe the flow of data flowing on an information system. DFD system consists of several processes in data flow diagrams, can be seen in Figure 2.4. following.

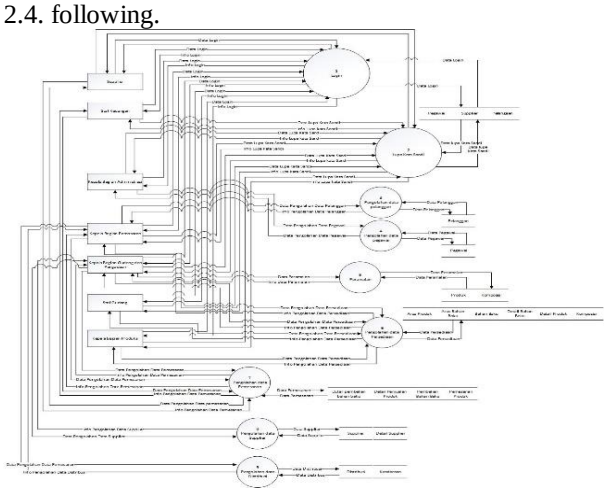
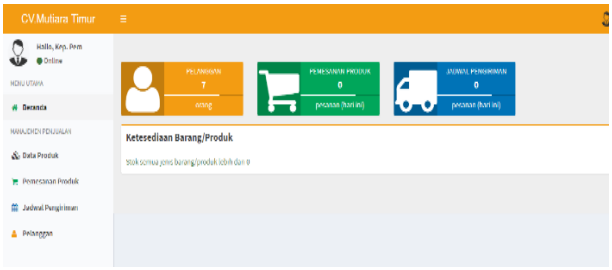


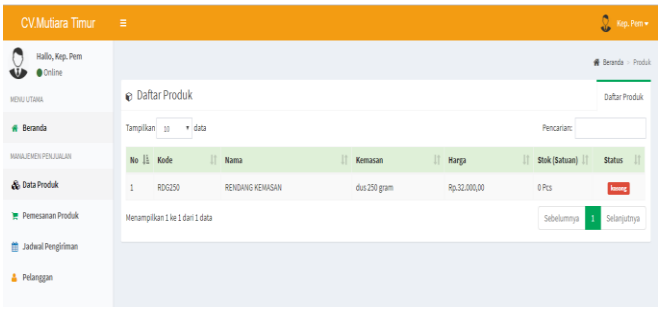
Figure 2.4 Data Flow Diagram Level 1

2.8 Implementation Interface

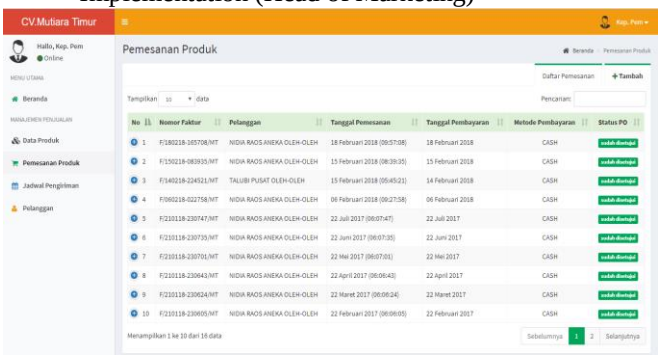
1. Home Interface Implementation (Head of Marketing)



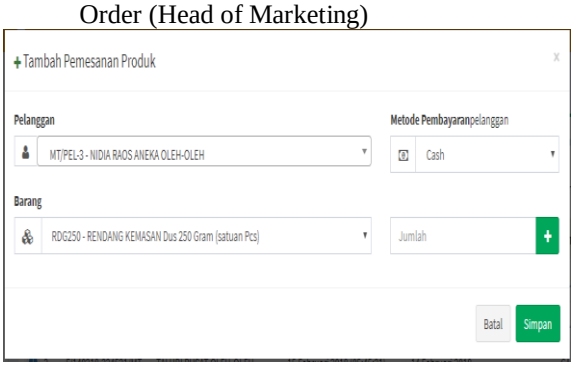
2. Implementation of Data Interface Products (Head of Marketing)



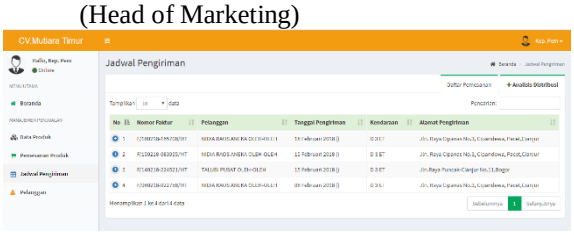
3. Product Ordering Data Interface Implementation (Head of Marketing)



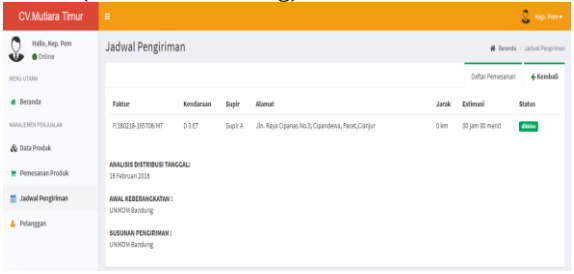
4. Implementation Interface Add Data Product Order (Head of Marketing)



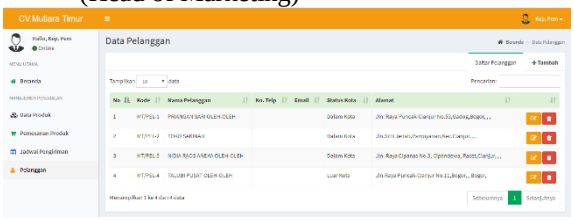
5. Interface Implementation Delivery Schedule (Head of Marketing)



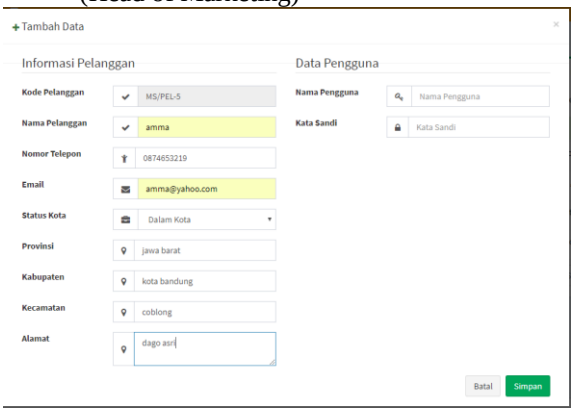
6. Interface Implementation Delivery Status (Head of Marketing)



7. Implementation of Customer Data Interface (Head of Marketing)



8. Implementation Interface Add Customer Data (Head of Marketing)



2.9 Testing System

1. Black Box Testing Scenarios (Alpha)

Tampilan	Butir Uji	Jenis Pengujian
Login	Login Pengguna	*Black Box*
Lupa Kata Sandi	Lupa Kata Sandi Pengguna	*Black Box*
Pengolahan Data Pegawai	Penambahan data pegawai	*Black Box*
	Pengubahan data pegawai	
	Penghapusan data pegawai	
	Pencarian data pegawai	
Pengolahan data pelanggan	Penambahan data pelanggan	*Black Box*
	Pengubahan data pelanggan	
	Penghapusan data pelanggan	
	Pencarian data pelanggan	
Pengolahan Data Supplier	Penambahan data supplier	*Black Box*
	Pengubahan data supplier	
	Penghapusan data supplier	
	Pencarian data supplier	
Pengolahan Data Kendaraan	Penambahan data kendaraan	*Black Box*
	Pengubahan data kendaraan	
	Penghapusan data kendaraan	
	Pencarian data kendaraan	
Pengolahan Data Produk	Penambahan data produk	*Black Box*
	Pengubahan data produk	
	Penghapusan data produk	
	Pencarian data produk	
	Komposisi produk	

Based on test results with sample test cases that have been done, it could be concluded that the processes on the system is running properly. Filtering processing errors in the form of user interface is quite optimal. Functional systems can already produce the expected output.

2. Interview (Beta)

Beta testing is done by an interview to the head of the warehouse and procurement as well as the head of marketing. Based on the results of these interviews be concluded that the supply chain management information system built on the calculation of purchasing raw materials is quite correct and in accordance with what is needed. For the distribution of the product itself is quite helpful in determining the route, the vehicle and the scheduled delivery of products to customers. As for the display system is built is quite interesting and easy to understand.

3. COVER

3.1 Conclusion

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

1. These information systems are built to facilitate the head of the warehouse and procurement in determining the amount of raw materials to be ordered to the supplier.
2. These information systems are built to facilitate the scheduling of the head of marketing in the distribution of products with the determination of the vehicle and route distribution thus reduce distribution costs to a minimum.

3.2 advice

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

1. Providing access a more robust network to support the system work smoothly.
2. Adding new services to customers, so that customers can order the product through the system.

BIBLIOGRAPHY

[1] Sutabri, Tata. 2014. The Management Information System (Revised Edition). Yogyakarta: Andi.

[2] Pujawan, I Nyoman 2010. Supply Chain Management Second Edition. Surabaya: To Widya

[3] S. Choper and P. Meindel. 2007. Supply Chain Management: Strategy, Planning, and Operations, New Jersey: Prentice Hall Pearsin.

[4] S. Makridakis, SC Wheelwright and VE McGree.1999.Metode and Forecasting Applications Volume 1, Jakarta: Binarupa Script.

[5] Taufik, Muh. 2010. Monitoring and Evaluasi.Jakarta: PNPM-KDP.

[6] Nur Bahagia, senator. 2006. Inventory System. Bandung: ITB Publishers

[7] Lerbin R, Aritonga R. 2009. Business Forecasting Second Edition. Jakarta: Ghalia Indonesia

[8] Alma, Buchari. 2005. Marketing Management and Marketing Services. Bandung: PT. Alfabeta

[9] AS Rosa, Saladin, M. 2014. Software Engineering. Bandung:

Informatics.

[10] Fatansyah. 2012. Database. Bandung: Informatics.