DEVELOPMENT OF INFORMATION SYSTEMS WITH SUPPLY CHAIN MANAGEMENT APPROACH AT CV KIARA MOTOR

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ABSTRACT

CV Kiara Motor is one of the companies engaged in sparepart and scooter accessories manufacturing located in Jl. Arief Rahman Hakim no.40a Cianjur. CV Kiara Motor often have difficulty in procuring raw materials from suppliers due to uncertainty of product demand from consumers.Another problem that CV Kiara Motor faces is that there is no determined schedule of routes to deliver products to consumers, Supply chain strategy that CV Kiara Motor use is push supply chain, because it determines the production of the product first before the order, to make the product stock in the warehouse this is also called make to stock. Forecasting method used to estimate the number of product demand is Fuzzy Tsukamoto's method. Product Delivery schedule is using TSP (Traveling Salesman Problem) method to determine which consumers will be sent first by the closest distance to the company .Based on the results of blackbox testing, and interviews with every divison of the Company,it can be concluded that this system has helped the company in estimating the amount of raw materials to be purchased to suppliers and helps in determining delivery schedules to each consumer.
Keywords : Supply Chain Management, Fuzzy Tsukamoto, Push Supply Chain, Travelling Salesman Problem,.

1. INTRODUCTION

CV Kiara Motor is one of the companies engaged in the manufacture and sale of sperpart and scooter accessories or commonly known as Vespa. Activities contained in the procurement section carried out by CV Kiara Motor with suppliers are procuring raw materials to suppliers, receiving raw materials from suppliers, producing raw materials into products. Also produced products are various body protectors, front bumpers, rear bumpers and baskets. For raw materials used in iron and plate. Based on the results of interviews with Mr. Ujang as a part of the supervisor in procuring raw materials to suppliers, it is often difficult due to uncertainty in product demand from consumers . And based on the results of the interview with Mr. Adhitya as part of the delivery it is known that the problems in shipping occur when ordering products is high but there is no delivery schedule resulting in delays in the delivery process to consumers and for the selection of routes that are not determined resulting in uncertainty over which customer will first sent.

1.1 Formulation of the problem

Based on the results of the formulation of the problem above the problems that occur at CV Kiara Motor are as follows:

1. The procurement department has difficulty in determining the amount of raw material requirements that will be ordered to the supplier.
2. The shipping department has difficulty in determining the delivery schedule and which route first will be sent to the consumer.

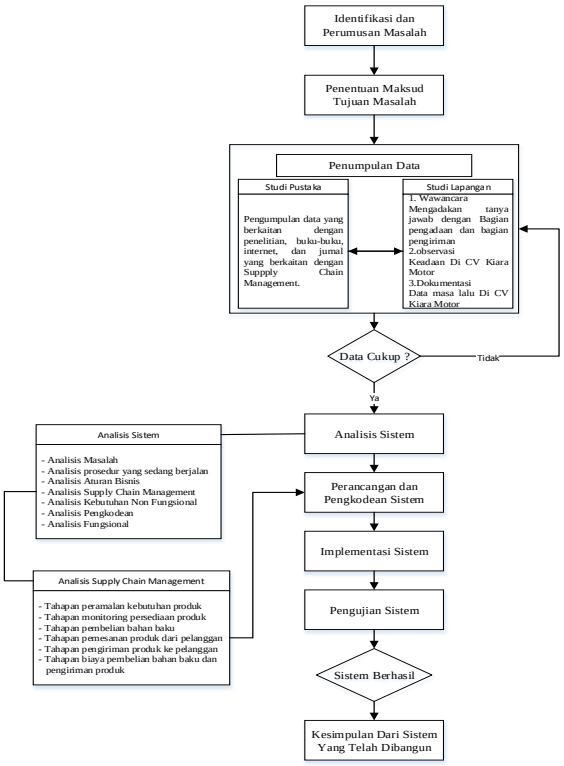
1.2 Purpose and objectives

The purpose and objective of this research is to build an information system with the SCM approach at CV Kiara Motor. The purpose of building a supply chain management information system at CV Kiara Motor :

1. Facilitate the procurement part in determining the amount of raw material to be ordered to suppliers to meet the product requirements ordered by consumers.
2. Facilitate the delivery part in scheduling product shipments to each consumer and determining which route will first be sent to the consumer.

1.1 Metodologi Penelitian

Research methodology is one of the stages process that can be used to solve a logical problem, the following steps will be taken during the research at CV Kiara Motor which can be seen in Picture 1.



Picture 1 Stages of Research Methodology at CV Kiara Motor

2. CONTENTS OF RESEARCH

2.1 Basis Theory

The theoretical foundation is a collection of definitions and concepts from various sources. for the development of information systems with a supply chain management approach at CV Kiara Motor. The theory will be discussed about the theory of information systems, Supply Chain Management, inventory, methods (fuzzy Tsukamoto), and about salesman transportation problems (Tsp).

2.1.1 Information Systems

The information system is divided into two groups of system approaches, namely the first system that emphasizes the procedure and the second is the element approach. The result of the element approach is this system as interrelated parts that operate together to achieve several objectives or intentions to be carried out. [1]

2.1.2 Supply Chain Management

Supply Chain Management According to "I Nyoman Pujawan and Mahendrawati" Supply Chain Management is an integrative method or approach to managing the flow of products, information and money in an integrated manner involving parties ranging from procurement to delivery consisting of suppliers, companies, distribution networks and logistic services [2].

2.1.3 Inventory

According to the coverage area in supply chain management which shows that there is a process of controlling the supply of raw materials or products, each company always needs inventory, the lack of inventory the company will be faced with a risk that is not good for the company which results in shortages or excess material both the standard and the product that is produced will not be able to meet the needs of the consumers. [3]

2.1.4 Fuzzy Tsukamoto

The Fuzzy Tsukamoto method is a method that is aimed at rules in the form of if-then which must be represented by fuzzy sets with membership functions. As a result, the output of the inference from each rule is explicitly given (crisp) based on α-predicate (fire strength) and the end result is obtained using the average weight. To obtain the crisp value is obtained by changing the input value which is a fuzzy set obtained from the composition of fuzzy rules into numbers in the fuzzy set domain [4].

2.1.5 Traveling Salesman Problem with Metode Nearest Neighbour

TSP problems that can be solved in several ways, depending on the system of problems faced. The methods or ways that can be done to solve various kinds of TSP problems are, Nearest Neighbor, Insertion, and Sweep. The current study uses the Nearest Neighbor method to solve the problem of the distribution of "PT cola cola". The Nearest Neighbor method is the principle method that always adds a store that is the closest to the last visited store, at the beginning departs from the warehouse so that it is looking for a store that is the closest distance from the warehouse until returning to the warehouse.

S + T + T + T + S = Result of Distance (1)

Information:

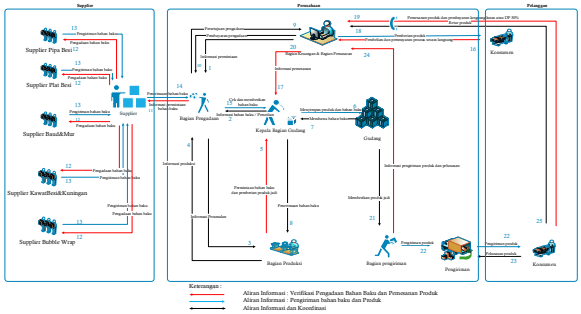
S: The beginning of the journey from the company.

Q: Customer goals or returns.

S: End of the destination back to the company.

2.1.6 SCM model at CV Kiara Motor

The SCM model covers the company's flows from the procurement of raw materials to shipping to consumers or customers, which can be seen in Picture 2.

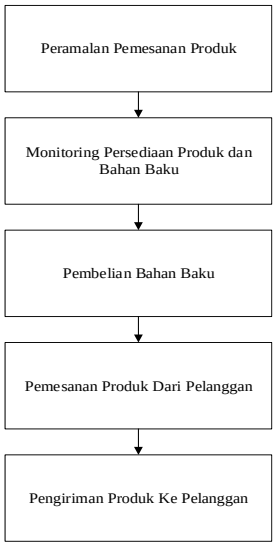


Picture 2 Supply Chain Management model at CV Kiara Motor

CV Kiara Motor has 5 categories of suppliers of raw materials for its production activities, the 5 categories of suppliers include:
a. Supplier of Raw Materials for Iron Pipes.
b. Supplier of Raw Material Iron Plate.
c. Supplier of Raw Material Baud, Mur.
d. Supplier of Raw Materials for Iron Wire and Brass Wire.
e. Bublle Wrap Supplier.

CV Kiara Motor uses the make-to-stock strategy, make to stock is a rule in which this rule covers production first before an order is made by consumers or customers, therefore it is necessary to plan the purchase of raw materials so that the production process continues without lack of raw materials. Production determination can be done by Fuzzy Tsukamoto method.

2.1.7 Stages Suplly Chain Management at CV Kiara Motor



Picture 3 Stages Supply Chain at CV Kiara Motor

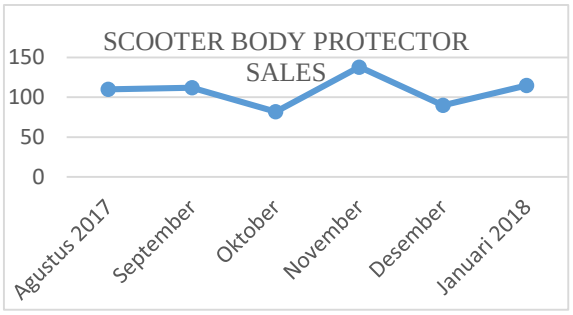
Based on figure 3 above is: Supply Chain Management information system that will be built in CV Kiara Motor consists of several stages.
1. Forecasting product orders.
2. Monitoring the supply of products and raw materials.
3. Purchase of raw materials.
4. Order products from consumers or customers.
5. Delivery of products to consumers or customers.

The following are product sales data at CV Kiara Motor in August 2017-January 2018 which can be seen in table 1.

Tabel 1 Recapitulation of Product Sales At CV Kiara Motor

Month	Body Protektor	Front Bumper	Front Basket	List Body
August 2017	110	55	54	63
September	112	62	56	68
October	82	52	60	54
November	138	73	69	78
December	90	51	66	72
January 2018	115	81	70	88
Total Sales	647	374	375	423
TOTAL	1.819			

According to the data described above, it is produced that the body protector product is the product with the most sales. The following sales chart for body protector can be seen in Pitcure 4.



Pitcure 4 Body Protector Sales Chart

Based on the data pattern from the sales data of body protection products, the forecasting method that will be used in forecasting the production of the number of products in CV Kiara Motor is Fuzzy Tsukamoto's method because the pattern of movement shows a fluctuating pattern irregularly. Forecasting is done after knowing the pattern form of the data presented on the CV. Kiara Motor has the following stages:

Prepare request data from the previous period to be processed as input data. The data used as samples is ordering data from August 2017 to January 2018 for a minimum of 6 months.
1. Calculating demand, supply and production data.
2. Calculating the number of requests in February 2018 with the Tsukamoto fuzzy method.
3. Determine R1, R2, R3, R4 for the Tsukamoto fuzzy rule.

Calculating forecasting for protective body products in February 2018, minimum data entered is 6 months before the month to be predicted. The data needed is data request, inventory data and production data for Body protection products in August 2017-January 2017. The following are data on request recapitulation, supply and production of body protector products.

Table 2 Recapitulation of supply and production requests. Body protector products in August 2017 - January 2018

Mount	Demand	Stock	production
August	110	-10	100
September	112	-22	100
October	82	26	130
November	138	8	120
December	90	38	120
January	115	23	100

If the February 2018 Request Amount = 56 and supply = 23 what is the total production in February 2018?

• The February 2018 request value is taken from the most demand - the smallest request.
• Supply is taken from the last remaining stock.

Aturan Fuzzy Tsukamoto

- R1 = IF THE DEMAND DOWN AND INVENTION IS MUCH THERE IS LESS PRODUCTION
- R2 = IF DEMAND DOWN AND LITTLE LICENSE THEN LESS PRODUCTION
- R3 = IF THE DEMAND Rises AND SUPPLIES A LOT OF PRODUCTION ADDED
- R4 = IF THE DEMAND RETURNS AND LITTLE LITTLE THEN ADDED PRODUCTION

Information :
b = the largest number of requests
a = the smallest number of requests
x = the value of the request soughtPermintaan

Demand

Batas Kiri	Batas Kanan
82	138

Linier Turun

$$\frac{b-x}{b-a} = \frac{138-56}{138-82} = \frac{82}{56} = 1{,}46428$$

Linier Naik

$$\frac{x-a}{b-a} = \frac{56-82}{138-82} = \frac{-26}{56} = -0{,}46428$$

Information :
b = the largest amount of supply
a = the smallest amount of supply
x = the value of the available inventory

Stock

Batas Kiri	Batas Kanan
-22	38

Linier Sedikit

$$\frac{b-x}{b-a} = \frac{38-23}{38-(-22)} = \frac{15}{60} = 0{,}25$$

Linier Banyak

$$\frac{x-a}{b-a} = \frac{23-(-22)}{38-(-22)} = \frac{45}{60} = 0{,}75$$

Information :
b = the largest amount of production
a = the smallest amount of production
x = the value of production sought

Production

Batas Kiri	Batas Kanan
100	130

Linier Sedikit

$$\frac{b-x}{b-a} = \frac{130-x}{130-100} = \frac{130-x}{30}$$

Linier Banyak

$$\frac{x-a}{b-a} = \frac{x-100}{130-100} = \frac{x-100}{30}$$

Fuzzy Rules :

R1 = IF THE DEMAND DOWN AND INVENTION IS MUCH THERE IS LESS PRODUCTION
P1 min(1,46 : 0,75)
MIN= 0,75

$$x1 = \frac{b-x}{b-a} = \frac{130-x}{30} = 0{,}75$$

130-x = 0,75 X 30
130-x = 22,5
130-22,5 = x
x =107,5

R2 = IF DEMAND DOWN AND LITTLE LICENSE THEN LESS PRODUCTION
P2 min(1,46 : 0,25)
MIN=0,31

$$x2 = \frac{b-x}{b-a} = \frac{130-x}{30} = 0{,}25$$

130-x = 0,25X 30
130-x = 7,5
130-7,5= x
x = 122,5

R3 = IF THE DEMAND Rises AND SUPPLIES A LOT OF PRODUCTION ADDED
P3 min(-0,46 : 0,75)
MIN= -0,46

$$x3 = \frac{b-x}{b-a} = \frac{x-100}{30} = -0{,}46$$

x-100 = -0,46 X 30
x-100 = -13,8
100-(-13,8)= x
x = 113,8

R4 = IF THE DEMAND RETURNS AND LITTLE LITTLE THEN ADDED PRODUCTION
P4 min(-0,46 : 0,25)
MIN=-0,46

$$x3 = \frac{b-x}{b-a} = \frac{x-100}{30} = -0{,}46$$

x-100 = -0,46 X 30

x-100 = -13,8
100-(-13,8)= x
x = 113,8

$$x = \frac{(p1.x1)+(p2.x2)+(p3.x3)+(p4.x4)}{p1+P2+P3+p4}$$

$$= \frac{(80,625)+(30,625)+(-52,348)+(-52,348)}{0,08}$$

$$= \frac{6,554}{0,08}$$

= 81,925 ~ 82

Inference :

If Request = 56 and Stock = 23
Then the predicted amount of production in February 2018 is = 82

2.2 Monitoring the Supply of Raw Materials and Products

The actors involved in monitoring raw material inventories are internal parts of the company. After the forecasting phase, CV Kiara Motor will monitor the supply of raw materials in the warehouse and determine how safe the product must be in the warehouse to avoid shortages or vacancies in the warehouse. The following monitoring table for raw material and product supply can be seen in table 3 and table 4.

Table 3 Monitoring the supply of Raw Materials

Name Material	Total Material Order	Remaining stock	Safety Stock	Status
Pipa Besi 4 cm	17 pcs	15	4,8 meter	Aman
Pipa Besi 2 cm	17 pcs	15	4,8 meter	Aman
Baud 8	164 pcs	24	8 pcs	Aman
mur 8	164 pcs	24	8 pcs	Aman
plat besi 2 mm	11 pcs	5	3,2 meter	Tidak Aman
Kawat Besi	246 pcs / 8 dus	24	12 pcs	Aman
kawat kuningan	246 pcs / 8 dus	24	12 pcs	Aman

Table 4 Monitoring the supply of body protector products

Name product	Forecasting Results	Remaining stock	Safety Stock	Status
Body Protektor	82 pcs	23 pcs	4 pcs	Aman

2.3 Stage Of Purchasing Raw Materials

The actors involved in the problem of purchasing raw materials are the head of the procurement department at CV. Kiara Motor. The head of the procurement department will buy raw materials from the forecasting data obtained. Suitable raw materials and the amount of raw material that must be used for suppliers can be seen in table 5 and table 6.

Table 5 Number of Raw Materials ordered

Name Material	Forcasting	Stock	Total Material Order
Pipa Besi 4 cm	17 pcs	15 pcs	2 pcs
Pipa Besi 2 cm	17 pcs	15 pcs	2 pcs
Baud 8	164 pcs	24 pcs	140 pcs
mur 8	164 pcs	24 pcs	140 pcs
plat besi 2 mm	11 pcs	5 pcs	6 pcs
Kawat Besi	246 pcs	24 pcs	222 pcs
kawat kuningan	246 pcs	24 pcs	222 pcs

Table 6 Number of Raw Materials that must be purchased to suppliers

Name Material	Total Material Order	Supplier
Pipa Besi 4 cm	2 pcs	Akbar Jaya Toko Besi & Baja
Pipa Besi 2 cm	2 pcs	Akbar Jaya Toko Besi & Baja
Baud 8	140 pcs	Balindo Mur&Baud
mur 8	140 pcs	Balindo Mur&Baud
plat besi 2 mm	6 pcs	Akbar Jaya Toko Besi & Baja
Kawat Besi	222 pcs / 8 dus	Akbar Jaya Toko Besi & Baja
kawat kuningan	222 pcs/ 8 dus	Akbar Jaya Toko Besi & Baja

2.4 Product Delivery Stages

The perpetrators involved in delivering products to customers are shipping. The head of the shipping department will make a product delivery schedule and determine the distribution data owned by CV Kiara Motor that will be used in product shipments to be seen in Table 8.

Table 8 Transportation At CV Kiara Motor

Plate Number	Transportation	Cargo product
F 1967 WA	Grand Max	30 pcs

From the ordering table above, the company will use a grand max car with police number F 1967 WA because the total order of 16 pcs or less than the car capacity is 30 pcs and the delivery route will be determined using the TSP method.

Table 10 Specifies the Code for calculation

Code	Name	Addres
A	Kiara Motor	Jl. Arief Rahman hakin No.40 A
B	Aneka Motor	jln.pasundan 267
C	SRS Motor	komp Racabali rt009/001 no78
D	Scooter Line Shop	jl.passir kencana no 33
E	royal scooter	jln BLK

Calculating the distance of consumers using Google API can be seen in table 11.

Table 11 Inter-consumer distance for delivery on January 29, 2018

	A	B	C	D	E
A	0	5 km	6,5 km	9 km	7,8 km
B	5 km	0	4 km	12 km	6 km
C	6,5 km	4 km	0	10 km	4 km
D	9 km	12 km	10 km	0	14 km
E	7,8 km	6 km	4 km	14 km	0

From the table 11 above, the Nearest Neighbor calculation will be done with the formula:

S + T+ T + T + T+S (1)
Keterangan :
S first = Start
T = purpose
S end = Finis
Get the following results :

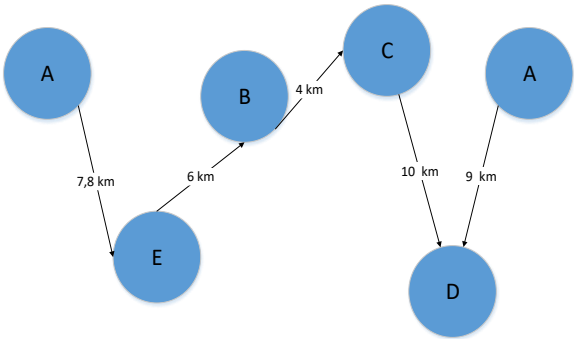
S + B + C + D +E+ S
0+5+4+10+14+7,8 = 40,8 KM

S + C + B + D +E+ S
0+6,5+4+12+14+7,8 = 44,3 KM

S + D + E + B + C + S
0+9+14+6+4+6,5 = 39,5 KM

S + E + B + C + D + S
0 +7,8+6+4+10+9 = 36,8 KM

From the calculation above, the shortest path is S + E + B + C + D + S with the total distance of 36.8 km will be described in Picture 5.



Picture 5 Shortest Path

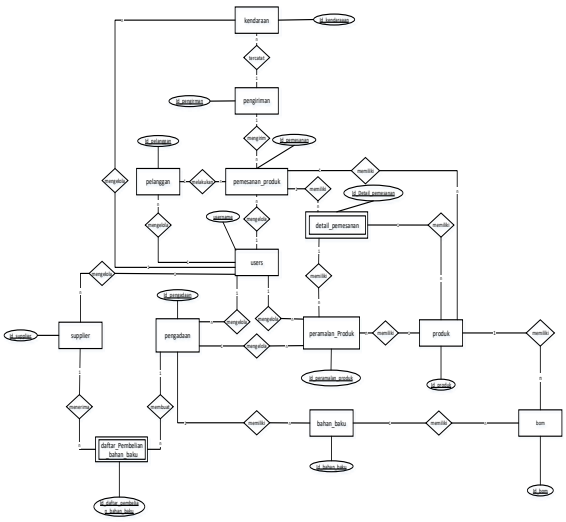
Based on Figure 5 shipments that will be carried out CV.Kiara Motor on January 2, 2018 can be seen in Table 12.

Table 12 Delivery Schedule on January 2, 2018 at CV Kiara Motor

Sent date	Customer's Name	Location Name	Remaining payment
02 January 2018	royal scooter	jln BLK	**LUNAS**
02 January 2018	Aneka Motor	jln.pasundan 267	DP 50% Rp 420.000
02 January 2018	SRS Motor	komp Racabali rt009/001 no78	DP 50% Rp 840.000
02 January 2018	Scooter Line Shop	jl.passir kencana no 33	DP 50% Rp 420.000

2.5 Database Analysis

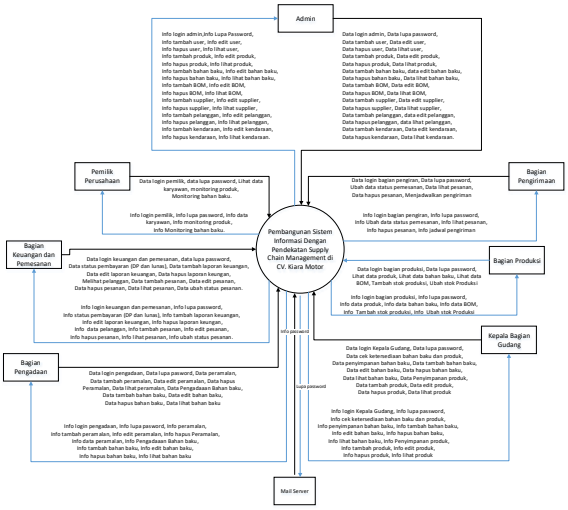
Database analysis on the system to be built using ERD. ERD is a data model that uses several notations to describe data in an entity and relationship context that are described by the data as for the diagram described in Picture 6.



Picture 6 ERD Supply Chain Management Information System at CV Kiara Motor

2.6 Context Diagram

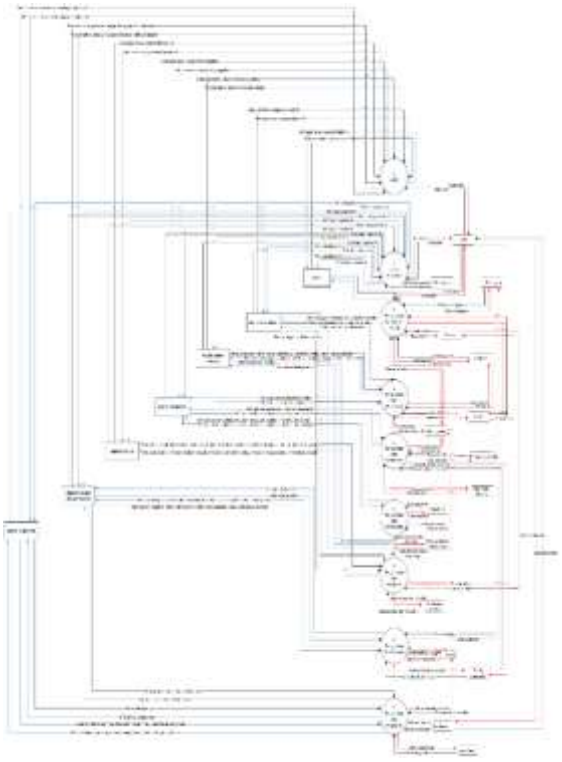
Context diagram is a model to explain globally how data is used and transformed to process or describe the flow of data into and out of the system. The context diagram on the system can be seen in Picture 7.



Picture 7 Diagram Konteks

2.7 DFD Level 1 SCM at CV Kiara Motor

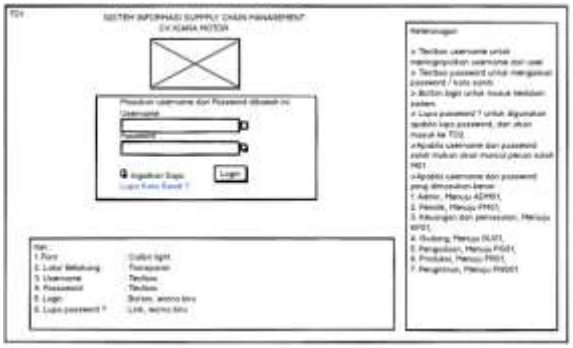
DFD Level 1 Supply Chain Management at the Kiara Motor CV in Picture 8 explains in general what processes can be performed on the system



Picture 8 DFD Level 1 SCM at CV Kiara Motor

2.8 Perancangan Antarmuka Halaman Login

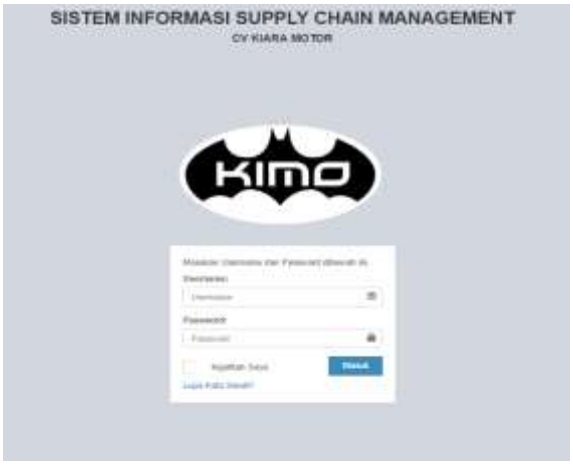
The design of the interface is made to describe the appearance of the program that will be used by the following employees or users. The design of the login interface in the Kiara Motor CV can be seen in Picture 9.



Picture 9 Interface Design Login at CV Kiara Motor

2.9 Interface Implementation Login

The implementation of the login interface used by all users at CV Kiara Motor Implementation of the user login interface can be seen in Picture 10.



Picture 10 Interface Implementation Login at CV Kiara Motor

3. CLOSING

This chapter is a conclusion that contains the results that have been done after the analyst, the design and implementation of the software design that has been built on CV Kiara Motor and the suggestions that will provide important notes for improvements that need to be done at CV Kiara Motor for the future.

3.1 Concilicions

Based on the results obtained from black box testing, and testing user user acceptance test, and testing the end user acceptance after the system is

implemented in CV Kiara Motor, it can be concluded as follows:

1. The supply chain managemet information system at CV Kiara Motor can help the head of the procurement department in determining the amount of raw material to be ordered so that production activities continue and run smoothly.
2. The supply chain managemet information system at CV Kiara Motor can help the head of the shipping department in scheduling product shipments to every customer or customer who has made an order.

3.2 Advices

Suggestions for the development of the information system that will be carried out are some suggestions that can be added, including:

1. Research is expected to combine a supply chain management (SCM) information system with a customer relationship management information system (CRM) in managing relationships with consumers or customers.
2. This information system can be developed by adding features to the online ordering process carried out by each customer or consumer.

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