

# DEVELOPMENT OF INFORMATION SYSTEM SUPPLY CHAIN MANAGEMENT IN CV. ARF PRODUCTION

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## ABSTRACT

CV. ARF Production is a company engaged in the field of fashion, located on Jl. Kalidam No. 122, Cimahi. CV. ARF Production in procuring raw materials to suppliers often experience difficulties due to uncertainty of product demand from consumers / customers. Another problem is that there is no schedule for determining the route for sending products to consumers. The supply chain strategy used is the push supply chain, because it determines the products that are produced before an order is made to make product stock in a warehouse. This research aims to develop a supply chain management information system that enables companies to more easily manage raw material procurement and product distribution. Forecasting method used to estimate the number of product requests is the Trend Moment forecasting method and the results obtained for forecasting products in January 2019 are 205 products that must be produced. The product delivery schedule uses the Traveling Salesman Problem and the results are obtained to calculate the initial delivery in December 2018 with the shortest total route along 113.0 KM. Based on the results of blackbox testing and interviews with each section in the company it can be concluded that this system can assist companies in estimating the amount of raw materials that must be purchased to suppliers and assist in determining delivery schedules to each consumer.

**Keywords :** *Supply Chain Management, Trend Moment, Push Supply Chain, Travelling Salesman Problem, Blackbox.*

## 1. INTRODUCTION

CV. ARF Production is a company engaged in the field of fashion. Products that are produced from the best fiber material, are comfortable and contain benefits (bamboo cotton fiber). Some of the products produced include anime jackets, anime shirts, home made cosplay clothes that use producing strategies to store stock and have a series of work from upstream to downstream. The marketing system is retail, namely sales from companies to retail stores and reseller agents to consumers. Ordering of raw materials is done via telephone or the procurement

department comes directly to the supplier. How to determine suppliers by looking at the stock of raw materials needed at the supplier if the stock of raw materials needed at the first supplier runs out or is lacking, then the company will contact the second supplier to buy the shortage of raw materials.

Based on the results of interviews with the head of the procurement section, that the process of procurement of raw materials is currently held monthly and in determining the amount of raw materials ordered often still uses estimates without calculation. This results in uncertainty in determining the need for the amount of raw material to be ordered and also affects the stock of raw materials in the warehouse experiencing a vacuum and can hamper the production process. Based on the results of the interview with the head of the distribution section, product distribution experienced several delivery delays. The obstacle is the impact of upstream if the shortage of raw materials in the warehouse will result in a vacuum or product shortage so that product demand is not fulfilled resulting in the process of scheduling product distribution often experiencing delays, as well as determining the shipping route that is approximate without calculation.

### 1.1 Formulation of the problem

Based on the preliminary description above, the problem in CV. ARF Production is as follows :

1. The head of the procurement section has difficulty in determining the amount of raw materials to be ordered.
2. The head of the distribution section has difficulty in scheduling product shipments to retail and resellers.

### 1.2 Purpose and objectives

The purpose of this research is to build a supply chain management information system in CV. ARF Production. The purpose of developing supply chain management information systems in CV. ARF Production as follows :

1. Facilitate the head of the procurement section in determining the amount of raw materials that must be ordered to suppliers.

- Facilitate the distribution section head in scheduling product shipments to retail and resellers.

### 1.3 Research methodology

The methodology used in this research uses descriptive analysis method, which is a method that describes facts and information systematically, factually and accurately. The steps taken during conducting the research can be seen in Figure 1.

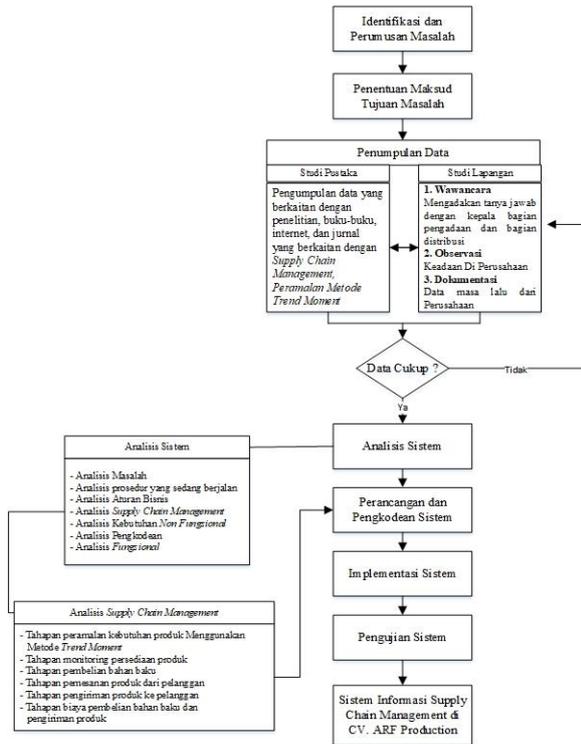


Figure 1. Stages of Research Methodology in CV. ARF Production.

## 2. CONTENTS OF RESEARCH

### 2.1 Basis Theory

The theoretical foundation is a collection of definitions and concepts from various sources. The foundation of this theory is a strong basis in a study. The theory that will be discussed is about the theory of Information Systems, Supply Chain Management, inventory control, Trend Moment method, and about management of transportation (traveling salesman problem).

#### 2.1.1 Information Systems

Information systems are defined as a network of interconnected and collaborative work to collect, process, store and distribute information to support the decision making, coordination and control processes. The purpose of an information system is to systematize information from all events or activities needed to control an organization's operations. The intended activities include taking, processing, storing, and conveying information in operating all organizational activities. [1]

#### 2.1.2 Supply Chain Management

According to I Nyoman Pujawan and Mahendrawati, Supply Chain Management is an integrative approach in managing the flow of information in an integrated manner involving many parties ranging from upstream to downstream consisting of suppliers, factories, distribution and logistics services. Supply Chain is also a network of various companies that work together to create and deliver products to the final hand (consumers). The said companies are suppliers, factories, distributors, agents, shops and supporting companies such as logistics services. [2]

According to Eko and Angga, the implementation of the Supply Chain Management system can integrate all parts of the business from one division to another, so that the supply chain information flow is simplified and runs more effectively and efficiently. [3]

#### 2.1.3 Inventory

Inventory is a number of materials, parts that are provided and materials in the process that are in the company for the production process, as well as finished goods or products that are provided to meet the demand from consumers or retail at any time. Inventory is an element in the company that is used in the production process where the element is used to meet consumer demand. Looking at the scope along the supply chain management shows the big implications for finance and performance in a company. [4]

#### 2.1.4 Trend Moment

The Trend Moment method can be done using historical data from one variable, the formula used in the preparation of this method according to Muthia [5] :

$$Y' = a + bX \quad (1)$$

Where :

- Y = the predicted value or variable.
- a = constant number.
- b = slope or trend line coefficient.
- X = forecast time index (starting from 0,1,2,3, ... n).

To calculate the values of a and b, use the formula :

$$b = \frac{n(\sum XY) - (\sum X)(\sum Y)}{n(\sum X^2) - (\sum X)^2} \quad (2)$$

$$a = \frac{\sum Y - b(\sum X)}{n} \quad (3)$$

Where :

- $\sum X$  = Cumulative amount of time period.
- $\sum Y$  = Cumulative amount of sales data.
- $\sum XY$  = The cumulative number of periods is

$n$  multiplied by the number of sales.  
 $n$  = many time periods (months).

After the Trend value is obtained from forecasting results using the Trend Moment method it will be corrected for seasonal influences using the season index with the formula :

$$\text{Season Index} = \frac{\text{Rata-rata permintaan bulan tertentu}}{\text{Rata-rata permintaan perbulan}} \quad (4)$$

For the final forecast results after being influenced by the season index, use the following calculation :

$$Y^* = \text{Season Index} \times Y' \quad (5)$$

Where :

$Y^*$  = The forecast results of the Trend method have been influenced by the season index.

$Y'$  = Forecast results using Trend.

### 2.1.5 Travelling Salesman Problem Nearest Neighbour Method

Traveling salesman problem is a problem model that aims to find a short route for the traveling salesman to visit each of his customers once.

The nearest neighbor method is used in this study, because this method is one of the methods that has the characteristics of forming distribution routes according to the conditions and conditions in the field. The nearest neighbor method principally always adds the destination closest to the last visited destination, at the beginning of departing from the warehouse so that the destination closest to the warehouse is returned to the warehouse. [6]

$$S + T + T + S = \text{Distance Results} \quad (6)$$

Dimana :

S = Beginning and End of Trip.

T = Customer Destination.

### 2.1.6 The SCM model at CV. ARF Production

The SCM model is a description of activities carried out from upstream to downstream (procurement of raw materials to the delivery of products). SCM Model CV. ARF Production can be seen in Figure 2.

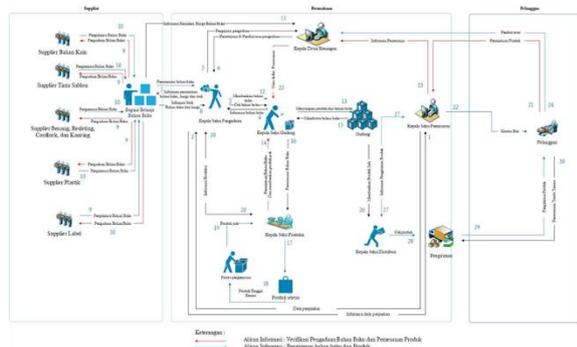


Figure 2. The SCM model at CV. ARF Production

CV. ARF Production has 5 categories of suppliers of raw materials for production activities, including :

1. Supplier of fabric raw materials.
2. Supplier of ink screen printing raw materials.
3. Supplier of raw materials for zippers, threads and buttons.
4. Supplier of plastic raw material packing.
5. Supplier of label raw materials.

CV. ARF Production uses a make-to-stock strategy that is determining the products to be produced first before ordering from customers. Then there needs to be a plan for the procurement of raw materials which are calculated from the estimated production using forecasting moment trend methods for needs in the coming period.

### 2.1.7 SCM stages at CV. ARF Production

The SCM stage is used to describe the supply chain process that will be built in the CV. ARF Production based on the SCM model in Figure 2. Analysis of the stages can be seen in Figure 3.

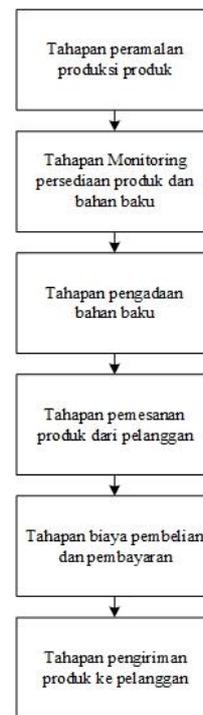


Figure 3. SCM stages at CV. ARF Production

Based on Figure 3 above, the SCM stages in CV. ARF Production can be divided into 6 stages :

1. Forecasting stages of product production.
2. Stages of monitoring product inventory and raw materials.
3. Stages of procurement of raw materials.
4. Stages of ordering products from customers.
5. Stages of the costs of purchase and payment.
6. Stages of shipping the product to the customer.

## 2.2 Forecasting stage of product production

Product sales data in the CV. ARF Production in January 2017-December 2018 can be seen in Table 1.

**Table 1.** Recapitulation of product sales at CV. ARF Production

Bulan	One Ok Rock T-shirt	Anime Hoodie	Tas Multi fungsi SNK
Januari 2017	147	154	142
Februari 2017	161	160	109
Maret 2017	155	114	113
April 2017	159	135	135
Mei 2017	165	92	97
Juni 2017	187	124	136
Juli 2017	199	163	161
Agustus 2017	154	136	129
September 2017	138	162	132
Oktober 2017	210	200	141
November 2017	267	194	199
Desember 2017	221	178	178
Januari 2018	181	209	161
Februari 2018	228	184	173
Maret 2018	166	172	156
April 2018	161	170	98
Mei 2018	222	202	157
Juni 2018	243	163	143
Juli 2018	258	194	186
Agustus 2018	215	212	165
September 2018	234	202	186
Oktober 2018	202	209	213
November 2018	258	180	152
Desember 2018	239	230	181
Total	4770	4139	3643

Based on the data described above, it is produced that the One Ok Rock T-Shirt product is the product with the most sales in the last 2 years in the CV. ARF Production. Sales charts are needed to see data patterns from product sales data in the company as well as to determine the forecasting method that will be used. The chart of One Ok Rock T-Shirt product sales can be seen in Figure 4.



**Figure 4.** One Ok Rock T-shirt product sales chart

Looking at the data patterns from the graph above, the forecasting method that will be used in predicting the amount of product production is the Trend Moment method because the pattern of data movement is influenced by conditions in a particular month. Forecasting that will be carried out has the following stages :

1. Prepare data requests from the previous period to be entered as data. The sample is the OneOkRock T-Shirt order data for 2 years from January 2017 to December 2018.
2. Calculate the forecast value using the Trend method.
3. Look for the season index that will be used to influence the value of the Trend in order to become a Trend Moment.
4. Assume demand for January 2019.

If you want to do forecasting for January 2019, then the data entered as a reference is the demand and inventory data for One Ok Rock T-Shirt products from January 2017 to December 2018, you can see in Table 2.

**Table 2.** Recapitulation of demand, supply and production of OneOkRock T-Shirt January 2017-December 2018

Bulan	Permintaan	Persediaan	Produksi
Januari 2017	147	13	160
Februari 2017	161	2	150
Maret 2017	155	17	170
April 2017	159	18	160
Mei 2017	165	13	160
Juni 2017	187	-4	170
Juli 2017	199	-3	200
Agustus 2017	154	43	200
September 2017	138	65	160
Oktober 2017	210	-5	140
November 2017	267	-42	230
Desember 2017	221	-13	250
Januari 2018	181	6	200
Februari 2018	228	-22	200
Maret 2018	166	2	190
April 2018	161	1	160
Mei 2018	222	-21	200
Juni 2018	243	-14	250

Bulan	Permintaan	Persediaan	Produksi
Juli 2018	258	-32	240
Agustus 2018	215	3	250
September 2018	234	9	240
Oktober 2018	202	27	220
November 2018	258	-1	230
Desember 2018	239	10	250

Looking for Trend forecasting by using the formula (1) by :

- Determine the actual time index (X) by entering the index value starting from 0 for January 2017 to 23 for December 2017.
- Determine the time index for the month you want to forecast. Calculating from the December 2018 actual time index (23), so the time index for January 2019 is 24.
- Finding the values of b and a based on the formulas (2) and (3).

$$b = \text{slope or trend line coefficient. (2)}$$

$$b = (24 \times 59292 - 276 \times 4770) / (24 \times 4324 - 76176)$$

$$b = 106488 / 27600$$

$$b = 3,85826087$$

$$a = \text{constant number (3)}$$

$$a = (4770 - (3,85826087 \times 276)) / 24$$

$$a = 3705,12 / 24$$

$$a = 154,38$$

- Calculating the value of the Trend or predicted variable.
 
$$Y' = a + bX$$

$$Y' = 154,38 + 3,85826087(24)$$

$$Y' = 246,978261$$

$$Y' \approx 246,98$$
- Finding the season index value according to the month you want to predict using the formula (4).
 
$$IM \text{ Januari } 2019 = ((147 + 181) / 2) / 198,75$$

$$IM \text{ Januari } 2019 = 164 / 198,75$$

$$IM \text{ Januari } 2019 = 0,825157$$

$$IM \text{ Januari } 2019 \approx 0,83$$
- Calculate forecast moment trends.
 
$$Y^* = IM \text{ Januari } 2019 \times Y'$$

$$Y^* = 0,83 \times 246,98$$

$$Y^* = 204,99$$

$$Y^* \approx 205$$

The final result is the conclusion of the calculation of the January 2019 Trend Moment. The demand is assumed to be 205 pieces.

### 2.3 Stages of monitoring product inventory and raw materials

Inventory monitoring involves the internal parts of the company, namely the head of the warehouse section. After the forecast value is released, the Company will monitor raw materials and products to see the safe limit of raw materials and products that must be available to avoid stock shortages in the warehouse. If it is below the safe limit, the warehouse section head immediately contacts the procurement section head to immediately procure raw materials. Monitoring of products and raw materials can be seen in table 3 and table 4.

**Table 3.** Monitoring inventory of OneOkRock T-Shirt products

Hasil Ramalan	Stok Bulan Sebelumnya	Safety Stock	Status
205 pcs	10 pcs	20 pcs	Tidak Aman

**Table 4.** Monitoring inventory of OneOkRock T-Shirt raw materials

Nama Bahan Baku	Jumlah Ramal	Sisa Stok	Safety Stock	Status
Kain Cotton Combed 24s	51,25	2,5	5	Tidak Aman
Benang	20,5	3	2	Aman
Tinta Sablon Plastisol Gelap	1,28	0,5	0,125	Aman
Tinta Sablon Plastisol Terang	1,28	0,5	0,125	Aman
Rib	5,125	1	0,5	Aman
Label	205	30	20	Aman
Plastik	205	100	20	Aman

### 2.4 Stages of procurement of raw materials

In the raw material procurement stage, the head of the procurement section is involved. Procurement is influenced by forecasting results and inventory monitoring results. Procurement analysis can be seen in table 5.

**Table 5.** Amount of raw materials that must be purchased from suppliers

Nama Bahan Baku	Supplier	Jumlah Dipesan
Kain Cotton Combed 24s	WSK Textile	53,75 Kg
Benang	Aneka Benang	19,5 Roll
Tinta Sablon Plastisol Gelap	Lucas SPS	0,905 Kg

Nama Bahan Baku	Supplier	Jumlah Dipesan
Tinta Sablon Plastisol Terang	Cipta Warna Sablon	0,905 Kg
Rib	WSK Textile	4,625 Kg
Label	Cahaya Grafika	195 pcs
Plastik	Surya Plastik	125 pcs

## 2.5 Stages of shipping the product to the customer

At this stage the actors involved are the head of the distribution section. The head of the distribution section will make a schedule and determine the delivery route. Product delivery is based on order, location and nearest route. From the sales data of the head of the distribution section, processing the shipping route using the TSP method can be seen in table 6.

**Table 6.** Shipping calculation code

Kode	Nama	Alamat
A	CV. ARF Production	Jl. Kalidam No 122 Cimahi Tengah
B	Kizaru Japan	Jl Merdeka No 56
C	Onwkidz	Jl AH Nasution No.180
D	Ryu Fashion	Jl Sindangsari I Antapani
E	Pipit Purie Purwanti	Jl Nagreg Cicalengka
F	John Simanjuntak	Jl Mars Utara no 40 C

Calculating the distance of each destination on the Google API can be seen in table 7.

**Table 7.** Distance (KM) for delivery on December 4, 2018

	A	B	C	D	E	F
A	0	12,6	22,5	19,7	50,0	27,2
B	12,6	0	11,9	7,9	37,1	11,8
C	22,5	11,9	0	6,3	24,1	6,8
D	19,7	7,9	6,3	0	31,4	9,5
E	50,0	37,1	24,1	31,4	0	28,4
F	27,2	11,8	6,8	9,5	28,4	0

From the following table will be calculated traveling salesman problem using the nearest neighbor method with the formula (6). The results of the calculation are as follows :

$$S + B + C + D + E + F + S$$

$$0+12,6+11,9+6,3+31,4+28,4+27,2 = 117,8 \text{ KM}$$

$$S + C + D + E + F + B + S$$

$$0+22,5+6,3+31,4+28,4+11,8+12,6 = 113,0 \text{ KM}$$

$$S + D + E + F + B + C + S$$

$$0+19,7+31,4+28,4+11,8+11,9+22,5 = 125,7 \text{ KM}$$

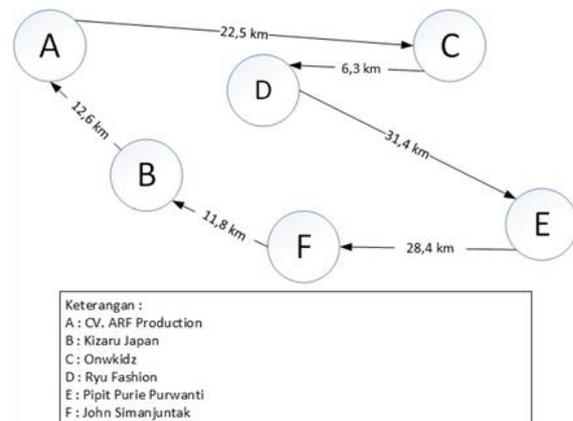
$$S + E + F + B + C + D + S$$

$$0+50,0+28,4+11,8+11,9+6,3+19,7 = 128,1 \text{ KM}$$

$$S + F + B + C + D + E + S$$

$$0+27,2+11,8+11,9+6,3+31,4+50,0 = 138,6 \text{ KM}$$

From the above calculation results taken the shortest path  $S + C + D + E + F + B + S$  with a total distance of 113.0 KM. The track will be presented on the graph in Figure 5.



**Figure 5.** Shortest Track

Based on Figure 5, the shipping list can be seen in table 8.

**Table 8.** Delivery schedule of products to customers

Nama Pelanggan	Alamat	Tgl Kirim	Status
Onwkidz	Jl AH Nasution No.180	4-12-2018	Lunas
Ryu Fashion	Jl Sindangsari I Antapani	4-12-2018	Lunas
Pipit Purie Purwanti	Jl Nagreg Cicalengka	4-12-2018	Lunas
John Simanjuntak	Jl Mars Utara no 40 C	4-12-2018	Lunas
Kizaru Japan	Jl Merdeka No 56	4-12-2018	Lunas

## 2.6 Database Analysis

Database analysis on the system to be built using ERD (Entity Relationship Diagram). ERD is a model that explains data relationships with one another in a database based on data objects that have a relation. [7] ERD diagram can be seen in Figure 6.

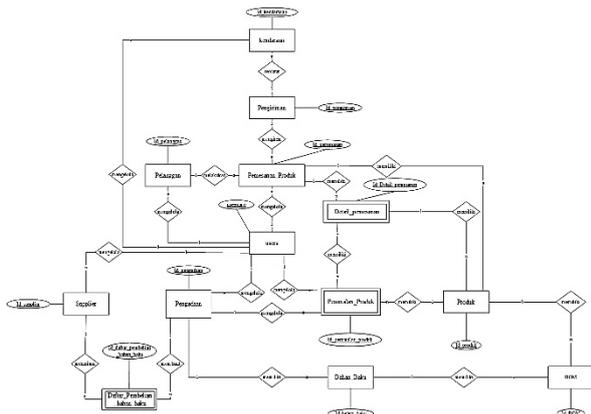


Figure 6. ERD Supply chain management information system at CV. ARF Production

### 2.7 Context diagram

Context diagram is a diagram that consists of processes and describes the scope of the system. Context diagram is the first level of DFD which describes all system inputs or outputs. [7] The context diagram can be seen in Figure 7.

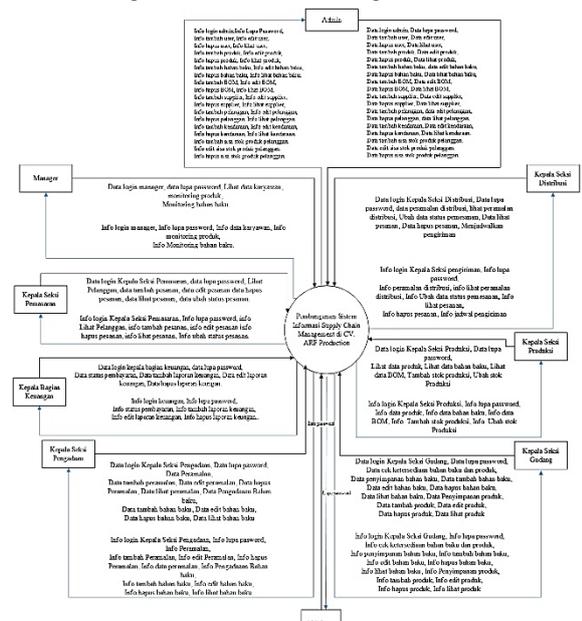


Figure 7. Context diagram

### 2.8 DFD Level 1 SCM at CV. ARF Production

DFD (data flow diagram) level 1 on SCM in the CV. ARF Production describes the overall process in general, what is explained is what can be done on the system to be built. DFD level 1 on the SCM information system at CV. ARF Production can be seen in Figure 8 below.

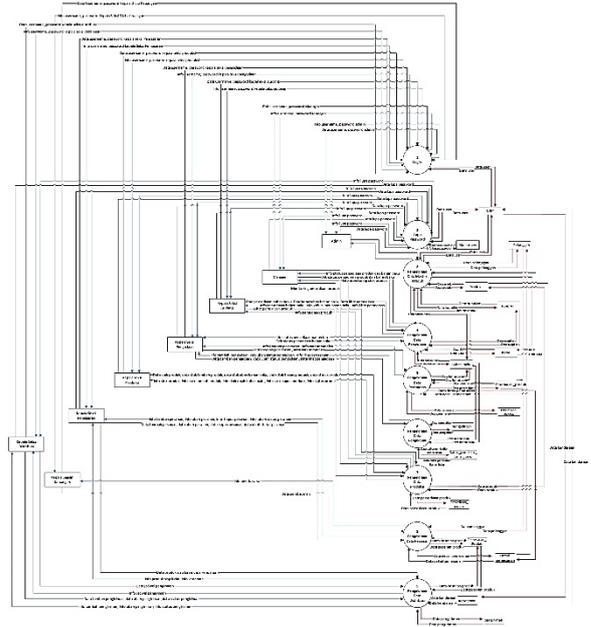


Figure 8. DFD Level 1 SCM CV. ARF Production

## 3. IMPLEMENTATION AND TESTING

Implementation is carried out to implement the design that has been done in the previous stage. Implementation is carried out to cover the processes that exist in the system by providing convenience for users of supply chain management information systems that in the future will provide added value for future development [8].

System testing is the process of executing a software system to determine whether the software system matches the system specifications and runs as expected. System testing is often associated with finding bugs, program imperfections, program line errors that cause software system execution to fail. In testing this software using blackbox testing. [9]

The blackbox testing plan is used to explain testing a system. This plan describes the sequence and what will be tested on the system being built. [10]

Table 9. Blackbox testing plan

Kasus Uji	Detail Pengujian	Jenis Pengujian
Login	Memasukkan <i>username</i> & <i>password</i>	Black Box
Lupa Password	Validasi <i>username</i> dan Email	Black Box
	Mengirim <i>password</i> email	Black Box
Pengolahan data master	Pengolahan data <i>user</i>	Black Box
	Pengolahan data produk	Black Box
	Pengolahan bahan baku	Black Box
	Pengolahan data BOM	Black Box

Kasus Uji	Detail Pengujian	Jenis Pengujian
Pengolahan data master	Pengolahan data supplier	<i>Black Box</i>
	Pengolahan data pelanggan	<i>Black Box</i>
	Pengolahan data kendaraan	<i>Black Box</i>
Pengolahan data persediaan	Lihat data persediaan	<i>Black Box</i>
	Tambah data persediaan	<i>Black Box</i>
	Ubah data persediaan	<i>Black Box</i>
	Cek status persediaan	<i>Black Box</i>
Pengolahan data peramalan	Tambah peramalan produk	<i>Black Box</i>
Pengolahan data pengadaan	Tambah data pengadaan	<i>Black Box</i>
	Ubah data pengadaan	<i>Black Box</i>
	Lihat data pengadaan	<i>Black Box</i>
Pengolahan data produksi	Melihat stok bahan baku	<i>Black Box</i>
	Melihat BOM	<i>Black Box</i>
Pengolahan data pemasaran	Tambah pemesanan	<i>Black Box</i>
	Ubah pemesanan	<i>Black Box</i>
	Hapus pemesanan	<i>Black Box</i>
	Lihat data pemesanan	<i>Black Box</i>
	Cek pembayaran	<i>Black Box</i>
Pengolahan data pengiriman	Lihat data kendaraan	<i>Black Box</i>
	Tambah data pengiriman	<i>Black Box</i>
	Hapus data pengiriman	<i>Black Box</i>
	Ubah data pengiriman	<i>Black Box</i>
	Tambah rute pengiriman	<i>Black Box</i>

## 4. CLOSING

In this chapter contains conclusions that include the results obtained after the analysis, design and implementation of software design that is built in the CV. ARF Production and suggestions that will provide notes for improvements that need to be done in the future.

### 4.1 Conclusion

From the analysis and test results, the conclusions that can be drawn are as follows :

1. SCM information system in CV. ARF Production can assist the head of the procurement section in determining the raw materials to be ordered so that production continues to run smoothly.
2. SCM information system in CV. ARF Production can assist the head of the distribution section in scheduling deliveries to each customer.

### 4.2 Suggestion

Some suggestions that can be given for the development of this information system are as follows :

1. Combining supply chain management with customer relationship management as the backend and frontend of the information system.
2. Add an online ordering feature for new customers.

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