# SUPPLY CHAIN MANAGEMENT INPT RFS

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## ABSTRACT

PT. RFS is an industrial company engaged in the manufacture of macaroni. The company produces macaroni in the form of raw macaroni and mature macaroni. the ordering of raw materials to suppliers is still intuitive and not predictable, the distribution process is done in different time and quantity in each period, so the head of the marketing department has difficulty in determining the type of vehicle that is sometimes unavailable and the nearest location of the customer, causing the distribution process is hampered.

Based on the problems that have been described, then the proposed solution is to build a Product Distribution Information System PT RFS Using Suplly Chain Management Approach. The goal is to facilitate the head of warehouse & procurement in planning the procurement of raw materials to suppliers to avoid shortages of raw materials, as well as facilitate the head of marketing in determining the type of vehicle and the shortest distance from customers during the distribution process. Forecasting method used in this research is Single Exponential Smoothing with Mean Square Error, inventory control method of product in warehouse using Safety Stock.

From the observation of the built system has assisted the head of the warehouse in planning the procurement of raw materials to suppliers and facilitate the head of the marketing department in determining the type of temporary distribution.
Keywords: Supply Chain Management, single exponential smoothing, Safety Stock, Information System.

## 1. PENDAHULUAN

PT. RFS is an industry engaged in the manufacture of macaroni. The company produces macaroni in the form of raw macaroni and mature macaroni. The company has a series of work starting from ordering raw materials to suppliers, receiving raw materials from suppliers, and processing raw materials into finished goods. From the finished goods will then be packed and directly distributed to customers who have previously made an order.

PT. RFS has a storage warehouse to store raw materials ordered from suppliers. PT. RFS cooperates with several suppliers, ordering raw materials to suppliers is done by the Head of Warehouse and Procurement by phone, after previously comparing the price and quality of raw materials, to process payment from PT. RFS to supplier is done when raw material has been received and done by cash or transfer agreement with supplier.

Based on observations in PT. RFS, from the sales recapitulation data during May 2017 - August 2017 shows sales data up and down, so that at the time of booking a lot of makroni customers can lead to shortage of raw materials in warehouses used to meet orders from customers, on the contrary at the time of ordering little material accumulation raw in the warehouse. Due to one of the raw materials of this product one of them is a material that is not durable as eggs, then when there is accumulation of raw materials result in damage to raw materials that cause losses. Booking raw materials to the supplier takes four to seven days for the delivery process to arrive at the warehouse. This resulted in the production process stalled some time when the stock of raw materials in the warehouse empty or in the process of delivery.

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Based on the above problems can be concluded that if there is a problem in the supply of raw materials can cause the process of distribution is hampered and customer demand is not met. This problem can be solved by Supply Chain

Management (SCM) system, Supply Chain Management (SCM) itself is a complete chain management cycle starting from supplier, operational activity in company, continuing to distribution until end user. The goal is to manage the flow of products and the flow of information in the company, ranging from receipt of orders from pelnggan, product procurement, product acceptance to delivery of products to customers will create synchronization and consistency.

Based on the description of existing problems in PT. RFS, then needed a Distribution Information System with Supply Chain Management (SCM) approach to manage information from upstream to downstream.

# 2. RESEARCH CONTENTS

## 2.1 System Information

Information system is a system within an organization that reconcile the needs of daily transaction processing, support operations, managerial and strategic activities of an organization and provide certain outside parties with the necessary reports [1].

## 2.2 *Supply Chain Management*

Supply Chain Management is an integrative method or approach for managing an integrated flow of products, information, and money involving parties from upstream to downstream. An important principle in supply chain management is the transparency of information and collaboration between the internal functions of the company and with the parties in the company along the supply chain. In supply chain management activities include the development of material and component control products, product planning, inventory control, production, and distribution / transportation [2].

### 2.2.1 Component Supply Chain Management

*Supply Chain Management has three main components that support the running of a business process as follows* [2]:

1. *Upstream Supply Chain*

   The most important activity in Upstream Supply Chain is the procurement process.

2. *Internal Supply Chain*

   The most important activities in the Internal Supply Chain are production management, factory, and inventory control.

3. *Downstream Supply Chain*

   Activities within the downstream supply chain involve the delivery process to the end consumer. The main activities in the downstream supply chain are the distribution of goods, warehouses, transportation.

### 2.2.2 Types of Supply Chain Management

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

1. *Integrated make-to-stock*

   Aiming for the production process in order to procure and supply efficient in overcome by integrated information system. The company can see customer demand at s = the right time and can be used for on production schedule.

2. *Continuous Replesnishment*

   This method is very suitable for companies whose data is stable.

3. *Build-to-order*

   this method is intended for the finished goods that customers have made prior bookings.

## 2.3 Forecasting

Forecasting is a way of predicting a value of a variable and taking a value from the previous one. The point is berdasrkan previous data.

When viewed in terms of time, the purpose of forecasting can be seen as follows [4]:

1. Short Time

   This method is usually done on a daily basis.

2. Middle Time

   For the medium term is done on a monthly basis.

3. Long Time

   Usually done yearly.

### 2.3.1 *Single Exponential Smoothing*

This method is intended to reduce the problem of inappropriate data. Thus this method is very suitable to be applied in the process of procurement of a goods in the form of make to stock. For more details see the formula below [4].

while for Exponential calculations for N can be seen in the equation (2.3).

$$Ft+1=\frac{x1+x2+\cdots+xT}{T}=\frac{1}{T}\sum_{1}^{T}=1^{xl} \qquad (2.1)$$

$$F_{t+2}=F_{t+1}+\frac{1}{T}=(X_{T-1}-{}_{1}) \qquad (2.2)$$

Metode *Exponential* for N observations is

$$Ft+2=Ft+1\left(\frac{Xt}{N}-\frac{Xt-N}{N}\right) \qquad (2.3)$$

After calculating data with the above formula further by looking at the data in the period 1 month before. so it can be calculated by equation (2.4) and (2.5).

$$F_{t+1}=F_t+\left(\frac{Xt}{N}-\frac{Ft}{N}\right) \qquad (2.4)$$

$$F_{t+1}=\left(\frac{1}{N}\right)X_t+\left(1-\frac{1}{N}\right)F_t \qquad (2.5)$$

If 1 / N = a, it can be calculated by the equation (2.6).

$$F_{t-1}=aX_t+(1-a)F_t \qquad (2.6)$$

Information

$F_{t+1}$ = result t+1

$a$ = indeterminate value

$X_t$ = Actual demand data for period t

$F_t$ = forecasting data

### 2.3.2 *Mean Square Error* (MSE)

Mean Squared Error (MSE) is the mean of forecasting error is squared and can be seen in the equation (2.11).

$$MSE = \frac{\sum(Xt-Ft)^2}{n} \quad (2.11)$$

Information

$X_t$ = Actual data in period t

$F_t$ = Forecast data of the model used in the period t

n = Many predicted data.

### 2.4 Monitoring

Monitoring is the continuous and regular collection of information that will help answer questions about projects or activities. Monitoring helps alert when things go wrong and help keep the work on track [5].

Monitoring aims to improve the effectiveness and efficiency of a project or organization and is based on defined goals and plans. Monitoring enables us to determine whether our resources are sufficient and well used and serve as a useful basis for evaluation and knowing our capacity is feasible and sufficient.

### 2.5 *Safety Stock*

Different times in the order of a good. There is a call with time tenggan this usually for inventory. Booking an item until the item) [6].

this method is too low, then the inventory runs out at a time that does not match the one already specified. Which resulted in his disturbed production.to calculate this method with the formula as below.

The safety stock formula can be calculated by the equation (2.13).

$$SS = Pemakaian\ rata - rata\ periode\ sebelumnya\ x\ LT \quad (2.13)$$

Information :

SS = *Safety Stock*

LT = *Lead Time* (procurement Product from supplier to company)

### 2.6 Transportation and Distribution Management

The saving matrix method is a method to minimize distance or time or cost by considering the constraints. The steps that must be done in saving matrix method are as follows [2]:

a. I dentifies distance matrixs

In this step we need the distance between the warehouse to each store and the distance between stores. To simplify the problem, we will use the nearest route to be the main route. Then after knowing his route we can use the formula below to calculate routes between customers. And the formula as below:

$$J(1,2) = \sqrt{(x_1 - x_2)^2 - (y_1 - y_2)^2} \quad (2.14)$$

If the route is known, it is better to use a known route instead of using the theoretical route.

b. Savings Matrix

Aiming to save on the shipping process to be more efficient and not wasting time in the delivery process.

The formula is as follows:

$$2J(G,1) + 2J(G,2)-[J(G,1) + J(1,2) + J(1,2) + J(2,G)] \quad (2.15)$$

$$= J(G,1) + J(G,2) - J(1,2) \quad (2.16)$$

The above results can be generalized as follows :

$$S(x,y) = J(G,x) + J(G,y) - J(x,y) \quad (2.17)$$

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

c. Allocate shop to vehicle or rute

After knowing the savings of the distance on the route to be addressed the third stage of allocating stores to vehicles or routes it aims to minimize the number of vehicles during delivery.

Here are some methods to determine the order of this visit, including as follows:

1. Method *Nearest Insert*

   The workings of this method is to find or determine the first customer and then add to the existing route. Then the end result of this method is to determine the route of the company to the customer [2].

2. Method *Nearest Neighboard*

   The way this method works is the same, looking at the closest jrute store of the company [2]. This method is very easy to use but it has not become that this would be the right solution.

### 2.7 *Entity Relationship Diagram* (ERD)

Aim to describe the data structure and connect between the two data. there are some stuff that should be in this ERD:

1. Entitas
   Is data that is not equal to other data.
2. Atribut.
   Is the character of the entity that has been created.
3. Relationship
   Relationship between several different data.
4. Kardinalitas/Derajat Relasi
   Is the data that shows some entities that can not be together.

### 2.8 *Data Flow Diagram* (DFD)

Or with a data flow diagram, is a flow that describes the origin of data and destination data [12].

DFD describes in detail the step sequences of each process described in the data flow diagram. DFD is synonymous with bubble chart, transformation graph, and process model.

### 2.9 Problem Analysis

Based on research conducted at PT. RFS there are some problems between them:

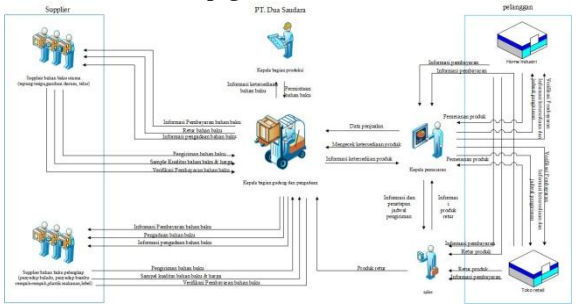
1. Uncertainty of order quantity of raw materials to supplier, resulting in the accumulation of raw materials at the time of ordering products from customers and shortage of raw materials at the time of ordering products from many customers resulting in loss.
2. Head of the marketing department difficulty in determining the type of vehicle and the closest distance from the customer, because the distribution process is done in time and the same amount is different every day. So it can cause a delayed delay during the distribution process.

### 2.9 Analysis *Supply Chain Management*

Supply Chain Management anlisis is used to apply the Supply Chain Manegement approach to the supply chain system to be built. First is the flow of goods, the second is the flow of information.

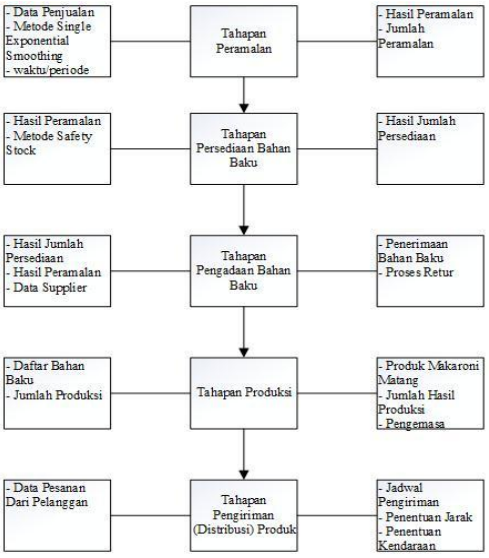
The flow of goods that occur among the flow of raw materials sent from suppliers to PT. RFS and products shipped from PT. RFS to customers. The flow of money that occurs such as the flow of money for the purchase of raw materials and payment for ordering products. The flow of information that occurs diantaranta information procurement of raw materials to ssupplier, information delivery of raw materials from suppliers to PT. RFS, ordering information from customers to PT. RFS, product delivery information from PT. RFS to customers.

Mapping of Supply Chain Management in PT. RFS shown on the pigure 1



**Gambar 1.** Mapping *Supply Chain Management* in PT. RFS

The information system strategy approach Supply Chain Management to be built at PT. RFS consists of several stages shown in the pigure 2




**Gambar 2.** Mapping Supply Chain Management in PT. RFS

Based on Figure 2 regarding the stages of supply chain management in PT. RFS, then can be analyzed against the Supply Chain Management in the company of PT. RFS that is as follows:

#### 2.9.1 Analysis Stages Forecasting

As already explained in the supply chain management analysis there are stages of doing forecasting analysis for the flow of information procurement forecasting calculation of sales transaction data some previous period. The data to be sampled is data of maize product sale transaction transactions from May 2017 until August august 2017.

Recapitulation data of mature macaroni product sales in May 2017 until August 2017 are in the table 1.

**Table 1.** Sales Data Macaroni Mature

| Periode | Banyak(kemasan makanan) |
|---|---|
| Mei | 18213 |
| Juni | 12980 |
| Juli | 16819 |
| Agustus | 13461 |

Forecasting done after knowing the Pattern form of data presented at PT. Two Brothers have the following stages:

1. Preparing sales data for the previous period to be processed as data enter.
2. Menghitung nilai ramalan pada data penjualan dengan menggunakan peramalan Single Calculate the forecast value in sales data by using Single Exponential Smoothing forecasting Smoothing.
3. Find the MSE value of the forecasting method to find the smallest result
4. Compare the smallest value of the MSE calculation results from alpha 0.1 to alpha 0.9.

5. Select the forecasting result by looking at the smallest forecasting error value of MSE.

For example will be calculated in May 2017, then the minimum data entered is the data of June 2017. Forecasting is done by taking samples of data sales of mature macaroni products PT. Two brothers from May 2017 to August 2017 can be seen in Table 3.2. The first step that must be done to calculate the single exponential smoothing forecasting method is to determine the value of constant alpha = 0.1 and forecast the demand for the 2nd period. The variable values are taken from product sales data in table 1, then distribute these values into the formula (2.6) it will get the calculation as below:

Perhitungan peramalan untuk α=0.1:

Based on the sales data of Makaroni Matang product in Table 1, calculate sales forecast for September 2017. It is known that:

Sales of Makaroni Matang products in August of 2017 (Xt) = 13461 packaging and forecasting results in August of 2017 (Ft) = 17602.63 packaging,
So get the calculation as below:

$F_{agust}$ = (0.1 *13461) + (1 – 0.1) * 17602,63
= (1346,1) + (15842,36)
= 17188,47 kemasan

After calculating product forecasting, then calculation of error value in forecasting. Calculation of error value using MSE (Mean Squared Error) with the formula (2.11). The result of MSE calculation for α = 0.1 is as follows:

$$= \frac{((18213 - 18213)^2 + (12980 - 18213)^2 + (16819 - 17689{,}70)^2 + (13461 - 17602{,}63)^2)}{4}$$

$$= \frac{(0 + 27384289 + 758118.49 + 17153099{,}06)}{4}$$

$$= 11323876.64$$

For calculation errors alpha = 0.2 and up to 0.9 is done in the same way.

### 2.9.2 Analysis of Stages of Raw Material Inventory with Safety Stock Method

After doing the forecasting, the next step is to monitor inventory to monitor and control the inventory in the warehouse. For monitoring of inventory control by looking at monthly inventory data every month. Monitoring function to avoid the occurrence of vacancy and stock shortage of mature macaroni product that exist in the warehouse. This inventory control monitoring requires an indicator to determine how many safe limits must be available in the warehouse using the safety stock method.

Implementation of the safety stock method is the process of calculating the safe limit of inventory that must be available in the warehouse for the next period and the point of re-ordering. The calculation of safety stock can be seen in equation (2.13) which has been explained. Here's an example calculation using safety stock.

1. Safety Stock Calculation for Mature Macaroni Products total sales in June

$$safety\ stock = \frac{(13461)}{31} x4 = 1736.90 = 1737$$

Based on the above safety stock calculation, PT. Two Brothers must provide 1674 pcs for the month of July. So when the product stock is less than the amount of safety stock then the system will tell that there is unsafe stock. The product offer will be presented in tabular form. Examples of product monitor inventory presentations are listed in the table 2.

**Table 2.** Safety Stock of Raw Material Based on Safety Stock Products

| Nama Produk | Safety Stock | Jenis Bahan Baku | Safety Stock Bahan baku | Satuan | Status |
|---|---|---|---|---|---|
| Makaroni Matang | 1674 | Gandung Durum | 750 | Kg | Persediaan tidak aman |
| | | Terigu | 250 | Kg | Persediaan tidak aman |
| | | Telor | 500 | Kg | Persediaan tidak aman |
| | | Air | 500 | Mili liter | Persediaan tidak aman |
| | | Penyedap Balado | 250 | Kg | Persediaan tidak aman |
| | | Rempah - Rempah | 250 | Kg | Persediaan tidak aman |
| | | Kemasan Makanan | 1000 | Pcs | Persediaan tidak aman |
| | | Label | 1000 | Pcs | Persediaan tidak aman |

### 2.9.3 Raw Material Procurement Analysis

Pada analisis pengadaan bahan baku ini kepala In this raw material procurement analysis the head of warehouse and procurement made an order based on forecasting results that have been done. Warehouse and procurement made an order based on the results of forecasting that has been done.

Based on table 3.5, if the remaining stock of the product has unsafe status, then the company procured raw materials with the amount as follows:
Total procurement = (sales forecasting results + safety stock) - remaining stock
= (17689.7 + 2170) – 1500
= 18359,1 pcs

After knowing the amount of raw materials to be ordered, then the company needs to procure raw materials to suppliers who have done cooperation before.

### 2.9.4 Product Delivery (Distribution) Analysis

n the supply chain there are distribution / delivery activities. Scope of activities include monitoring of delivery status, delivery scheduling, vehicle capacity to be used in distribution, and

determination of the closest customer route during distribution. Distribution monitoring is done so that the product reaches the customer at the right time and place and knows the delivery status. Product distribution schedule to customer is done on schedule which have been agreed between PT. RFS with customers.

The first stage in the distribution of products that know the ordering of products made by customers. The second stage is to know the packaging of product order to be distributed to the customer. The third stage is the company determines the vehicle for distribution.

After determining the vehicle for distribution, then the company determines the distance the company with customers and distance between customers. To know the distance PT. RFS with customers and intercustomers. This step is the first step to know the delivery route. To determine the distance can use the formula (2.14). The formula can be used when already know the coordinates between customers. But in this case because the real distance has been known with the help of google maps GPS. At this stage it is assumed that every customer will be visited by one vehicle during delivery. So there will be 7 different delivery routes. The distance matrix between firms with customers and distance between customers is shown in Table 3.

**Table 3.** Distance Matrix from Subscribers Company
Subscribers Using Google Maps

| | perusahaan | Pd. Saputra | Home Industri Makaroni Jhon | Toko Ghifar | Makaroni Sedap Juara | Pd. Sumber Usaha | Toko Andara | Ibu Hj Imas |
|---|---|---|---|---|---|---|---|---|
| Pd. Saputra | 22.2 | 0 | | | | | | |
| Home Idustri Makaroni Jhon | 62 | 97.5 | 0 | | | | | |
| Toko Ghifar Putra | 24.7 | 33.8 | 68.9 | 0 | | | | |
| Makaroni Sedap Juara | 71 | 99.1 | 10.7 | 73.7 | 0 | | | |
| Pd. Sumber Usaha | 17 | 25.3 | 78.6 | 10.0 | 73.1 | 0 | | |
| Toko Andara | 12.2 | 61.8 | 87.8 | 19.3 | 82.9 | 9.6 | 0 | |
| Ibu Hj. Imas | 54.1 | 42.4 | 72.7 | 55.3 | 74.7 | 65.5 | 65.5 | 0 |

After determining the type of vehicle to be used and knowing the distance between customers and the distance between customers, the system will be built will determine the delivery route using the Nearest Neighbors method, here is the delivery route:

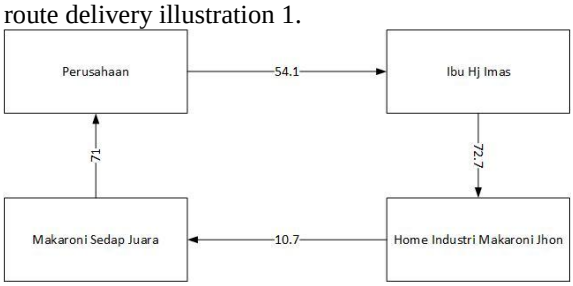
Route 1 is Home Industry Macaroni John, Success Makaroni Champion and Mrs. Hj Imas. The distance between the company and the customer and the customer is as follows:

a. Jarak Perusahaan – Ibu Hj Imas = 54.1 km
b. Jarak Perusahaan – Home Industri Makaroni Jhon = 62 km.
c. Jarak Perusahaan – Makaroni Sedap Juara = 71 km

Because the closest distance generated is 54.1 km then that will be visited first is Mrs. Hj Imas. then in the same way determined the second visit as follows:

a. Jarak Perusahaan – Ibu Hj Imas – Home Industri Makaroni Jhon = 54.1 km + 72.7 km = 126.8 km
b. Jarak Perusahaan – Ibu Hj Imas – Makaroni Sedap Juara = 54.1 km + 74.7 km = 128.8 km

Found the closest distance 126.8 km. Then the delivery route is the Company - Mrs. Hj Imas - Home Industry Makaroni Jhon - Successful Macaroni Champion - Company with total distance for route 1 is 208.5 km. Here is a description of the route delivery illustration 1.




**Gambar 3,** Gambara Pengiriman Rute 1

## 2.10 *Entity Relationship Diagram* (ERD)

ERD yang dipa ERD used to describe the flow of data processed so that will produce the necessary information. The relationship between these entities is shown in the figure to explain the data stream that is processed so that it will produce the necessary information. The relationship between these entities is shown in the figure 3.

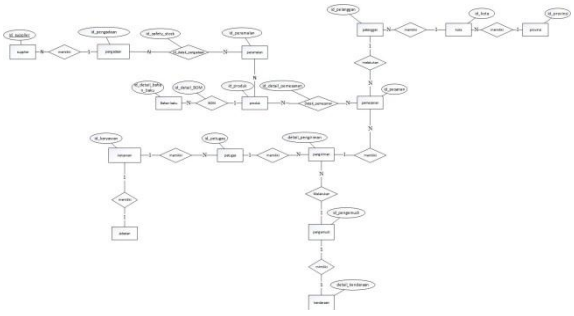


**Figure 4.** Entity Relationship Diagram Development of Product Distribution Information System at PT. RFS With Approach Supply Chain Management Method (SCM)

### 2.11 Diagram Konteks

Aims to describe the flow of data systems and external entities. This context diagram is shown in Fig 5.

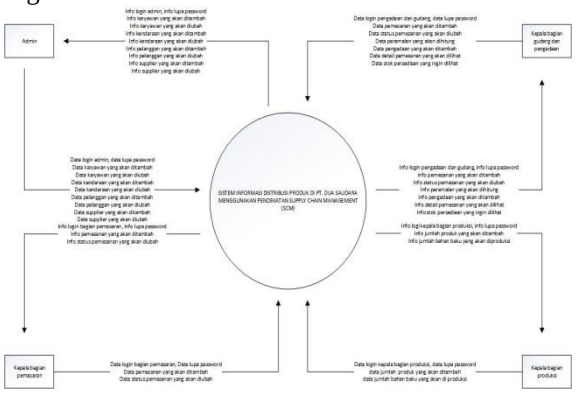
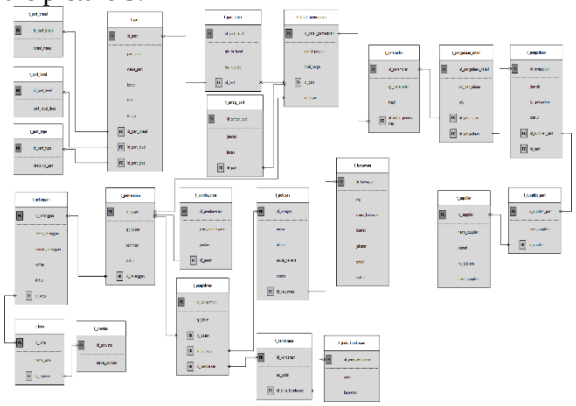


**Figure 5.** Context Diagram Information System Distribution of Motor Vehicle Parts at PT. RFS With Approach Supply Chain Management Method *(SCM)*

### 2.12 Table Relasion

Table Relationships aims to Describe the linkage of tables in the system in detail or clear, then use table relations. Table relation will be described in the picture 5.



**Gambar 6.** Table Relation

### 2.13 Sistem Testing

Aims to make mistakes and flaws in the application of the information being tested. Testing to find out what has been made has fulfilled the design objectives or not.

#### 2.13.1 The conclusion of alpha testing

From the conclusion that the system is appropriate. Funds can generate output data in accordance with what is desired.

#### 2.13.2 The conclusion of beta testing

After an interview at PT. RFS can be concluded that this information system has helped pohak PT. RFS in managing product planning to suppliers, managing ordering data, forecasting, monitoring product inventory, and managing delivery well enough, in terms of use of the language used is good, easy to use and interface is good enough.

## 3. CLOSING

### 3.1 Conclusion

The conclusions that can be drawn from all the processes that have been done in building this information system are as follows:

1. Supply chain management information system can facilitate the Head Warehouse and Procurement in terms of planning ordering of raw materials to suppliers so as not to happen the accumulation of raw materials or lack of raw materials.
2. Can facilitate the head of the marketing department in the process of distribution to customers and the determination of the closest distance in order to avoid delay.

### 3.2 Suggestion

Information system built with supply chain management approach at PT. This RFS can still be developed further with higher system specifications and better performance.

Here are some suggestions that can be used for the development of this research:

1. The interface display on the next research is expected to be more interesting for system users.
2. n this system does not process data related to finance. It is expected that the following research can manage the data related to finance so that the implementation of supply chain management can be more complete.

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