DEVELOPMENT OF AGRICULTURAL MEANS DISTRIBUTION MANAGEMENT INFORMATION SYSTEM IN PT. INTI TANI NIAGA

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ABSTRACT

PT. Inti Tani Niaga is a company engaged in the distribution of agricultural facilities located in Natar, South Lampung. The problem faced by the company is that in the process of determining the number of procurement of goods carried out based on estimates so that it has excess stock, from the excess stock there is a buildup of goods in the warehouse and as a result some goods are damaged so that the company is detrimental, not only that so far the process of item distribution is based on each sales area so that in one day there is often the same delivery place while the contents of the vehicle load have not been maximal, which is 4 tons, this causes a swollen distribution operating costs. Based on the problems that occur, used Management Information Systems (SIM) Distribution with PDCA models (*Plan, Do, Check, Act*). The method used to help determine the number of procurement of goods is *Single Exponential Smooting* while the method to assist the process of determining the route and scheduling delivery is *Saving Matrix*. Based on the results of this study concluded that the system has been able to assist companies in the process of determining the amount of procurement of goods to *suppliers* and has been able to assist in determining the route and scheduling so that distribution costs become more minimal than before.

Keywords : Distribution, PDCA, *Single Exponential Smoothing*, *Saving Matrix*.

1. INTRODUCTION

PT. Inti Tani Niaga is a company engaged in agricultural and plantation facilities, in this case PT. Inti Tani Niaga is a business that provides agricultural production facilities (saportan) which has a distribution range almost throughout Lampung. This company was established on 9 August 2004 in Natar, South Lampung.

Based on the results of interviews conducted with Mrs. Rebbeca as General Manager, all this time in the process of determining the number of procurement of company goods only based on estimates, so that there was excess stock, from the excess stock there was a buildup of goods in the warehouse and as a result some goods were damaged so that the company was detrimental. As in January 2017 the company ordered 1000 Bksa 40 Sp 100 Gr and at the end of the year experienced 80% excess stock, from the excess stock, the Bonsa 40 Sp 100 Gr product was damaged by 17%.

Not only that, according to you Wagimin as the *Marketing Manager*, so far the process of distributing goods was carried out using 6 vehicles Colt Diesel with a load capacity of 4 Ton each. Delivery is carried out by *drivers* based on sales requests that have their respective sales areas, so that within 1 day there is the same delivery place while the contents of the cargo have not reached 4 tons (maximum load) as on March 29, 2017, 3 *drivers* distributed goods to Lampung East. The process of distributing goods based on their respective territories was carried out when the order came through a sales person who then distributed each of them to their territory using 1 truck with *drivers.* This causes the swelling of operational costs for the distribution of goods due to distribution costs consisting of fuel costs and the cost of feeding the *driver*. The more vehicles that come out, the greater the distribution costs.

Based on existing problems, it is necessary to build an Information System for the Management of Agricultural Facilities Distribution at PT. Inti Tani Niaga.

2. RESEARCH CONTENT

2.1 Management information system

System that is useful for managing information. Information is an important element, therefore it needs an issue that can regulate. [1]

2.2 Distribution

Distribution is the process of sending products to get to the right hands at the right time and place. The process of distributing products to customers involves transportation. The thing that must be considered in designing a distribution network is cost, flexibility and response. [2]

2.3 Forecasting

Various efforts to solve future problems are carried out with approaches that are in line with actual data and also with forecasting. Forecasting is needed not only to estimate the future, but also for decision making. An important step is to choose the

right periodic series method by estimating the type of data pattern. Data patterns are divided into several cyclical types and *trends*, namely:

1. Horizontal Data Patterns occur when the average value is constant.
2. Seasonal Data Patterns, are influenced by the seasonal factors of the
3. Cyclic Pattern, occurring influenced by economic fluctuations.
4. patterns *Trend*occur when there is a long-term increase or decrease in [3]

2.4 *Single Exponential Smoothing*

Single exponential smoothing is a forecasting method used for data that tends to be stable and short-term forecasting. To find the results of forecasting using a *single exponential smoothing* can use the following equation. [3]

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

2.5 *Safety Stock*

Safety stock is used to protect forecasting errors during lead times. The formula for finding *safety stock* is as follows**.**

Safety stock Z x Sdl (2)

Description:
Z = Service Level
Sdl = demand uncertainty. [4]

2.6 *Saving Matrix*

Saving Matrix is a method that serves to assist the route search process by looking at the distance and the vehicle to be used for shipping products to consumers. The saving matrix steps are:

1. Determining the distance matrix The distance matrix is searched using the equation below:

$$Dist\ (A, B) = \sqrt{(X_a - X_b)} \qquad (3)$$

2. Determine the saving matrix The saving matrix is the distance traveled from consumer x to consumer y then returns to the depot. The saving matrix can be searched using the following equation:

$$S\ x, y = Dist\ (DC, x) + Dist\ (DC, y) - Dist\ (x, y) \qquad (4)$$

Description:
S (x, y) = *saving* matrix or distance value saved.
Dist (DC, x) = trip from depot to consumer *x*.
Dist (DC, y) = journey from depot to consumer *y*.
Dist (x, y) = journey from consumer *x* to consumer *y*.

3. Searching for routes Route search is done by sorting the matrix savings results with the maximum transport load limitation
4. Determining the delivery order.

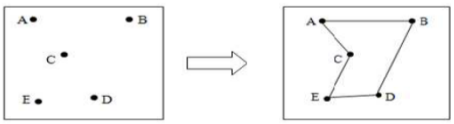
Determination of the delivery sequence is determined using several methods The results of the method are compared and the shortest distance results are selected. These methods are:

1. *Farthest Insert*

Farthest Insert starting from consumers who have the farthest distance. Evaluation of the biggest distance increase using the following equation.

$$\Delta f = C_{ik} + C_{kj} - C_{ij} \qquad (5)$$

Illustration of completion:



Picture 1. *Fartherst Insert*

2. *Cheapset Insert*

Cheapset Insert selects the consumer with the most with the depot and chooses the minimum distance. Theequation *Cheapest Insert* is as follows.

$$\Delta f = C_{ik} + C_{kj} - C_{ij} \qquad (6)$$

Illustration of completion:

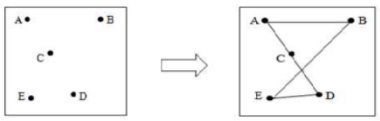


Picture 2. *Cheapest Insert*

3. *Nearest Neighbor*

Nearest Neighbor adds the closest consumer from the last point visited until all consumers are visited.

Completion illustration:



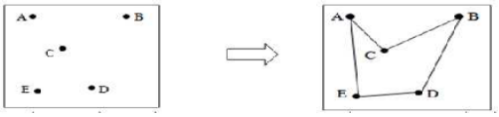
Picture 3. *Nearest Neighbour*

4. *Nearest Insert*

Nearest Insert starts from the consumer with the shortest travel distance. Evaluation of the shortest distance increase using the following equation. [5]

$$\Delta f = C_{ik} + C_{kj} - C_{ij} \qquad (7)$$

Illustration of completion:



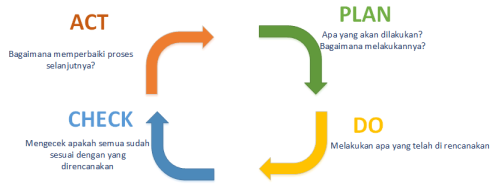
Picture 4. Rute Pengurutan *Nearest Insert*

2.7 PDCA (*Plan, Do, Check, Act*)

PDCA is a problem-solving process with 4 steps, namely plan, do, check, and follow up. In quality control, PDCA can assist the process of solving problem control with a systematic pattern.

The explanation of the 4 PDCA stages is as follows.

1. *Plan*, namely the planning stage determines what needs to be improved related to the organization's vision and mission and determines the data and information needed for the next process.
2. *Do* that the implementation phase of what was planned in the previous phase.
3. *Check* is the stage of checking whether the thing done is in accordance with what was planned at the beginning of the stage.
4. *Action* is the stage to take corrective actions for the results of all stages that have been implemented. [6]



Picture 5. PDCA

2.8 PHP (Perl Hypertext Preprocessor)

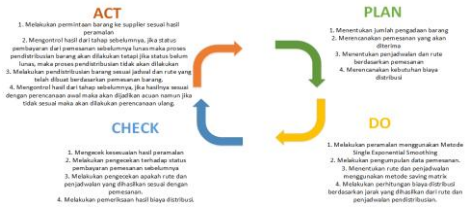
PHP is a programming language that integrates with HTML to create dynamic web pages. PHP can be run on several operating systems such as Windows, Linux, and Unix.[7]

2.9 SIM Analysis of Distribution of Agricultural Facilities at PT. Inti Tani Niaga uses the PDCA model PDCA

Analysis in this section will be analyzed a procedure that will be implemented in the system built. PDCA analysis on this system includes:

a. Analysis of the determination of the amount of procurement of goods
b. Analysis of goods ordering
c. Analysis of distribution of goods
d. Distribution cost

analysis Analysis of Information Systems Management of Distribution of Agricultural Facilities at PT. Inti Tani Niaga with the PDCA model is found in the following figure.



Picture 6. PDCA Model

2.9.1 Determination Analysis of Procurement Amounts on SIM Distribution of PT. Inti Tani Niaga

1. *Plan*

This stage is the planning stage for the procurement of goods to *suppliers*. The thing that must be considered is the procurement of goods must be as needed so there is no excess stock which results in the creation of goods in the warehouse. The process of determining the number of procurement of these items uses a tool that is themethod *Single Exponential Smoothing*.

Based on data on sales of goods, it is known that the Ridox 480 SL 1 LT @ 20 product is the most sold item so that it can be sampled in analyzing the number of goods procured. Forecasting is done every 25th. Ridox 480 SL 1 LT @ 20 sales data are found in Table 1

Table 1. Ridox 480 SL 1 LT Sales Data @ 20

Months	Request Amount
January	2360
February	3640
March	1980
April	2660
May	2100
June	2280
July	2140
August	1980
September	2570
October	2060
November	2168
December	1978

2. *Do*

at this stage the process of forecasting goods using theis carried out *Single Exponential Smoothing* at alpha a = 0.1 so that the results of forecasting the procurement of Ridox 480 SL 1 LT @ 20 January 2018 are 2284 BTL.

3. *Check*

At this stage, checking is done according to what has been planned using monitoring techniques withcalculations *safety stock*. The following is the calculation process for *safety stock*.

results for January 2018 = 2284
of working days in one month = 26 days
Lead time for procurement of products to *suppliers* (l) = 7 days
Average order in one month (d) = 2284/26 = 87.84
Standard deviation of the amount of forecasting July 2016 (sd) = 87.84 / 10 = 8.784
Standard deviation from lead time (sl) = 7/10 = 0.7
Service level 95% (Z) = 1.645
Safety Stock = Z x Sdl
Sdl = √ ((d ^ 2 x ⟦ Sl⟧ ^ 2) + (lx d Sd⟧ ^ 2))
Sdl = √ ((⟦ 87.84⟧ ^ 2 x ⟦ 0.7⟧ ^ 2) + (7 x ⟦ 8,784⟧ ^ 2))
Sdl = √ ((7715.86 x 0.49) + (7 x 77.158))
Sdl = √ ((3780.77) + (540.106))
Sdl = √4320,876 = 65,73337

Safety Stock = 1,645 x 65 , 73337 = 108.131 => 109 BTL (rounding result).
Based on the results of thecalculation *safety stock*, the company must provide *safety stock* for Ridox 480 SL 1 LT @ 20 as much as 109 BTL.

4. *Act*

At this stage an order is made to the *supplier* made by the Marketing Manager with details in Table 2 below.

Table 2. Order Details

Item Name		Ridox 480 SL 1 LT @ 20
Forcast Results		2284 BTL
Final Stock		1203 BTL
Order		2284 + 109-1203 = 1190 BTL
Supplier		Sustainable Chemicalindo Asiana

Based on table 2, then on the 25th December 2017 the company must order Ridox 480 SL 1 LT @ 20 as many as 1190 BTL to the *supplier of* Chemicalindo Lestari.

2.9.2 Analysis of Ordering of Goods on SIM Distribution of PT. Inti Tani Niaga

1. *Plan*

This stage plans the number of goodsfrom *orderedcustomers*. The thing that must be considered is *customer* that the orderinghas paid off the order beforehand while the *customer* newwho will order does not need to check the status of the previous payment. Orders whose status is accepted, will be processed in the next stage, namely the process of shipping the goods.

2. *Do*

This stage is carried out by ordering data collection from each kiosk.

Table 1. Order Data

Order Date	Name Sales	Name *Customer*	Name Item	QTY
a 24 Mar 2017 25 Mar 2017	Kusnan	Imam Banjid	KAYABIO GENERAL 5kg @	4400BKS
			SIDAMIN 865AS 200ml @ 40	40 BTL
			SIDAMIN 865AS 400ml @ 25	125 BTL
			SIDAFOS 480 US 20 LT	10 CAN
		Sarjono Bahuga	FERTILIZER NPK BLAUKORN 25KG	25 ZAK
			INTANTOP 490 SL 20LT	1 CAN
		Mukani Balitang	LINDAS 2240 AS 5 LT @ 4	40 PAIL
		Aan Kiosk	CABE TM 333 10 GR	10 BKS

3. *Check*

At this stage checks the status of payment of the previous order against the kiosk that made the order.

Table 2. Payment Status

Date of Ordering	Name *Customer*	Status
03-Feb-17	Imam Banjid	Lunas
03-Feb-17	Sarjono Bahuga	Lunas
27-Jan-17	Mukani Balitang-17-17	Lunas
28-Jan-17	Aan Kios	Lunas
03	Sigit Kios	Lunas
22-Dec-16	Restu Belitang	Lunas
22-Dec-16	Maju Jaya Metro	Lunas
22-Dec-16	Maryanto Metro	Off
22-Dec-16	Andar Rawa Jitu	Lunas
22-Dec-16	Nurhidayah Kiosk	Has Not Been Abroad
10-Nop-16	Hadi PD Ratu	Lunas

4. *Act*

At Stage this is used to control the previous stage, if the payment status is paid off then the process of distributing goods will be carried out but if it has not been paid off then the process of distributing goods will not be carried out.

Table 3. Order Status

Order Date	Name *Customer*	Name Item	QTY	Remarks
a 24 Mar 2017 25 Mar 2017	Imam Banjid	KAYABIO GENERAL 5kg @	4400BKS	Accepted
		SIDAMIN 865AS 200ml @ 40	40 BTL	Accepted
		SIDAMIN 865AS 400ml @ 25	125 BTL	Accepted
		SIDAFOS 480 US 20 LT	10 CAN	Accepted

	Sarjono Bahuga	25kg NPK BLAUKOR N	ZAK 25	Accepted
		INTANTOP 490 SL 20lt	1 CAN	Received
	Mukani Balitang	LINDAS US 2240 5 LT @ 4	40 PAIL	Accepted

2.9.3 SIM Analysis Distribution of Goods on PT. Inti Tani Niaga

1. *Plan*

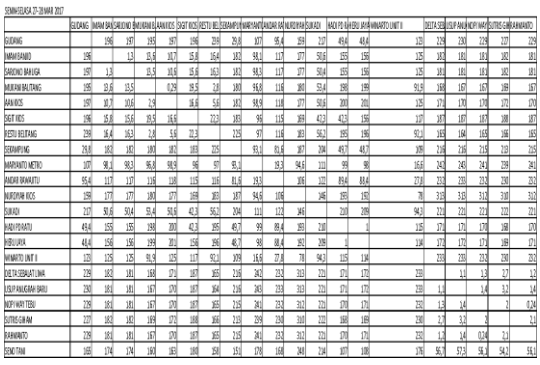
At this stage the objective is to schedule the delivery of goods. Distribution scheduling after checking order status due to the business rules of the company, the distribution of goods will be made to the customer who has made repayment on the previous order.

2. *Do*

The steps taken at this stage determine the route according to the order by using themethod *saving matrix*. To schedule a delivery at the *customer* PT. Inti Tani Niaga sends goods a day after ordering or a maximum of three days after ordering. Delivery will be sent via the nearest route first.

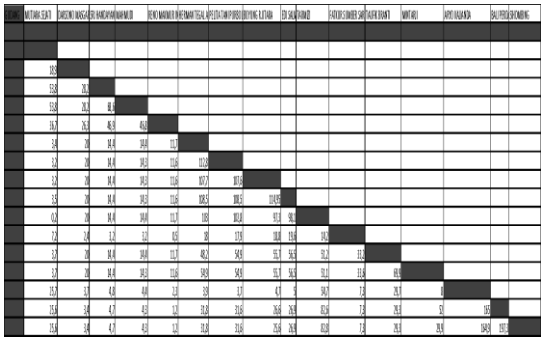
The first step is to determine the distance matrix for each *customer* as in Table 6 below.

Table 4. Distance Matrix



The next step is to determine the savings matrix as shown in Table 7 below.

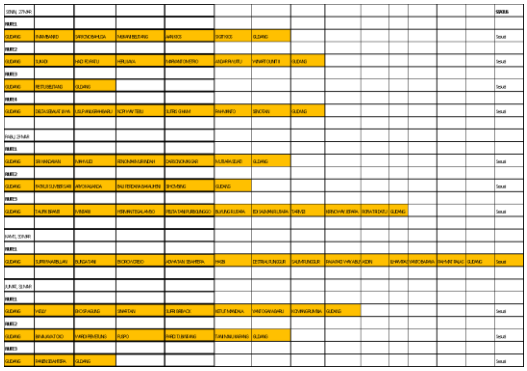
Table 5. Saving Matrix



3. *Check*

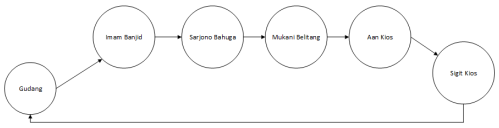
This stage checks whether the resulting route is in accordance with the order. Appropriate status means the shipping route is in accordance with the order and the status is not appropriate means the shipping route is not in accordance with the order. Route checking is found in Table 8 below.

Table 6. Route Checking



4. *Act*

At this stage delivery is carried out according to the route and scheduling that has been made based on the order of goods. Routes are in Figure 7.



Picture 7. Route

Scheduling isin Table 9

Table 7. Scheduling

DAY / DATE	OF VEHICLE NUMBER	NAME *DRIVER*	RUTE
Monday-Tuesday / 27-28 March 2017	BE0923IU	Restu	GUDANG - IMAM BANJID - SARJONO BAHUGA - MUKANI BELITANG - AAN KIOS - SIGIT KIOS - GUDANG
Monday-Tuesday / 27-28 March 2017	BE1283AF	Didi	GUDANG - SUKADI - HADI PD. RATU - HERU JAYA - MARYANTO - MEANDAR RW . JITU - WINARTO UNIT II - GUDANG

2.9.4 Analysis of Goods Distribution Costs on SIM Distribution PT. Inti Tani Niaga

1. *Plan*

This stage takes the planning stage for distribution costs. Distribution costs consist of the cost of diesel fuel and the cost of feeding *drivers*. Solar costs are obtained from the total distance generated by the route and then divide by 8 (because the diesel used is 1 Liter per 8 Km) and the results are multiplied by the price of diesel fuel which is Rp. 5,150. Besides that themeal costs *driver's* are as big as Rp. 30,000 per day. The results of distribution

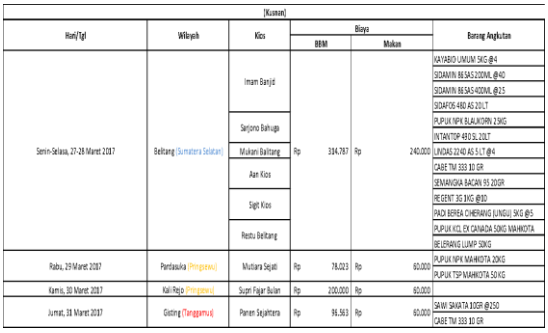
costs with the route generated by the *saving matrix* will then be compared with the distribution costs by the route before themethod is carried out *saving matrix*.

2. *Do*

At this stage the calculation of distribution costs is based on the route generated by *saving matrix* and distribution costs based on the route beforemethod is carried out *saving matrix*. Solar costs are obtained from the distance generated by the route and then divide by 8 (because diesel fuel is 1 Liter per 8 Km) and the results are multiplied by the price of diesel fuel which is Rp. 5,150. Besides that themeal fee *driver's* is Rp. 30,000 per day.

The following table is a route and the cost details before themethod *saving matrix* are the distribution process based on each region.

Table 8. Route dan cost before Saving Matrix



[Kosong]					
Hari/Tgl	Wilayah	Kios	Biaya		Barang Angkutan
			BBM	Makan	
Senin-Selasa, 27-28 Maret 2017	Beltang (Sumatera Selatan)	Imam Banjit	Rp 334,787	Rp 240,000	KAYABOI UMUM 5KG @4
					SIDAMIN BESAS 200ML @40
					SIDAMIN BESAS 400ML @25
					SIDAFOS 480 AS 20LT
		Sarjono Bahuga			PUPUK NPK BLAUKORN 25KG
					INTANTOP 480 SL 20LT
		Mukmi Baltang			LIVIDAS 2240 AS 5LT @4
		Aan Kios			CABE TM 333 10 GR
					SEMANGKA BACAN 95 20GR
		Sigit Kios			REGENT 3G 3KG @30
					PADI BERAS CHERANG (UNGU) 5KG @5
		Restu Beltang			PUPUK KCL EX CANADA 50KG MAHKOTA
					BELERANG LUMP 50KG
Rabu, 29 Maret 2017	Pantauska (Pringsewu)	Mutiara Sejati	Rp 76,023	Rp 60,000	PUPUK NPK MAHKOTA 20KG
					PUPUK TSP MAHKOTA 50 KG
Kamis, 30 Maret 2017	Kali Rejo (Pringsewu)	Supri Figar Bulan	Rp 200,000	Rp 60,000	
Jumat, 31 Maret 2017	Gisting (Tanggamus)	Panen Sejahtera	Rp 96,563	Rp 60,000	SAWI SHAKTA 100SR @250
					CABE TM 333 10 GR

The following table is the result of distribution cost calculations before *saving matrix*.

Table 9. Cost before Saving Matrix

Day / Date	Total Distance	Total Solar (Liter)	Eating Money	Total Distribution Costs
Monday-Tuesday / March 27-28 2017	2131.29	266,4113	Rp. 1,110,000	Rp 2,482,018
Wednesday / March 29 2017	842,25	105,2813	Rp. 360,000	Rp 902,198
Thursday / March 30 2017	916.75	114,5938	Rp. 390,000	Rp. 980,158
Friday / March 31, 2017	945,8	118,225	Rp. 330,000	Rp 1,058,596

While the following table is the route and the costs generated aftermethod *saving matrix* is the process of distributing goods based on routes and scheduling.

Table 10. Cost After Saving Matrix

Day / Date	Total Distance	Total Solar (Liter)	Eating Money	Total Distribution Costs
Monday-Tuesday / March 27-28 2017	1928,57	241,0713	Rp. 240000	Rp 1,481,517
Wednesday / March 29 2017	638,43	79,80375	Rp. 180000	Rp. 690,989
Thursday / March 30 2017	587,3	73,4125	Rp. 240000	Rp. 438,074
Friday / March 31, 2017	843,9	105,4875	Rp. 180000	Rp. 723,261

3. *Check*

This stage checks the distribution costs after themethod *saving matrix* is made more minimum compared to distribution costs beforemethod is used *saving matrix*.

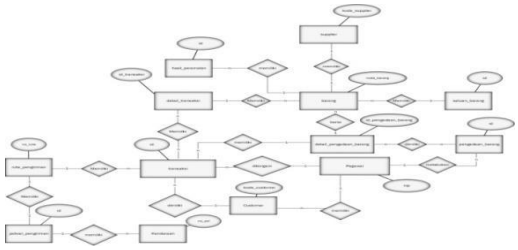
Based on Table 11 and Table 12, it can be concluded that distribution costs incurred after using themethod *saving The matrix is* more mimimun than the distribution cost before themethod is carried out *saving matrix*.

4. *Act*

At this stage it is carried out to control the results of each stage, if according to the original plan, it will be used as a reference.

2.10 Database Analysis Database

analysis uses the *Entityy Relationship Diagram* (ERD) as shown in Figure 8 below.



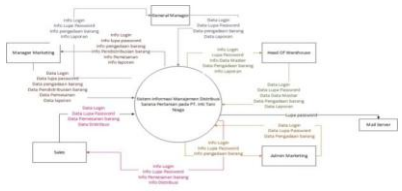
Picture 8. ERD

2.11 Functional Need Analysis Analysis of functional

requirements is an analysis of data flow that is useful in the process of making software design.

2.11.1 Context Diagram

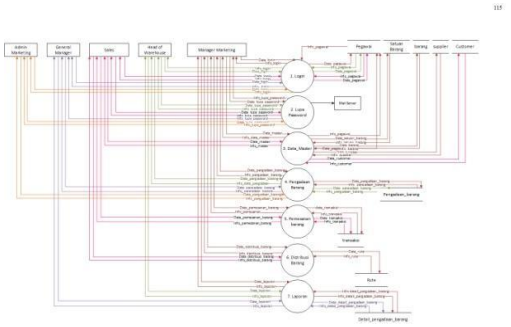
diagram is a model to explain data used and process data flow into and out of the system. The context diagram in the system is shown in Figure 9 below.



Picture 9. Context Diagram

2.11.2 *Data Flow Diagram*

Data Flow Diagrams (DFD) are descriptions of data flows and storage. *data flow* Level 1diagrams (DFD) are found in Figure 10.



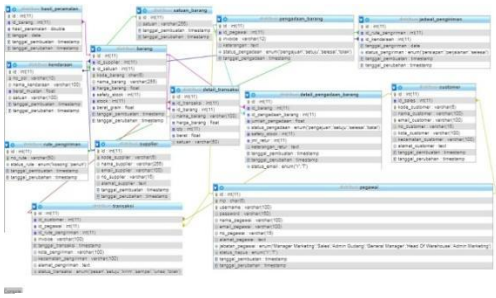
Picture 10. DFD Level 1

2.12 System

Design is an information structure representation, program interface characteristics and procedure details.

2.12.1 Relationship Diagram

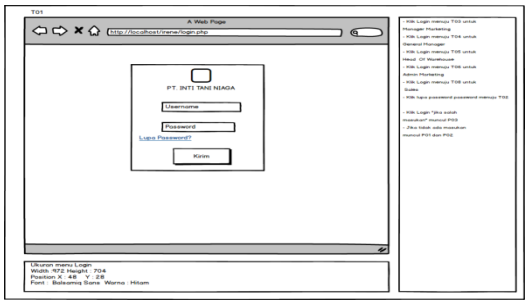
diagram is an illustration of the relationship between data. The relation diagram is shown in Figure 11 below.



Picture 11. Diagram Relation

2.12.2 Interface Design Interface

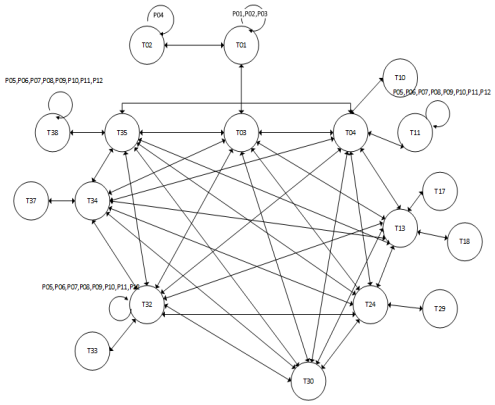
design is the design of the program that is used to interact between users and the system. The design of the Login interface can be seen in Figure 12 below.



Picture 12. Login Interface Design

2.12.3 Semantic Network Design

design of semantic networks in the information system of agricultural facilities distribution management at PT. Inti Tani Niaga is found in Figure 13 below.



Picture 13. Semantic Network Design

2.13 System Implementation and Testing System

2.13.1 implementation System

implementation is the stage to translate design based on analysis.

2.13.2 Testing *Blackbox*

Testing *Blackbox* is the testing done by observing the results of the execution of the test data and functional examination.testing is *Blackbox* found in Table 13 below

Table 11. Blackbox Testing

Item Test	Details Testing	Type Test
Login	login verification	*Black Box*
Forgot Password	Enter username and email	*Black Box*
Item Processing	Add data Edit data Search data	*Black Box*
Processing Unit Items	Add data Edit data Search data	*Black Box*
Processing Supplier	Add data Edit data Search data	*BlackBox*
Data ProcessingEmployees	Add data Edit data Search data	*Black Box*

2.13.3 User Acceptance Test (UAT)

UAT testing is listed in Table 14 below.

Table 12. UAT Testing

No	Description of Testing	Procedure Test	Results obtained	Status
1	Testing Login	1. Access www.intitaniniaga.com 2. Enter user name and password 3. Press the login button	Marketing Manager can perform data processing according to the access rights Marketing Manager	[√] Received [] Denied [] Received With Notes
2	Test	1. Click the	Marketing	[√]

	Forgot Password	button here 2. Enter user email 3. Press the reset buttonpass word	Managerretrieves the password and can log in again on the system	Received [] Denied [] Received With Notes

2.13.4 Final Recipient Scenario

In this test is done by interviewing prospective system users. The questions asked when interviewing the *Marketing Manager* are as follows.

1. Is the system built can manage goods data, supplier data, transaction data, employee data and vehicle data properly?
2. Has the system been able to determine the amount of procurement of goods to the supplier?
3. Has the system been able to schedule freight forwarding activities?
4. What do you think of the language used in the system, is it easy to understand?
5. What do you think about the features that are in the system that is built?
6. What do you think about the ease of use of the system?

3. CLOSING

3.1 Conclusions

Based on the results of the analysis, design until the implementation of the interface, it can be concluded as follows:

1. The information system built is enough to help the *Marketing Manager* to determine the amount of procurement of goods to the *supplier* every month.
2. The information system built is enough to help the *Marketing Manager* to determine the route and schedule the delivery of goods to minimize distribution operating costs.

3.2 Suggestion

Based on the existing conclusions, the suggestion that can be done is in the process of determining the route using themethod, it *saving matrix* needs to be developed again so that the route search process is faster.

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