GEOGRAPHIC INFORMATION SYSTEM OF DISTRIBUTION AND SPREAD OF FERTILIZER TO FARMERS IN CV. PRIMA SEJAHTERA ABADI

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ABSTRACT

CV. Prima Sejahtera Abadi, located in Karangtengah sub-district, Cianjur Regency, has 2 main producers, namely PT Pupuk Kujang with the appointment number 068 / PK / SP / UM / 1/2017 and PT Petrokimia Gresik designation number 1851 / TU.04.06 / 24/2017 and distributes types of fertilizers are SP-36, ZA, UREA, NPK, and Phonska Plus. Cianjur Regency consists of 32 sub-districts, 5 sub-districts are the responsibility area of CV. Prima Sejahtera Abadi namely Cikalong Kulon sub-district with 20 villages, Ciranjang sub-district with 8 villages, Karangtengah sub-district with 16 villages, Leles sub-district with 11 villages, and Mande sub-district with 14 villages.Based on the current problems CV. Prima Sejahtera Abadi does not yet have information on the distribution and spread of fertilizers to farmers quickly and accurately in the form of spatial-based digital maps, because the information obtained by the company only through kiosk confirmation every 1 month and the company only uses map in the form to find out information in fertilizer distribution paper and distribution in each region. Lack in obtaining information also results in difficulties for companies in monitoring areas that require fertilizer, which results in problems in predicting future fertilizer requirements.The results of the testing carried out on the Geographic Information System built can be concluded that the system can assist the Director and Marketing of the company in monitoring and finding needs that will be distributed in the next period.

Keywords: geographic information system, distribution, spread, fertilizer, cianjur.

1. PRELIMINARY

Cianjur Regency is located in West Java Province geographically located at coordinates 106o 42'- 107o 25 'East Longitude and 6o 21' -7o 25 'South Latitude, with an altitude of 7-2,962 masl and has a slope of 0-40%. Cianjur Regency has a large potential in the field of agriculture with a large scale in Indonesia as many as 283,042 agricultural business units based on the preliminary figures of the complete enumeration of the 2013 agricultural census (ST2013) from the Central Statistics Agency (BPS) of Cianjur Regency. Meanwhile, to meet the needs of farmers in the Cianjur Regency, there are several fertilizer distributors supervised by Fertilizer Producers and the Agriculture Service. Farmers will get fertilizer through the kiosk because the kiosk is a retailer that has permission from the producer and fulfills the requirements and has signed a purchase and sale agreement (SPJB) with the distributor. One of the fertilizer distributor companies is CV. Prima Sejahtera Abadi, located in Karangtengah sub-district, Cianjur Regency, has 2 main producers, namely PT Pupuk Kujang with the appointment number 068 / PK / SP / UM / 1/2017 and PT Petrokimia Gresik designation number 1851 / TU.04.06 / 24/2017 and distributes types of fertilizers include SP-36, ZA, UREA, NPK, and Phonska Plus. Cianjur Regency consists of 32 sub-districts, 5 sub-districts are the responsibility area of CV. Prima Sejahtera Abadi namely Cikalong Kulon sub-district with 20 villages, Ciranjang sub-district with 8 villages, Karangtengah sub-district with 16 villages, Leles sub-district with 11 villages, and Mande sub-district with 14 villages.

The results of the interview with Mr. Achmad Hidayatul Mustofa as the director of CV. Prima Sejahtera Abadi stated that currently CV. Prima Sejahtera Abadi distributes fertilizer to each farmer, through the company gets information about the distribution and distribution of fertilizer from each kiosk group every 1 month and the company only uses maps in the form of paper to monitor fertilizer distribution and distribution in each region, this is the result of information what is obtained is less accurate and fast, and the use of paper maps will make it difficult if the data will be updated.

Lack of information also causes companies to have difficulty supervising stalls or stalls that require fertilizer, which results in problems in determining the amount of fertilizer demand that will be distributed in the future based on information that already exists because it has an impact in August 2017 as many as 11 tons of fertilizer demand NPK is not fulfilled because of the delay in information obtained by the company.

So, to make it easier to see the distribution and distribution of fertilizers, we need a media that is by using a Geographic Information System, because GIS

can do data processing and perform data analysis so as to produce output that can be used as a benchmark in decision making. CV. Prima Sejahtera Abadi requires a geographical information system that can facilitate obtaining information on the distribution and distribution of fertilizers to each farmer based on its geographical location quickly, accurately and a system to predict the need for more objective fertilizers in order to plan fertilizer requirements in the coming period.

2. BASIC THEORY

2.1 Geographic Information System

Geographic information system (GIS) or Geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, organize and display all types of geographic data. Reference [1] explains that the main purpose of utilizing Geographic Information System is to make it easier to get information that has been processed and stored as an attribute of a location or object. The main characteristic of data that can be used in the Geographic Information System is data that has been bound to the location and is a basic data that has not been specified [1].

2.1.1 Spatial data

References [2] Explains that spatial data is one of the systems of information, in which there is information about the earth including the surface of the earth, under the surface of the earth, waters, marine and under the atmosphere. Spatial data and derivative information are used to determine the position of the identification of an element on the earth's surface [2]. The spatial data model used in geographic information systems is divided into two, namely [2]:

1. Vector data model

Vector data model is the most widely used data model, this model is based on points (points) with coordinate values (x, y) to construct spatial objects. The object built is divided into three more parts, namely [2]:

   a. Point
   b. Line
   c. Area (polygon)

2. Raster data model

Raster data (also called grid cells) is data generated from remote sensing systems [2]. In raster data, geographical objects are represented as grid cell structures called pixels (Picture Element). In raster data, the resolution depends on the pixel size [2].

2.1.2 Non-spatial data

Non-spatial data or attribute data are data that represent aspects of the description of the modeled phenomena that cover items and properties, so that the information conveyed will be more diverse, non-spatial data also store attributes of the appearance of the earth's surface such as land that has texture attributes, depth and so forth. Non-spatial data / attributes are stored in the form of records and fields, for example non-spatial data are: Regency Name, Address of government office, Website address, Mountain name [2].

2.2 Fertilizer Distribution

As a Fertilizer Subsidy Implementer assigned by the Government, PT Pupuk Indonesia (Persero) implements the procurement and distribution of subsidized fertilizers through producers, distributors and distributors in their respective areas of responsibility [3]. PT. Pupuk Indonesia (Persero) is given the authority to regulate the distribution of the areas of subsidized fertilizer procurement and distribution between producers (its subsidiaries) in accordance with production capabilities, with the aim to be more flexible, efficient and effective [3]. The procurement and distribution of subsidized fertilizer is carried out through the producer to the distributor (distributor in Line III) who has been appointed in the working area and the distributor then distributes it to the appointed Retailer / Kiosk (distributor in Line IV) in his working area [3].

Fertilizer distribution to farmers / farmer groups is carried out by authorized retailers / kiosks that have been appointed in their working area and carried out in a closed system based on the Definitive Plan of Group Needs (RDKK) with the Highest Retail Price (HET) as stipulated in the Minister of Agriculture Regulation on the Need and Subsidized Fertilizer HET For the Agricultural Sector [3].

2.3 Fertilizer Supervision

In order to secure subsidized fertilizer distribution, the packaging / bag of subsidized fertilizer must be given an additional label that reads "Government Subsidized Fertilizer, Goods in Supervision" that are easy to read and not easily lost / erased. Especially for subsidized Urea fertilizer is pink ("pink") and subsidized ZA fertilizer is orange ("orange") which is intended to facilitate supervision of subsidized fertilizer distribution by producers, distributors and authorized retailers. Authorized manufacturers, distributors, and retailers must guarantee the availability of subsidized fertilizers in the area of responsibility in accordance with the provisions of the stipulated stock.

There needs to be a level of inherent supervision from producers and distributors and the Fertilizer and Pesticide Control Commission (KP3). Based on a recommendation from the Supreme Audit Agency (BPK) on the implementation of subsidized fertilizer procurement and distribution in 2012, among others, drafting a reconciliation procedure for subsidized fertilizer distribution between the Agriculture Service and Distributors and / or Retail Kiosk, verification and validation of fertilizer distribution is necessary. subsidized from Retail Kiosks to farmer groups by a

tiered Verification Team starting from the District, Regency / City, Province to the Central level [3].

2.4 Dashboard

Dashboard is as computer interface that displays many charts, reports, visual indicators, and the alert mechanism, which consolidate into a dynamic information platform and relevant [4].

The visual appearance here implies that the presentation of information should be designed as possible, so that the human eye can capture information quickly and the human brain can be monitored at a glance [4].

2.4.1 Key Performance Indicator

Key Performance Indicator (KPI) is a set of standards on the most important aspects of performance to determine an organization's success in the present and future [5].

2.5 Forecasting

Forecasting (forecasting) is predictive values of a variable based on the known value of the variable or variables related. Predict can also be based on skills assessment, which is in turn based on historical data and experience [6].

2.5.1 Single Exponential Smoothing

Single Exponential Smoothing Methods used in conditions where the weight of the data in the period differs from the data in the previous period and form exponential function. for the exponential calculation is as follows [6]:

$$Ft + 1 = \alpha \times t + (1- \alpha)\ Ft \qquad (2.1)$$

Information

$Ft + 1 =$ Result forecast for period $t + 1$
$a =$ Constant smoothing
$Xt =$ actual demand data for the period t
$Ft =$ Forecast in period t

2.5.1 Forecasting Errors Counting

Calculating forecasting errors is used to find out the accuracy of the forecasting results that have been carried out on the actual data. There are many models for calculating forecasting errors. The method used to calculate forecasting errors is using the Mean Squared Error (MSE) method. MSE is the average of the squared difference of the predicted values observed [6].

Mean Squared Error (MSE) is the average of forecasting errors squared and can be seen in the equation.

$$MSE = \frac{\sum(Xt-Ft)2}{n} \qquad (2.2)$$

Information

Xt = Actual data in period t
Ft = forecast data from the model used in period t
n = Lots of forecasted data..

3. CONTENTS OF RESEARCH

3.1 Geographic Information System Analysis

Geographic information system analysis is a stage where we know what kind of geographic information system will be created. Geographic information system analysis can be seen in Figure 1.

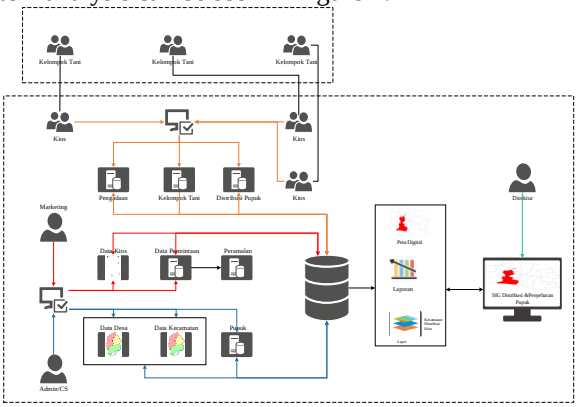


Figure 1. Geographic Information System Analysis

3.2 Spatial Data Analysis

Spatial data on applications that will be built include sub-districts, fertilizer distribution and kiosk distribution. The spatial data is distinguished by different shapes and colors so that the information displayed appears more clearly. Spatial data analysis can be seen in Table 1.

Tabel 1. Spatial Data Analysis

No	Supervision Indicator	Description	Spatial Data	Example
1	Districts	Cikalongkulon Districts	Polygon	
		Mande Districts	Polygon	
		Ciranjang Districts	Polygon	
		Karangtengah Districts	Polygon	
		Leles Districts	Polygon	
2	Fertilizer Distribution	Villages with a spread of fertilizer that has a number < 50 Ton	Polygon	
		Villages with a spread of fertilizer that has a number > 50 Ton sd 100 Ton	Polygon	
		Villages with a spread of fertilizer that has a number > 100 Ton	Polygon	
3	Kiosk	Stall distribution Points are obtained from latitude and longitude	Point	

3.3 Non Spatial Data Analysis

Non-spatial data used to construct geographic information systems for distribution and distribution of fertilizers to farmers in CV. Prima Sejahtera Abadi more clearly can be seen in Table 2.

Tabel 2. Non Spatial Data Analysis

No	Name	Description	Attribute
1	Distribution	Contains information about distribution data	Id_distribusi , nama_desa,nama_pupuk, kelompok_tani,kios.
2	Fertilizer Type	Contains types of fertilizers distributed in Cianjur Regency	Kode Pupuk, Jenis Pupuk, Jumlah Distribusi
3	Kios	Contains information about data per kiosk	Kode Kios, Nama Kios, Alamat, Penanggung Jawab, Stok Pupuk

3.4 Dashboard Analysis

Dashboard is a medium for presenting information, solutions for information needs.

3.4.1 Analysis of Objectives and KPI Dashboard Design

Here is the analysis of objective and KPI Dashboard design to be made can be seen in Table 3.

Primary objective	Sub - Objective	KPI	Target
Distribution and fertilizer to farmers	Improving compliance in fertilizer demand in each - each stall	Total demand of fertilizer per month	150
		Number of meeting the demand of fertilizer per month	150
		Average - Average demand for the type of fertilizer per month	100
	Improving the distribution of fertilizers to farmers	The amount of fertilizer to farmers month deployment	100
		Average - Average spread fertilizer to farmers per month	100
		The number of registered farmer groups	100
		Number of registered stall	50

3.4.2 Graph

The graph on the dashboard will be used to see the visualization and implies a comparison of the distribution of fertilizers to farmers can be seen in Figure 2.

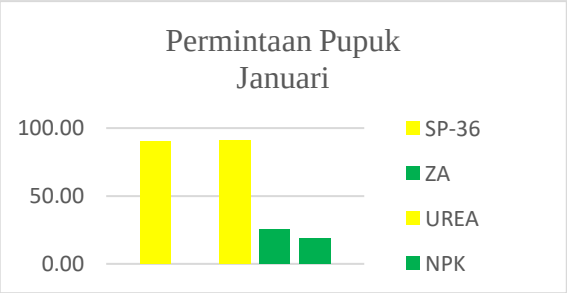


Figure 2, Graph Fertilizer Demand in January

3.5 Analysis of Needs Fertilizer

Stages conduct a needs analysis fertilizer use forecast or forecasting techniques to determine the amount of fertilizer should be provided.

The data will be used as the sample ie urea fertilizer product demand data from the month of July 2017 - December 2017 on PD Barokah kiosk can be seen in Table 4.

Table 4. Fertilizer Demand PD Barokah

No.	Month	Demand
1	July	10
2	August	68
3	September	50
4	October	135
5	November	69
6	December	25

Based on the urea fertilizer demand data, has calculated the demand forecast for January 2018, which can be seen in Table 5.

Table 5. Urea Fertilizer Demand Forecasting

Period	Actual Data	Alpha value								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
July	10									
August	68	10	10	10	10	10	10	10	10	10
September	50	16	22	27	33	39	45	51	56	62
October	135	19	27	34	40	45	48	50	51	51
November	69	31	49	64	78	90	100	110	118	127
December	25	35	53	66	74	79	81	81	79	75
Forecasting Results		34	47	54	55	52	48	42	36	30

The next step is to look at the accuracy in forecasting the results of which have been calculated using MSE method that can be seen in Table 6.

Table 6. Calculation of MSE

Period	Currents	Alpha value								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
July	10	-	-	-	-	-	-	-	-	-
August	68	3364	3364	3364	3364	3364	3364	3364	3364	3364
September	50	1170	807	511	282	121	27	0	41	149
October	135	13405	11604	10165	9040	8190	7583	7194	7009	7019
November	69	1459	407	21	80	431	971	1645	2426	3320
December	25	93	776	1664	2438	2957	3189	3155	2900	2476
The results of MSE		3898	3391	3145	3041	3012	3027	3072	3148	3266

From the comparison of the MSE error seen that $\alpha = 0.5$, has the smallest value error as much as 3012 it can be concluded in January CV. Prima Sejahtera Abadi will be prompted as much as 52 tons of urea fertilizer.

3.6 Analysis Database

Analyzing the data base can use the Entity Relationship Diagram (ERD) .ERD is a technique to describe the information required in the system and the relationship between these data. Here ERD on a system that can be seen in Figure 3.

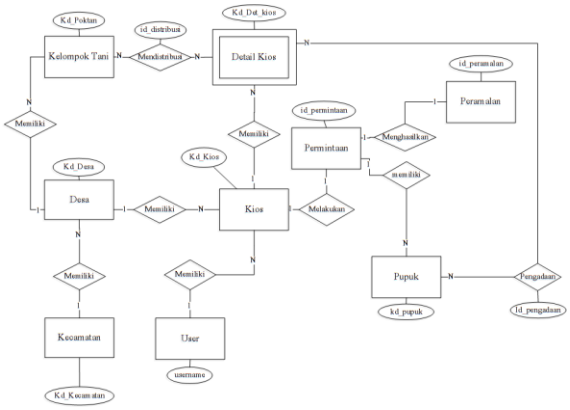


Figure 3. Relasionship Entity Diagram Geographical Information Systems and Distribution of Fertilizer Distribution To Farmers In CV. Prima Sejahtera Abadi.

3.7 Diagram Context

Context diagram is a diagram illustrating the relationship between external entities with which the system will be built. Can be seen in Figure 4.

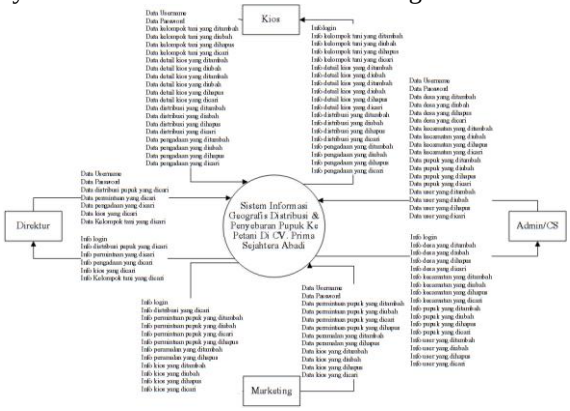


Figure 4. Context Diagram Geographical Information Systems and Distribution of Fertilizer Distribution To Farmers In CV. Prima Sejahtera Abadi

3.7 DFD Level 1

Level 1 Data Flow Diagram Geographical Information Systems and Distribution of Fertilizer Distribution To Farmers In CV. Prima Sejahtera Abadi can be seen in Figure Figure 5.

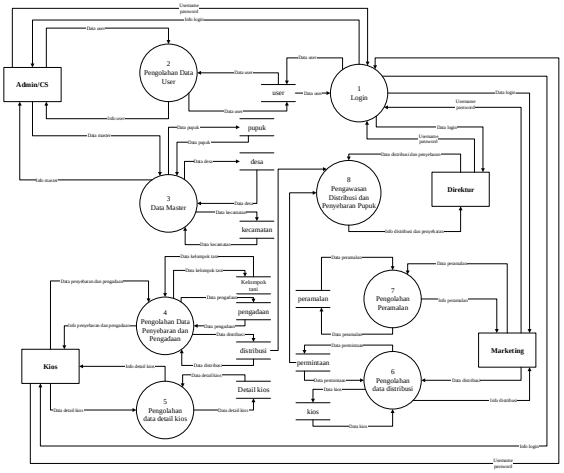


Figure 5.DFD Level 1 Geographical Information Systems and Distribution of Fertilizer Distribution To Farmers In CV. Prima Sejahtera Abadi

3.8 Relationship Diagram

Relationship diagram is a database design. This design is a relationship for each table in the database. Geographic information system relationship diagram is shown in Figure 6.

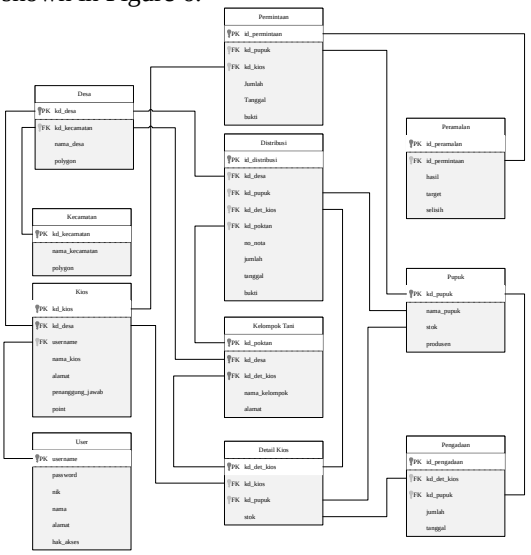


Figure 6. Relationship Diagram Geographical Information Systems and Distribution of Fertilizer Distribution To Farmers In CV. Prima Sejahtera Abadi.

3.7 Interface

Interface designlog on geographic information system of distribution and fertilizer to farmers in the CV. Prima Sejahtera Abadi can be seen in Figure 7.

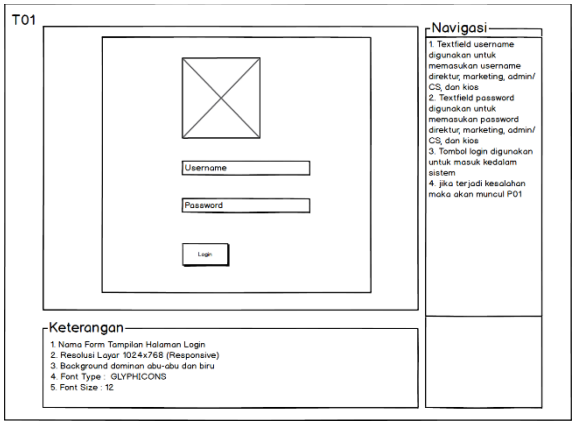


Figure 7. Login Interface Design of Geographic Information Systems and Distribution of Fertilizer Distribution To Farmers In CV. Prima Sejahtera Abadi.

3.7.1 Interface Home Director

Interface design director at s homepageistem geographic information distribution and fertilizer to farmers in the CV. Prima Sejahtera Abadi can be seen in Figure 8.

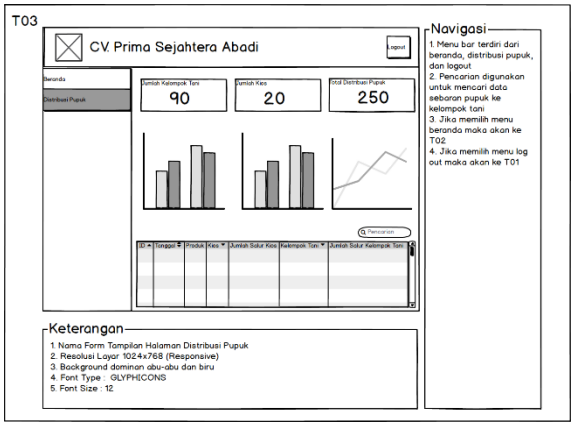


Figure 8. Interface Design Home Director of Geographic Information Systems and Distribution of Fertilizer Distribution To Farmers In CV. Prima Sejahtera Abadi.

3.7.2 Interface Home Marketing

Merketing homepage interface design on sistem geographic information distribution and fertilizer to farmers in the CV. Prima Sejahtera Abadi can be seen in Figure 9.

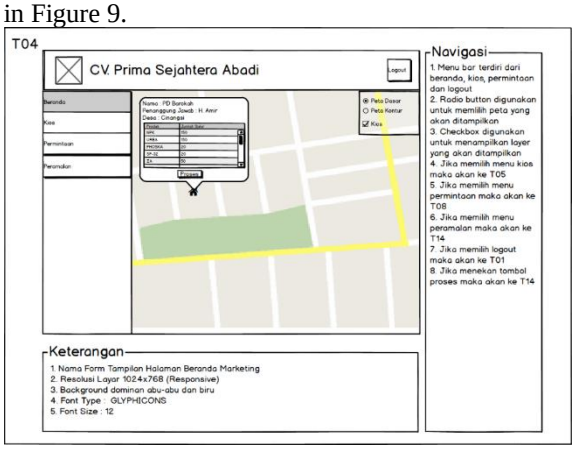


Figure 9. Interface Design Home Marketing Geographic Information Systems and Distribution of Fertilizer Distribution To Farmers In CV. Prima Sejahtera Abadi.

3.7.3 Interface Home Admin / CS

Interface design veranda admin / cs on sistem geographic information distribution and fertilizer to farmers in the CV. Prima Sejahtera Abadi can be seen in Figure 10.

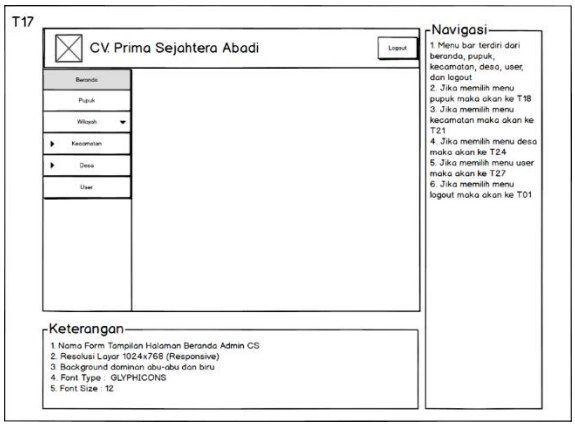


Figure 10. Home Admin Interface Design / cs Geographical Information Systems and Distribution of Fertilizer Distribution To Farmers In CV. Prima Sejahtera Abadi.

3.7.4 Interface Home Store

Kiosk homepage interface design on sistem geographic information distribution and fertilizer to farmers in the CV. Prima Sejahtera Abadi can be seen in Figure 11.

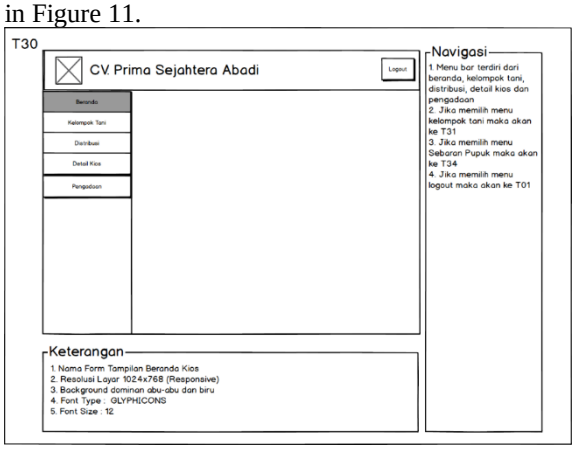


Figure 11. Kiosk Interface Design Home Geographic Information Systems and Distribution of Fertilizer Distribution To Farmers In CV. Prima Sejahtera Abadi.

3.8 Procedural Design

Design is a stage doing drafting procedural flow diagram of the whole system works in a geographic information system that will be created. Here is a procedural design such as login, additional data, alteration of data, deletion of data, search data.

3.8.1 Procedural Login

Procedural login is the process used to be entered into the system. Procedural login can be seen in Figure 12.

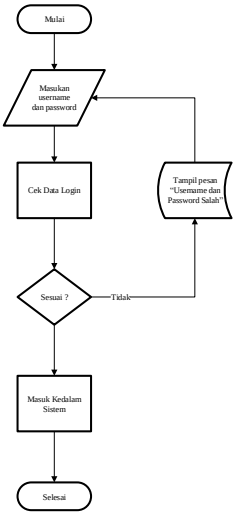


Figure 12. procedural Login

3.8.2 Procedural Data Additions

Procedural addition of data is a process used to perform additional data. additional procedural data can be seen in Figure 13.

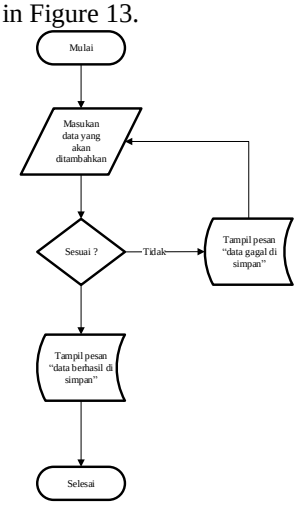


Figure 13. Procedural Data Additions

Procedural 3.8.3 Forecasting

Procedural data forecasting is a process used for forecasting data. Procedural forecasting data can be seen in Figure 14.

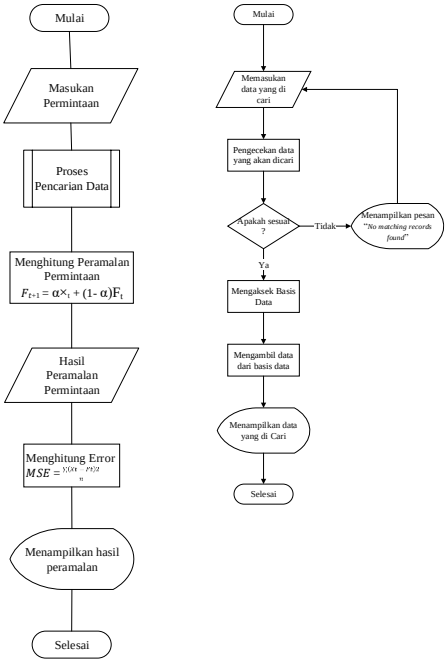


Figure 14. procedural Forecasting

3.9 Testing System

examination to assess whether the system has been built according to the needs and to evaluate the advantages of the new system with the old one. The activities in this phase that Blackbox testing, UAT testing.

3.9.1 Kesipulan Blackbox Testing

Based on the results of system testing has been done can be concluded that the geographic information system of distribution and fertilizer to farmers in the CV. Prima Sejahtera Abadi has produced the expected output.

3.9.2 Conclusion UAT Testing

Based on test results Accepteance User Test (UAT) has been conducted on the geographic information system of distribution and fertilizer to farmers in the CV. Prima Sejahtera Abadi, it can be concluded that the system can be used by end users.

Conclusion 3.9.3 User Acceptance

Based on test results, it is concluded that the geographic information system of distribution and fertilizer to farmers in the CV. Prima Sejahtera Abadi is in accordance with the expected goals that can help a company director in overseeing the distribution and spread of fertilizer to farmers and help Marketing predict fertilizer requirements for the next period.

4. COVER

4.1 Conclusion

Based on test results obtained from studies conducted in the preparation of this thesis as well as referring to the purpose of the study that has been created, it can be concluded that:

1. The system can help the director CV. Prima Sejahtera enduring to see and oversaw and penyebarn fertilizers to farmers in each area of responsibility of the company.
2. Marketing system can help predict the fertilizer needs to be distributed in future periods

4.2 Recommendations

Based on the results that have been achieved in building a Geographic Information System for Distribution and Distribution of Fertilizer to Farmers in the CV. Prima Sejahtera Abadi it still has shortcomings, therefore it is advisable to add things that can complement the future, including:

1. Geographic Information Systems are built to be developed in also features a display that can be made more attractive, and the system can be integrated with the system found on the manufacturer.
2. For the future development of this application and the scope of information dissemination fertilizer distribution is not limited to its area of Java CV. Prima Sejahtera Abadi but throughout the area of responsibility of other distributors.

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