THE DEVELOPMENT OF APAR RAFT MATERIAL INVENTORY MANAGEMENT INFORMATION SYSTEM AT CV. RESIK

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ABSTRACT

CV. Resik is one of company which supply fire fighting equipment's, one of items which sell is Alat Pemadam Api Ringan (APAR) which need to assembling, APAR has 3 kind of different raft material, there are Dry Chemical Powder (DCP 90%), Foam AFFF 3%, and Clean Agent (CA) HCFC R123. The problem which often consist is stockout raft material, this is happened because the planning about quantity raft material which must ordered is still by presupposition and the planning about 'when' the company must order to supplier is still use 'close to run out' method, that's why often the raft materials are can't complete the necessary of production because the raft material are not ordered or still in process of ordered. The solution for this problems are managing inventory using PDCA model with doing forecasting to expending of APAR raft material for the next period to determine quantity has to buy with using single moving average method, prepare of Safety Stock, and doing the calculation using Reorder Point (ROP) to resolve the problem "when" the company must have to buy raft materials to supplier again. The result of this research are that this system can help to determine the planning of raft materials quantity that must to have buy again, determine of safety stock and ROP.

Keywords : information system, inventory management, Single Moving Average, Safety Stock, Re-Order Point

1. INTRODUCTION

CV. Resik is one of the companies providing fire extinguishers for offices, hotels, factories, housing and individuals, this company is located in the city of Bandung which was established in 2014. One of the items sold is a Light Fire Extinguisher that requires assembly, APAR has 3 different types of raft materials, namely Dry Chemical Powder (90% DCP), 3% AFFF Foam, and Clean Agent (CA) HCFC R123) provided in the form of APAR products ranging from tube size 1 Kg to 160 Kg.

At present the company must first arrange raft material before producing APAR, this is because this type of item is the most popular type of goods and one type of raft material (DCP) currently has a process of purchasing raft materials to suppliers that require average time - 54 days so that the raft material must always be available in the warehouse even when the PO from the consumer does not yet exist, and for the APAR assembly itself, it will only be done when the PO from the consumer enters the assembly completion time for 1-2 weeks. At present the company does not have a definite time when the purchase to the supplier must be done, the purchase of raft material will be done only if the raft material available in the warehouse is nearing completion.

Currently Deputy Director as the planner the amount of purchase of APAR assemblies to suppliers only plans the amount of APAR assemblies that must be purchased to suppliers based on estimates (the high use of APAR raft materials in the previous period) as a result there is a shortage of APAR assemblies especially in the type of raft material made from Dry Chemical Powder 90% which results in production delays and delays in shipping goods to consumers that can provide opportunities for loss of customers and reduce service quality of the company. From January 2016 to June 2018, there were 21 POs which experienced delays in meeting the need for APAR Dry Chemical Powder 90% due to lack of supplies. This disadvantage is because the stock that does not meet the consumers' needs for APAR is sometimes booming as a result of which the production process stops and impacts on the process of late delivery to consumers.

In addition, the Deputy Director stated the difficulty in determining when the right time to make a buy back to the supplier. This is because there is no determination of the point of reorder by the company which results in the time of purchase when approaching the depleted inventory, the impact of meeting consumer needs for APAR is late because of insufficient conditions in the supply of fire extinguishers in the warehouse. excise affects inventory in the form of reduced inventory, namely by taking inspection samples, and currently not a concern of the company, even though it affects the amount of inventory in the field when the Production Head is asked to provide inventory-related reports as a benchmark for receiving further orders,

consequently often receive orders even though the warehouse is not enough. Based on the problems that exist in CV. Resik is known that the company needs the construction of an APAR Raft Material Inventory Management Information System.

Previous research is similar, namely a study at PT. Klaten Java Furniture, this study has the same purpose, namely to help the owner to do a description of planning or demand in the next period, also helps consumers so that the goods ordered can be obtained, namely by the method of single moving average and exponential smoothing which is used as a comparison method forecasting [11]. The purpose of building the system are :

1. Assist the Deputy Director in determining the number of assemblies that must be purchased to the supplier and plan when to buy back the raft material to the supplier in order to avoid a shortage of inventory in the warehouse.
2. Helping the Head of Production manage the inventory of APAR assemblies so that they can provide better inventory information.

2. RESEARCH CONTENT

2.1 Theoretical Basis

Platform Theory in this study will discuss the theories relating to Inventory Management Information Systems in CV. Resik.

2.1.1 Management Information Systems

The definition of a management information system is a system that is integrated (integrated), to provide information that can support the functions of operations, management, and decision making in an organization [1]. SIM is a system designed to provide information that can support decision making in management activities within an organization [2].

2.1.2 Inventory

Inventory is a number of materials, parts provided and materials in the process contained in the company for the production process, as well as finished goods / products that are provided to fulfill requests from consumers or subscriptions at all times [3]. Inventories are generally finished goods or raw materials used for certain purposes [4].

2.1.3 Inventory Management

Inventory Management aims to help companies improve quality or provide maximum service to consumers [3].

2.1.4 Safety Stock

Safety Stock, is the minimum amount of inventory that must always be available in the warehouse to prevent the occurrence of outages or delays in the arrival of goods sent by suppliers [5].

The following is the formula for finding safety stock values [7].

$$Safety\ Stock = Z\ x\ Sdl \quad (2.1)$$

$$Sdl = \sqrt{(d^2 \times Sl^2) + (l \times Sd^2)} \quad (2.2)$$

2.1.5 Reorder Point (ROP)

Reorder Point (ROP) is a method that can be used to decide when a company must re-submit an order to create a balance between inventory and demand [6].

The ROP model used in this study is Variable Demand Rate, Variable Lead Time Model (demand magnitude and grace period are variable) [3].

$$ROP = \bar{d}\ (\overline{LT}) + z\sqrt{\overline{LT}\,\sigma d^2 + \overline{d^2}\,\sigma \overline{LT^2}} \quad (2.6)$$

2.1.6 Single Moving Average Method

The main purpose of using a moving average is to eliminate or reduce randomness in a time series. This goal can be achieved by averaging several data values together, by the way in which positive and negative errors that may occur can be excluded or omitted. The average is done on all numbers of constants from observation [9].

In algebraic, forecasting techniques with moving average methods can be expressed with a simple formaula as follows: [9]

$$Ft + 1 = \frac{(Xt + Xt-1 + \cdots\ldots\ldots + Xt-N+1)}{N} \quad (2.7)$$

2.1.7 The PDCA Model

The PDCA model is a good quality improvement program, for example by implementing the PDCA program (Plan, Do, Check, Act). The PDCA process can be explained as follows [8]:

1. P (Plan = Plan), that is, this Planning is done to identify goals and processes by finding out what things are wrong then looking for solutions or ideas to solve this problem.
2. D (Do = Do) means doing planning processes that have been previously set on planning.
3. C (Check = Evaluation) means evaluating the goals and processes and reporting what results are done.
4. A (Act = Follow Up) means to do a total evaluation of the results of the target and process to follow up with improvements [8].

3. Results and Discussion

3.1.1 Problem Analysis

Problem Analysis is an assumption of the problem that will be described in the procedure. From the results, a problem is found which consists of:

a. Deputy Director has difficulty in determining the number of assemblies that must be purchased to the supplier and Deputy Director has difficulty in determining when the re-purchase of raft material to the supplier must be done so that there is no shortage of stock in the warehouse before the raft material arrives

b. The Head of Production has difficulty managing storage, resulting in a lack of synchronization between real warehouse data information and inventory record data

3.1.2 Analysis of Inventory Management of APAR Raft Materials

The management analysis of this preparation is an analysis that contains how an inventory procedure will be implemented into a built-in management information system. Following is the general PDCA model of the APAR Raft Material Management Information System at CV. Resik can be seen in figure 2.1.

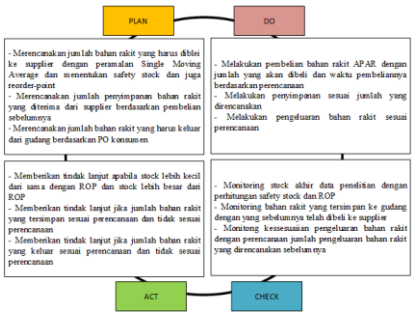

Figure 3.1 PDCA General Model Inventory Management Information System

3.1.2.1 Management Activities for Purchasing APAR Materials

The following is the process of analyzing management activities for purchasing APAR assemblies on CV. Resik which can be seen in figure 2.2.

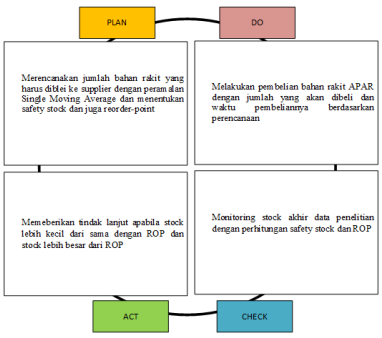

Figure 3.2 PDCA Management Activities for Purchasing APAR Raft Material

1**. Planning Phase (Plan)**

At this stage, problem identification is carried out, namely to plan the amount of dry chemical powder assemblies of 90% (as samples) that must be purchased in the next semester (January 2018 - June 2018) and when the purchase of APAR assemblies must be carried out again.

The data for the use of Dry Chemical Powder assemblies of 90% during the period of January 2016 to June 2018 can be seen in table 2.1.

Table 3.1 Data on the use of Dry Chemical Powder Assembling Materials 90% Januari 2016 - June 2018

Periode	Total use of Dry Chemical Powder 90%
Semester 1 2016	1209,73
Semester 2 2016	1746,53
Semester 1 2017	2692,75
Semester 2 2017	2355,26
Semester 1 2018	1928,1

Based on the data in the data table the use of Dry Chemical Powder raft material 90% produces a graph to find out the pattern of data, graph data can be seen in Figure 2.3.

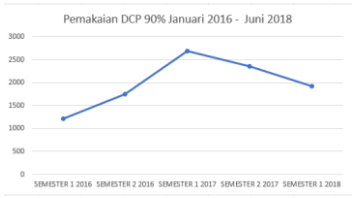

Figure 3.3 Pattern of Dry Chemical Powder 90% Data

Dry Chemical Powder data pattern Next is to do forecasting using the Single Moving Average forecasting method. The purpose of forecasting in this study is to forecast the next semester, which is for July 2018 - December 2018 (semester 2 2018). Forecasting the Single Moving Average is done on data on the use of Dry Chemical Powder raft materials 90% on 1 semester and 3 semester. as followsder 90%.

1) Calculation for n = 1

Forecasting results for n = 1 are obtained by entering the Xt1 value of the semester before the semester which wants to know the results of forecasting. The following is the breakdown of the calculation results to determine forecasting for the semester 2 of 2018 using equations (2.7), as follows.

$$Fsmt2\ 2018 = (Xsmt1\ 2018) \div 1$$
$$Fsmt2\ 2018 = (1928{,}1) \div 1$$
$$Fsmt2\ 018 = 1928{,}1\ Kg$$

2) Calculation for n = 3

Then for n = 3 it is done in the same way as n = 1.

$$Fsmt2\ 2018 = (Xsmt1\ 2018 + Xsmt2\ 2017 + Xsmt1\ 2017) \div 3$$
$$Fsmt2\ 2018 = (2692{,}75 + 2355{,}26 + 1928{,}1) \div 3$$
$$F2smt2018 = 2325{,}37\ Kg$$

Following are all forecasting results using the Single Moving Average method which can be seen in table 2.2.

Table 3.2 All Forecasting Restults of the Single Moving Average Method

No	Amount of expenditure	1 Semesteran	3 Semesteran
1	1209,73	-	-
2	1746,53	1209,73	-
3	2692,75	1746,53	-
4	2355,26	2692,75	1883
5	1928,1	2355,26	2264,85
Forecasting Results		**1928,1**	**2325,37**

After obtaining the forecasting results for each moving average perode, then determining the forecasting results by choosing the best method, whether the semester moving average is 1 semester or 3 semester. The parameters used were by using the Mean Squared Error (MSE) criterion.

Based on the results of the comparison it can be concluded that forecasting using the 3 semester Single Moving Average method will be used as the basis for forecasting in determining the amount of raft material in the CV. Resik, this is because the smallest MSE error value is obtained when calculating the semester 3 forecasting MSE. The following results of the MSE calculation can be seen in table 2.3

Table 3.3 MSE Calculation Results

Periode	Amount of expenditure	1 Semester			3 Semester		
		Forecast	Error	Error^2	Forecast	Error	Error^2
SMT 1 2016	1209,73	-	-	-	-	-	-
SMT 2 2106	1746,53	1209,73	536,80	288154,24	-	-	-
SMT 1 2017	2692,75	1746,53	946,22	895332,29	-	-	-
SMT 2 2017	2355,26	2692,75	-337,49	113899,50	1833	522,26	304991.1
SMT 1 2018	1928,1	2355,26	-427,16	182465,67	2264,85	-336,75	113400,56
MSE		**369962,93**			**209195,83**		

Then next is calculating safety stock. The list of lead times for each APAR building material in the CV. Resik is like in table 2.4.

Table 3.4 Average APAR Assembling Material Lead Time

No	Name of Raft Material APAR	Lead Time average
1	*Dry Chemical Powder 90%*	54 days
2	*Aqueous Film Forming Foam (AFFF) 3%*	60 days
3	*Clean Agent HCFC 123*	7 days

Next is the calculation of the safety stock of 90% Dry Chemical Powder raft material.

Calculation of Safety Stock

The number of forecasting for the next semester 2018 = 2326 Kg (Rounding Results)
The number of working days in one semester = 136 days
Purchase Lead Time to Supplier (l) = 54 days
Average purchase per day (d) = 2326/136 = 17.1
Services Level 96% (Z) = 1.75
Standard Lead Time Deviation (sl) = 136/10 = 13.6
Standard Deviation Amount of Forecasting (up to) = 17.1 / 10 = 1.71

The safety stock calculation using equation (2.1) and earlier to find the Sdl value must use equation (2.2) first, namely as follows.

$$Sdl = \sqrt{((292{,}41 \times 184{,}96) + (54 \times 2{,}79))}$$
$$Sdl = \sqrt{((54084{,}15) + (150{,}66))}$$
$$Sdl = \sqrt{54234{,}81}$$
$$Sdl = 232{,}88$$

After obtaining the Sdl value, the next step is to calculate the safety stock value using equation (2.1), which is as follows.

$$Safety\ Stock = 1{,}75 \times 232{,}88$$
$$= 407{,}54$$
$$= 408\ Kg\ (Rounding\ Results)$$

Based on the calculation results of the safety stock above, the CV. Resik must provide safety stock for APAR with 90% Dry Chemical Powder of 408 Kg for semester 2 in 2018. Safety stock for Dry Chemcial Powder 90% can be seen in table 2.5.

Table 3.5 Safety Stock of Dry Chemical Powder 90% Raft Material

Name of Raft Material APAR	Stock	Safety Stock
Dry Chemical Powder 90%	70,73	408 Kg

The next time is the time to buy back APAR assemblies to suppliers for the second semester of 2018

Re-Order Point Calculation:

The need for raft materials in semester 2 2018 = 2326 Kg Working days for 1 semester 2018 = 136 days Raft material needs per day = 2326 Kg / 136 days = 17.1 Optimum waiting time = 54 days Safety inventory = 408 Kg Usage during waiting time = 17.1 x 54 days = 924 (rounding results) Services Level 96% (Z) = 1.75

Re-Order Point calculations are carried out using equation (2.6), which is as follows.

$$ROP = (17{,}1 \times 54) + 1{,}75\sqrt{54(1{,}71)^2} + 17{,}1\text{^}2(13{,}6)^2$$

$$ROP = 924 + 1{,}75\sqrt{157{,}90} + 292{,}41\ (184{,}96)$$
$$ROP = 924 + 1{,}75\sqrt{54242{,}05}$$
$$ROP = 924 + 1{,}75 \times 232{,}9$$
$$ROP = 924 + 407{,}57$$

$$ROP = 1331{,}57$$
$$ROP = 1332(Rouding\ Results)$$

Then it can be concluded that the company must make a repurchase when the amount of inventory of raft material Dry Chemical Powder 90% has left 1332 Kg.

2. Implementation Phase (Do)

This stage is the stage that must be done when going to purchase raft materials according to the plan. The following is the number of assemblies that must be ordered by the Administration Section for Semester 2 2018 made from 90% DCP types, can be seen in table 2.6.

Name of Raft Material	Forecasting Result	Stock	Safety Stock	(Forcast result – Stock) + Safety Stock	ROP	Status
Dry Chemical Powder 90%	2326 Kg	70, 73 Kg	408 Kg	2664 Kg (hasil pembulatan)	1332 Kg	Tidak Aman

Table 3.6 The amount of Dry Chemical Powder 90% Raft Material must be purchased to the supplier

From these results it can be concluded from the planning of the amount of Dry Chemical Powder raft material 90% that must be purchased to the supplier is a number of 2664 Kg, but because of the company's business rules CV. Resik which has a minimum level of sales to suppliers for Dry Chemical Powder 90% is 25 Kg and multiples, then for semester 2 the amount to be purchased in 2018 is 2675 Kg (107 Sacks) and the implementation of purchases when inventory reaches ROP is 1332 Kg (including safety stock).

3. Examination Phase (Check)

After purchasing a supplier, then comparing the final stock with the calculation of the safety stock and reorder point, to find out the current condition of the inventory, can be seen in Table 2.7 and an explanation of the status of inventory can be seen in Table 2.8.

No	Name of Bahan Rakit APAR	Stock	Safety Stock	ROP	Status
1	*Dry Chemical Powder 90%*	70, 73	408	1332	Not Safe

Table 3.7 The Inventory of Dry Chemical Powder 90% Raft Material for 2018 Semester 2 periode

Table 3.8 Explanation of Inventory Status and Inventory Conditions

No	Status	Conditions
1	Safe	When Stock > ROP
2	Not Safe	When Stock <= ROP

4. Act Phase

Next after the monitoring process at the check stage. The follow-up phase is based on an evaluation in the previous stage that the company needs to do the purchase of 90% APAR Dry Chemical Powder assemblies in the amount of 2675 Kg because the current inventory shows insecure status, ie where stock <= ROP.

3.1.2.2 APAR Storage Material Management Activities

The following is a PDCA model of management activities for the storage of APAR assemblies on CV. Resik, can be seen in Figure 2.4.

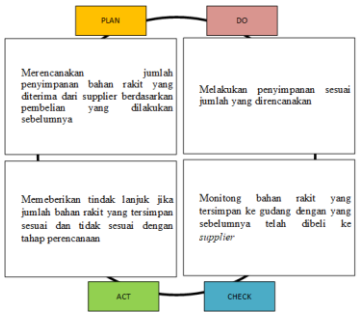

Figure 3.4 PDCA Raft Materials Storage Activities at CV. Resik

1. Planning Phase (Plan)

At this stage, problem identification is done, namely planning the amount of raft material to be stored in the warehouse, which is equal to 2675 Kg of Dry Chemical Powder 90%.

2. Implementation Phase (Do)

This stage is the implementation stage of storing APAR assemblies in accordance with the planning of 2675 Kg, but due to the business rules it has been explained that for 90% Dry Chemical Powder raft materials always check goods during customs checks, then 3 grams of material is always taken Dry Chemical Powder 90% every time you

Name of Raft Material	Stock	Amount of Planning	Reduction of Beacukai	Saved amount / in	Last Stock (Stok + in)
Dry Chemical Powder 90%	70,73 Kg	2675 Kg	3 gram	2674,997 Kg	2745,727 Kg

check. As a result the amount saved to the warehouse became 2674,997 Kg.

3. Checking Phase (Check)

This stage is the monitoring stage between the amount saved and the planned amount.

Table 3.9 Monitoring of The APAR Raft Materials

4. Act Phase

on the results of the evaluation at the checking stage, it can be seen that the number planned with the implementation does not match the amount, this is due to the sample taking during customs clearance, resulting in a difference of 3

grams. For this reason, the amount stored in the warehouse is 2674.997 and the final stock resulting from the sum of the remaining stock added to the stored amount will be used later to be released when the assembly process occurs.

3.1.2.3 Management Activities for APAR Expenditures

The following is the PDCA model of management activity for issuing APAR assemblies on CV. Resik, can be seen in figure 2.7.

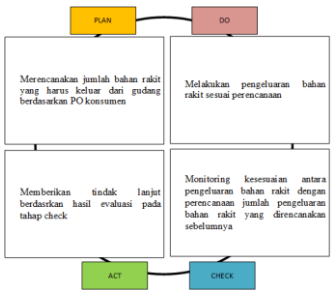

Figure 3.5 PDCA APAR Raft Material Expenditures Activities at CV. Resik

1. Planning Phase (Plan)

At this stage, problem identification is carried out, namely planning the number of APAR assemblies to be released from the warehouse based on the needs of the consumer PO. In this case a sample of PO data was taken from consumers with 90% Dry Chemical Powder raft material.

Table 3.10 Consumer PO Samples

No. PO	Tanggal Pemesanaan	Tanggal Pengiriman	Jenis Barang	Ukuran (kg)	Qty	Raft Material	Amount of Raft Material
-	2 Juli 2018	3 Juli 2018	REFILL APAR DCP Cap. 3 Kg Stored Pressure	3	6	DCP 90%	17,1 Kg

2. Implementation Phase (Do)

The next step is to remove raft material from the warehouse based on assembly needs to meet product needs for consumers.

Table 3.11 The Sample of Expenditure APAR Raft Material

Product	Raft Material	Stock (kg)	Out (Kg)
REFILL APAR DCP Cap. 3 Kg Stored Pressure	Dry Chemical Powder 90%	2745,727	17,1

3. Checking Phase (Check)

This stage is the stage of inspection of the expenditure of 90% Dry Chemical Powder material on final stock in the warehouse.

Table 3.12 Monitoring of APAR Raft Material Expenditures

Name of Raft Material	Stock (kg)	Out (Expenditures) (Kg)	Last Stock (kg)	Safety Stock	ROP	Status
Dry Chemical Powder 90%	2745,727	17,1	2728,627	408	1332	Aman

4. Act Phase

Furthermore, the amount of 17.1 Kg issued will have an impact on reduced inventory and in this case there is no need to repurchase because inventory still shows a condition greater than ROP which means that the inventory is still in a safe status.

3.1.3 System Analysis and Design

Analysis is carried out on all ongoing system components and those needed in the construction of management information systems.

3.1.3.1 Database Analysis

Database analysis on the management information system of APAR assemblies in CV. Resik that will be built using Entity Relationship Diagram (ERD), can be seen in figure 2.7.

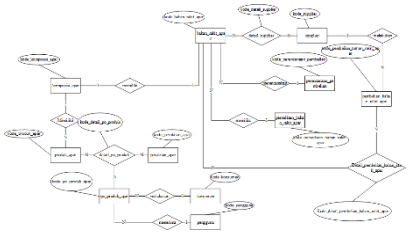

Figure 3.6 ERD

3.1.3.2 Context Diagram

Context Diagram explains how data is used and transformed for processes in the form of data flow into and out of the APAR material management information system in CV. Resik.

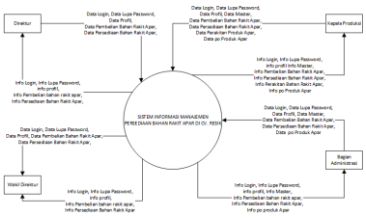

Figure 3.7 Context Diagram

3.1.1.6 Interface Design The following is an example of designing the interface for calculating the planning of the number of raft materials that must be purchased to the supplier.

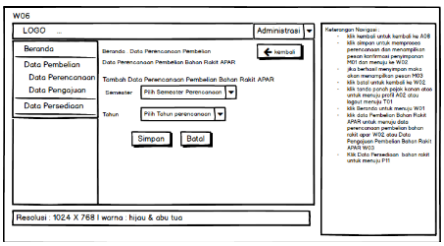

Figure 3.8 W06 The Add Purchase Planning Data

3.1.4 System Implementation and Testing

The implementation phase is the stage of translating the design based on the results of the analysis into a particular programming material and the application of software built in the real environment.

3.1.4.1 Interface Implementation

Interface implementation is the appearance of the interface on the system built for example can be seen in Figure 2.11.

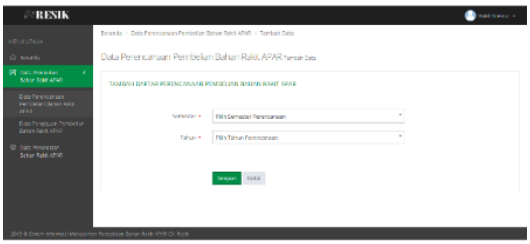

Figure 3.9 add purchase planning data

3.1.4.2 System Testing

System testing that aims to find errors or shortcomings in the information system being tested.

1. Functional Testing

The test used to test the new system is the black box testing method. In black box testing, we try various inputs and check the output produced [10].

Based on the results of testing with a sample test case that has been done, it gives a conclusion that the process is correct. Filtering process errors in the form of a message page display direction is quite maximal. Functionally the system can produce the expected output.

2. End User Testing

Testing that focuses on the acceptance of users (end users) by using Beta testing using the interview method.

After an interview at CV. Resik to the Head of Production, Section Administarsi, Deputy Director and Director (Appendix C), it can be concluded that the main objective of the implementation of this system has been achieved, namely assisting in planning the amount and timing of purchasing APAR raft materials and also assisting the Production Head in managing storage.

4. CLOSING

In this section, we will explain the conclusions and suggestions for further software development.

4.1 Conclusions

The conclusion can be drawn from all the processes that have been carried out in building the APAR Assembling Material Management

Information System on the CV. Resik can help the deputy director in determining the amount of APAR assemblies that must be purchased for future needs, and also helps the deputy director in determining when the right time to purchase, besides being able to assist the head of production in managing storage and inventory data. synchronous so that it can provide better (controlled) information.

4.2 Suggestions

The expected thing or suggestion for the future is that the system built can work better, should be added to the discussion of the price of the APAR raft material so that it will also facilitate the company in determining the capital that must be prepared for the purchase of APAR raft materials later on CV. Resik.

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