SUPPLY CHAIN MANAGEMENT AT. MULTI INSTRUMENTASI

Akida Tawaka[1], Tati Harihayati M [2]
[1,2]Informatics Engineering - University Computer Indonesia
Jl. Dipatiukur 112-114 Bandung
E-mail: 17akida@gmail.com[1], tharihayati@yahoo.com[2]

ABSTRACT

This research aims to facilitate production planning activities to avoid vacancy stock by or accumulation of stock by the division of Production and simplify scheduling activities delivery of the products sold to customers by the Marketing division at PT. Multi Instrumentasi. This research is descriptive quantitative research where data on companies analyzed so as to determine the flow of data flowing on the company that will be the basis for consideration in making managerial decisions in PT. Multi Instrumentasi.

Collecting data in this study by taking the company's internal data, conduct interviews with implementing any activity in the company, the study of literature supporting the settlement of the problems of the company, as well as direct observation of the work environment and learn the current procedures in the company.

Based on the test results of this study, we can conclude that the system is quite helpful in planning raw material requirements and avoid any lack of stock. The system is also quite helpful in scheduling delivery of the products sold to customers.

Keywords : *supply chain management*, Push supply chain, make-to-stock, single moving average, safety stock.

1. INTRODUCTION

PT. Multi Instrumentasi is an industrial company that concentrates on manufacturing. PT. Multi Instrumentasi included in the Primary Metals Industry Group and the Electronic Water Meters with Linflow product name. Linflow consists of two types of products namely water meter LF-1 15 mm and 15 mm LF-2, each of which consists of six products, namely raw material Polyacetal, Arbelac, AS Kibisan, ABS Hailac Polytheline, and Body Casing. PT. Multi Instrumentasi has two storage sheds, the Parent Warehouse used to store raw materials and finished goods warehouse to store products. Strategy inventories of raw materials and products at the company's inventory strategy approach both use make-to-stock. Activity on the upstream side of the PT. Multi Instrumentasi conducted by the Procurement Section is an order of raw goods to the Supplier and receive raw materials are ordered. PT. Multi Instrumentasi has worked with 10 suppliers. In the downstream section performed by the Division of Marketing whose role is to accept the sale of products ordered by customers. Currently customers who make purchases of products consists of taps and Private (Property Developer).

According to interviews with Mr. Triza as Head of PPC, Production division conduct production planning activities each month. Total production planning based on the number of products sold in the previous month .. In Data Production Planning and Sales for the product LF-1 35mm attached there when in July 2016 the number of planned production of 5,000 units, but in fact sales in July 2016 indicate when the unit which must be sold as many as 6,300 units. The phenomenon occurs because the Chief Procurement can not know exactly how much planning is needed in the production in order to meet buyer demand for the month. Production activities that are not in accordance with the production plan to cause the supply of raw materials on the production requirement was often lacking. As a result, it is often the production process to be blocked so that the supply of the products stored in the warehouse of finished goods became less so as the company experiencing a shortage of stock products from making sales to customers.

Head of Marketing Division conducting product distribution to customers. Based on the interview with Mr. Triza as Head of the Division of PPC, PT. Multi Instrumentasi do distribute products to customers after the customer makes payments in cash or by bank transfer. Activity distribution of products using freight forwarding services. Number expedition used by the company in distributing this product there 3. During the marketing division often experience delays in the distribution of products to customers, it can be seen in the sales data dated December 6, 2016, PDAM Indramayu to purchase products LF-1 as many as 1000 units, but the distribution of product conducted on December 8, 2016.

Solutions that can be done to overcome the problems in the background of the problem in PT. Multi Instrumentasi is needed an information system by using Supply Chain Management at PT. Multi Instrumentasi set forth in the form of research thesis titled "Supply Chain Management at PT. Multi Instrumentasi ".

2. RESEARCH CONTENT

2.1 Basis Theory

The cornerstone of the theory would explain the theories applied to the Supply Chain Management research at PT. Multi Instrumentasi either analysis or application form.

2.1.1 System

According to Jacob, System is a network of procedures interconnected, gathered together to perform an activity or a particular purpose. [1]

Then according to Jogiyanto, the system is a collection of elements that interact to achieve a certain goal. [2]

Based on two explanation can be concluded if the system is a collection of elements or procedures that are connected to achieve an activity or a particular purpose.

2.1.2 Supply Chain

According to I Nyoman Pujawan, Supply Chain is a network of companies that jointly work to create and deliver a product into the hands of end users. [3]

Meanwhile, according to According to Simchi-Levi Supply Chain is a network of independent organizations and interconnected to work together in a cooperative and mutually beneficial in controlling, regulating and improving the flow of materials and information from supplier to consumer. [4]

Based on the above two viewpoints concluded supply chain is in the form of a network of companies that work together and are connected to create a mutually beneficial cooperation in controlling, regulating and improving the flow of material and information about a product from the supplier to the end user.

2.1.3 Supply Chain Management

According to I Nyoman Pujawan and Mahendrawati, Supply Chain Management (SCM) is a method or an integrative approach to managing the flow of products, information, and money in an integrated manner involving parties from upstream to downstream consisting of suppliers, factories, distribution networks and rendering logistics services. [3]

According to James A. and Mona J. Fitzsimmons Supply Chain Management is a total system approach to deliver the products to the end users by using information technology to coordinate all elements of the supply chain from suppliers to retailers start and reach the next level which is a competitive advantage that is not available The traditional logistics system. [5]

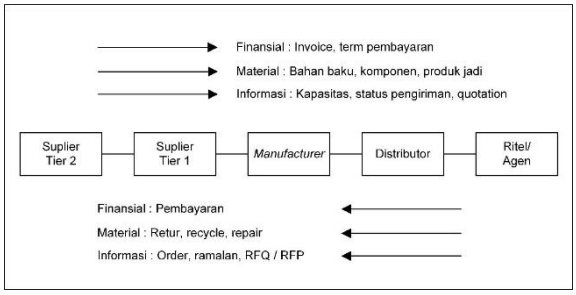
*Supply Chain Management*is a method to manage the flow of products, information, and money are connected involving parties from upstream to downstream. An important principle in SCM is transparency of information and collaboration between the company's internal functions as well as with the parties in the company are related to the scope of the supply chain. Supply Chain is the physical network, the companies involved in supplying raw materials, produce goods or products, and deliver it to end users. These companies are usually including suppliers, manufacturers, distributors, retail as well as companies support such as logistics services company.

According to Nyoman and Mahendrawati on the supply chain there are 3 kinds of streams that must be managed. Three kinds of streams that must be managed in the supply chain is as follows [3]:

1.Aliran goods flowing from upstream to downstream.

2.Aliran money and the like flowing from downstream to upstream.

3.Aliran information flowing from upstream to downstream and vice versa.



Picture 1 Three sorts of managed flow in the supply chain management [3]

Supply Chain Management has three main components that support the passage of a business process as follows:

1.Upstream Supply Chain

Overall activity manufacturing company with distribution or distributor relationship may be extended to the multiple levels. The main activity in the Upstream Supply Chain is the procurement of goods.

2.Internal Supply Chain

Internal Supply Chain is the delivery of goods to the warehouse. The main activity in the Internal Supply Chain is a production management, manufacturing, and inventory control.

3.Downstream Supply Chain

Downstream Supply Chain activities within this involves the delivery process to the end consumer. The main activities in the Downstream Supply Chain is the distribution of goods, warehousing, transportation. [3]

2.1.4 Forecasting

According to Hery Prasetya and Fitri Lukiastuti Forecasting is an attempt to predict the circumstances in the future through state testing in the past. [5]

Meanwhile, according to Spyros Makridakis 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]

In terms of time, the purpose of forecasting can be seen as follows [6]:

1. Short Term Forecasting

Determining the quantity and timing of the items used as production. Usually daily or weekly and are determined by Low Management.

2. Mid Term Forecasting

Determining the quantity and timing of production capacity. Usually monthly or quarterly and is determined by the Middle Management.

3. Long Term Forecasting

Planning the quantity and timing of the production facilities. Annual usually 5 years, 10 years, or 20 years and are determined by the Top Management.

There are several types of forecasting used. Forecasting the type used are as follows [6]:

1.Time Series Model

Method of time series forecasting method quantitatively using time as the basis for forecasting.

2.Casual Model

Forecasting method using causal connection as an assumption, namely that what happened in the past will be repeated at this point.

3.Judgemental Model

When the time series and causal models rely on quantitative, on judgmental covers to incorporate quantitative factors / subjective into forecasting methods. In particular useful when subjective factors is expected to be very important when accurate quantitative data already acquired.

2.1.5 Data Flow Diagram (DFD)

Data flow diagrams are used to describe a system existing or new systems that will be developed logically without considering the physical environment where the data flow or physical environment in which the data will be stored. [7]

Data Flow Diagrams (DFD) is used to describe an existing system or systems to be designed logically without considering the state of the physical environment in the field where the data is flowing. DFD is a tool used in a structured system development methodologies and to develop the data flow within the system with structured and clear.

2.1.6 Entity Relationship Diagram (ERD)

ERD is a network model that uses the arrangement of data stored in the abstract system. [8]

Understanding ERD according to James A. Hall is a technique that is used to present documentation of relationships between entities in a system. [9]

From the above definition of the notion of two ERD is a network model that uses a data set composed to illustrate the relationship between storage or data.

2.**2 Analysis of the Problem**

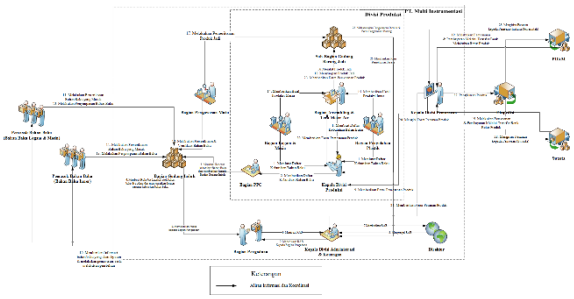
Analysis of the problem is a summary of the problems that occurred in the scope of research on case studies where this is a problem in PT. Multi Instruentasi. The analysis of the current problems are:

1.Chief of Production Division difficulty in determining the amount of production planning for the number of sales of products that can not be predicted.

2.Chief of Marketing Division difficulty in selling products because of the number of products stored in the warehouse of finished goods are often less so late distribute products to customers.

2.3 Supply Chain Management Model

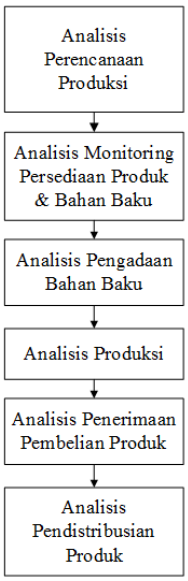
Supply Chain Management Model is based on the procedures to run at. Multi Instrumentasi. The Model of Supply Chain Management at PT. Multi Instrumentasi can be seen in Picture 2



Picture 2 Model Supply Chain Management at PT. multi Instrumentasi

2.4 Analysis of Supply Chain at PT. Multi Instrumentasi

Supply chain analysis conducted as the design of supply chain management which will be built at PT. Multi instrumentasi based on the model of supply chain at Picture 2, The analysis of the supply chain at. Multi Instrumentasi can be seen in Picture 3 ,



Picture 3 Analysis of Supply Chain Management at PT. Multi Instrumentasi

From Picture 3will be spelled out one by one, analyzes of supply chain management at PT. Multi Instrumentasi as follows:

1. Analysis of Production Planning

Analysis of production planning is to determine how many products will be generated on a monthly basis so as to get the amount of raw materials needed to meet the planned amount of production of products that have been set.

Production planning is done by forecasting based production planning data in the previous 3 months. Forecasting results obtained are used to determine the amount of raw materials needed and as the basis for consideration in the procurement of raw materials to the Supplier. Stages forecasting that will do is predict the production plan for the procurement of raw materials. Forecasting technique used is quantitative forecasting techniques, due to the availability of past data that adequately met.

Forecasting method used is the Single Moving Average for the production planning data can be seen that the pattern of the data is the Horizontal or Stationary patterns that showed the presence of volatile uniformly with an average value that does not change over time.

Based on production planning data from July 2016 to June 2017 concluded that the product LF-1 15 mm is the most produced product. So sales LF-1 15mm more numerous than the LF-2 15mm. Therefore, the author will make production planning data LF-1 15mm as a reference in the analysis of forecasting at. Multi Instrumentasi.

Forecasting	Name of Raw Materials	Composition	Total
6500 Units	polyacetal	40.69 gr	265 kg
	Arbelac	111.98 g	728 kg
	US Kibisan	61.6 g	401 kg
	ABS Hailac	15.1 g	99 kg
	Polythelin e	4.43 gr	29 kg
	Body Casing LF-1	1 set	6333 Set

Table 1 Forecasting Results LF-1 15mm

based on Table 1, It can be concluded if the result of forecasting a number of 6500 units.

2. Stock Monitoring Analysis Products and Raw Materials

After conducting forecasting, the next step is checking or monitoring inventories of raw materials and determining the amount of raw materials that should be stored in a warehouse holding aimed to avoid shortages of raw materials or emptiness. Monitoring supply of products and raw materials will use methods Safety Stock. Sample calculation based on the raw materials inventory product inventory using formulas 2.1 and 2.2 are as follows:

- Total production planning forecasting month December 2016 = 6333 units
- The number of working days in a month = 20 days
- Lead Time procurement to suppliers (l) = 3 Days
- The average procurement in a month (d) = 6500/20 = 325
- Standard Deviation Lead Time (sl) = 3/10 = 0.3
- Sales of standard deviation (sd) = 20/10 = 2
- Service Level 96% (Z) = 1.55

After getting the value of these variables, then the safety stock will be calculated as follows:

- Safety Stock = Z x Sdl
- Sdl = √ ((d ^ 2 x 〖〗 sl ^ 2 + lx sd 〖〗 ^ 2))
- Sdl = √ (〖325〗 ^ 2 x 0.3 〖〗 ^ 2 + 3 x 2 ^ 2)
- Sdl = √9519
- Sdl = 98
- Safety Stock = 1.55 x 98 = 152 (rounded)

Based on the calculation of safety stock, PT. Multi Instrumentasi should have a stock of raw materials safety stock in accordance with the Water Meter products LF-1 15mm ie number of 152 units for each raw material. Safety stock for each of the raw materials can be seen inTable 2 ,

Forecasting	Name of Raw Materials	Compo sition	*safety Stock* Raw material
52 Units	polyacetal	40.69 gr	7 kg
	Arbelac	111.98 g	18 kg
	US Kibisan	61.6 g	10 kg
	ABS Hailac	15.1 g	3 kg
	Polytheline	4.43 gr	1 kg
	Body Casing LF-1	1 set	152 Set

Table 2 Table Safety Stock Raw Materials

3. Analysis of Raw Material Purchasing

In the analysis of raw material purchase, Procurement Section made a purchase based document production plan created by the PPC section and checks by the Warehouse Master.

Purchase of suppliers include polyacetal, arbelac, as kibisan, ABS Hailac, polytheline and Body Casing.

The purchase process is carried out based on the price of raw materials of the most economical. When the raw materials that have been ordered to come will be handled by the warehouse. Warehouse inspect the raw materials have to meet the standards. If the goods are coming to meet the standards, it will be entered into the warehouse inventory of raw materials and if it does not meet the standards will be immediately informed to the Supplier.

Based on the monitoring of raw materials, if raw material supply has a status is not secure, then the PT. Multi Instrumentasi must procure the raw material amount booked is the result of forecasting and reduced safety stock plus stock in the warehouse. Jmlah purchase of raw materials can be found atTable 3

Name of Raw Materials	Rounding Results Forecasting	safety Stock	stock Wareho use	Total
polyacetal	258 kg	7 kg	10 kg	255 kg
Arbelac	710 kg	18 kg	5 kg	723 kg
US Kibisan	391 kg	10 kg	20 kg	381 kg
ABS Hailac	96 kg	3 kg	10 kg	89 kg
Polythelin e	29 kg	1 kg	15 kg	15 kg
Body Casing LF-1	6500 Set	152 Set	50 sets	6602 Set

Table 3 Table Purchasing Raw Materials

After an unknown amount of raw materials hasrus booked PT. Multi Instrumentasi should make the process of procurement of raw materials to suppliers. Selection of suppliers is based on the lowest price offered by the supplier.

4. Production analysis

Production division to check whether the amount of raw material inventory available raw materials sufficient to perform activities of daily production. The number of products produced is calculated based on the results of forecasting divided by the number of working days in a month. Here is an example of the calculation of the amount of water meter Linflow production LF-1 15 mm.

- Number forecasting production plan in December 2016 = 6333 units
- The number of working days in a month = 20 days
- Total production = 6500/20 = 325

Based on the results of calculation of the amount of production, then the water meter products Linflow LF-1 15 mm will be produced as many as 325 units per day and require raw materials for production needs.

5. Purchase Receipt Analysis Products

At the stage of receipt of purchase of the product, the Marketing Division received a purchase products and conduct sales transaction receipts with customer water meter products. Purchases made by way of a customer calls the marketing division to make purchases of products.

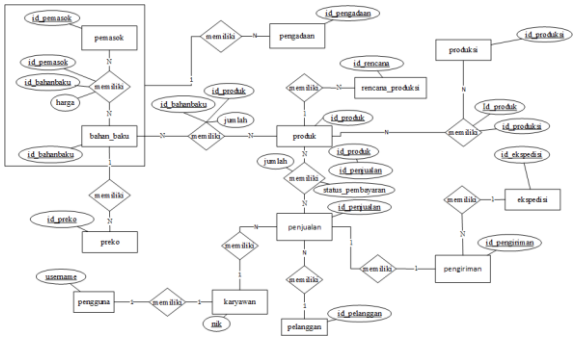
6. Analysis of Product Distribution

Based on product sales data, the next stage is a water meter product delivery to the customer. This stage is the determination of the amount of shipping products to customers and product sales monitoring what has been up to Customer.

Delivery wears third parties in doing so. Division of responsibility in the stage of product distribution is the Marketing Division. Marketing division gives the number of products that will be shipped to the customer. Items shipped inserted into the cardboard box in which a cardboard box store 10 units of water meters. Then the water meter which has been prepared by the company will be sent by the expedition to the customer.

2.5 Database Analysis

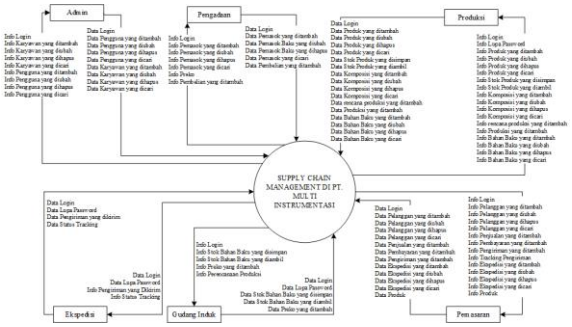
Analysis of the data on the basis of Supply Chain Management at PT. Multi Instrumentasi using Entity Relationship Diagram (ERD). Entity Relationship Diagram (ERD) is described inPicture 4



Picture 4Entity Relationship Diagram Supply Chain Management at PT. Multi Instrumentasi

2.6 Context Diagram

Context diagram illustrates how data will be used and managed for the process in the form of data flow into and out of Supply Chain Management at PT. Multi Instrumentasi in general. Diagram context of the system can be seen in Picture 5

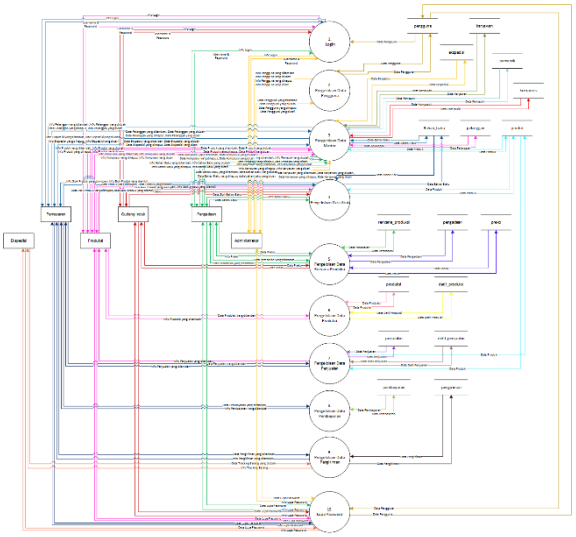


Picture 5 Diagram Context of Supply Chain Management at PT. Multi Instrumentasi

2.7 Data Flow Diagram (DFD)

Data flow diagrams are one tool to show the flow of the process of an application and the data used in each process and are described to be a detailed process. In such a context diagramPicture 5 can be broken down into several DFD.

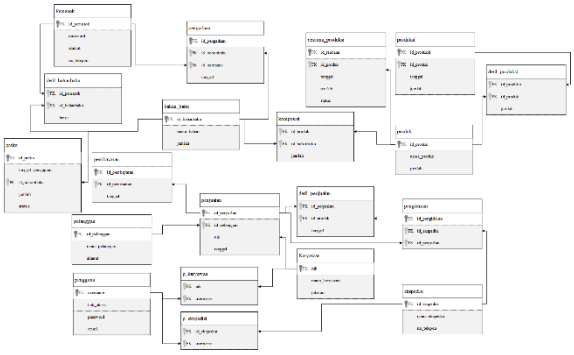
DFD Level 1 Supply Chain Management at PT. Multi Instrumentasi onPicture 6 which describes the general process of what is available on the system.



Picture 6DFD Level 1 Supply Chain Management at PT. Multi Instrumentasi

2.8 Relation Diagram

Relation schema describes the relationships among the data. The process of relations between attributes is a combination between the attributes that have the same primary key, so that these attributes will become an integral and connected by the key content. The relation scheme of Supply Chain Management at PT. Multi Instrumentasi can be seen inPicture 7

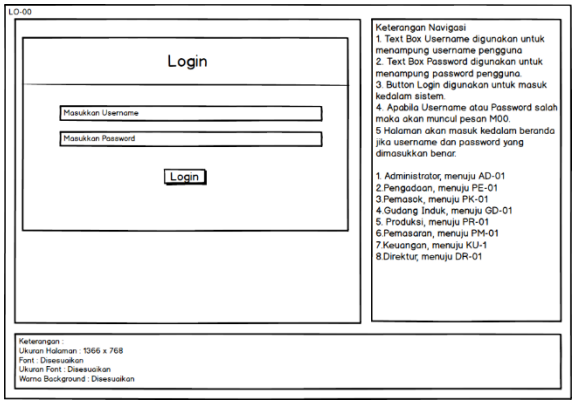


Picture 7 Relation Scheme Supply Chain Management at PT. multi Instrumentasi

2.9 Interface Design

The design of the interface is made to describe the design of the display program to be used by users to connect with the system to be built. The design is based on the interface display both input and output to be generated when the application is implemented.

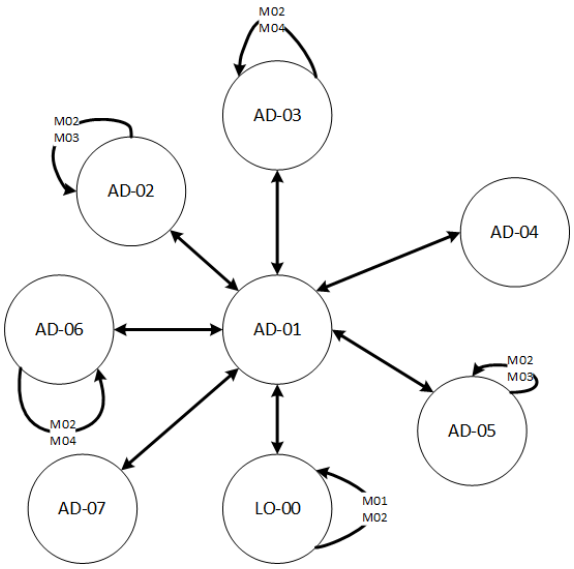
Planning login interface can be seen in Picture 8



Picture 8 Login Interface Design

2:10 Semantic Network Design

The design of the semantic network representation of the design interface that shows how each interface is connected. Login semantic network planning in supply chain management at PT. Multi Instrumentasi can be seen in



Picture 9 Network Design Semantics Login

2:11 Testing System

Testing is central system that aims to find errors or deficiencies in the system being tested. The test aims to determine the supply chain management are prepared to comply with the prescribed standards when designing.

Tests are used to test the system is a black box testing methods. Black box testing focuses on testing the functional requirements of information systems.

Test plan will do is to test the system built by Black Box and beta. Testing of supply chain management at PT. Multi Instrumentasi using test data based on data provided from some of the data that has been given.

1. Black Box Testing

Black box testing focuses on functional requirements of software built. Black Box Testing can be seen in*Table 4*

Table 4 Table Testing Black Box

class Test	Test Item	types of Tests
Login	Login	*Black Box*
Management of Production Plan	Forecasting Data Production Plan	*Black Box*
	Storing Data Production Plan	
User management	Password Changing User Data	*Black Box*
	Add User Data	
	Delete User Data	
Raw Material Management	Change Data Raw Materials	*Black Box*
	Add Data Raw Materials	
	Delete Data Raw Materials	
Product management	Change Data Products	*Black Box*
	Add Data Products	
	Clear Data Products	
Sales management	Add Sales Data	*Black Box*
Delivery of goods	Add Data Delivery	
Expedition management	Change Data Expedition	*Black Box*
	Add Data Expedition	
	Clear Data Expedition	
Customer management	Change Customer Data	*Black Box*
	Add Customer Data	
	Clear Data Customers	
Employee management	Change Data Employees	*Black Box*
	Add Employee Data	
	Clear Data Employees	

2. Beta testing

Beta testing is directly carried out in the actual environment. Users make an assessment of the software with the interview. From the results of these interviews it can be concluded whether the software has been built in accordance with the purpose or not.

Interviews conducted for the users of the system consisting of an administrator, the production division, the Warehouse parent, parts procurement, marketing.

3. CONCLUSION AND SUGGESTIONS

This chapter will explain about the conclusions which contains the results obtained after the analysis, design, testing, and implementation of software design that has been designed and developed as well as suggestions that will provide important records and improvements that need to be done for software development previous.

3.1 Conclusion

Based on the results obtained in this thesis, it can be concluded as follows:

1.This system can facilitate Production Division in determining the amount of the production plan of products every month so as to get the required amount of raw materials, so there is no shortage of raw materials for the production process

2.This system can help Marketing Division in determining the schedule of delivery of products to customers, so regular scheduling and do not experience delays in delivery.

3.2 Suggestions

There are some suggestions that can diajadikan consideration in the development of supply chain management system in PT. Multi Instrumentasi, among others:

1.Need to add features on supplier selection in the purchase so that the Procurement obtain input and consideration in the purchase of raw materials to the optimum.

2.Need to add feature on expedition election in transferring the products in which the program will display the expedition are available and have a large transmission capacity that can be used services so that products sold can be directly shipped to the customer.

BIBLIOGRAPHY

[1] Jacob, Introduction to Information Systems, Yogyakarta: Graha Science, 2012.

[2] Jogiyanto, Analysis and Design of Information Systems: Theory and Practice Structured Approach Business Applications, Yogyakarta: ANDI 2005.

[3] IN Pujawan and M. ER, "Supply Chain Management Second Edition," Surabaya, Widya Guna, 2010, p. 5.

[4] S.-L. &. Bishop, Supply Chain, 2003.

[5] Lukiastuti F. and H. Prasetya, "Operations Management First Edition," Yogyakarta, MedPress (Member IKAPI) 2009.

[6] S. Makridakis, SC Wheelwright and McGee VE, Forecasting Methods and Applications Volume 1, Jakarta: Binarupa Script, 1999.

[7] H. Jogiyanto, Analysis and Design, Yogyakarta: Andi Offset 2004.

[8] AB b. Ladjamudin, Concept and Implementation of Database Systems, Yogyakarta: Graha Science, 2005.

[8] JA Hall, Accounting Information System, Jakarta: Four Salemba 2009.