DEVELOPMENT OF SUPLLY CHAIN MANAGEMENT SYSTEM IN ANDRIAN ASTRA

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ABSTRACT

Andrian Astra is one of the convection companies operating in the manufacture of apparel, especially women's clothing. Andrian Astra manufactures various types of women's clothing including robe shirts, babydoll clothes, ola shirts, bat clothes, cuffs, tanktops, leggings, culottes, and cardigans. This company will only carry out the production process if there are orders from consumers. The problems that exist in the company at this time is that companies are often wrong in determining the completion time of products that are due to the main raw material (primary) ordered sometimes have to wait for one to two days due to ordering queues on the supplier and improper procurement of raw materials and the absence of a monitoring system for raw material inventories that impedes the production process, which causes the delivery of products to consumers not on time. Stocks of supporting raw materials are always in excess, which causes raw materials to accumulate in the warehouse for too long, so there is a possibility of damage to raw materials. The strategy used is pull supply chain and push supply chain because the ordering of the main raw material and the production of new products is done after the order from the consumer and the finished product is sent to the consumer or called make to order, while the push supply chain strategy is used because ordering supporting raw materials is done every once a month. Planning the purchase of the main raw materials using the JIT method and forecasting supporting raw materials using the single moving average method. The test results can be concluded that this system has helped manage a list of product orders from consumers, forecasting ordering of supporting raw materials for one month, helping determine the number of raw material orders to suppliers and helping in determining the completion date of the product.

Keywords: supply chain management, pull supply chain, push supply chain, mak-to-order, make-to-stock, safety stock, just in time, single moving average.

1. INTRODUCTION

Andrian Astra is one of the convection companies operating in the manufacture of apparel, especially women's clothing. Andrian Astra manufactures various types of women's clothing including robe shirts, babydoll clothes, ola shirts, bat clothes, cuffs, tanktops, leggings, culottes, and cardigans. The strategy used by the company is make to order, that is, it will only carry out the production process if there is an order from the consumer. The order is made by the consumer via telephone or come directly to the ordering section, each order has a minimum order of half a dozen that has been set and the order can be produced after the consumer makes a payment in full or in advance as much as 30% of the total order which is then recorded, then given to the production section, which will then check the raw materials to the warehouse and to the procurement department to determine the ordering of raw materials needed. The raw material in this company is divided into two types, namely raw materials that are stocked (secondary) and raw materials that are not distilled (primary), secondary raw materials consist of yarn, stamp, rubber, buttons, plastics, for this category use make to stock strategy and raw materials that are not stocked, namely fabrics, raw material purchases occur if there are orders from consumers.

The results of the interview with Mr. Budi as the ordering section at Andrian Astra, stated that the company will first produce the ordered goods of the customer who have finished making a minimum payment of 30% of the total order, the consumer will be given information on the completion of the work and delivery of the ordered products. During this time the company always gets complaints from consumers because of the failure to reach the product completion time in accordance with the initial agreement. The timeliness of the completion of the work of a product is caused because the raw materials ordered sometimes have to wait for one to two days due to the queue of orders on the side of the

supplier as well as improper procurement of raw materials and the lack of a monitoring system for raw material inventory that impedes the production process, as happened February 2017 to August 2017 (Appendix E). This can make the level of consumer confidence decrease and can harm the company.

The results of the interview with Mr Rahmat as the procurement department stated that Andrian Astra did not keep a stock of primary raw materials (primary) in the warehouse, because the capital for the purchase of raw materials was quite large because the company had limited capital to procure primary raw materials (primary). For the procurement of supporting raw materials (secondary) is done once a month. The process of procuring raw materials is still seen from the procurement of raw materials before, as in what happened in February 2017 to August 2017 (Appendix E), so companies sometimes have excess or lack raw materials. Uncertainty of orders from consumers results in the accumulation of raw materials in the warehouse for too long, so the possibility of raw material damage in terms of shape or quality degradation, and if the shortage of raw materials will cause the production process to be hampered which will also affect the production process.

The results of the interview with Mr. Heri as part of the dispatch stated that what the company did was to deliver products to consumers using three ways, namely by taking it directly by consumers, using company vehicles and shipping services for shipping out of town. The company's vehicle has 3 units of vehicles, 1 pickup and 2 motorbikes, this vehicle has a different capacity. The shipping process is carried out after the consumer has made payment and the company will immediately send the product to the consumer. The process of sending to customers is also still experiencing difficulties because the manufacturing time of products ordered is different depending on product capacity, because the first order can be longer than the second order according to the level of complexity and what products are ordered.

The results of the presentation found problems in Andrian Asta, namely the need for a facility that can process supply chain information. Therefore, supply chain management is the right choice to deal with problems in the company.
The purpose of building this information system is:
a. Assist the ordering part in determining the completion of the product to consumers who have made an order.
b. Assisting the procurement department in determining the amount of raw material procurement that must be ordered to suppliers in the following month for the category of supporting raw materials.
c. Assist the shipping department in the shipping process by scheduling product delivery to each customer who has made an order to be on time.

2. RESEARCH CONTENT

2.1. Information System

According to Jacob, the system is a network of related procedures, collected together to carry out certain activities or goals [1].

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

The information system can be defined as a set of components that are interconnected and work together to collect, process, store and distribute related information to support the decision-making process, coordination and control contained therein. The purpose of the information system is to provide and systematize information from all events or activities needed to control the operation of an organization. The activities referred to in this information system include taking, processing, storing, and conveying information needed in operating all the activities of the organization concerned [3].

2.2. Supply Chain Management

"Supply chain management is a total approach system to deliver products to end consumers by using information technology to coordinate all elements of the supply chain from suppliers to retailers, then reach the next level which is a competitive advantage not available in traditional logistics systems [4].

"Supply chain management (SCM) is an integrative method or approach to managing the flow of products, information and money in an integrated manner that involves parties from upstream to downstream consisting of suppliers, factories, distribution networks and logistics services" [4].

2.2.1. Push dan Pull Supply Chain

"The pull process is based on consumer orders, while the push process begins and is done by anticipating consumer orders" [5].

Pull supply chain is a "make-to-order" production strategy whose main benefit is to avoid waste inventory or is a company strategy, especially a manufacturing company where new production is carried out always after market demand and actually done at the request of consumers [5].

Push Supply Chain is a Make-to-Stock production strategy. This strategy is the opposite of the Pull strategy where in pull appeal, the push strategy is more popular because the production system is based on forecasting and produces a large amount of output that will be entered into inventory before being distributed to consumers [5].

This strategy has a focus on activity efficiency and standardization. Push strategy can be connoted to lean supply. The more companies have fewer product variations, then this strategy is right. However, for products with changing market situations, the use of a push system will bring some losses, such as [5]:

1. *Inability to meet changing market demands.*
2. *Inventory accumulation that will bring a lot of waste and requires a lot of storage space.*
3. *Large production batch.*
4. *Risk of large obsolete products.*

2.2.2. Area Of Supply Chain Management Coverage

The main activities included in the Supply Chain Management classification are as follows [4]:

1. *Activities of designing new products (product development)*
2. *Activities to obtain raw materials (procurement, purchasing or control)*
3. *Production planning and inventory activities (planning & control)*
4. *Production activities*
5. *Delivery / distribution activities (distribution)*
6. *Product / goods return management activities (return).*

2.2.3. Monitoring

Monitoring allows us to determine whether our resources are sufficient and have been used properly and are a useful basis for evaluating and knowing our capacity is adequate and sufficient.

The monitoring objectives are as follows [4]:

1. *Assess whether the activities carried out are in accordance with the plan*
2. *Identifying problems that arise so that they can be directly addressed*
3. *Assess whether the work and management patterns used are appropriate to achieve the objectives of the activity.*
4. *Knowing the link between activities with the aim of obtaining a measure of progress.*
5. *Adjust activities with a changing environment, without deviating from the goal.*

2.2.4. Production Management

Production scheduling is very useful for an appropriate system, resulting in very low costs, efficient resources, and minimum production time.

Production system flow patterns are divided into two, namely flow shop and job shop. The problem in flow shop flow is some work and several machines with every job that determines the order in which the process is carried out with the same product trajectory. Flow shop production scheduling helps to minimize makespan. One of the methods used for flow shop welding is the branch and bound method developed to optimally schedule machines [6].

To calculate the production schedule at Andrian Astra itself uses the following technologies:

$T_{pr} = T_p + 1 +$ *Ordering time for raw materials (2.1)*

T_{pr} *= Production date*

T_p *= Ordering date*

2.3. Just In Time

Just In Time (JIT) is the philosophy of resolving the problem strictly and continuously to eliminate waste and unexpected deviations. JIT itself is a production philosophy developed by Toyota Motor, which has succeeded in making the Japanese automotive and electronics industry an industry that is able to work efficiently with good output quality. The Japanese industry was able to shift by taking the automotive and electronics market share which had been dominated by European and United States.

According to Yamit, "Just In Time" is an attempt to eliminate waste in all fields of production, so as to produce and deliver the final product on time for sale [7].

2.4. Determination of Raw Material Needs

Determination of raw material requirements is used to determine the amount of raw material to be used for the production process in accordance with the number of product orders from consumers. The determination of the needs of each raw material for all Andrian Astra products can be calculated by the formula in equation (2.2).

the amount of raw material = X ordering products X composition (2.2)

Information :

Xproducts product = Number of product orders from consumers.

The company policy in ordering raw materials to suppliers in determining raw material requirements, which can be calculated by the equation formula (2.3).

Number of orders = number of raw materials x 5% (2.3)

2.5. Determination of Product Delivery Schedule

Determination of product delivery schedules is used to calculate when products can be sent by the company to consumers. The calculation formula can be seen in equation (2.4) to equation (2.6).

Tp = Ordering + (length of time ordering raw materials + length of production) (2.4)

production duration = number of product orders (2.5)

amount of production / day

Production amount / day = total production per hour x many machines x t (2.6)

Information :

Send = product delivery date

But product = date of product order

T = production time in a day (8 hours)

2.6. Single Moving Average Forecasting Method

A single moving average method uses a number of new actual data requests to generate forecast values for future requests. This method will be effectively applied if we can assume that market

demand for products will remain sTable over time. This method has two special properties, namely to make forecasts require data [8].

Historically over a certain period of time, the longer the moving averages will produce an increasingly smooth moving average, systematically moving averages can be calculated by equation 2.7.

$$S_{t+1} = \frac{x_t + x_t - 1 + \cdots + x_t - n + 1}{n} \quad (2.7)$$

Information:

St + 1 = Forecast for periods to t + 1.

Xt = Data in period t.

n = The period of Moving Averages

2.7. Measurement of forecasting errors

Mean Squared Error (MSE) is the average of forecasting errors squared and can be seen in equation 2.16.

$$MSE = \frac{\sum(X_t - F_t)}{n} \quad (2.16)$$

Information :

X_t *= Actual data in period t*

F_t *= Forecast data from the model used in period t*

n *= Lots of forecasted data*

2.8. Safety Stock

Security stock or Safety stock serves to protect errors in predicting requests during Lead Time. Lead Time is the time needed between ordered raw materials to arrive at the company. The value of the Safety stock depends on the uncertainty of supply and demand. The following is the formula in determining Safety stock can be seen in equation 2.19.

$$Safety\ Stock = Z \times Sdl \quad (2.19)$$

Information :

Z = Service Level

S_{dl} *= Demand uncertainty and uncertainty of Lead Time*

The reorder point is when inventory reaches the point where it needs to be re-ordered. The following is the formula in determining the reoder point can be seen in equation 2.20.

$$Sdl = \sqrt{(d^2 \times sl^2 + l \times sd^2)} \quad (2.20)$$

Information :

d = Average usage

sl = Standard Deviation Lead Time

l = Lead Time

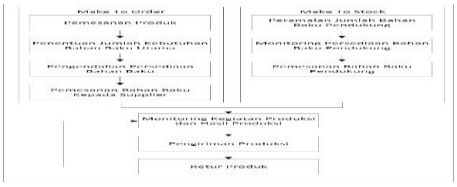
sd = Average Usage Deviation

2.9. Supply Chain Management (SCM) Analysis

Supply chain management analysis is used to apply the supply chain management approach to the system to be built.

2.10. Supply Chain Analysis in Andrian Astra

Supply chain analysis is carried out to describe the supply chain management process that will be built in Andrian Astra based on the supply chain model in Figure 3.



Gambar 3 *Supply Chain Management at Andrian Astra*

1. *Forecasting Supporting Raw Materials*

Analysis of the forecasting phase that will be carried out is to forecast the needs of supporting raw materials for the procurement process. Forecasting raw material needs aims to meet the production needs that have been ordered by consumers. Forecasting techniques used are quantitative forecasting techniques, because sufficient availability of past data is fulfilled. The forecasting method used is Single Moving Average. Based on the data pattern found, the seasonal pattern shows fluctuations that appear regularly every month. The data to be sampled is data ordering products for adult long Leggings can be seen in Table 1.

Tabel 1 *Ordering data for adult long Leggings Products*

No	Periode	Data Aktual Pemesanan Legging Panjang Dewasa
1	Februari	2700 Pcs
2	Maret	678 Pcs
3	April	948 Pcs
4	Mei	4218 Pcs
5	Juni	1452 Pcs
6	Juli	3336 Pcs
7	Agustus	1944 Pcs

The next step is forecasting using the single moving average forecasting method. The period of moving average value used is the 3 month and 5 monthly periods because in the third and fifth months there are quite large fluctuations.

a. *Calculation of 3 months period (n=3)*

Forecasting period of 3 months is obtained by entering 3 months of order data before the month to be forecasted. Here is a detailed calculation to determine forecasting in September 2017 using formula 2.7.

$$F\ September = \frac{X_{Juni} + X_{Juli} + X_{Agustus}}{3}$$

$$F\ September = \frac{1452 + 3336 + 1944}{3}$$

$$F\ Juli = 2244$$

b. *Calculation of 5 months period (n=5)*

The forecasting period of 5 months is obtained by entering 5 months of order data before the month to be predicted. The following is a breakdown of the calculation results to determine the forecast in September 2017 using the formula 2.7.

$$F\ September = \frac{X_{April} + X_{Mei} + X_{Juni} + X_{Juli} + X_{Agustus}}{5}$$

$$F\ September = \frac{948 + 4218 + 1452 + 3336 + 1944}{5}$$

$$F\ Juli = 2379.6 \approx 2380$$

Here are all the results of forecasting using the single moving average forecasting method can be seen in Table 2.

***Tabel 2** Results of adult long Leggings Forecasting*

Bulan	Jumlah Pesanan	per-3 Bulan	per-5 bulan
Februari	2700		
Maret	678		
April	948		
Mei	4218	1442	
Juni	1452	1948	
Juli	3336	2206	1999
Agustus	1944	3002	2126
Hasil Peramalan Bulan September		2244	2380

Forecasting used can be measured accuracy in forecasting. There are several methods to calculate the accuracy of error rates, one of which is used in this study is the MSE (Mean Square Error) method. The following are the results of the calculation of MSE (Mean Square Error) from forecasting adult long Leggings products in the period of 3 months and 5 months can be seen in Table 3.

Tabel 3 Mean Square Error Calculation

Bulan	Jumlah Pesanan	3 Bulanan			5 Bulanan		
		Ramalan	Kesalahan	Kesalahan ^2	Ramalan	Kesalahan	Kesalahan ^2
Februari	2700						
Maret	678						
April	948						
Mei	4218	1442	2776	7706176			
Juni	1452	1948	-496	246016			
Juli	3336	2206	1130	1276900	1999	1337	1787034
Agustus	1944	3002	-1058	1119364	2126	-182	33270
RATA-RATA		2587114			910152		

It was concluded that in July 2017 Andrian Astra was recommended to procure 910152 pcs of raw materials for adult long Leggings products. The following is the composition of adult long Leggings products can be seen in Table 4.

***Tabel 4** Composition of adult long Leggings Products*

Nama Produk	Nama Bahan Baku	Jumlah Bahan
Legging panjang Dewasa	Kain Spandek Rayon	0,49 m
	Benang Jahit 5000yard	12 m
	Benang Polyester	12 m
	Karet 1 inc	0,63 m
	Hang Tag	1 pcs
	Toppin	1 pcs
	Plastik	1 pcs

It is known that the composition of adult long Leggings products, then the need for raw materials to meet the forecasting results of 910152 pcs can be seen in Table 5.

***Tabel 5** Composition of adult long leggings based on forecasting results*

Peramalan	Nama Bahan Baku	Perhitungan	Jumlah Bahan	Jumlah yang Harus Dipesan
910152 Pcs	Benang Jahit 5000yard	910152 x 12	12 m	10921824 m / 2388,48 = 2389 cones
	Benang Polyester	910152 x 12	12 m	10921824 m / 2388,48 = 2389 cones
	Karet 1 inc	910152 x 0,63	0,63 m	573395,76 m / 23891,5 = 23892 roll
	Hang Tag	910152 x 1	1 pcs	910152 pcs
	Toppin	910152 x 1	1 pcs	910152 pcs
	Plastik	910152 x 1	1 pcs	910152 pcs

1. Monitoring Raw Material Inventories

The next stage is to monitor the raw material inventory and determine the safe limit of raw materials that must have a raw material warehouse that aims to prevent the occurrence of shortages or vacancies of raw materials using the Safety Stock method. Examples of calculation of raw material inventory based on product inventory using formulas 2.19 and 2.20 are as follows:

Calculation of Safety Stock

Forecasting number in September 2017 = 910152 pcs

Number of workdays in one month = 26 hari

Procurement Lead Time to supplier (l) = 2 Hari

Procurement average in one month (d)

= 910152 / 26

= 35005.8 = 35006

Standard Deviation Lead Time (sl) = 0.2

Order Standard Deviation (sd) = 3500.6

Service Level 96% (Z) = 1.75

Safety Stock = Z x Sdl

$Sdl = \sqrt{(d^2 \times sl^2 + l \times sd^2)}$

$Sdl = \sqrt{35006^2 \times 0.2^2 + 2 \times 3500.6^2}$

$Sdl = \sqrt{73525202.2}$

Sdl = 8573.5

Safety Stock = 1.75 x 8573.5

Safety Stock = 15003.6 ≈ 15004

Safety stock for each raw material can be seen in Table 6.

***Tabel 6** Safety Stock of Raw Material Adult long leggings*

Safety stock	Nama Bahan Baku	Perhitungan	Jumlah Bahan	Jumlah yang Harus Dipesan
15004	Benang Jahit 5000yard	15004 x 12	12 m	180048 m / 39,38 = 40 cones
	Benang Polyester	15004 x 12	12 m	180048 m / 39,38 = 40 cones
	Karet 1 inc	15004 x 0,63	0,63 m	9452,5 m / 393,8 = 394 roll
	Hang Tag	15004 x 1	1 pcs	15004 pcs
	Toppin	15004 x 1	1 pcs	15004 pcs
	Plastik	15004 x 1	1 pcs	15004 pcs

3. Ordering Supporting Raw Materials

At this stage the Procurement Section orders the supporting raw materials to suppliers based on the results of forecasting in the previous stage. The following is the ordering data of supporting raw materials can be seen in Table 7.

***Tabel 7** Number of Raw Materials to Purchase*

Nama Bahan Baku	Jumlah yang Harus Dipesan
Benang Jahit 5000yard	21 cones
Benang Polyester	21 cones
Karet 1 inc	394 roll
Hang Tag	15004 pcs
Toppin	15004 pcs
Plastik	15004 pcs

4. Analysis of Product Ordering

Product ordering is the beginning of supply chain activities in Andrian Astra. In this process, consumers will order products. The order process will be a benchmark for determining the amount of raw material requirements and also determining the product delivery date. Therefore, the product ordering process must be recommended to consumers so that orders are made using the system.

The following are examples of product ordering from three consumers who make data processing that will be sampled is the order data in August 2017 namely the design of aladin Long Pants and Babydoll Shirt products. Request data is used as a reference for the production process and raw material procurement can be seen in Table 8.

***Tabel 8** Product Order for August 2017*

Tanggal	Pemesan	Kode Produk	Jml	Alamat	Status Bayar	Total Bayar
26 Agustus 2017	Dedi	Baju Babydoll	36	Cigasong Majalengka	Lunas	Rp 1.710.000
26 Agustus 2017	Grosir Meymey	Aladin Panjang	24	Tasik	Lunas	Rp 912.000

***Tabel 9** Product Order for August 2017*

Tanggal	Pemesan	Kode Produk	Jml	Alamat	Status Bayar	Total Bayar	Jumlah DP
26 Agustus 2017	Popon	Aladin Panjang	12	Cicalengka	DP	Rp 456.000	Rp 136.000,-

Table 8 and Table 9 present the number of orders for Aladin Panjang product design is 24pcs and 36pcs Babydoll Shirt, the order amount will be a parameter for determining raw material requirements. After knowing the number of products ordered, the next step is to determine raw material requirem

5. *Monitoring the Supply of Products and Raw Materials*

The monitoring phase of raw material inventory is carried out to see the raw materials left over from previous production which can be used for previous production activities, this is done to reduce waste of raw materials. before seeing the remaining raw materials available, here is the composition for Aladin Panjang product designs and Babydoll clothes that have been ordered by consumers. The composition can be seen in a row in Tables 10 and 11.

***Tabel 10** Aladin Long Composition*

No	Nama Bahan Baku	Jumlah Kebutuhan
1	Kain	0.9 meter
2	Karet	0.54 meter
3	Benang 5000 yard	22 meter
4	Benang Obras	22 meter

***Tabel 11** Babydoll Shirt Composition*

No	Nama Bahan Baku	Jumlah Kebutuhan
1	Kain	0.95 meter
2	Kancing	8 buah
3	Benang 5000 yard	32 m
4	Benang Polyester	32 m

6. *Determination of Raw Material Needs*

After finding out the composition of the long Aladin Pants and Babydoll shirts in Tables 3.18 and 3.19, the next is to calculate the amount of raw material requirements. calculation of the number of planned raw material requirements using the Just In Time (JIT) method. Calculation of raw material procurement with Just In Time (JIT) is always in accordance with the standard requirements for production. Calculation is done using equation 2.2.

Raw Material Needs Plan = product order x raw material requirements (product composition)

1. Aladin Long Product Raw Material Needs

The following is a calculation of the plan for the need for raw materials to produce orders with the design of Aladin Panjang products.

***Tabel 12** Plans for Raw Material Needs for Long Aladin Products*

No	Nama Bahan Baku	Jumlah Kebutuhan	Rencana Produksi	Rencana Kebutuhan Bahan Baku
1	Kain	0.9 meter	24	21.6 meter
2	Karet	0.54 meter		12.96 meter
3	Benang 5000 yard	22 meter		528 meter / 1 Kones
4	Benang Polyester	22 meter		528 ter / 1 Kones

1. *Raw Material Requirements for Babydoll Clothes*

The following is a calculation of the plan for raw material requirements to produce orders with the design of Babydoll products.

***Tabel 13** Plans for Raw Material Requirements for Babydoll Clothes Products*

No	Nama Bahan Baku	Jumlah Kebutuhan	Rencana Produksi	Rencana Kebutuhan Bahan Baku
1	Kain	0.95 meter	36	34.2 meter
2	Kancing	8 buah		288 buah
3	Benang 5000 yard	32 m		1152 meter / 1 kones
4	Benang Polyester	32 m		1152 meter / 1 kones

7. *Ordering Raw Materials*

After the raw material needs are known, the next stage is the ordering of raw materials to suppliers. Before making an order, it is necessary to analyze the supplier so that the raw material ordered comes on time and is able to reduce costs so that it is not too large. The following is a list of suppliers that supply the company's raw materials complete with the type of raw material, price and delivery time in Table 14.

***Tabel 14** List of Raw Material Prices in each Supplier*

Supplier	Nama Bahan Baku	Harga	Satuan
Wintek	Kain Spandek Rayon	Rp. 27.000	/meter
Cita Sandang	Kain Spandek Rayon	Rp. 28.000	/meter
Idola	Kain Spandek Rayon	Rp. 29.000	/meter
Cemerlang	Benang 5000 yard	Rp 11.000	/kones
	Benang Obras	Rp 10.000	/kones
	Karet	Rp 18.000	/gulung
	Kancing	Rp 6.000	/gross
Nasional	Benang 5000 yard	Rp 11.500	/kones
	Benang Obras	Rp 10.000	/kones
	Karet	Rp 16.000	/gulung
Toko 1001	Benang 5000 yard	Rp 11.500	/kones
	Benang Obras	Rp 10.000	/kones
	Karet	Rp 16.000	/gulung
	Kancing	Rp 5.000	/gross

From Table 14, it is known that raw materials have the lowest prices from each supplier. In the JIT system, the company only buys raw materials needed for production activities, as can be seen in Table 15 and Table 16.

***Tabel 15** Total Procurement of Aladin Long Product Raw Materials*

Bahan Baku	*Supplier*	Kebutuhan Bahan Baku	Pesanan /Rencana Produksi	Jumlah / Rencana Kebutuhan Bahan Baku	Sisa Bahan Baku	Bahan Baku untuk dibeli	Harga
Kain	Wintek	0.9 meter	24	21.6 meter	-	21.6 meter	Rp 27.000,-/meter
Karet	Nasional	0.54 meter		12.96 meter	-	12.96 meter / 5 golong	Rp 16.000,- /golong
Benang 5000 yard	Cemerlang	22 meter		528 meter / 1 Kones	-	1 kones	Rp 11.000,- /kones
Benang Polyester	Cemerlang	0.9 meter		528 meter / 1 Kones	-	1 kones	Rp 10.000,- /kones
							Total

***Tabel 16** Total Procurement of Raw Materials for Babydoll Clothes*

Bahan Baku	*Supplier*	Kebutuhan Bahan Baku	Pesanan /Rencana Produksi	Jumlah / Rencana Kebutuhan Bahan Baku	Sisa Bahan Baku	Bahan Baku untuk dibeli	Harga	Tot
Kain	Wintek	0.95 meter	32	0.95 meter	-	34.2 meter	Rp 27.000 /meter	Rp 9
Kancing	Toko 1000	8 buah		8 buah	-	2 gross	Rp 5.000 /meter	Rp 1
Benang 5000 yard	Cemerlang	32 m		32 meter / 1 Kones	-	1 Kones	Rp 11.000 /kones	Rp. 1
Benang Polyester	Cemerlang	32 m		32 meter / 1 Kones	-	1 Kones	Rp 10.000,- /kones	Rp 1
							Total	Rp 9

8. *Production Scheduling*

Production scheduling is done to regulate the production schedule. An order will enter the production schedule when the status has been paid and production activities will begin when the raw material for an order is available. The following is the order on August 26, 2017.

***Tabel 17** Pemesanan Produk Tanggal 26 Agustus 2017*

Tanggal Pesan	Pemesan	Kode Produk	Jml	Status Bayar
26 Agustus 2017	Dedi	P-0015	36	Lunas
26 Agustus 2017	Grosir Meymey	P-001	24	Lunas
26 Agustus 2017	Popon	P-001	12	DP

From Table 17, it can be seen that all orders have been paid, so that everything will enter the production schedule. Production schedule calculations are carried out using equation 2.1

$T_{pr} = T_p$*+1+ long ordering of raw materials*

= 26 August 2017 + 1 + 1

= 28 August 2017

In addition to determining the production schedule, the rate of production can also be determined by the monitoring of production. Whether production activities are being processed, or are finished. Besides that, when the completion of the production of a product can be known, it is calculated the time of processing a product with the company's ability to complete it by looking at the quantity and quality of production workers. For the calculation of the completion time of production using equation 2.4

$T_s = T_p$ *+ 1+ (length of time ordering raw materials + length of production)*

= 26 August 2017 + 1+(1 day + 1 day)

= 29 August 2017

Production monitoring activities can be seen in Table 18.

***Tabel 18** Production Monitoring*

Tanggal Produksi	Pemesan	Kode Produk	Jml	Status Bayar	Status Produksi	Waktu Sele Pengiriman
28 Agustus 2017	Dedi	P-0015	36	Lunas	Sedang berjalan	29 Agustus
28 Agustus 2017	Grosir Meymey	P-001	24	Lunas	Sedang berjalan	29 Agustus
28 Agustus 2017	Popon	P-001	12	DP	Sedang berjalan	29 Agustus

9. Delivery of Products

For this type of shipping service, divided into 3 categories, namely by using company vehicles, shipping services and taken directly by consumers. A list of vehicles owned by the company and capacity for product storage can be seen in Table 19.

***Tabel 19** Andrian Astra Company Vehicles*

Jenis Kendaraan	Nomor Polisi	Kapasitas
Mobil Pick Up	Z 529 AM	800 Lusin
Motor Vario	Z 5299 CN	30 Lusin
Motor Xeon	Z 6100 AZ	20 Lusin

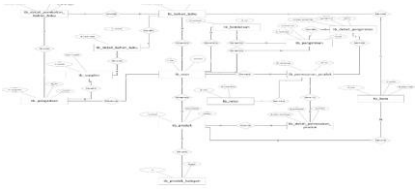
The following is the shipping Table for orders with product codes P-015 and P-001 on August 26, 2017.

***Tabel 20** Product Delivery*

Pemesan	Waktu Pengiriman	Kode Produk	Alamat	Jenis Kendaraaan	Status Kirim
Dedi	29 Agustus 2017	P-015	Cigasong Majalengka	Motor Z 6100 AZ	Dikirim
Grosir Meymey	29 Agustus 2017	P-001	Tasik	Motor 5299 CN	Dikirim

1.14 Database Analysis

Database analysis on the information system to be built using ERD. ERD is a data model that uses several notations to describe data in an entity and relationship context described by that data.



***Gambar 4** Entity Relationship Diagram of SCM Information System in Andrian Astra*

1.15 Diagram Konteks

Context diagram is a model to explain globally how data is used and transformed to process or describe the flow of data into and out of the system. The context diagram in the system can be seen in Figure 5.



***Gambar 5** Andrian Astra SCM Information System Context Diagram*

1.16 System Testing

The test used to test the new system is the black box testing method. Black box testing focuses on testing the functional requirements of information systems.

The test plan that will be carried out is by testing the system built in Black Box, UAT and beta. Testing of the supply chain management information system development in Andrian Astra uses test data based on the data provided from some of the data that has been provided.

1.17 Black Box Testing

Based on the results of the system testing that has been carried out in its entirety it can be concluded that the application process of the Supply Chain Information System has been maximal and the system functionality can produce the expected output.

1.18 User Acceptance Test (UAT) Testing

Based on the results of the User Acceptence Test (UAT) that has been carried out on the supply chain management information system in Andrian Astra, it can be concluded that the system can proceed to the testing phase of end user acceptance. tahap pengujian penerimaan pengguna akhir.

1.19 Beta Testing

Beta testing is a test that is direct in the real environment. Users evaluate the software using the interview method. From the results of the interview, it can be concluded whether the software that is built is suiTable for the purpose or not.

Interviews are conducted for users of the system consisting of Procurement Section, Ordering Section, Warehouse Section, Production Section, and Shipping Section. This research was conducted at Andrian Astra in order to find out the extent to which the system built can be a solution and a solution to the problems described earlier .

Based on testing user acceptance, it can be concluded that:

1. *The system has not been enough to help the Order Section, Production Section, Procurement Section, Warehouse Section, Shipping Section in carrying out their respective work because there are still features that do not work according to their functions, and there are still errors in the system being built.*
2. *The system built is quite easy to use after a guide.*
3. *The system has a fairly easy to understand interface.*
4. *Use of the language applied to the system is easy to understand.*

CLOSING

This section describes the conclusions that contain the results obtained after the analysis, design, and implementation of the software design that has been developed and has been developed as well as suggestions that will provide important notes and possible improvements to previous software development.

3.1. Conclusion

Based on the results obtained from black box testing, testing user acceptance (user acceptance test), and testing the end user acceptance after the system is implemented in the company's environment, the following conclusions can be drawn:

1. *The information system of supply chain managemet in Andrian Astra can help in determining the estimated time of completion of the product that must be given to consumers appropriately.*
2. *The supply chain managemet information system at Andrian Astra can assist the procurement department in determining raw material requirements.*

3.2. Suggestion

Based on the results of the testing, as for suggestions for the development of this information system. There are several suggestions that can be done, including:

1. Perform improvements / development to the system in the distribution section because the system that is built is still not maximal and not enough to help the relevant part in distributing products to consumers.

2. Adding user data managers will be better if there is a special system that manages finance and employees so that users can be selected directly from the system.

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