INFORMATION SYSTEMS DEVELOPMENT TROUGH *SUPPLY CHAIN MANAGEMENT* APPROACH AT CAL7CIO SPORTWEAR

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ABSTRACT

Cal7cio Sportwear is a company engaged in convection. The products produced are standard jersey, jersey printing, training jersey, shirt, t- *shirt* and polo *shirt* . Cal7cio Sportwear in managing its business uses two strategies, namely *push supply chain* (*make to stock*), that is the company procures raw materials in a period and *pull supply chain* (*make to order*), that is, the company will only produce if there is an order from the customer. The problems that exist in Cal7cio Sportwear are that procurement managers have difficulty in determining the amount of raw material procurement that must be purchased to the *supplier* , this happens because the order from the customer is uncertain, if the order goes up it causes a shortage of raw materials and vice versa if the order goes down there is a buildup of raw materials in the warehouse, other than that the procurement manager has difficulty in determining raw materials after ordering from customers. Other problems that exist at Cal7cio Sportwear are managing production difficulties in determining the completion date and marketing managers having difficulty determining product delivery information. Based on the existing problems, Cal7cio Sportwear requires an information system using a *supply chain management* approach . The method used to determine the number of procurement in the coming month using *single moving average* forecasting method, while to determine the procurement of raw materials after ordering from customers, determine the completion date and determine the date of delivery using the *just in time* (*JIT*) method . Based on the test results it can be concluded that the system can help the company in determining the amount of raw material that must be purchased and avoid shortages of raw materials so that it can minimize the problems that will occur.

Keywords : *supply chain management, push supply chain, make to stock, push supply chain, make to order, single moving average, just in time (JIT)*

1. INTRODUCTION

Cal7cio Sportwear is a company engaged in convection , which manufactures sports apparel including standard jersey, jersey printing, training jersey, shirt, t- *shirt* , and polo *shirt* . Cal7cio Sportwear receives orders from all over Indonesia. Strategy in running its business *using pull supply chain* and *push supply chain* .

After conducting interviews with related parties at Cal7cio Sportwear that currently the process of procuring raw materials is carried out with two events, namely the procurement of the period and procurement after an order from the customer. Procurement of raw materials for the period using the report from the previous month in this case there are problems when the order has increased, it will result in a shortage of raw materials so that the production process becomes late and the delivery of products to customers becomes delayed . procurement after an order refers to the order, but there are problems when the customer places an order *online* but does not make payment within the time specified (6 days) it will cause losses because the company buys raw materials for unpaid orders. Based on the ordering data of the last six months there was an increase and decrease in orders,

within the six-month period the highest increase was in the 2018 maternal month which reached 30% while the lowest decrease occurred in June 2018 reaching 18%.

Based on the problems that occur at this time at Cal7cio Sportwear, a *Supply Chain Management (* SCM *)* system is needed to fix current problems so that the company is better and can maximize its business processes. The method used to solve the existing problem is the method *single moving average (*SMA*)* and *just in time (*JIT*)* . The objectives to be achieved in this study are

1. Assisting procurement managers in determining the amount of raw material procurement and helping determine the procurement of raw materials
2. Assist the production manager in determining the completion date of production
3. Assist marketing manager in determining product delivery date information

2. THEORETICAL BASIS

The foundation of the theory is a strong basis in a study that will be carried out

2.1. Information Systems

Information systems consist of two words, namely the system and information. The system is a framework of procedures that are mutually integrated with the same intent and purpose to solve certain goals [1].

2.2. Supply Chain Management

Supply chian management is a complex process that requires coordination of various activities so that the delivery of goods and services from *suppliers* to companies is carried out effectively and efficiently [2].

2.3. Forecasting

Forecasting is a prediction of what will happen in the future. While the plan is the determination of what will be done in the future. By itself there is a difference between *forecast* and plan. *Forecast* is a forecast of what will happen, but it cannot necessarily be implemented by the company. *Forecasting* aims to get forecasting or predictions that can minimize errors in forecasting which is usually measured by *mean square error, mean absolute error* [2] .

2.4. Single moving average

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. *Historically* within a certain period, the longer *moving averages* will produce increasingly fine *moving average,* systematically *moving average* can be calculated using equation 2.1

$$S_{t+1} = \frac{x_t + x_t - 1 + \cdots + x_t - n + 1}{n} \qquad (2, 1)$$

Information :

S_{t+1} = *Forecast* for periods to *t + 1.*

Xt = Data in period t.

n = Duration of *Moving Avera ges*

2.5. *Just in time*

The *just-in-time* (JIT) method is basically to emphasize all material must be an active part of the production system and should not cause problems that ultimately lead to the emergence of inventory costs. In the *Just In Time* (JIT) system, inventory must be minimized so that it can reduce inventory costs which include the cost of raw material inventory, the cost of semi-finished goods and the cost of finished goods inventory. In general, *Just In time* (JIT) is a concept of a production system where operations (material movements, processing, to delivery) will be carried out if the company has received orders from customers, the rest of the company will not carry out operations if there is no request from customers. On the other hand, *Just In Time* (JIT) is a production system to balance the production process and control raw materials [4] .

3. RESEARCH METHODS

Research methodology is a *scientific* way to get data with specific purposes and uses. The research

methodology is a process used to solve a logical problem . In this study the methods used to solve problems found in Cal7cio Sportwear are *moving average* and *just in time single* forecasting methods . The following is the research flow

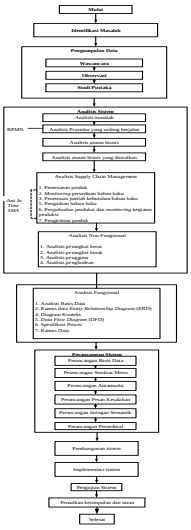


Figure 1. Research flow

4 RESULTS AND DISCUSSION

4.1. Problem analysis

Based on the results of interviews with the company and making observations made during the research there are problems at Cal7cio Sportwear as follows:

1. Procurement managers have difficulty in determining the amount of raw material procurement and determining the list of raw material procurement. Sometimes raw materials purchased to fulfill orders from customers sometimes experience shortcomings and strengths. Because sometimes the procurement department buys raw materials for unpaid orders.
2. Production managers have difficulty in determining the date of completion of production. Because sometimes the raw materials needed for the production process are not suitable so the production process becomes hampered.
3. Marketing managers have difficulty determining product delivery schedule information. Information on product delivery to customers often experiences incompatibility with a predetermined time.

4.2. Supply chain management analysis

Supply Chain Management analysis is used to apply the *suply chain management* approach to the supplier chain system to be built. Cal7cio Sportwear uses the *make to order* method in carrying out its production activities, *make to order* is a production concept that is run when there is an order from the customer.

4.2.1. Supply chain management model

The model of *supply chain management* in Cal7cio Sportwear can be seen in the following figure.

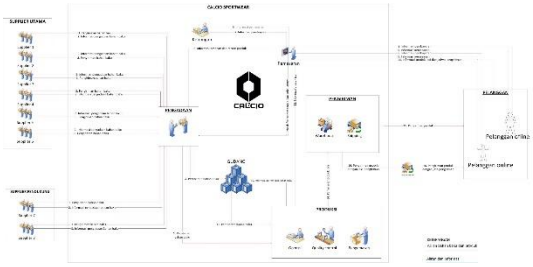


Figure 2 . *Supply management chian* model at Cal7cio Sportwear

4.2.2. *Supply chain management* (SCM) stages

The stages of the *supply chain management* found in Cal7cio Sportwear can be seen in the following figure .

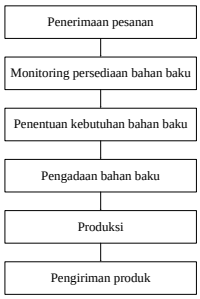


Figure 3. *Supply chain management* stages

4.2.3. Order products

In analyzing the determination of raw material requirements, the data that will be the reference is the following order data on March 14 2018.

Table 1. Reservations dated March 14 2018

Orderer's name	Jml	Number of DP	Total pay
Unikom football	67	IDR 4,000,000	Rp. 9,035,000
SI Unikom	41	Rp.2,500,000	Rp.5,535,000
Ardy Yudistira	76	Rp0	Rp. 10,260,000

4.2.4. Inventory monitoring

The *monitoring* phase of raw material inventories is carried out to see that the raw material is still available or already used up for previous production which can be used for further production .

Table 2. List of Cal7cio Sportwear raw materials

No.	Raw material	Ket	Unit
1	Sewing thread	Distok	Roll it up
2	Obras yarn	Distok	Roll it
3	Rubber	Distok	Roll
4	Button	Distok	Sir
5	Ink	Distok	Gram
6	Hard cloth	Distok	Meter
7	Wafer dryfit fabric	Not stocked	Kilo gram
8	Catton combad fabric	Not stocked	Kilo gram
9	Diadora cloth	Not stocked	Kilo gram
10	Planel fabric	Not stocked	Kilo gram
11	Polyflex	Not stocked	Meter
12	Print table	Not stocked	Meter
13	Transfer paper	Not stocked	Dozen

After the list of raw materials is known, the next step is monitoring the raw material stock. The following is the stock of raw materials in March 2018.

Table 3. Stock of raw materials

No.	Raw material	Jml Stock
1	Sewing thread	754 rolls
2	Obras thread	444 rolls
3	Rubber	43 roll
4	Ink	4 bottles
5	Hard cloth	19 meter
6	Button	105 sir

4.2.5. Determination of needs

Once it is known that the procurement of raw materials is carried out periodically and the procurement of raw materials after an order has been made by the customer, the next stage is determining raw material requirements . In determining the calculation of raw material requirements using the *single moving average* and *just in time* methods . The data to be sampled is the standard ordering jersey data which has the most number of orders among other products. Following is the standard jersey booking data for March - July 2018.

Table 4. Standard jersey ordering

No.	Period	amount
1	February	929 Pcs
2	March	1570 Pcs
3	March	1305 Pcs
4	May	1237 Pcs
5	June	964 Pcs
6	July	1190 Pcs

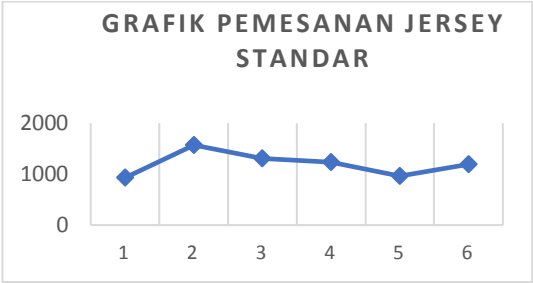


Figure 4. Graph of ordering

Subsequently perform calculations to determine the amount of raw material procurement

a. Calculation of n = 3

$$St_{Agustus} = \frac{Xt_{mei} + Xt_{juni} + Xt_{juli}}{n}$$

$$= \frac{1237+964+1190}{3}$$

= 1130 , 33

= 1131 (Rounding results)

b. Calculation of n = 5

$$St_{Agustus} = \frac{Xt_{maret} + Xt_{april} + Xt_{mei} + Xt_{juni} + Xt_{juli}}{n}$$

$$= \frac{1570 + 1305 + 1237 + 964 + 1190}{5}$$

= 1253 , 2

= 1254 (rounding result)

To avoid shortages of raw materials, rounding is done by rounding up. Here are the results of forecasting using the *single moving average* method

Table 5. Forecasting results

No.	Period	Data	3 Monthly	5 Monthly
1	February	929	-	-
2	March	1570	-	-
3	March	1305	-	-
4	May	1237	1268	-
5	June	964	1371	-
6	July	1190	1169	1201
Forecast Results inAugust			1131	1254

Before calculating raw material requirements, the composition must be known, here is a standard jersey composition .

Table 6. Standard jersey composition

No.	Material name	Jml	Unit
1	Wafer dryfit fabric	0.33	Kilo gram
2	Polyflex	0.20	Meter
3	Sewing thread	150	Meter
4	Obras thread	100	Meter
5	Rubber	0.50	Meter
6	Print table	0.10	Meter

After the composition is known, the next step determines the amount of raw material needs by using the following equation.

Kebutuhan = *komposisi* x hasil *peramalan*

The following is the amount of raw material requirements for August based on forecasting results.

Table 7. Raw material requirements for August 2018

Raw material	needs	Jml	+10 %	JTK
Sewing thread	1254x150m	188100meters	18810meters	206,910 meters
Obras thread	1254x100m	125400meters	12540 Meters	137,9 Met
Rubber	1254 x 0.5m	627meters	62.7 meters	689. Met

Information :
Pro = product, Jml = number of needs, + 10% = additional 10%, JTK = total number of needs.

After the raw material period is known, the next step is to determine the need for raw materials after an order is made, berutut is the raw material requirement for ordering on March 14, 2018.

Table 8. Plan for needs dated March 14, 2018

No.	Name of raw material	Order x composition	Needs
1	Wafer dryfit fabric	184 x 0.33	60.72Kg
2	Polyflex	184 x 0.2	36.8 M
3	Print table	184 x 0.1	18.4 M

In the JIT system the company can reduce waste of raw materials to a minimum, but to maintain shortages of raw materials when the company experiences a production defect, the system recommends an additional 10%. Following are the results of calculations with a 10% increase.

Table 9 . Planned needs March 14 2018 + 10%

No.	Name of raw material	Order x composition	+ 10%
1	Wafer dryfit fabric	184 x 0.33	66.8KG
2	Polyflex	184 x 0.2	40.5 M
3	Print table	184 x 0.1	20.2 M

4.3. Analysis of functional needs

Functional needs analysis is an analysis that explains the flow of data or information which includes the depiction, planning and sketching or arrangement of several elements that are separated into a single unit that is complete and functioning in the process of making the soft device to be built.

4.3.1. ERD

Database analysis aims to analyze the data that will be applied in the system that will explain what data is needed so that the system can run properly according to the needs of its users .

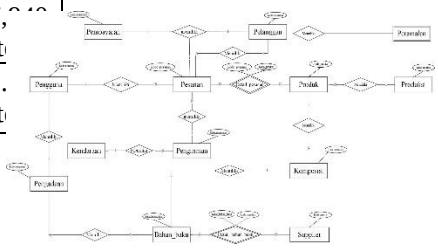


Figure 5. Entity relationship diagram

4.3.2. Context diagram

Context diagram is a general description of the system to be built, the context diagram is the highest level of the DFD that describes the relationships in the system with the system user.

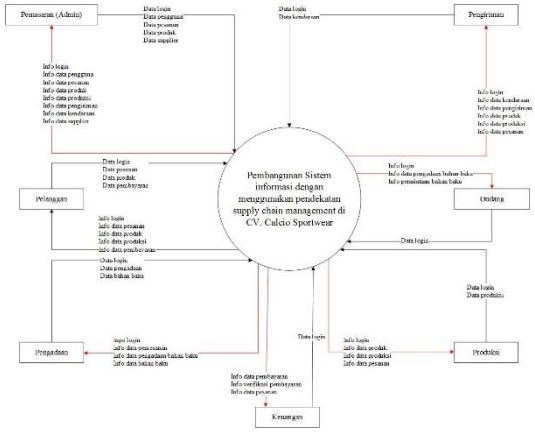


Figure 6. Context diagram

4.3.3. Data flow diagram

Data flow diagrams are used to describe the flow of an existing system or a system that will be built logically without considering the physical environment where the data flows or the physical environment where the data will be stored.

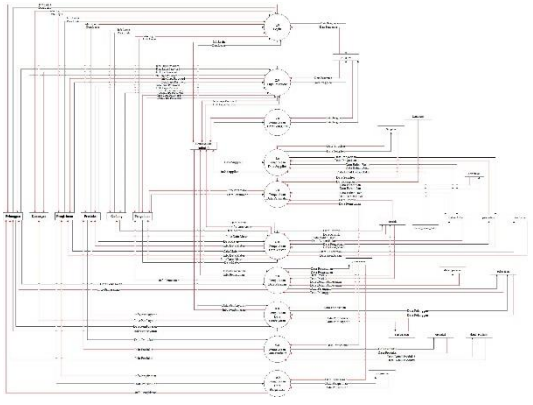


Figure 7 Level 1 data flow diagram

4.4. Database design

At the database design stage, modeling will be described using relation charts and table structures .

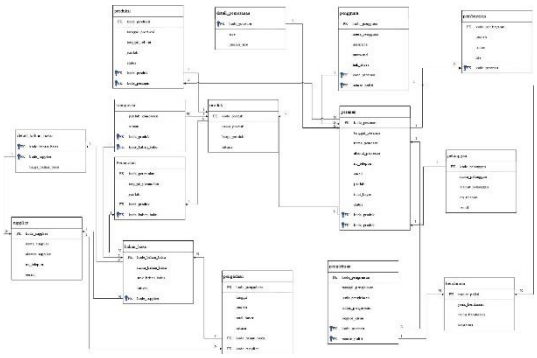


Figure 8. Relationship diagram

4.5. Menu structure design

Menu structure design is designed to provide functions that will be used in the *supply chain management* information system to be built .

1. Administration menu structure

The following is the administration menu structure can be seen in Figure 9.

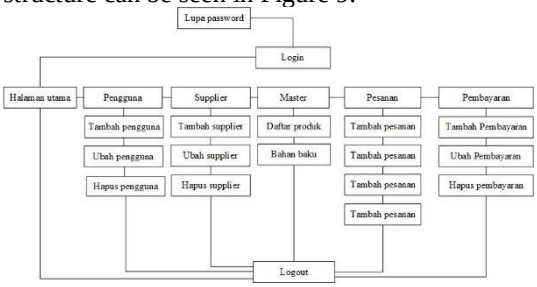


Figure 9. Administration menu structure

4.6. Interface Design Design

Interface design is a description of the system to be built. The design is made based on input or output from the system .

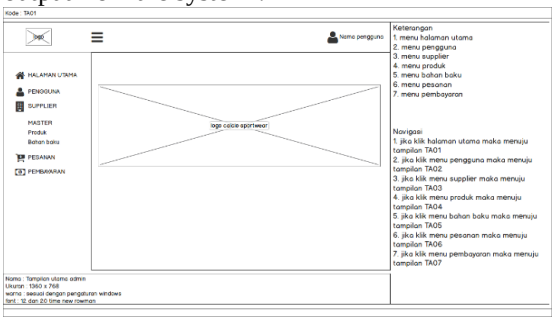


Figure 1 0 . Administration interface designation

4.7. Designing semantic networks

Semantic networks are a process that describes the relationship between page menus .

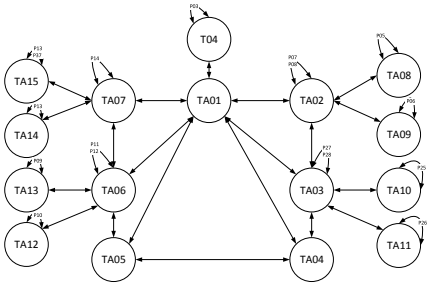


Figure 1 1 . Semantic network design k

4.8. Hardware Implementation

The hardware used for the implementation of Cal7cio Sportwear's *supply chain management* information system can be seen in the following table .

Table 10. Implementation of hardware

No.	Device	Specification
1	Processor	2.20 GHz speed
3	Memory (RAM)	2 GB
3	VGA	On board
4	Hard drive	500 GB
5	Monitor	Monitor 14 ", Resolution 1024 x 768

4.9. Software Implementation

The software used for the implementation of Cal7cio Sportwear's *supply chain management* information system can be seen in the following table .

Table 11. Software implementation

No.	Device	Specification
1	Operating system	Windows 7 32 bit
2	Web browser	Google chrome, Opera, Internet explorer
3	Web server	Xampp
4	DBMS	MySQL

4.10. Database Implementation

Database development is done using a database management system (DBMS) with the implementation of the database using the SQL language as follows.

1. Order table

Table 13. Implementation of the ordering table

SQL

```
CREATE TABLE `order` (
  `kode_p ordering` varchar
(15) NOT NULL,
  `customer_ code` varchar
(15) NOT NULL,
  `ordering_ date` date NOT NULL,
  `order_name` varchar (50) NOT NULL,
  `order_address` varchar
(50) NOT NULL,
  `phone number ' varchar
(13) NOT NULL,
  `email` varchar (50) NOT NULL,
  `type_product` varchar
(50) NOT NULL,
  `file` varchar (30) NOT NULL,
  `number` int (11) NOT NULL,
  `total_bayar` int (11) NOT NULL,
  `status` varchar (15) NOT NULL,
  PRIMARY KEY (`kode_pandat`)
FORIGN KEY ('code_customer')
REFERENCES
) ENGINE =
InnoDB DEFAULT CHARSET = latin1
```

4.11. Interface Implementation

The following is the implementation of the logical interface used to enter the system.



Figure 1 2 . Implementation between login login

The following is a product forecasting interface

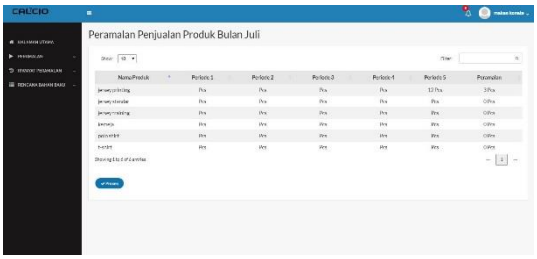


Figure 1 3 . Antamuka forecasting implementation

4.12. System testing

System testing is the stage where the newly built system will be tested, testing this system using the *black box* method . *Black box* testing is a test that is focused on testing the functional requirements of information systems

4.12.1. Functional testing

The stages of functional testing that will be carried out are testing plans and test results on the *supply chain management* information system at Cal7cio Sportwear

4.12.2. Testing user acceptance test

The purpose of the *user acceptance test* (UAT) is to confirm that the system being tested can meet business needs to provide assurance that the system that is tested to work properly and can be used before being officially given to the end user .

4.12.3. Beta testing

Beta testing is a direct test in a real environment . Users provide an assessment of the software that was built using the interview method. From the results of interviews that have been carried out, it can be concluded whether the software that is built has been as expected or not

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

I concluded the development of *supply chain management* in CV Calcio Sportwear among others .

1. Development of information systems using this *supply chain management* approach can facilitate the procurement part in determining the amount of raw material procurement and procurement of raw materials made after an order is made.
2. Development of information systems using this *supply chain management* approach can facilitate production in determining production dates.
3. The development of information systems using this *supply chain management* approach can facilitate the marketing section in determining the production completion date and product delivery date

5.2. Suggestion

As for suggestions for developing a system for later writers or developers so that a better system is built, there are several suggestions including the following:

1. There is an addition to the order chart feature to see the increase and decrease in each period.
2. The addition of the user data change feature for each user, so as to make it easier for each user to change their data.
3. There is an additional notification feature in every activity carried out in the system, for example when the system receives an order, a notification will appear.
4. There is an additional verification feature via email so that it can simplify work .

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