DEVELOPMENT OF SUPPLY CHAIN MANAGEMENT INFORMATION SYSTEM AT PT MARC & STUART INDONESIA

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ABSTRACT

PT Marc & Stuart Indonesia is a company engaged in fashion for women and men. Products sold consist of sandals, shoes and bags. While the products produced are M6 category men's sandals. The problems that occur at PT Marc & Stuart Indonesia are ordering new products from PPIC (Production Planning and Inventory Control) to offer products to each outlet while outlets have difficulty in making repeat orders because the product model must be based on sales data that is processed into best seller data. The problem that occurs in procurement is the procurement department has difficulty in determining the amount of raw material purchases to meet production needs. The problem that occurs in shipping is the shipping part of the difficulty in determining the delivery schedule to the outlet due to having to wait for the next product to meet the minimum amount of expedition capacity. Based on these problems, PT Marc & Stuart Indonesia needs a Supply Chain Management information system. The production system uses the Pull Supply Chain (make-to-order) approach. The Economic Order Quantity method is used to calculate the number of raw material requirements. Based on the results of the tests that have been carried out it can be concluded that this system has helped the company manage orders, determine the number of raw material requirements and choose the right product for shipping outlet requests.

Keywords: *supply chain management, production planning and inventory control, pull supply chain, make-to-order, economic order quantity*.

1. INTRODUCTION

PT Marc & Stuart Indonesia is a company engaged in fashion for women and men. Products sold consist of sandals, shoes and bags. While the products produced are men's sandals with the M6 category. The company has seven outlets spread across several regions of Indonesia, namely: Dago, Setiabudi, Jepara, Yogya, Makassar, Medan and Lombok.

The results of the interview with Mr. Indra as the booking section at PT Marc & Stuart Indonesia, the company has two ways to handle product orders, namely: new products and repeat orders. For new products, PPIC (Production Planning and Inventory Control) offers upcoming data on an A-1 attachment to outlets based on the current model in the market. The outlet will choose a new product in an upcoming order in A-2 attachment for 2-3 days. As for repeat orders, outlets choose products that have a minimum stock of 12 pairs in the outlet warehouse. The order section will check the repeat data order in Appendix A-3 based on the best seller model attached to A-5. The order part will make a recapitulation of PO (Purchase Order) attachments to A-4 both new products and repeat orders for mass production. This results in a long time in 1 x order process because the product model must be based on sales data which is processed into best seller data.

The results of the interview with Mrs. Tini as the procurement department and Mr. Asep as part of production at PT Marc & Stuart Indonesia, the process of ordering raw materials was calculated and adjusted to the number of product orders from the outlet. This results in the procurement section to calculate the amount of raw material purchase every product order.

The results of the interview with Mr. Asril as part of the delivery at PT Marc & Stuart Indonesia, the shipping process has 2 periods in scheduling delivery, namely: period per month and outlet request period. In the period per month, the shipping department sends the product at the beginning of the month to be sent to all outlets that have been ordered. Whereas in the outlet request period, the number of products to be shipped often does not meet the minimum amount of expedition capacity. This results in the shipment being late in sending the product due to having to wait for the next product to be sent first to meet the minimum amount of expedition capacity. Based on these problems, then PT Marc & Stuart Indonesia requires an information system development that can manage product orders, purchase raw materials and delivery scheduling. Therefore it is necessary "Development of Supply Chain Management Information Systems at PT Marc & Stuart Indonesia".

The purpose of this research is to build a Supply Chain Management Information System at PT Marc & Stuart Indonesia. The objectives to be achieved in research are.

1. Helping outlets in ordering new products and repeat orders in accordance with the request.
2. Assist the procurement department in purchasing raw materials to suppliers that are suitable for production needs.
3. Assist the shipping department in scheduling product delivery for the outlet request period to be on time

2. RESEARCH CONTENT

2.1 Theoretical Basis

Theoritical basis aims to provide explanations from various sources and theoretical studies related to the development of Supply Chain Management Information Systems at PT Marc & Stuart Indonesia.

2.1.1 Information System

Information system includes several components that are interrelated with each other from human, computer, technology and work procedures to be processed in an information that is in line with the goals or objectives.[1]

2.1.2 Supply Chain Management

Supply Chain Management is a method for managing the flow of products, information, and money that involves various parties ranging from suppliers, factories, distribution networks and logistics services that work together with each other. [2]

2.1.3 Supply Chain Management Strategy

Supply Chain Management needed to help achieve the goals of the company that are expected in the company's strategy related to innovation in order to be able to make the company excel in competition. [3]

2.1.4 Push and Pull Supply Chain Management

Push Supply Chain is a "make-to-stock" production strategy. Push Supply Chain strategy is often used, especially manufacturing companies in the scope of the production system because it is based on forecasting that can produce large outputs for inventory before being distributed to customers. [4]

Pull Supply Chain is a “make-to-order” production strategy that can avoid waste inventory so that it is timely used when a customer requests a request or is a company strategy, especially for manufacturing companies that have goals or objectives in the production process to be carried out after an integrated market demand customer request. [4]

2.1.5 Purchase Of Raw Materials

Purchase of raw materials is an activity carried out mainly manufacturing companies in the production process to obtain raw materials, equipment or equipment. The main objective is to obtain raw materials by minimizing the lowest possible costs in accordance with the quality of the standards that have been determined. [5]

2.1.6 EOQ (Economic Order Quantity) Method

EOQ (Economic Order Quantity) is a model used to determine the size of an economical or minimal order quantity. The scope of this model lies in the two costs of inventory, namely the cost of the message and the cost of storing. Message fees are fixed costs when making an order that does not depend on the size or volume of the order. While the cost of storage is the cost that comes out because the company keeps inventory items for a certain period. [6]

EOQ (Economic Order Quantity) is a method used to minimize total inventory costs in the right order quantity. To find the optimal quantity of raw material purchases to be purchased every time you purchase. [7]

The EOQ formula that can be used is: [6]

$$EOQ = \frac{\sqrt{2SD}}{H} \quad (1)$$

Note :

D: Request per unit time.

S: Ordering fee per order.

H: Storage costs per unit in units of time.

The following is how to determine the number of orders can be seen, namely: [6]

$$Order\ Amount = \frac{D}{Q} \quad (2)$$

In determining the optimal amount of purchase, variable costs are needed to provide inventory to be able to manage the flow of production activities that can be classified as follows: [8]

a. Costs fluctuate due to uncertain order frequency.

b. Costs fluctuate which is consistent with the amount of 'average inventory'

The use of EOQ techniques can only be done if it meets the requirements: [9]

a. The amount of material needs in one period remains or does not change.
b. Goods are available whenever needed.
c. Fixed price of goods.
d. The time limit or order lead time has been determined or relatively fixed when the order process is carried out.

2.1.7 Cost of inventory costs

In making decisions about inventory costs, variable costs are needed to influence the amount of inventory, the variable costs are: [10]

a. Storage cost
   A holding costs or carrying costs consisting of the cost of inventory quantities. Like: obsolescence costs, lighting, etc.
b. Order fee
   Ordering costs (order costs or procurement costs) occur every time making an order. Such as: wage costs, telephone charges, etc.

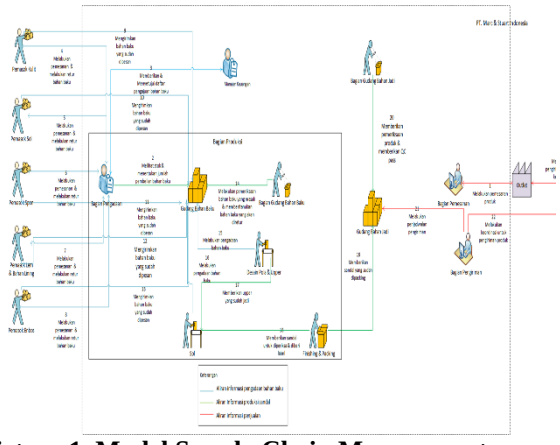
2.2 Problem Analysis

Problem analysis is a step to analyze the problems that will be described in data procedures in Supply Chain Management at PT Marc & Stuart Indonesia. Problem analysis at PT Marc & Stuart Indonesia is as follows:

1. Ordering new products from PPIC (Production Planning and Inventory Control) offers products to each outlet while outlets experience difficulties in repeat orders because the product model must be based on sales data that is processed into best seller data.
2. The procurement department has difficulty in determining the amount of purchase of raw materials to meet production needs.
3. The shipping section has 2 periods in scheduling the delivery, namely: period per month and outlet request period. For the demand period, outlets experience difficulties in determining the delivery schedule for outlets.

2.3 Model Supply Chain Management

The following is a mapping of supply chain management models which can be seen in Picture 1.



Picture 1. Model Supply Chain Management

2.4 Supply Chain Management Analysis

Supply Chain Management analysis at PT Marc & Stuart Indonesia consists of several stages which can be seen in Picture 2.



Picture 2. Supply Chain Management Analysis

1. Product Ordering

Product ordering have two new products and repeat orders. New product orders occur from the PPIC (Production Planning Inventory Control) offering upcoming data on June 2 2017 and June 21 2017 described in table 1.

Table 1. Data Upcoming

Date	Produk ID	Color	No	Price
02-Jun-17	M6-LG5-HEROS-1	Black	39 – 43	Rp. 300.000
02-Jun-17	M6-LG5-HEROS-2	Black	39 – 43	Rp. 300.000
21-Jun-17	M6-LG5-PHILO-1	Black Brown	39 – 43	Rp. 306.000
21-Jun-17	M6-LG5-PHILO-2	Black Brown	39 – 43	Rp. 306.000

If the outlet is interested in upcoming data, then give an upcoming order as proof to choose a new product.

Table 2. Data Order Upcoming Outlet Dago

Produk ID	Color	39	40	41	42	43
M6-LG5-PHILO-1	BLACK	2	1	1	1	1
M6-LG5-PHILO-1	BROWN	1	2	1	2	1
M6-LG5-PHILO-2	BLACK	1	3	1	1	2
M6-LG5-PHILO-2	BROWN	1	2	1	2	1

Table 3. Data Order Upcoming Outlet Lombok

Produk ID	Color	39	40	41	42	43
M6-LG5-HEROS-1	BLACK	1	1	2	2	3
M6-LG5-HEROS-2	BLACK	2	2	1	2	3

Table 4. Data Order Upcoming Outlet Medan

Produk ID	Color	39	40	41	42	43
M6-LG5-HEROS-1	BLACK	3	2	1	1	1
M6-LG5-HEROS-2	BLACK	2	2	3	1	1
M6-LG5-PHILO-1	BLACK	2	1	2	1	1
M6-LG5-PHILO-1	BROWN	1	2	2	3	1
M6-LG5-PHILO-2	BLACK	2	1	2	1	1
M6-LG5-PHILO-2	BROWN	2	1	2	1	1

Table 5. Data Order Upcoming Outlet STB

Produk ID	Color	39	40	41	42	43
M6-LG5-HEROS-1	BLACK	1	1	2	1	2
M6-LG5-HEROS-2	BLACK	2	1	2	2	1

Table 6. Data Order Upcoming Outlet Jepara

Produk ID	Color	39	40	41	42	43
M6-LG5-HEROS-1	BLACK	1	1	3	2	1
M6-LG5-HEROS-2	BLACK	2	2	2	2	2
M6-LG5-PHILO-1	BLACK	1	2	2	3	1
M6-LG5-PHILO-1	BROWN	2	2	2	2	1
M6-LG5-PHILO-2	BLACK	1	2	3	1	2
M6-LG5-PHILO-2	BROWN	3	2	1	2	1

The upcoming Order Data will be recapitulated into PO (Purchase Order) data as the basis of production activities.

Repeat order is the process of ordering products with reference to best seller data the previous month. Outlets will repeat orders per week for best seller products with a minimum stock of 12 pairs as shown in table 7.

Table 7. Data Repeat Order Upcoming

Outlet	Produk ID	Color	39	40	41	42
Dago	M6-LG5-DEO-1	MAROON	3	2	4	1
MKS 2	M6-LG5-DEO-HIGH	BLUE	2	2	2	1
Jepara	M6-LG5-HECTOR-2	BLACK	4	2	2	1
STB	M6-LG5-HECTOR-2	BROWN	2	1	2	1
Lombok	M6-LG5-DEO-HIGH	BLUE	1	1	2	1
MKS 2	M6-LG5-HECTOR-2	BLACK	2	1	2	3

This product is a product that has been produced in May 2017 so that it is called a repeat order. The repeat order will not be directly responded to by the company because it is necessary to check the suitability of the best seller model data contained in the F-5 attachment. Repeat order data will be recapitulated into PO (Purchase Order) data as the basis of production activities.

2. Monitoring The Remaining Raw Materials

This stage is carried out to control the remaining raw materials in the raw material warehouse. The rest of the raw material will be checked by the warehouse of raw materials for the purposes of further production. this stage will also determine the need for raw materials as previously explained and how much raw material is needed to produce the product.

Table 8. BOM M6-LG5-HEROS-1 and M6-LG5-HEROS-2

Part	Type Of Material	Usage	Unit
Basic 1	Bk Dicky	1.5	Feet
Upper Layer	Merimes	0.1	Meter
Upper	B30	1	Piece
Tatak	Mukasin	1	Roller
Tatak	B6	1	Piece
Bensole	Spon Eva 3mm	0.05	Meter
Insole Wrap	Black	0.2	Meter
Sole	Matiz 657	1	Pair
Insole Screen Printing	Marc Stuart	1	Pair
Midsole	TA 1mm	0,10	Meter
Glue	-	-	-
Box	M6	1	Piece
Doorslag	-	1	Sheet

Table 9. BOM M6-LG5-DEO-1

Part	Type Of Material	Usage	Unit
Basic 1	Napa Yayan	1.5	Feet
Upper Layer	Analin Cream	0.1	Meter
Upper	B30	1	Piece
Tatak	Mukasin	1	Roller
Tatak	B6	1	Piece
Bensole	Spon Eva 3mm	0.04	Meter
Insole Wrap	Maroon	0.2	Meter
Sole	GM 506	1	Pair
Insole Screen Printing	Marc Stuart	1	Pair
Midsole	TA 1mm	0,15	Meter
Glue	-	-	-
Box	M6	1	Piece
Doorslag	-	1	Sheet
Silica Gel	-	0.004	Kg
Polyfoam	-	0.04	Meter

Table 10. BOM M6-LG5-PHILO-1 and M6-LG5-PHILO-2

Part	Type Of Material	Usage	Unit
Basic 1	Bk Dicky	1.5	Feet
Upper Layer	Merimes	0.2	Meter
Upper	B30	1	Piece
Tatak	Mukasin	1	Roller
Tatak	B6	1	Piece
Bensole	Spon Eva 3mm	0.04	Meter
Insole Wrap	Brown	0.2	Meter
Sole	Matiz 657	1	Pair
Insole Screen Printing	Marc Stuart	1	Pair
Midsole	TA 1mm	0,12	Meter
Glue	-	-	-
Box	M6	1	Piece
Doorslag	-	1	Sheet
Silica Gel	-	0.004	Meter
Polyfoam	-	0.04	Meter

Table 11. BOM M6-LG5-HECTOR-2

Part	Type Of Material	Usage	Unit
Basic 1	Bk Dicky	1.5	Feet
Upper Layer	Merimes	0.2	Meter
Upper	B30	1	Piece
Tatak	Mukasin	1	Roller
Tatak	B6	1	Piece
Bensole	Spon Eva 3mm	0.04	Meter
Insole Wrap	Brown	0.2	Meter
Sole	Matiz 657	1	Pair
Insole Screen Printing	Marc Stuart	1	Pair
Midsole	TA 1mm	0,04	Meter
Glue	-	-	-
Box	M6	1	Piece
Doorslag	-	1	Sheet
Silica Gel	-	0.004	Kg
Polyfoam	-	0.04	Meter

3. Determination of Raw Material Requirements
This stage is carried out to procure raw materials to suppliers through plans to purchase raw materials as in table 12.

Table 12. Plan To Purchase Raw Materials

No	Name Of Raw Material	Puchase Plan	Remaining Raw Materials In The Warehouse
1	Bk Dicky	254 feet	10 feet
2	Napa Yayan	33 feet	20 feet
3	Analin Cream	2 meter	0
4	B30	9 fruit	0
5	Mukasin	3 roller	2 roller
6	B6	4 fruit	0
7	Spon Eva 3 mm	11 meter	2 meter
8	Insole (Brown) Wrap	5 meter	0
9	Insole (Black) Wrap	3 meter	0
10	Insole (Maroon) Wrap	1 meter	0
11	GM 506	22 plug it	0
12	Matiz 657	106 plug it	0
13	Matiz 765	62 plug it	0

No	Name Of Raw Material	Puchase Plan	Remaining Raw Materials In The Warehouse
14	Marc Stuart	190 plug it	0
15	TA 1 mm	11 meter	2 meter
16	Glue	15 kg	4 piece
17	Box	190 fruit	0
18	Doorslag	190 sheet	10 sheet
19	Silica Gel	3 Kg	0
20	Polyfoam	9 meter	0

Table 13. List Of Order Fee Each Month

No	Type Of Fee	Price
1	Telephone Charge	100000
2	Transportation Cost	300000
Total Order Cost		400000

From the above table, it is obtained the order fee in 1 month is 400000. For the frequency of ordering to suppliers is done twice a month as in formula (3).

$$S = \frac{Total\ Order\ Cost}{Order\ Frequency} \qquad (3)$$

= 400000/2 = 200000

Note : S = order fee every time a message

Table 14. List Of Storage Fee Each Month

No	Type Of Fee	Price
1	Electricity cost in warehouse	100000
Total Fee Storage		100000

From the table above can be obtained for 1 month storage costs of 100000.

Following is the calculation of the Economic Order Quantity (EOQ) method in table 15.

Table 15. EOQ Calculation

Raw Material	Purchase	Amount	Frequency
Bk Dicky	$\frac{\sqrt{2x200000x254}}{100000}$ = $\sqrt{1016}$ = 31,875	32 feet	D/Q =254/32 =7,938 = 8 times
Napa Yayan	$\frac{\sqrt{2x200000x33}}{100000}$ = $\sqrt{132}$ = 11,490	12 feet	D/Q =33/12 = 2,75 = 3 times
Analin Cream	$\frac{\sqrt{2x200000x2}}{100000}$ = $\sqrt{8}$ = 2,829	3 meter	D/Q =2/3 = 0,667 = 1 time
B30	$\frac{\sqrt{2x200000x9}}{100000}$ = $\sqrt{36}$ = 6	6 piece	D/Q =9/6 = 1,5 = 2 times
Mukasin	$\frac{\sqrt{2x200000x3}}{100000}$ = $\sqrt{12}$ = 3,464	4 roller	D/Q =3/4 = 0,75 = 1 time
B6	$\frac{\sqrt{2x200000x4}}{100000}$ = $\sqrt{16}$ = 4	4 piece	D/Q =4/4 = 1 time
Spon Eva 3 mm	$\frac{\sqrt{2x200000x11}}{100000}$ = $\sqrt{44}$ = 6,633	7 meter	D/Q =11/7 = 1,571 = 2 times
Bungkus Insole (Brown)	$\frac{\sqrt{2x200000x5}}{100000}$ = $\sqrt{20}$ = 4,472	5 meter	D/Q =5/5 = 1 time
Bungkus Insole (Black)	$\frac{\sqrt{2x200000x3}}{100000}$ = $\sqrt{12}$ = 3,464	1 meter	D/Q =3/1 = 3 times
Bungkus Insole (Maroon)	$\frac{\sqrt{2x200000x1}}{100000}$ = $\sqrt{4}$ = 2	2 meter	D/Q =1/2 = 0,5 = 1 time
GM 506	$\frac{\sqrt{2x200000x22}}{100000}$ = $\sqrt{88}$ = 9,381	9 piece	D/Q =22/9 = 2,444 = 2 times
Matiz 657	$\frac{\sqrt{2x200000x106}}{100000}$ = $\sqrt{424}$ = 20,591	21 pair	D/Q =106/21 = 5,048 = 5 times
Matiz 765	$\frac{\sqrt{2x200000x62}}{100000}$ = $\sqrt{248}$ = 15,748	16 pair	D/Q =62/16 = 3,875 = 4 times
Marc Stuart	$\frac{\sqrt{2x200000x190}}{100000}$ = $\sqrt{760}$ = 27,568	28 pair	D/Q =190/28 = 6,786 = 7 times
TA 1 mm	$\frac{\sqrt{2x200000x11}}{100000}$ =$\sqrt{44}$ = 6,633	7 meter	D/Q =11/7 = 1,571 = 2 times
Lem	$\frac{\sqrt{2x200000x15}}{100000}$ = $\sqrt{60}$ = 7,746	8 kg	D/Q =15/8 = 1,875 = 2 times

Raw Material	Purchase	Amount	Frequency
Dus	$\frac{\sqrt{2x200000x190}}{100000}$ = $\sqrt{760}$ = 27,568	28 piece	D/Q =190/28 = 6,786 = 7 times
Doorslag	$\frac{\sqrt{2x200000x190}}{100000}$ =$\sqrt{760}$ = 27,568	28 sheet	D/Q =190/28 = 6,786 = 7 times
Silica Gel	$\frac{\sqrt{2x200000x3}}{100000}$ = $\sqrt{12}$ = 3,464	3 kg	D/Q =3/3 = 1 time
Polyfoam	$\frac{\sqrt{2x200000x9}}{100000}$ = $\sqrt{36}$ = 6	6 meter	D/Q =9/6 = 1,5 = 2 times

4. Ordering Raw Materials to Supplier

This stage describes ordering raw materials to suppliers at PT Marc & Stuart Indonesia. The raw material ordered consists of several ingredients, namely: leather, soles, sponges, glue & lining materials, enbos. For soles from the time of order to being sent to the warehouse, it takes 2 weeks due to the queue of orders at the supplier.

5. Monitoring Production Activities

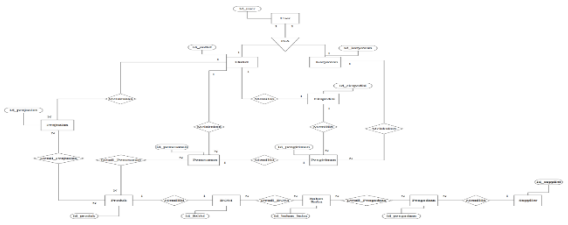
This stage is part of the production activities that took place at PT Marc & Stuart Indonesia. 1 upper worker will produce as many as 20 upper pairs for 1 day. Similarly, 1 sol worker will produce 20 pairs of soles for 1 day.

6. Product Delivery

This stage explains the product delivery that occurred at PT Marc & Stuart Indonesia. Product delivery through the expedition service used in its distribution. The purpose of this stage is to be able to monitor the product until the outlet has been received or not .

2.5 Entity Relationship Diagram (ERD)

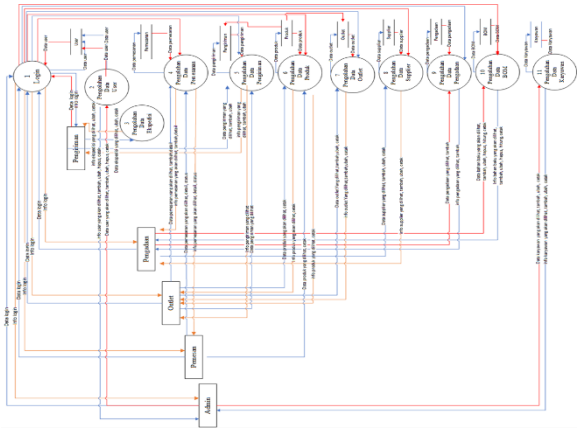
Entity Relationship Diagram (ERD) is a data model that describes several designs conceptually in an entity context. Here is the Entity Relationship Diagram (ERD) which can be seen in Picture 3.



Picture 3. Entity Relationship Diagram (ERD)

2.6 Data Flow Diagram (DFD)

Data Flow Diagrams (DFD) explain that users of information systems that are built can access the available systems based on the access rights they have. The following are Data Flow Diagrams (DFD).



Picture 4. Data Flow Diagram (DFD)

2.7.1 System Testing Conclusion

The conclusion obtained based on functional testing that has been done previously is that the process in the system is declared to be correct and the error process in the form of messages is good.

2.7.2 Conclusion User Acceptance Test (UAT) Testing

The conclusion obtained based on the test of User Acceptance Test (UAT) that has been done is that the functionality within the system can produce the expected information.

2.7.3 Conclusion Beta Testing

Based on user answers from the supply chain management information system at PT Marc & Stuart Indonesia regarding system testing, it can be concluded that the system has been built: Can help Procurement in determining the right amount of raw material requirements, help ordering in product ordering steps and help shipping to find out the status of the shipment.

3. COVER

3.1 Conclusion

Based on the results of the tests and discussions that have been made, the following conclusions can be drawn:

1. This Supply Chain Management Information System can assist the ordering section at PT Marc & Stuart Indonesia in determining the right order for the outlet.
2. This Supply Chain Management Information System can assist the procurement department at PT Marc & Stuart Indonesia in determining the amount of raw material
3. This Supply Chain Management Information System can assist the shipping department at PT

Marc & Stuart Indonesia in monitoring delivery schedules.

3.2 Suggestion

In order for the system to be built to work better, additional things should be done as follows:

1. There are additional graphic facilities to see the rate of orders per month
2. There are additional user profile facilities in the system

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