DEVELOPMENT OF INFORMATION SYSTEM USING SUPPLY CHAIN MANAGEMENT AT PT. MUAWANAH AL MA'SOEM

Randy Reiza Alviandy[1], Tati Harihayati Mardzuki[2]

[1,2]Informatic Engineering – Indonesia Computer University
JL. Dipatiukur 112-114 Bandung
E-mail : randy.reiza.95@gmail.com[1], tati.harihayati@email.unikom.ac.id[2]

ABSTRACT

PT. Muawanah Al Ma'soem is a company engaged in the production of bottled drinking water located in Cileunyi, Bandung, West Java. In the production planning process, it is carried out by looking at the previous period's product sales report which is used as a reference in planning the number of products to be produced for the next period. Each product has a different composition of raw materials, that makes the company has difficulty when determining the amount of raw materials to be ordered to suppliers. Distribution problems occur when there are many customers who order products, the company has difficulty in scheduling the distribution. The Supply Chain strategy used is push supply chain, because the purchase of raw materials and production will continue to be carried out even though there is no demand. Production planning uses the Weighted Moving Average method. Safety of raw material stock using Safety Stock method. For distribution problems, there are scheduling distributions and selection of vehicles used. Based on the problems that exist at PT. Muawanah AL Ma'soem, it requires an information system with the Supply Chain Management approach. The results of the tests that have been carried out can be concluded that the system can help manajer unit produksi in production planning, manajer unit persediaan & umum in the procurement of raw materials and the distribution of the amount of raw materials sent by suppliers, and also pimpinan divisi marketing in scheduling product distribution.

Keywords : Supply Chain Management, Push Supply Chain, Weighted Moving Average, Safety Stock

1. INTRODUCTION

PT. Muawanah Al Ma'soem is a company engaged in the production of Bottled Drinking Water located in Cileunyi, Bandung, West Java. In doing production, the company uses the make-to-stock strategy that is the product production process is carried out before the prior order. The company always doing the production of their products on a mass production to anticipate the purchase of products by the customers. PT. Muawanah Al Ma'soem has been established since 1999 and until now it has 3 brands of bottled mineral water, there are Al Ma'soem (240 ml of cup, 330 ml of bottle, 600 ml of bottle, 1500 ml of bottle, and 19 liter of gallon), Asri (240 ml of cup, 600 ml of bottle) and Quazam (240 ml of cup, 600 ml of bottle and 19 liter of gallon). The marketing area for the Al Ma'soem brand covers West Java and Jakarta, for the Asri brand covers Cianjur and Limbangan, while the Quazam brand for mass organizations or recitation. The series of work found in this company, in the upstream part is the production plan by Manajer Unit Produksi and the procurement of raw materials by Manajer Unit Persediaan & Umum, while the downstream activities are receiving orders from customers and distributing products to customers who have ordered by Pimpinan Divisi Marketing

The results of the interview with Mr. Rukmana as Manajer Unit Produksi, the production planning process was carried out by looking at the previous period's product sales report which was used as a reference in planning to know the number of products to be produced for the next period. Each product has a different composition of raw materials, that makes manajer unit persediaan & umum has difficulty when calculating and determining the amount of raw material to be ordered to suppliers to meet production needs. The raw materials supplied include packaging, cardboard, lidcup, straws, and others. The process of receiving raw materials from suppliers for a number of raw materials is done in part, because of the limited capacity of the raw material warehouse, so that the raw materials have a maximum stock in the raw material warehouse. Product sales from January to December 2017 amounted to 4,186,475 boxes (Appendix E), from the fact that sales of products every month were known to be uncertain, so Manajer Unit Produksi had difficulties in production planning. This is a problem when ordering products is very high, and causes a shortage of raw materials, which has an impact on the production process, such as the raw material procurement data in November and December 2017, 240 ml cup card raw material Al Ma'soem brand and 330 ml bottle packaging several times experienced shortages so that the production process is disrupted.

The results of the interview with Mr. Adit Tio Nugraha as the Pimpinan Divisi Marketing, the product delivery process is done by checking the availability of products, if the product is available in accordance with customer orders, delivery will be carried out. If the product is not available, the warehouse part of the finished goods will ask the production department to fulfill the product demand and be returned to the customer whether to wait until the product is available or cancel the purchase. In delivering products, the company uses transportation equipment in the form of 3 units of Mitsubishi L300, 3 units of Mitsubishi Engkle, and 1 unit of Mitsubishi Double. Distribution problems occuring when there are many customers who order products, the company has difficulty in making delivery schedules, especially when the product cannot meet customer demand. This results in delays in product delivery and the company does not know when the product will be shipped.

Based on the problems described, PT. Muawanah Al Ma'soem needs an information system with the Supply Chain Management (SCM) approach to be able to manage business processes that occur from upstream to downstream starting from the procurement of raw materials, production to the product delivery process.

The purpose of the research is to build an information system using the Supply Chain Management approach at PT. Muawanah Al Ma'soem. The objectives to be achieved in this study are:

1. Assisting Manajer Unit Produksi in planning production to fullfill product orders for the next period and Manajer Unit Persediaan & Umum in determining the amount of raw material that must be ordered to the supplier, as well as the number of raw materials sent from suppliers to certain raw materials, so that raw materials can meet production needs.
2. Assisting Pimpinan Divisi Marketing in scheduling product shipments to every customer who has made an order, as well as determining the type of vehicle used.

1.1 Information System

The information system according to John F. Nash is a combination of humans, tools, media, procedures and controls that intend to organize an important communication network, the process of certain transactions and routines, assist internal management and users and provide the basis for appropriate decisions. The information system according to Henry Lucas is an activity of procedures that are organized, if executed it will provide information to support decision making. Based on several definitions of the information system, it can be concluded that the information system is an activity, technology, a tool to facilitate people in managing, and also can produce information for decision making for users of information systems.

1.2 Supply Chain Management (SCM)

Supply Chain is a network of companies that work together to create and distribute products or services to end consumers. These companies are usually suppliers, factories, distributors, stores or retail, and supporting companies such as logistics service companies. In Supply Chain there are three entities that must be managed well including material, information and finance. Supply Chain Management is a method, tool, or approach in supply chain management.

Supply chains usually have 3 types of flows that are managed. Three types of flow are:

1. The first stream is the flow of goods that from upstream to downstream.
2. The second stream is the flow of money that flows from downstream to upstream.
3. The third stream is the flow of information that can occuring from upstream to downstream and vice versa.

The followin is a simplifivation of the supply chain model and 3 types of managed flows can be seen in figure 1.

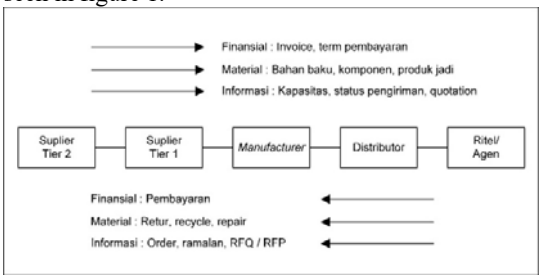

Figure 1. Three Types of Supply Chain Flow

1.3 Components of Supply Chain Management

Supply Chain Management has 3 main components that support a business process can run as follows [1]:

1. Upstream Supply Chain
   Part of the Supply Chain's upstream, the overall activities of a manufacturing company in its distribution or distributor relationship can be expanded to several levels. The main activity in the upstream supply chain is the procurement of raw materials.
2. Internal Supply Chain
   Internal Supply Chain has a part of the process of shipping goods to the warehouse. The main activities of the Internal Supply Chain are the management of production, manufacturing and controlling inventory of goods.
3. Downsteram Supply Chain
   Activities contained in the Supply Chain (Downstream) are all activities that involve the delivery of products to end customers. In the downstream supply chain, attention is directed

to distribution, transportation warehousing and after-sale service.

1.4 Push and Pull Supply Chain

Pull Supply Chain is a "make-to-order" production strategy whose main goal is to avoid inventory waste or is a company strategy, especially a manufacturing company where production is carried out always after market sales and is actually carried out on consumer orders.

Push Supply Chain is a "make-to-stock" production strategy. Push system is basically a production planning and control system. Push strategy is more popular compared to pull systems because the production system is based on forecasting and forecasting and generates large amounts of output which will be entered into inventory before being distributed to customers.

1.5 Weighted Moving Average Forecasting Method

The weighted moving average method or weighted moving average method uses a number of actual data to produce forecast values for future demand. This method is similar to the Single Moving Average method, but with different weights in each actual data. Weight given with assumption that the most recent data is the most accurate for forecasting so that it is given a greater weight.

$$F_{t+1} = \frac{\sum_{t=1}(Y_t \times w)}{\sum w} \quad (1)$$

Where:

F_{t+1} = Forecasting for the next period
Y_t = Actual data in period t
w = Weight

1.6 Mean Square Error (MSE)

Mean Absolute Error (MSE) measures the accuracy of the forecasting results by squaring the results of the error calculations obtained.

$$MSE = \sum_{t=1}^{n} E_t^2 / n \quad (2)$$

Where:

E_t (error) $= Y_t - Y_t'$ (3)
Y_t = Actual data in period t
Y_t' or F_t = Forecasting results from actual data periode t
n = The number of period used

2. CONTENT

2.1 Supply Chain Management Model at PT. Muawanah Al Ma'soem

Supply chain management model at PT. Muawanah Al Ma'soem is an illustration of a series of work done by PT. Muawanah Al Ma'soem which starts from activities upstream to downstream. The following is a supply chain management model at PT. Muawanah Al Ma'soem:

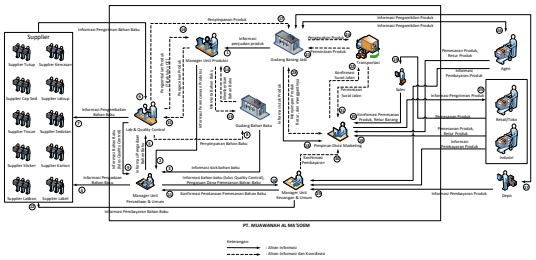

Figure 2. Supply Chain Management Model at PT. Muawanah Al Ma'soem

2.2 Supply Chain Management Analysis at PT. Muawanah Al Ma'soem

Supply chain management analysis at PT. Muawanah Al Ma'soem is to describe what processes will be in the supply chain management system that will be built at PT. Muawanah Al Ma'soem. Supply chain analysis at PT. Muawanah Al Ma'soem can be seen in Figure 3.

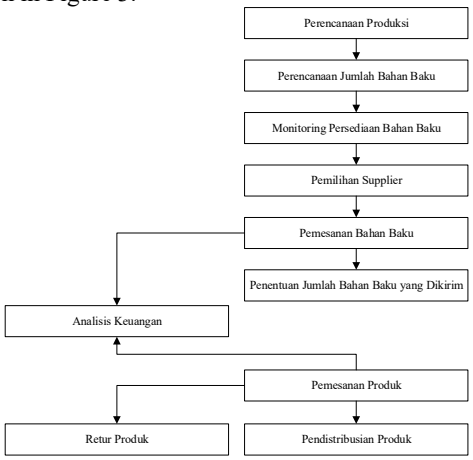

Figure 3. SCM stages at PT. Muawanah Al Ma'soem

1. Production Planning

Production planning is carried out to determine the number of products to be produced in the next period. Production planning is carried out using the Weighted Moving Average forecasting method to meet product demand based on actual data on product sales in the previous period. The results of the forecasting obtained will be used for the next period of production planning processes and the procurement of raw materials in order to find out the amount of raw material that must be ordered to the supplier. This is done to be able to meet the demand for raw materials needed for the production process.

Table 1. Sales of Al Ma'soem Cup 240 ml

No	Bulan	Penjualan Al Ma'soem Cup 240 ml
1	January	107.315 box
2	February	86.775 box
3	March	101.172 box
4	April	110.066 box
5	May	135.780 box

No	Bulan	Penjualan Al Ma'soem Cup 240 ml
6	June	110.868 box
7	July	151.749 box
8	August	158.049 box
9	September	165.960 box
10	October	114.553 box
11	November	106.838 box
12	December	130.688 box

From the sales data of Al Ma'soem 240 ml Cup packaging can be used as a graph to find out the data patterns that occur in the data. The following is a chart of 240 ml Al Ma'soem Cup sales data.

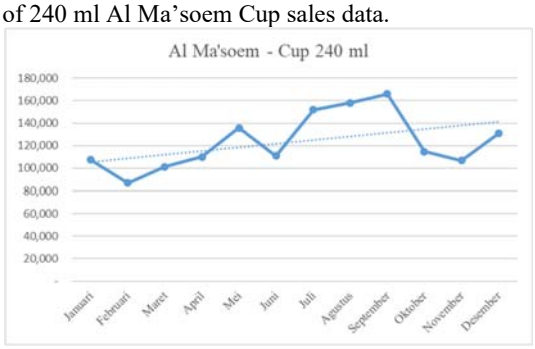

Figure 4. Graph of sales of Al Ma'soem Cup 240 ml product

According to Figure 4 the sales chart of the Al Ma'soem Cup 240 ml product, the pattern of the data is a horizontal pattern, because of the constant sales trend. From the actual data sales of the Al Ma'soem 240 ml Cup packaging products, sales forecasting will be carried out for January 2018. The forecasting method used in forecasting this is Weighted Moving Average with a period of 10 months.

Calculation of the Weighted Moving Average method, will use 10 periods. So to get sales forecasting for January 2018, the sales data needed are sales data for March, April, May, June, July, August, September, October, November and December 2017 (last 10 period data).

Then the calculation process,

$$F_{January\ 2018} = \frac{(Y_{March} \times w) + (Y_{April} \times w) + (Y_{May} \times w) + (Y_{June} \times w) + (Y_{July} \times w) + (Y_{August} \times w) + (Y_{September} \times w) + (Y_{October} \times w) + (Y_{November} \times w) + (Y_{December} \times w)}{\sum w}$$

$$F_{January\ 2018} = \frac{(101.172 \times 1) + (110.066 \times 2) + (135.780 \times 3) + (110.868 \times 4) + (151.749 \times 5) + (158.049 \times 6) + (165.960 \times 7) + (114.553 \times 8) + (106.838 \times 9) + (130.688 \times 10)}{55}$$

$$F_{January\ 2018} = \frac{(101.172) + (220.132) + (407.340) + (443.472) + (758.745) + (948.294) + (1.161.720) + (916.424) + (961.542) + (1.306.880)}{55}$$

$$F_{January\ 2018} = \frac{7.225.721}{55}$$

$$F_{January\ 2018} = 131.376{,}75 \approx 131.377 \text{ dus}$$

So, the sales forecasting results for January 2018 are 131. 377 boxes of 240 ml Al Ma'soem Cup product.

2. Planning the Ammount of Raw Material

At this stage the forecasting data that has been obtained can be calculated to meet the production needs of 240 ml Al Ma'soem Cup product.

Table 2. Al Ma'soem Cup 240 ml product raw material needs

Nama Produk	Hasil Peramalan	Bahan Baku	Perhitungan Bahan Baku	Jumlah Bahan Baku
Al Ma'soem Cup 240 ml	131.377	Cup 240 ml	48 x 131.377	6.306.096 pcs
		Lidcup Al Ma'soem	48 x 131.377	6.306.096 pcs (152 roll)
		Straw	48 x 131.377	6.306.096 pcs
		Al Ma'soem Cardboard	1 x 131.377	131.377 pcs
		Duct tape	1 x 131.377	131.377 meter (1.314 pcs)

3. Monitoring Raw Material Inventories

After the forecasting process is carried out and has obtained the required raw materials, the next stage is monitoring the raw material supply. Analysis of raw material inventory monitoring is carried out to be able to monitor the status of raw material supplies, to avoid lack of raw materials.

Table 3. Monitoring of Raw Material

Bahan Baku	Saldo Bahan Baku	Safety Stock	Status Bahan Baku
Cup 240 ml	512.121 pcs	576.768 pcs	Not Safe
Lidcup Al Ma'soem	43 roll	37 roll	Safe
Straw	693.775 pcs	813.168 pcs	Not Safe
Al Ma'soem Cardboard	14.311 pcs	12.016 pcs	Safe
Duct tape	80 pcs	121 pcs	Not Safe

4. Supplier Selection

At this stage, what to do is the stage of selecting suppliers according to the raw materials to be ordered, as well as the lead time of each supplier.

5. Ordering Raw Materials

After getting the results from the forecasting calculation which has been multiplied by the amount of raw material from the predicted product and safety stock, the next step is to order the raw material itself. If there are raw materials that are less than safety

stock or with the status of raw materials "Not Safe", then the related raw materials will be ordered.

Table 4. Raw Material Ordering

Supplier	Bahan Baku	Jumlah
PT. Sanitya Utama	Dop Al Ma'soem	90.379 pcs
PT. Omni Kemas Industry	Tissue Al Ma'soem	90.751 pcs
PT. Panca Buana Abadi	Cup 240 ml	6.370.743 pcs
PT. Sinar Sahabat Abadi	Straw	6.425.489 pcs
CV. Kendy Indopack	Duct Tape	1.355 pcs

6. Determination of the number of raw material sent

Determination of the amount of raw material sent is doing to be able to find out the amount or quantity of raw materials that must be sent from the supplier and the frequency of delivery. Packaging raw materials (except 19 liter gallon packaging), Al Ma'soem brand cartons (240 ml Cups and 600 ml Bottles) and carton brands Asri Cup 240 ml are carried out in parts due to limited capacity from the warehouse of raw materials, so the raw material has a maximum stock at the raw material warehouse.

7. Order Product

Customers order products to the company and calculate the number of orders ordered by customers to determine the transportation to be used when shipping. In monitoring the balance or stock of products available in the warehouse of finished goods, product monitoring is carried out.

8. Financial Analalysis

Financial analysis is doing to find out the financial processes that enter the company from the sale of products and finances that come out of the company to procure raw materials.

9. Distribution Product

Based on product ordering data, the company determines the product distribution schedule to customers who have made an order, as well as the selection of vehicles to be used for the product distribution process. Distribution monitoring is carried out so that the delivered product can arrive at the customer at the right time and schedule, and know the status of the shipment. Product shipments are carried out by the company using the company's vehicle fleet.

10. Product Return

Product returns is doing when there are customers who get products that are not suitable for use or damaged. The return process cannot be disbursed, but must be replaced with the same brand and type. Customers can do returns up to three days after the product is received by the customer.

Table 5. Product Return

Pelanggan	Produk	Jumlah Retur	Keterangan
H. Sobarna	Al Ma'soem Cup 240 ml	1 pcs	Leaking
Toko Pepen	Al Ma'soem Cup 240 ml	1 pcs	Dented

2.3 Database Analysis

Database analysis is an analysis to describe interconnected data that will be used in the system to be built. Database analysis will be made using Entity Relationship Diagram (ERD) which can be seen in Figure 5.

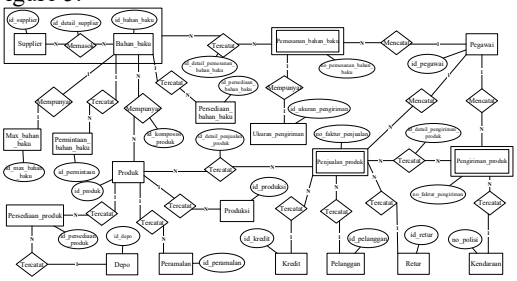

Figure 5. Entity Relationship Diagram of Supply Chain Management Information System

2.4 Context Diagram

Context diagram illustrates how data is used and transformed to process in the form of data flow into or out of supply chain management information systems at PT. Muawanah Al Ma'soem. The context diagram can be seen in Figure 6.

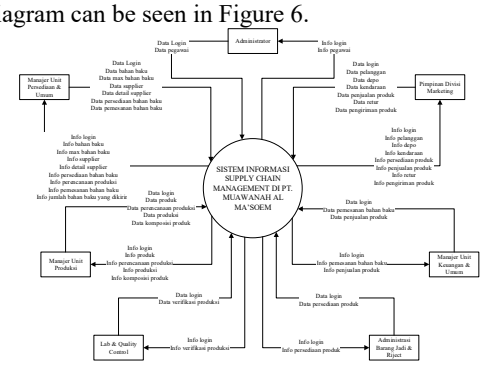

Figure 6. Context Diagaram of Supply Chain Management Information System

2.5 Data Flow Diagram (DFD)

Data Flow Diagrams (DFD) describe how the data flow describes the processes that occur in the system to a more detailed process into several process levels that explain what processes are contained in the supply chaim management information system at PT. Muawanah Al Ma'soem. The following figure is DFD Level 1:

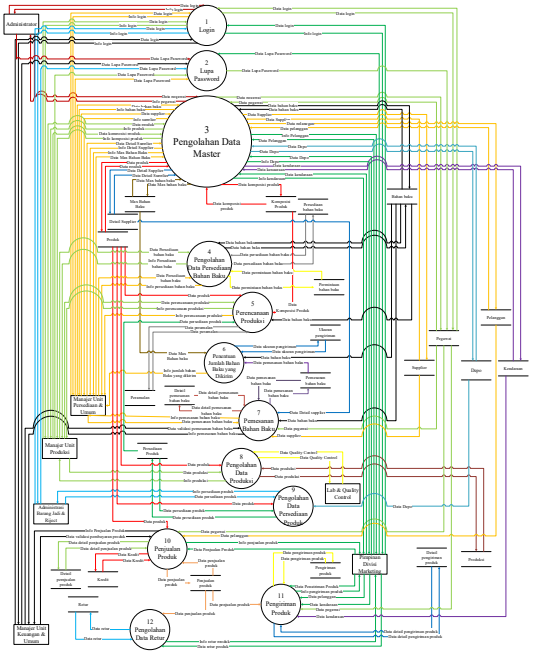

Figure 7. DFD Level 1

2.6 Relationship Scheme

The relation scheme describes the relationship or relation between data, the meaning of the data, and the limits. The process of relations between attributes is a combination of attributes that have the same primary key, so that the attribute becomes a single unit that is connected by the primary key. Supply chain management information system relation scheme at PT. Muawanah Al Ma'soem can be seen in figure 8.

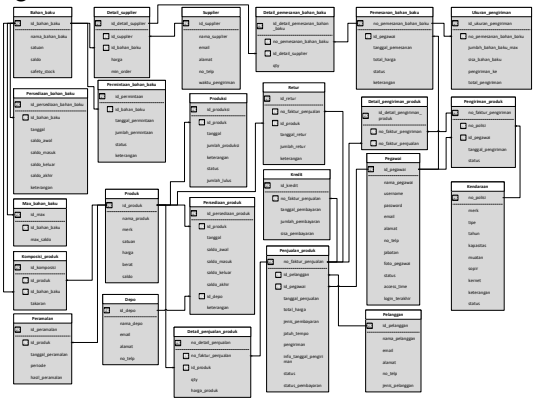

Figure 8. Relationship Scheme of Supply Chain Management Information System

2.7 Functional Testing

Functional testing is doing by testing each process to find possible errors that can occur.

Table 6. Functional Testing Login

Kasus dan hasil Uji (Data Benar)			
Data Masukan	**Yang Diharapkan**	**Pengamatan**	**Kesimpulan**
Username: "persediaan" Password: "persediaan"	Memasukkan data login yang telah terdaftar dan masuk ke dalam sistem	Data login yang dimasukkan benar dan dapat masuk kedalam sistem	[√] diterima [ ] ditolak
Kasus dan hasil Uji (Data Salah)			
Data Masukan	**Yang Diharapkan**	**Pengamatan**	**Kesimpulan**
Username: "persediaan" Password: "qwerty"	Muncul pesan "Login Gagal, Silahkan Coba Lagi!"	Muncul pesan "Login Gagal, Silahkan Coba Lagi!"	[√] diterima [ ] ditolak
Kasus dan hasil Uji (Data Kosong)			
Data Masukan	**Yang Diharapkan**	**Pengamatan**	**Kesimpulan**
Username: "persediaan" Password: " "	Muncul pesan "Login Gagal, Silahkan Coba Lagi!"	Muncul pesan "Login Gagal, Silahkan Coba Lagi!"	[√] diterima [ ] ditolak

2.8 User Acceptance Test (UAT)

User Acceptance Test (UAT) is done by the way the user tries directly to the information system that has been built. This method is done so that users can directly interact with the information system.

Table 7. UAT Login

Nama Pengujian	Prosedur Uji	Hasil yang didapatkan	Penguji	Hasil
Pengujian Login	Login menggunakan akun dengan jabatan manajer unit persediaan & umum	Data login yang dimasukkan benar dan dapat masuk kedalam sistem	Nama: Enung Rumyati Jabatan: Manajer Unit Persediaan & Umum User: persediaan	Berhasil

2.9 Beta Testing

Beta testing is done directly in the user's environment, by conducting interviews with users who have already used the system that has been built. The following table are the results of interviews with users:

t

Table 8. Beta Testing

Pertanyaan	Jawaban
Apakah sistem informasi supply chain management ini dapat memberikan kemudahan dalam melakukan perencanaan produksi?	Menurut Bapak Rukmana selaku Manajer Unit Produksi, sistem informasi dapat memberikan kemudahan dalam melakukan perencanaan produksi karena memberikan informasi untuk mengetahui perencanaan produksi di periode mendatang.
Apakah sistem informasi supply chain management ini memberikan kemudahan dalam memantau hasil produksi yang sudah dilakukan serta dalam meminta bahan baku?	Menurut Bapak Rukmana selaku Manajer Unit Produksi, sistem informasi ini dapat membantu dalam memantau hasil produksi.
Apakah sistem informasi supply chain management ini sudah dapat membantu dan	Menurut Bapak Rukmana selaku Manajer Unit Produksi, sistem informasi dapat membantu dalam

Pertanyaan	Jawaban
memberikan kemudahan untuk Unit Produksi?	memberikan kemudahan untuk Unit Produksi dalam merencanakan produksi
Bagaimana Pendapat anda mengenai tampilan antarmuka pada sistem ini?	Menurut Bapak Rukmana selaku Manajer Unit Produksi, sistem informasi sudah cukup terlihat baik.
Apakah sistem informasi supply chain management ini sudah menggunakan bahasa yang mudah untuk dimengerti?	Menurut Bapak Rukmana selaku Manajer Unit Produksi, sistem informasi sudah menggunakan bahasa yang dapat dengan mudah untuk dimengerti
Bagaimana pendapat anda tentang kemudahan penggunaan sistem informasi ini?	Menurut Bapak Rukmana selaku Manajer Unit Produksi, sistem informasi memberikan kemudahan.

3. CLOSING

3.1 Conclusion

Based on the results obtained in this final assignment, the following conclusions can be drawn:

1. This Supply Chain Management information system can assist Manajer Unit Produksi in production planning and Manajer Unit Persediaan & Umum in knowing the raw material requirements that must be purchased to meet production needs in the next period, as well as in determining the amount of raw materials sent by suppliers.
2. This Supply Chain Management information system can assist Pimpinan Divisi Marketingin scheduling product delivery according to customer orders and determining the vehicles used.

3.2 Suggestion

Supply Chain Management information system at PT. This Muawanah Al Ma'soem can still be developed further with more features. Suggestions for developing this Supply Chain Management information system include:

1. The appearance of the system can be improved again to make it more attractive to its users.

BIBLIOGRAPHY

[1] Pujawan, I Nyoman; ER, Mahendrawathi;, Supply Chain Management, 3 ed., Surabaya: ANDI Yogyakarta, 2017.

[2] McLeod, Management Information System, 2010.

[3] Yakub, Pengantar Sistem Informasi, Yogyakarta: Graha Ilmu, 2012

[4] L. R. Aritonang R., Peramalan Bisnis, 2 ed., Jakarta: Ghalia Indonesia, 2002

[5] A. Ristono, Manajemen Persediaan, Yogyakarta: Graha Ilmu, 2013.

[6] R. A. Rozak, "Pembangunan Sistem Informasi Supply Chain Management di CV. Surya Nedika Isabella," 2017. [Online]. Available: http://elib.unikom.ac.id/gdl.php?mod=browse&op=read&id=jbptunikompp-gdl-rizkiabdul-36401.

[7] F. M. Sudrajat, F. Renaldi and F. R. Umbara, "Pembangunan Sistem Manajemen Rantai Pasok Dalam Proses Produksi Air Minum Dalam Kemasan Di PT. Multi Sinimar Jaya," 2018. [Online]. Available: http://ojs.amikom.ac.id/index.php/semnastekno media/article/view/2032.

[8] G. L. Pramayudha, "Supply Chain Management Di PT. Komputer Kasir Indonesia," 2017. [Online]. Available: elib.unikom.ac.id/gdl.php?mod=browse&op=read&id=jbptunikompp-gdl-ghealutfia-36809.

[9] D. Nurhidayat, "Penerapan Aplikasi Supply Chain Management Di PT. Tirta Investama (AQUA)," 2008. [Online]. Available: https://diatnurhidayat.files.wordpress.com/2016/05/aqua-diat_nurhidayat.

[10] D. Sutawijaya, "Pembangunan Sistem Informasi Distribusi Air Mineral Softride Di PT. Riade Dengan Pendekatan Metode Supply Chain Management (SCM)," 2016. [Online]. Available: http://elib.unikom.ac.id/gdl.php?mod=browse&op=read&id=jbptunikompp-gdl-donisutawi-34789.

[11] F. Andzar, "Membangun Sistem Informasi Inventory Control dan Distribusi Air Mineral Di PT. Amidis Tirta Mulia Dengan Pendekatan Metode Supply Chain Management," 2017. [Online]. Available: http://elib.unikom.ac.id/gdl.php?mod=browse&op=read&id=jbptunikompp-gdl-fahrulandz-38445.

[12] Jogiyanto, Analisis & Disain Sistem Informasi : Pendekatan terstruktur teori dan praktek aplikasi bisnis, Yogyakarta: ANDI, 2001

[13] B. Raharjo, I. Heryanto and E. R.K., Modul Pemrograman Web (HTML, PHP, MYSQL), Bandung: Modula, 2010.