MANUFACTURING INFORMATION SYSTEM FOR SMALL AND MEDIUM ENTERPRISE (CASE STUDY TEXTILE SME)

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ABSTRACT

Information system (IS) has becoming as one of important thing in such a technology era like now. With the help of some good IS, operational work like certain manufactory could really improve, as well as their business profit. Industrial manufactory like SME XYZ, is Small and Medium Enterprise who already had some distributors in Indonesia to sell their Muslim dress and shirts. Actually, they need some IS to be able to manage their production scheduling system, so they could keep making good delivery product with their best possibility. The purpose of this IS is to optimize the scheduling process in production activity and ordering of raw materials. Distributor fulfillment could be realized hopefully after the implementation of this IS, so there will be no delay anymore when delivering product has to do to every SME's distributor. Furthermore, availability of every raw-materialswill always be under control with the information provide by this IS, and so some problem like lack of raw-materialscould be avoided surely.

Keywords*: production information system, scheduling, raw material, textile, small and medium enterprise, SME*

1. INTRODUCTION

XYZ SME is an industrial manufactory company who's been located in Cimanggis, South Jakarta. It's a Small and Medium Enterprise (SME) that already produced Muslim dress shirts in 83 dress models since their opening in 2008. So far, they had more than 20 regular distributors in Indonesia and made high number of order to their certain product in these 6 years of their existence.

Based on preliminary observations, XYZ SME have difficulties to determine how many product need to produce, and when is the right time to produce these products. However, they always produce a product (dresses) to make stock, but it's not proper and meeting the demand of distributor. It makes some disappointment to their distributor or best customer who already trust them, while some final products or stocks of finished goods piled up in their warehouses.

XYZ SME is also struggling to prepare the raw materials that would be needed for their production activities, in a timely manner. In addition, slower delivery times of raw materials from their supplier will only twisting these problems and of course could adding much delay time to start their production activity.

Manufacturing Information System is an IS that has been made to help SME XYZ in supporting their operational work like to handle scheduling production activities along with raw material's fulfillment by ordering certain amount of raw-materials to each supplier in a right time and in a right quantity, calculating the total production time required, and to controlling the availability of stocks of raw materials in the warehouse.

Implementation of this IS hopefully could solving these issues, so SME XYZ could make a better service to their distributor by following every schedule that will be provided from this IS, to ensure that every production activity and raw-materials fulfillment will be made in the best possible time.

2. THEORETICAL BACKGROUND

Production subsystem will be related to production activity of certain company/ manufactory. Usually, production subsystem contain with four activities like: product design, planning and scheduling, production operations, and cost accounting. Information flow of these production subsystem activities can be use to provide some decision such as: how many product need to produce, when is the right time to produce these products, what kind of production method will be used, how is the best way to assign every costs from these production activities, and decide to do some future investment or not. (Yuliana, 2002)

About material stock, Refer to what Tersine (1994) said material stock is every material that related to production activity. It could be raw materials, half-finish materials, or some ready-to-sell product. Stocking system is a group of decisions and controls about stock level monitoring, defining the minimum stock level, when is the time to make an order to supplier, and how much the material is going to be ordered to keep the availability of every needed materials. (Taqwa, 2013)

Approach used in this manufacturing information system is material requirement planning (MRP). material requirements planning (MRP) is a computer-based production planning and inventory control system.

MRP is concerned with both production scheduling and inventory control. It is a material control system that attempts to keep adequate inventory levels to assure that required materials are available when needed. MRP is applicable in situations of multiple items with complex bills of materials. MRP is not useful for job shops or for continuous processes that are tightly linked.

The major objectives of an MRP system are to simultaneously:

1. Ensure the availability of materials, components, and products for planned production and for customer delivery,
2. Maintain the lowest possible level of inventory,
3. Plan manufacturing activities, delivery schedules, and purchasing activities.

MRP is especially suited to manufacturing settings where the demand of many of the components and subassemblies depend on the demands of items that face external demands. Demand for end items are independent. So, The three major inputs of an MRP system are the master production schedule, the product structure records, and the inventory status records. Without these basic inputs the MRP system cannot function. (Gallego, 2002),

3. RESEARCH METHOD

This system was developed with the waterfall model, which refers to the SDLC (system development life cycle). This development is done sequentially, ie one step done after the previous stage has been completed. The sequential phases in Waterfall model are (McLeod, 2008):

1. **Requirement Gathering and analysis**: at this stage the problems defined and the goals of development are determined. All possible requirements of the system to be developed are captured by fact finding method: literature study, observation, document review (form and report), old-system review, and user interview. Requirement specification are documented in a requirement specification doc.
2. **System Design**: in this stage a complete project specification are prepared according to the requirement specification. Hardware and system requirements are specified like: process, data, interface, and also overall system architecture. Analyzing and designing method that has been used was object oriented method.
3. **Implementation**: With inputs from system design, the system is first developed in small programs called units, which are integrated in the next phase (with HTML, PHP, CSS programming language, and My SQL as DBMS). Each unit is developed and tested for its functionality which is referred to as unit testing directly by developer.
4. **Integration and Testing**: All the units developed in the implementation phase are integrated into a system after testing

of each unit. Post integration the entire system is tested for any faults and failures. User Acceptance Test (UAT) was done by black-box testing method.

5. **Deployment of system**: Once the functional and non functional testing is done, the product is deployed in the user environment.
6. **Maintenance**: There are some issues which come up in the client environment. To fix those issues patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the user environment.

4. RESULT AND DISCUSSION

4.1. System Analysis and Design

This manufacturing information system refers to the material requirements planning, which is a proactive strategy that identifies material, quantity and date required. This MRP system has four components include:

1. Production scheduling system, provides master production schedule which generates a production schedule that includes the longest lead time plus the longest production time.
2. the MRP system bill of materials, that
3. Capacity requirements planning system working with MRP systems to maintain and ensure that it is in accordance with the scheduled production capacity of the plant.
4. Order release system generates reports for floor work and purchase.

Actually this production system are connected with another system, that is Sales Order and Distribution Requirement Planning (DRP) Information System. It records sales-order activities, makes demand-forecasting from the sales order historical data, and finally creates DRP. The DRP result from sales order dan DRP system will be an input to this manufacturing Information System to know how many dresses will produce. Figure 1 is the example of DRP result .

Model	U102	*Safety Stock (unit)*		14	*Lot Size (unit)*		150	*Lead Time (minggu)*		1
CSF	IKM XYZ									
	Past Due	Periode (Minggu)								
		1	2	3	4	5	6	7	8	9
Gross Requirement		27	58	46	71	55	78	83	87	0
Scheduled Receipts										
Project on Hand	191	164	106	60	139	84	156	73	136	136
Net Requirement					25		8		28	
Plan Order Receipt					150		150		150	
Plan Order Release				150		150		150		

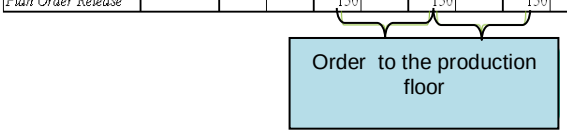

Figure 1. XYZ SME's DRP (Nuraini,2013)

There are 3 (tree) actor of this system : administrator, production division, materials division. These are the summarized process of the system built and also shown in figure 2:

1. DRP contains a certain amount of dresses in one model will be received by distributor at a certain time (plan order receipt), and also when that finished products are ready at the SME's warehouse (plan order release). Plan order release data come into this system. It's becoming a request notifications to this system, specially for production admin, to schedule production.
2. First, This system counts the total production time of the request, and also check the existing of the raw materials stock needed for production either sufficient or not.
3. Production schedule includes total production time and lead time of raw materials order from supplier. If the stocks of raw-materials are sufficient, production admin can assign the schedule of production.
4. The production starts at the start date determined.
5. Production process starts from cut-work station to packing-work station.
6. After all the production process is complete, production admin can confirm the production has been completed to the system.
7. Number of stock of finished goods in a database system are updated. The finished products are delivered and added to the finished-products warehouse and ready to meet the demand of distributors.

8. Alternative scenario is if the raw materials for production in step 3 is not sufficient. Production admin firstly makes order raw materials order for production to the admin of raw materials through the same system.
9. That order would be a notification for the admin of raw materials to schedule ordering process to the supplier. Raw materials are booked on each supplier.
10. Once booked, the raw materials will be waiting for the delivery according to the lead time from each supplier.
11. When the raw materials arrive at raw materials warehouse of XYZ SME, admin of raw materials makes confirmation arrival for production admin that requirement of raw materials for production are fulfilled.
12. Raw materials admin also add the number of the raw materials through this system, so raw materials data in database system is updated. Raw materials' received will be added in the warehouse of raw materials, and production activities from the previous query can be started . The scenario in step 3 will demonstrate sufficient availability of raw materials, the production activity in step are done.

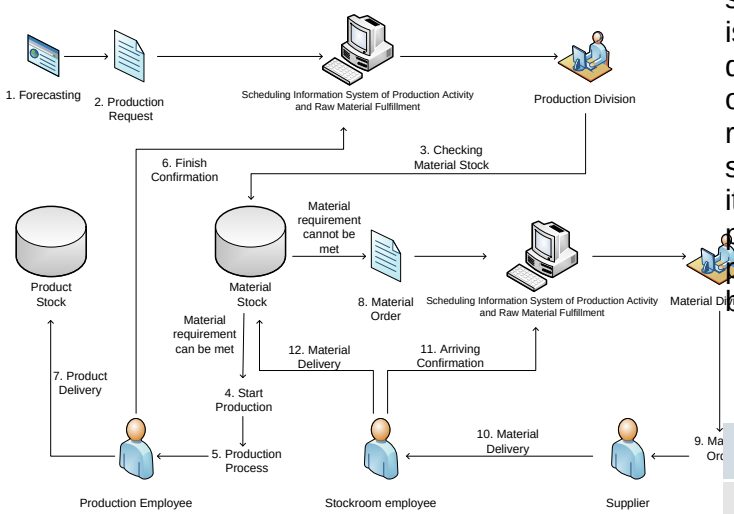

Figure 2. System Workflow

The interaction between every system functions with theirs actor will be describe in figure 3. The database structure and the relations between database tables will be shown in figure 4 and Logical Record Structured (LRS).

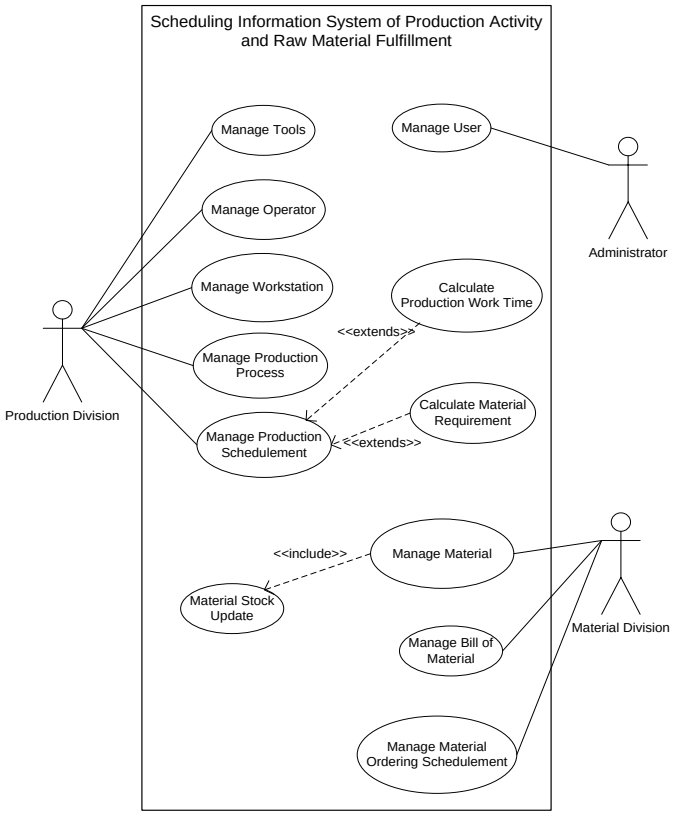

Figure 3. Usecase Diagram

The demand for end items is scheduled over a number of time periods and recorded on a **master production schedule (MPS)**, shown in table 1**.** The master production schedule expresses how much of each item is wanted and when it is wanted. The MPS is developed from forecasts and firm customer orders for end items, safety stock requirements, and internal orders. This system takes the master schedule for end items and translates it into individual time-phased component requirements. It involves production_request, product, bill_of_material, and material table.

Table 1. Master Production Schedule (production_request table)

Field	Type	Null	Default	Comments
request_code	int(8)	No		
product_code	int(5)	No		
request_time	date	No		
Sum	int(11)	No		
production_period	date	No		
Start	date	No		
Finish	date	No		
Status	varchar(10)	No		

The product structure records, also known as **bill of material records (BOM),** contain information on every item or assembly required to produce end items. Information on each item, such as part number, description, quantity per assembly, next higher assembly, lead times, and quantity per end item, must be available. It involves bill_of_material table, product table, and material table.

Operation List (OL) acts as a routing sheet. OL lists the steps that must be done, the machine is needed, and the time required at each step. It involves process table, product table, workstation table, and **operator table.**

This system also create output like **planned order schedule,** that lists the amount of each material requirements based upon the period of time, shown in table 2.

Table 2. Planned Order Schedule (material_order table)

Field	Type	Null	Default	Comments
order_code	int(10)	No		
material_code	int(5)	No		
order_time	date	No		
sum	double	No		
ordering_period	date	No		
start	date	No		
finish	date	No		
status	varchar(10)	No		
temp	int(11)	No		

The inventory status records contain the status of all items in inventory, including on hand inventory and scheduled receipts. These records must be kept up to date, with each receipt, disbursement, or withdrawal documented to maintain record integrity. It involves material table, material_order table, and production_request table, status table.
This system will determine from the master production schedule and the product structure records the gross component requirements; the gross component requirements will be reduced by the available inventory as indicated in the inventory status records.

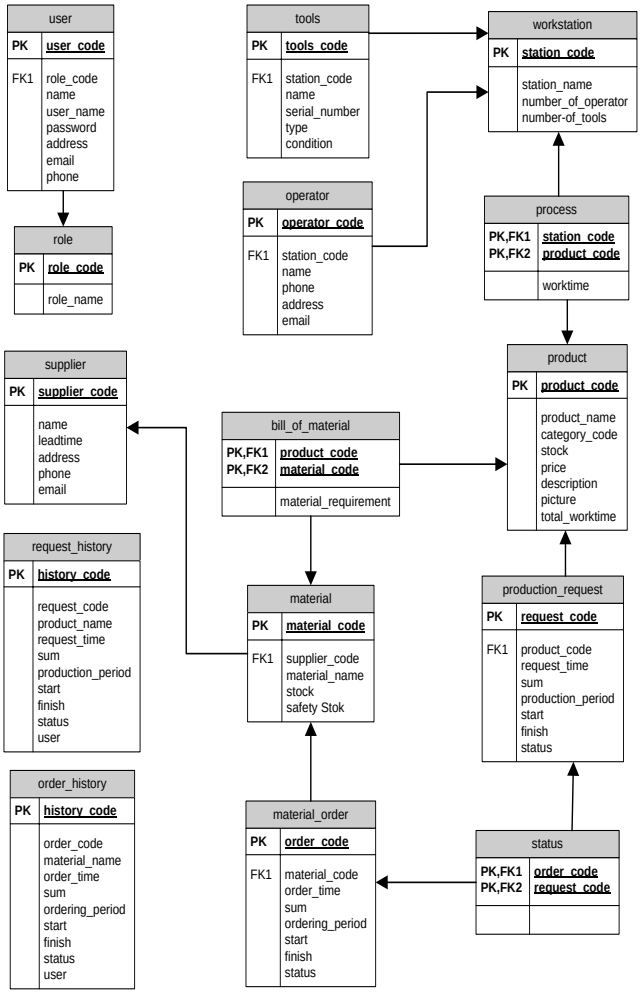

Figure 4. Logical Record Structured (LRS)

4.2. System Interfaces

Figure 5, figure 6, figure7, and figure 8 below will show the main page of this system.

1. Interface of Master Production Schedule

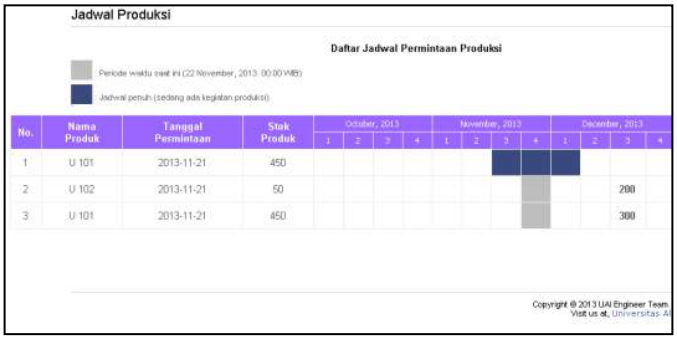

Figure 5. Master Production Schedule

2. Interface of Detail Production Activity

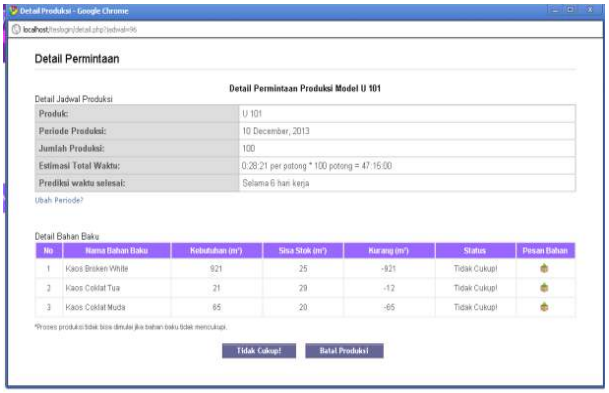

Figure 6. Production Activity Details

3. Interface of Planned Order Schedule

Figure 7. Planned Order Schedule

4. Material Order Details Page

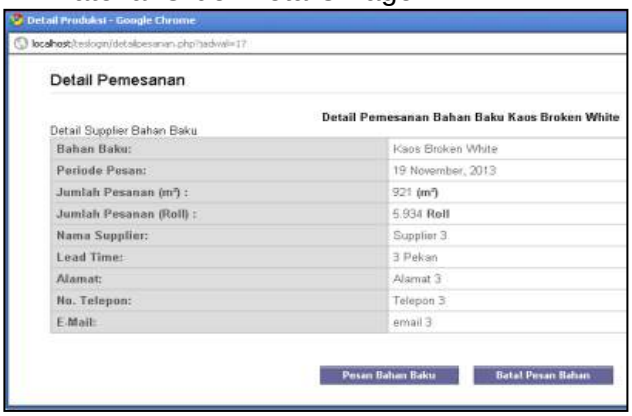

Figure 8. Material Order Details

5. CONCLUSION

MRP allows companies to manage materials better. Companies can avoid running out of inventory with the inventory schedule and prepare early before the production process. Also with this system we can determine the material needs of the future, so that the company can negotiate with suppliers to get the rebate.

MRP is also suitable to be applied to the textile SMEs who use the system make to stock. Production scheduling in these systems are based on demand forecasting system which are derived from previous sales records. It is expected the company to meet the demand of distributors, and avoiding the pile warehouse stock of the finished product because there is no proper production planning.

Availability of material stock in the stockroom can be control every time. It will be updated automatically in every material ordering activity or material used for production.

6. REFERENCES

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