Analysis of web-based integrated information system on production planning and control for small and medium scale garment industry

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ANALYSIS OF WEB-BASED INTEGRATED INFORMATION SYSTEM ON PRODUCTION PLANNING AND CONTROL FOR SMALL AND MEDIUM SCALE GARMENT INDUSTRY

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ABSTRACT

Information system (IS) technology has become the most important business enabler in the competitive industries. With the help of some good IS, operational work like certain manufacturing processes could really improve, as well as their business profit. As we know that in industry, there are too many difficulties if the processes are not handled using a computerized system, like producing production reports, production planning and controlling, calculating production cost, forecasting demand, and scheduling the purchasing raw-materials. The number of orders and complicated production processes also make it difficult to the company to control the production. The purpose of this study is to improve company performance to accelerate all processes by integration information system solution on production planning and control. Our focus on small and medium scale garment industry. The system integrates several subsystems: sales marketing, distribution, raw-material management, production and shop floor, In order to plan and control the production to be more effective, productive, and optimal. This system made with a web-based to support the divisions or all the components of the system, which are located far apart or different cities, can directly connected and accessed anytime and anywhere as long as the network connected to the Internet, as happened in the XYZ SME (Small and Medium Enterprise).

Keywords: *integrated information system, production planning and control, web-based, small and medium enterprise(SME)*

1. INTRODUCTION

Company will survive if he can survive in the market, even can win the market. In order to survive, the company must have a number of advantages that can be competitive with other companies or competitors, called competitive advantage. It is an advantage over competitors in some measure such as cost, quality, or speed, leads to control of a market and to larger-than-average profits (Rainer, 2012).

Threat of entry of new competitors is high, when it is easy to enter a market and low when significant barriers to entry exist. A barrier to entry is a product or service feature that customers expect from organizations in a certain industry. For most organizations, the Internet increases the threat that new competitors will enter a market.

According to the term 'value chain' was used by Michael Porter (1985), strategic information systems or information technology provide a competitive advantage by helping an organization to implement its strategic goals and to increase its performance and productivity (Porter, 1998), especially for manufacturing and service industries.

As we know that in industry, there are too many difficulties if the processes are not handled using a computerized system. This is the case also at garment industry, like XYZ SME in Jakarta. The head office and are in Rawa Belong South Jakarta, Head office handles warehouse, distribution, raw material management, and production planning and control. But its sales marketing

division is in Metro Market, Tanah Abang (Central Jakarta). It also has 11 branches of tailors for production operation around Jakarta and outside Jakarta, like in Pekalongan (Central Java) and Bandung (West Java). Its products are office pants, from polly fabrics, and also other types of clothes such as blazers, jeans, shorts, and jackets.

The business system of this SME (Small and Medium Enterprise) is quite unique. It's as a buyer of raw material and prepares the fabric for the entire product it makes. After the raw materials ready, then the SME will deliver the raw materials to its 11 branches of tailors. The tailors are its partners to outsource the production jobs.

This company faces problems in producing production reports, production planning and controlling in the different cities, calculating production cost and scheduling the purchasing and production. Currently, the company performs these activities manually. The number of orders and the production processes make it difficult to the company to control the production.

This paper is about to support the SME, especially garmenting industry, to win the market by using the concept of web-based integrated information system on production planning and control. The Final Product is the software, in this study provides the requirement gathering and analysis of this system.

There are five subsystems or modules covered by this system: sales marketing, product warehouse and distribution, raw-materials management, production, and shop floor.

Why integration system is the solution, because this system can improve the performance of the company to accelerate all processes and eventually will be able to increase corporate earnings.

And why it should be web-based, because to facilitate direct access easily to the system between one and another divisions apart, during they are connected to the internet. Also it can be a marketing strategy for the company that customers and distributors also can access the system easily as long as connected to the internet.

2. THEORETICAL BACKGROUND

Figure 1 shows the best-known framework for analyzing competitiveness is Michael Porter's competitive forces model (Porter, 1985), where competitive strategies can be implemented either with the support of information technology.

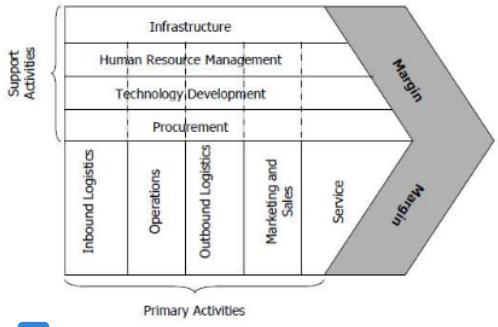

Figure 1. The Basic Model Porter's Value Chain (Porter, 1998)

Production is the process of converting raw materials into finished products. Production system is a set of activities for manufacturing a product, which is involved of labor, raw materials, machine, energy, information, capital, and management actions.

Production planning and control is the activity in the production system. Production systems aim to plan and control the production to be more effective, productive, and optimal. Usually production subsystem contain with four activities like: product design, planning and scheduling, production operations, and cost accounting (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-finished materials (or work-in-process, WIP) or some ready-to-sell product. Stocking system is a group of decisions and controls about stock level monitoring, defining the minimum stock level, and order schedules and quantities to suppliers (Taqwa, 2013).

Sales Order Information Systems and Distribution Requirements Planning (DRP) is a system that can assist in the management of product and order products from the customers or distributors. These systems

make demand forecasting based on historical data of customers or distributors orders and then create DRP. It can be input of production subsystem for planning and controlling production (Nuraini, 2013).

3. RESEARCH METHOD

This system will be developed with the waterfall model, which refers to the SDLC (system development life cycle). This development runs 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 specifications 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. Requirement Gathering

In this step, requirement specification is created. There are 5 (five) subsystems or modules covered by this system:

a. Sales Marketing, in this module records sales order transactions and markets the products.
b. Product Warehouse and Distribution, manage inventory of finished products, distributes the products, and focus on the use of sales strategy that is able to anticipate market changes, by making DRP (Distribution Requirement Planning). The main priority of these modules is to create a data structure that is capable of recording, analyzing, and control activities for customer satisfaction and generate profit in the accounting period will come. These subsystems make demand forecasting based on history data of customers or distributors on their request for each product, in order to make production planning and scheduling.
c. Raw Material Management, this subsystem manage the (Hasanati and Biki, 2014)
d. Production, this subsystem is to plan the most efficient production possible and can fulfill customer orders and can anticipate the needs of short-term customers without creating excess inventories of finished goods. in order to the purpose should be made Master Production Schedule (MPS). Other documents generated in activity planning and scheduling is production order and material requisition. Document production order is used to authorize the manufacture of a product. Whereas material requisition document used to authorize the transfer of a number of raw

materials needed from the warehouse to the plant site.

e. Shop Floor, the subsystem to handle production execution. In this case it refers to tailors. The transfer of raw materials or finished products in the process production documented on the move ticket (Yuliana, 2002) or production order (showed in table 7 and figure). This document notes that the raw material is transferred, the destination location, and the date of transfer.

There are 6 (six) actors in this system:

a. Administrator, a person that control and manage all the system.
b. Sales Marketing Operator.
c. Product Warehouse and Distribution Operator.
d. Raw material Operator.
e. Production Operator.
f. Shop Floor Operators, these consist of many tailors that receive job from production.

Table 2-7 show the requirement statements of this system. It describes the capabilities of the system, divided into 6 the subsystems.

Table1. Function Category

Function Category	Meaning
Evident	Should be done and the user is also aware that the function has been performed.
Hidden	To do but not visible to the user.
Frill	optional; add does not affect the function or other fees.

Table 2. The Capabilities of Administrator Subsystem

Req. No	Function	Category
R1.1	To use the system, each user must be logged in to the system by username and password	*Evident*
R1.2	Keeping track of the use of the system	*Hidden*
R1.3	To exit the system, each user must log out of the system	*Evident*
R1.4	Adding system user	*Evident*
R1.5	Changing user data	*Evident*
R1.6	Delete user data	*Evident*
R1.7	Manage overall master data (product, supplier, work-unit/division, etc.), including transactions and reports.	*Evident*

Table 3. The Capabilities of Product Warehouse and Distribution Subsystem

Req. No	Function	Category
R2.1	Update Finished Goods stock coming / received (from the production floor)	*Evident*
R2.2	Update Finished Goods stock that shipped to store /distributor	*Hidden*
R2.3	Display Product stock	*Frill*
R2.4	Display the demand history data distributors/customer.	*Evident*
R2.5	Doing forecasting by historical data of distributor of the desired product.	*Frill*
R2.6	Looking at the results of the data processing demand forecast for each value of the constant alpha.	*Hidden*
R2.7	Taking the results of forecasting demand distributor that has the smallest error value.	*Hidden*
R2.8	Save results forecasting, prediction of the number of requests in the form of a product by a particular distributor for some period ahead.	*Frill*
R2.9	Input the DRP component distributors.	*Evident*
R2.10	Calculating DRP of distributors.	*Evident*
R2.11	Calculating the DRP of SME	*Evident*
R2.12	Displaying the DRP	*Evident*
R2.13	Display and sending demand forecasting results to production subsystem	*Evident*

Table 4. The Capabilities of Sales Marketing Subsystem

Req. No	Function	Category
R3.1	Manage customer/distributor data	*Evident*
R3.2	Display product catalogue	*Evident*
R3.3	Show product stock (in store)	*Evident*
R3.4	Notifications final goods received from finished goods warehouse to store.	*Evident*
R3.5	update finished goods stock in store	*Hidden*
R3.6	Sales Order and cash payment	*Evident*
R3.7	Display invoice and print invoice	*Evident*
R3.8	Print Receipt.	*Evident*
R3.9	Payment confirmation by the distributor/customer.	*Frill*
R3.10	Handle backorder.	*Frill*
R3.11	Display order notification.	*Frill*
R3.12	reminder for payment that is not cash (in maximum due date)	*Frill*

Table 5. The Capabilities of Raw Materials Management Subsystem

Req. No	Function	Category
R4.1	Displaying products and bill of materials	*Evident*
R4.2	Manage materials	*Evident*
R4.3	Update stock of material	*Hidden*
R4.4	Display Production Schedule	*Evident*
R4.5	Count and Display Material requisition	*Evident*
R4.6	Manage schedule of raw materials ordering	*Frill*
R4.7	Record purchasing materials to suppliers	*Frill*
R4.8	Manage Suppliers	*Evident*
R4.9	Send materials to shop floors	*Evident*
R4.10	conversion of the number of materials into the number of products (cloths)	*Evident*
R.11	Display Track Record/ report of sending raw-materials to production floor every-month	*Evident*

Table 6. The Capabilities of Production Subsystem

Req. No	Function	Category
R5.1	Manage products and bill of materials	*Evident*
R5.2	Manage machines	*Evident*
R5.3	Manage operators	*Evident*
R5.4	Manage workstations	*Evident*
R5.5	Manage operation list (production process)	*Evident*
R5.6	Record shop floors	*Evident*
R5.7	Receive Production demand	*Evident*
R5.8	Count production time	*Hidden*
R5.9	Count material requisition	*Hidden*
R5.10	Create Production schedule	*Evident*
R5.11	Create and send Production-order to shop floors (move ticket)	*Evident*
R5.12	Control production progress on shop floors	*Frill*
R5.13	Control raw materials sent to shop floors	*Frill*
R5.14	Control finished goods sent by shop floors	*Frill*

Table 7. The Capabilities of Shop Floor Subsystem

Req. No	Function	Category
R6.1	Receive production order	*Evident*
R6.2	Display Production Schedule	*Evident*
R6.3	Count Accessories needed	*Evident*
R6.4	Display Production progress	*Evident*
R6.5	Display and make Notification of Materials Received	*Evident*
R6.6	Make and send invoice bill to head office (when it's outsourced to partners), can be printed	*Frill*
R6.7	Sending Products to warehouse	*Evident*

Figure 2 below shows the general architecture design of this system. It shows the interaction among subsystems (as clients) that all are connected to the server to access the system. The database is in one place, centered in server.
There are 2 ways to connect the system, first by LAN (Local Are Network) that all computer are connected in local area network, either wired or wirelessly. Second is using the internet network.

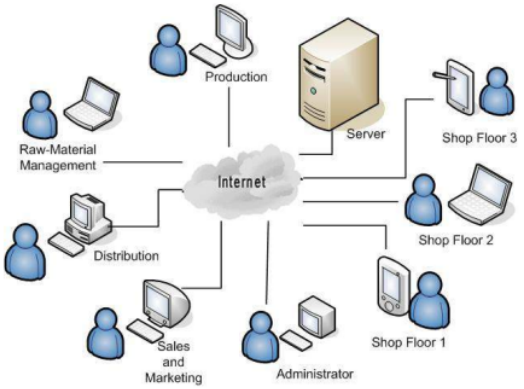

Figure 2. The System Architecture Design

4.2. System Analysis

In this section shows the use case diagram of the system as one of the results of system design

1. Use Case of Sales Marketing Subsystem

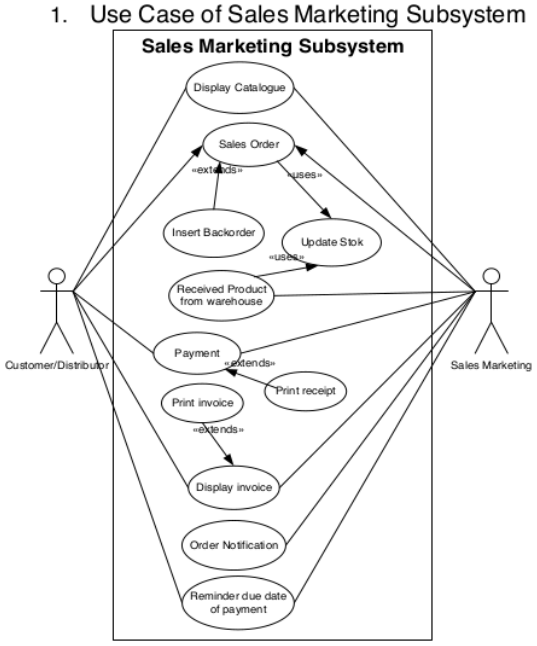

Figure 3. Use Case Diagram of Sales Marketing Subsystem

2. Interface of Product Warehouse and Distribution Subsystem

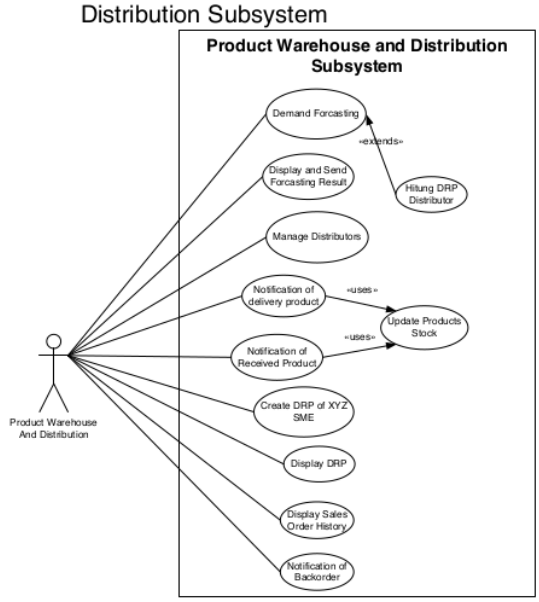

Figure 4. Use Case Diagram of Product Warehouse and Distribution Subsystem

3. Interface of Materials Management Subsystem

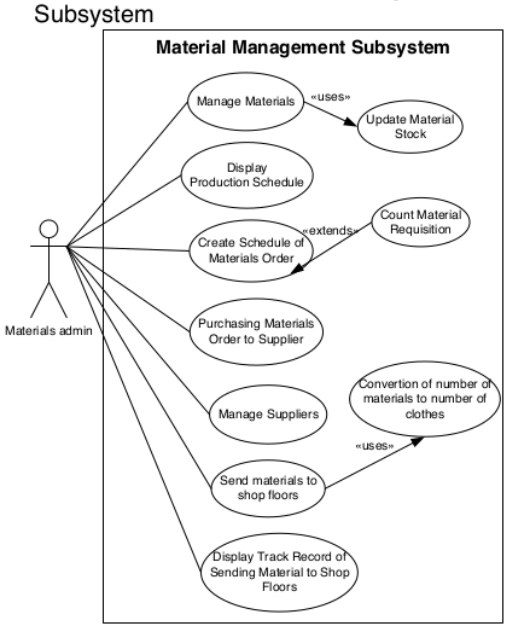

Figure 5. Use Case Diagram of Materials Management Subsystem

4. Interface of Shop Floors Subsystem

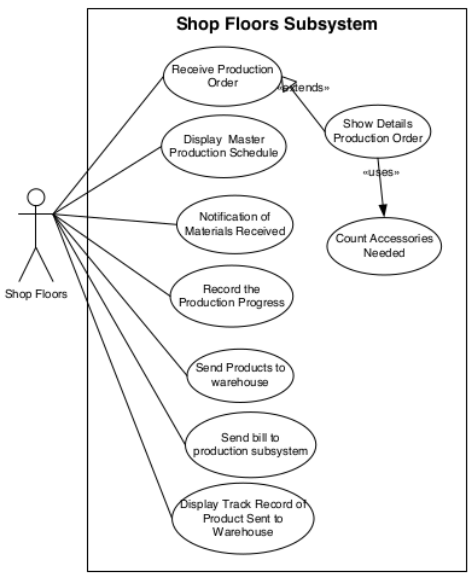

Figure 6. Use Case Diagram of Shop Floors Subsystem

5. Interface of Production Subsystem

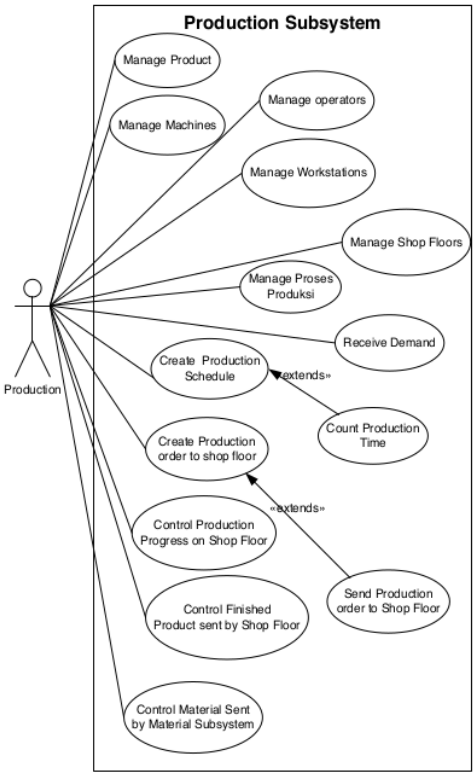

Figure 7. Use Case Diagram of Production Subsystem

5. CONCLUSION

This information system is web-based system that integrates several subsystems in order to plan and control production more effectively. It's suitable to be applied to the small and medium scale garment industry that has divisions located far apart or in the different cities. This system can solve problems of difficulties of producing production reports, production planning and control, calculating production cost and scheduling the purchasing and production, also handle the number of orders and the production processes. With Integration system, hopefully can improve the performance of the company to accelerate all processes and eventually will be able to increase corporate earnings.

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