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SOFTWARE OF PRODUCTION SCHEDULING PLANNING IN MANUFACTURE COMPANIES USING METHOD OF MAKE TO ORDER

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ABSTRACT

In a manufacturing company, a method to manage production scheduling system is highly needed in order to anticipate the needs of future orders. Production schedule planning using make to order method is the appropriate step to deal with the calculation of the time needed for production, materials, use of machinery and men power to achieve job effectiveness in a company. The design of this production schedule planning applications uses make to order to adjust with the needs of required work time calculation in PPIC (Product Planning and Inventory Control) work environment in a textile or garment manufacture industry based on the classification.

Keywords: *Production Scheduling Planning, Make to Order, Product Planning and Inventory Control*

1. INTRODUCTION

Information technology is a technology that unceasingly renews itself that all aspects directly in touch with information technology field can directly or indirectly implement information technology. Planning in a production activity requires a comprehensive and thorough calculation proven by the use of many applications to calculate production planning that in production planning, especially production schedule to calculate order's needs, can be carried out accurately and thoroughly using make to order method.

In a manufacture company, there are many divisions that control, manage, and supervise company's production process. A company with a high production level is certain to have a division responsible for planning the production for the next level or to add into the ongoing production process. Usually, the production planners are in charge to make the decision on the issue of effectiveness that will later be carried out by the company. It is PPIC or Production Planning and Inventory Control that acts as production planner and raw materials controller needed in every production in the company. In industrial field, planning system is only a small part of a system that may have been applied in a company. There are many other systems supporting its work performance in the decision making of work efficiency and effectiveness.

The need of a production planning application has been proven by a research done by Soedjanto et.al (2006). The research used forcasting MAD method that is to forecast orders using actual value in every period. The error value was made the absolute value or a constant. Another research is a research done by Pratama-Nur (2008) The application customized in this research was web application of information on MRP (Management Resource Planning) of the company's product. By comparing the researches done, it can be concluded that there is no particular application to deal with production planning to manage production scheduling using make to order method.

2. LITERATURE REVIEW

System is a set of various components that interacts with each other to achieve the shared goal, whereas production is an input processing into output. Therefore, it can be concluded that production system is a group of human, machines, money, materials, and methods in a production process to produce goods and services.

Some functions of production system: a) Bussiness Planning, b) Product Design and Engineering, c) Manufacturing Engineering, d) Supervision, e) Production Planning, f) Purchasing, g) Production, h) Production Control, i) Quality Control, and j) Receiving, Shipping and Inventory Control.

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Some factors that determine the success of Production System are: a) The relationship proximity between the workers and the systems, and b) The presence of good planning and controlling system.

The development of industry lately is marked by fast changes. The implication of the changes is that in one side, society as consumers have more choices and on the other side, it encourages companies to continuously follow the change of direction in the needs of society. In general, the mission of industrial companies is to fulfill the needs of society (consumers) by producing goods according to their needs. In order to fulfill the mission, industrial companies need to integrate all activities, both production and support activities.

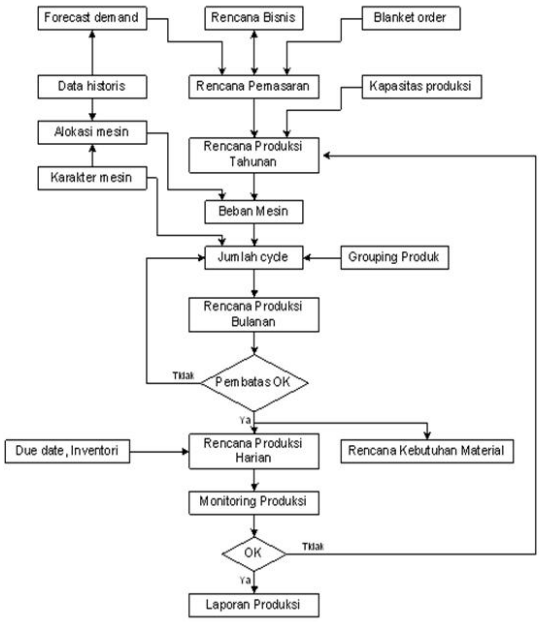

Figure 1: PPIC Workflow In Manufacture Companies [7], [8]

Figure 1 is the main data in the research. In day to day basis PPIC is responsible for the carrying out of the plan. Therefore, the PPIC is highly needed in all company management activities to design the planning for the targeted time. PPIC workflow starts from forecast marketing developed by marketing division. In the next step, PPIC develops production planning and production schedule [8]. Production schedule is developed together with the production division where in production we know that there are many production technicians who manage the flow of production and know the materials needed to produce a particular good.

2.1 Production Scheduling

Production process is an activity of producing goods from raw materials that involves machines, energy, technical knowledge, etc. Production planning and controlling is an activity of managing and arranging the production process [1], [4], [6]. Production planning and controlling involve some functions and activities such as managing customer's orders, predicting demands, managing stocks, developing aggregate plan, developing master production schedule, planning needs, scheduling machines and production facilities, monitoring and reporting as well as evaluation [1], [4], [6]. Production scheduling is the management of time, knowledge, technology, and resources possessed by operational activities. Scheduling includes the activities of allocating facilities, equipments and workforces for an operational activity and determining the order of production operation. the purpose of scheduling are to minimize processing time, customer waiting time, and stock level as well to maximize efficient use of facilities, workforces, and equipments. A good scheduling will give positive impact such as the low operating costs and short delivery time that improve customer's satisfaction [2], [5]. Production operation scheduling is the timing and use of resources in production operation activity. Timing concerns with ordering or sequencing and using resources for production operation in relation to job assignment or workload in production [2], [5].

2.2 Make To Order

Make to Order is a type of industry that produces goods only to fulfill orders. Production plan is developed based on the number of forecasts on time horizon planned reduced by the margins between the end of year and initial backlog target [3]. The statement is expressed in the equations below:

PP = Estimating + (end the backlog – start the backlog)

The formula to calculate the length of production process using this method is shown below:

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$$tP = \frac{n\ Order}{t}$$

Where

- tP = production time
- n Order = the number of products ordered
- t = time needed/length of ordering time

The characteristics of Make To Order are: 1) The inputs are raw materials, 2) Usually for various kinds of supply item, 3) Prices are quite high, 4) Requires special skills, and 5) Components are usually purchased for stocks.

The companies that are based on order are garment companies or textile factories. The correct scheduling techniques depend on the volume of orders, operation characters, and the whole job complexity along with the importance of place in each workplace. Four criteria to efficiency of production scheduling use are by: 1) Minimizing the finishing time or by determining the averge time to finish tasks, 2) Maximizing utilization or by using the facilities efficiently, 3) Minimizing good stocks in the process including the number of tasks, and stocks, and 4) Minimizing customer's or buyer's waiting time.

2.3 Gantt Chart

Gantt chart is a visual aid useful for loading and scheduling. This diagram visualizes the use of resources, in this research, the products produced in the targeted time. When it is used for loading, Gantt chart shows load time and idle time after the ordered product finished or after the orders fulfilled.

3. SUPPORTING SOFTWARE

Below are the software used to develop the system: a) JDK 6, allows to use Java programming language. JDK provides an environment to operate Java (JRE) application and JVM that applications can be operated in all platforms, b) Netbeans, is an editor of Java programming language, c) MySQL Database, provides a data base system to store company's data, d) Phpmyadmin, provides interface to ease the developing of data base scheme in this research, and e) Rational Rose, is an modeling language to develop illustration of class diagram, activity diagram, and etc.

4. DISCUSSION

A good application needs to conduct data management well, neatly, and fast. Realtime and continuous data change can be handled by minimizing error processing. Based on the problem, the application is developed with fast and accurate data processing that minimize error processing.

Through input system in the form of form, users can input product data that will be processed into production schedule, and set as dynamic schedule planning based on existing business flow. On the main application page, users can access information, search, add, change, and delete data presented in a one-paged information. It is expected to ease application users when they have to supervise realtime data change.

The flow of the production schedule planning process will be explained through the figure below:

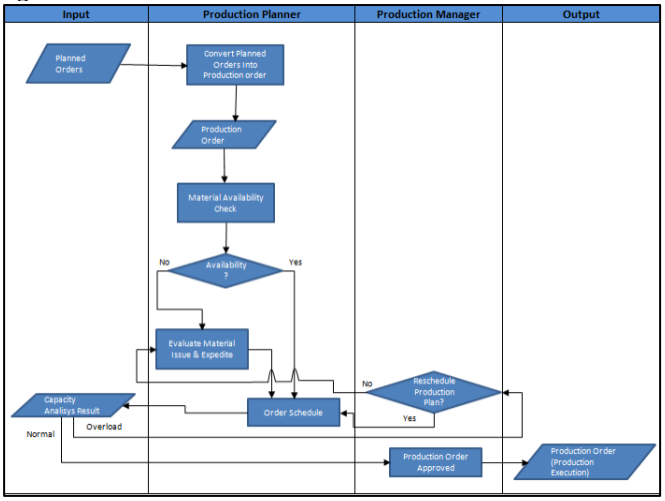

Figure 2 : Flow Of Production Schedule Planning Process [9]

Figure 2 explains the flow of production planning process data, the flow of production scheduling planning from purchasing and marketing division that accept invoice or letters of order which, in this research, is referred to as product orders. To analyze the needs to produce the orders, product sales division give the invoice to manufacturing division to be analyzed in terms of what are needed to produce the orders. In this research, the data needed are product data from inventory management data division as inventory data, part master bill of materials data division as

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product constituents to formulate product's needs, as well as purchasing and vendor as the division dealing with the division that purchases the needed materials.

Material planning and master planning schedule data divisions play a role to take all the data and process them by analyzing the invoice issued. The parameters above are needs parameter to plan master production schedule in a manufacturing company. By using the data above, the production planners will forecast by using the existing production analyses. The analyses are later set as considerations for the company to accept or reject the orders placed by the customers.

```
84
85      public int getReqQtyPart(String productID) throws Exception{
86          int sump = 0;
87          try {
88              List<Integer> f = new ArrayList<Integer>();
89              List<Bom> bom = new daoImpl().getBom();
90                  for (Bom bo : bom) {
91                      int sum = 0;
92                      if(bo.getProductId().equalsIgnoreCase(productID)){
93                          f.add(bo.getQuantity());
94                              for(int i=0; i<f.size(); i++){
95                                  sum = sum + f.get(i);
96                              }
97                          sump = sum;
98                      }
99                  }
100         } catch (Exception e) {
101             System.out.println(e.getMessage());
102         }
103         return sump;
104     }
105
```

Figure 3 : Coding To Calculate The Number Of Materials Used From BOM Table

As explained in the previous figure, there is an arithmetic function to calculate the use of materials by a particular product in BOM (Bom of Materials). The figure above explains the coding to calculate the number of product materials taken from BOM table.

```
// get Requirement Time of Product with out Level
public float getReqTimeProduct(String productID) throws Exception{
    float sump = 0;
    try {
        List<Float> f = new ArrayList<Float>();
        List<Bom> bom = new daoImpl().getBom();
            for (Bom bo : bom) {
                float sum = 0;
                if(bo.getProductId().equalsIgnoreCase(productID)){
                    f.add(bo.getReqtime());
                        for(int i=0; i<f.size(); i++){
                            sum = sum + f.get(i);
                        }
                    sump = sum;
                }
            }
    } catch (Exception e) {
        System.out.println(e.getMessage());
    }
    return sump;
}
```

Figure 4 : Coding To Calculate The Number Of The Use Of Time From BOM Table

Figure 4 is a coding figure explaining the implementation to calculate the use of time in producing products from which the parameter is taken from field reqtime in BOM table possessed by every record in the table. The parameters are then taken by developing a loop and inputted into LIST<float> variable, which is a variable that can store many data in a memory block. The storing result is then calculated and summed.

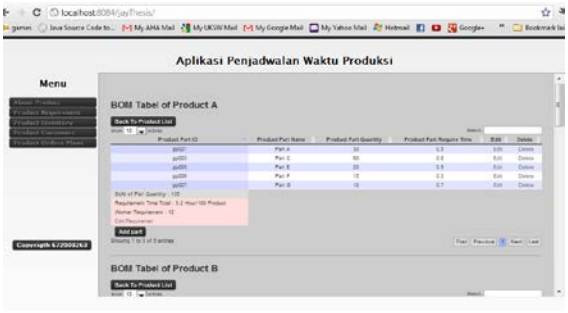

Figure 5 View Of Product Requirement Page

Figure 5 is a figure explaining the view of Product Requirement page that is useful for obtaining the information about the needs of materials, workers, and time/machine capacity to produce a number of products.

Figure 6 View Of Product Inventory Page

Figure 6 explains Product Inventory page. Product Inventory page is used to obtain information about the inventory of a product in production system and serves as a parameter in planning production scheduling.

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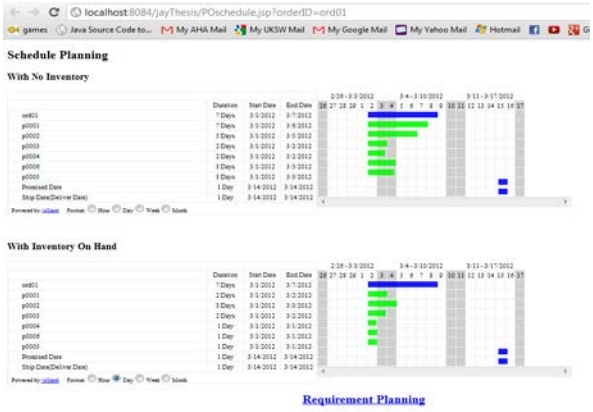

Figure 7 View Of Schedule Plan Page

Figure 7 is a figure from View Schedule Plan page, where the function of the page above is the result of product order analyses that is put in the form of table with a gant chart. Gant chart is a Chart to display the use of time block in a table. The page above has two analysis, they are production scheduling analyses based on orders without using product inventory as the primary material and production scheduling planning using product inventory as production primary material. There are some functions to analyze product order data from product order table.

```
public double RequirementProductInADay(String productID) throws Exception{
        double req = 0;
    try {
            List<ProductLevel> p = new daoImpl().getproductLevels();
            for(ProductLevel pl : p){
                if(pl.getLevelId().equalsIgnoreCase(productID)){
                    //req = minutes(getReqTimeProduct(productID))*24;
                    req = 24 / new mainDao().getReqTimeProduct(productID);
                    double reqday = req * pl.getCapacity();
                    req = reqday;
                }
            }
    } catch (Exception e) {

    }
    return req;
}
```

Figure 8 Coding To Calculate Total Production Time In 24 Hours

The figure 8 explains the implementation of the use of production time in machine capacity / 24 hours and calculates how many times the machine capacity is used.

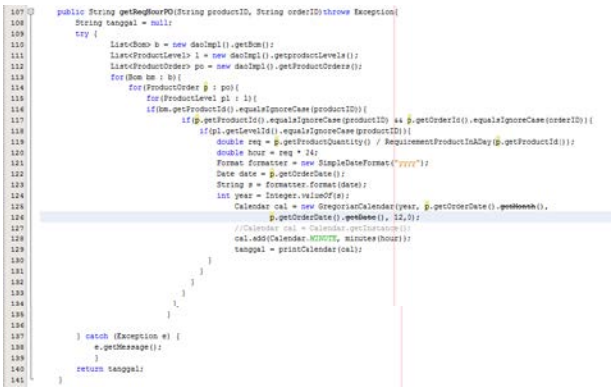

Figure 9: Coding To Calculate The Need Of Order Production Time.

Figure 9 explains coding to calculate the need of production time according to the orders without using product inventory as the primary material. The calculation of needs is taken from (the number of orders / production time capacity in 24 hours)* 24 hours.

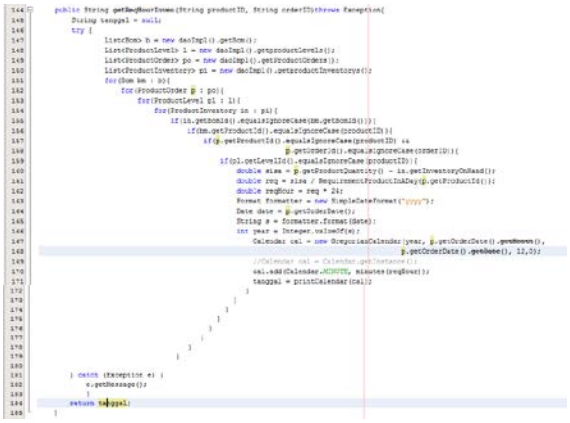

Figure 10: Coding To Calculate The Need Of Order Production Time Based On Product Inventory.

To calculate the need of production time with product inventory as a primary material, the first thing to do is to reduce orders with the existing inventory product. The remainder is regarded as equal to the calculation of the need of production time, which is (the remaining number of orders / production time capacity in 24 hours)* 24 hours.

4. CONCLUSION

In general, the conclusions of the research are as follow: 1) The realization of an application to manage production scheduling planning that helps production process in manufacture companies by implementing make to order method, 2) The

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use of make to order method as application characteristics that has to be used in textile or garment companies, 3) Theoretically, make to order method does not use product inventory for order replacement as basic material. However, to shorten production time in fulfilling orders, it becomes the rationale to reduce the load of production planning schedule in application, 4) Suggestion for the research is focused on the use of case study research because of the use of data and needs of production process calculation with many calculation and data form customizations.

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