Optimization Of Production Capacity In Manufacturing Multi Plate 424 Products Using Promodel Simulation At Pt CMP

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Abstract

A good production system is one of the important factors to determine the success of production. The integration of every process in production requires that every element in the system work properly. If one of the elements in the production process is jammed, this can cause big problems in the production process, such as a lot of idle time, inappropriate production targets, and so on. One alternative to overcome this is by simulating alternative solutions that have been proposed in a visual form with Promodel student version 7.5 software. The production process of making Multi Plate 424 at PT CMP occurs an imbalance in the machines used, which results in idle time and the length of the process of making the multi plate 424. This problem occurs because there are many piles of material on each of the machines used, so that it has an impact on the length of time for the multi plate. The proposed alternative solution is to reduce the bottleneck on each machine. Based on the simulation carried out between the existing system simulation and the proposed simulation model, there are several results including the schedule time, which is 21037.28 minutes, while the proposed simulation model is 18390.22 minutes with the total entries that enter the finished goods warehouse is 630 pcs

Key words: production capacity, multi plate 424, bottleneck, promodel student version 7.5

Introduction

Simulation is an imitation of a real system using a computer model that is used to evaluate and improve system performance. Simulation of the system itself is a system that is used to describe problems that are full of uncertainty, where the model becomes simpler so that it can be analyzed computationally mathematically (Simatupang, 1994).

The production capacity simulation made will be used in one of the companies engaged in the steel industry, namely PT CMP. PT CMP is one of the companies that produces products made of steel plates, one of which is the multi plate, where in the production process carried out by the company there are often obstacles such as problems with idle time on machines and operators, namely batches of material that causing too much idle time for each machine which of course will affect production results. Therefore, it is necessary to carry out an evaluation to minimize this. Through the simulation of the multi plate it is hoped that it can describe the actual situation that occurs so that it can find out the obstacles that occur in the production process carried out by PT CMP.

Simulation itself allows making conclusions from solutions to existing experiments and providing decisions regarding the experiment as an alternative approach. The use of simulation can be done on a manufacturing or
production system, in this study simulates the manufacture of multi plate 424. The simulation method used is a simulation using Promodel Student Version 7.5. Promodel is one of several software simulation Promodel (Production Modeler) is a software that can be used to model various manufacturing and service systems. In the promodel during the simulation, animations of ongoing activities can be observed and the results will be displayed in the form of tables or graphs that make it easier for analysis.

**Literature Review**

**Production System**

The production system has structural and functional components or elements that play an important role in supporting the production system. Structural components consist of raw materials, machinery, equipment, labor, capital, energy, information, land, and others. The functional component consists of supervision, planning, control, coordination, leadership, all of which are related to management and organization. A production system is always in the environment, so that environmental aspects such as technological, social and economic developments, as well as government policies will greatly affect the existence of the production system (Gaspersz, 1998).

The production system aims to plan and control production to be more effective, productive, and optimal. Production planning and control is an activity in the production system. The company is a collection of interrelated subsystems to achieve a goal. The production process is the activity of making finished products from raw materials involving machines, energy, technical knowledge, and others (Gaspersz, 1998).

**System Modeling System**

Modeling is a free translation of the term “modeling”. To avoid various understandings or different interpretations, modeling can be interpreted as a group of model-making activities. As a basis for understanding modeling, a study of the model itself is needed specifically in terms of the systems approach.

One of the main bases for developing a model is to find out what variables are important and appropriate. The discovery of these variables is closely related to the study of the relationships that exist between variables. In seeking to study the complex subject of organizational problem solving, two systems experts, RC Flood and MC Jackson, proposed in 1991 a Total System Intervention (TSI). This complex matter is referred to by them as complexity (messes), that is, the diversity of problems faced by managers and decision makers (Eriyatno, 2012).

**System Simulation System**

Simulation has many advantages, but it is also not free from shortcomings. The advantages of system simulation are that it can save time, can expand the analysis prediction time, cover a variety of sources, correct calculation errors, can be stopped according to the desired amount of data, and is easily repeated with changing random numbers. The weakness of system simulation is that it is not accurate. This technique is not an optimization process and does not produce an answer but only produces a set of results from the system under different conditions. In many cases, the accuracy is difficult to measure. A good simulation model can be very expensive, in fact it often takes years to develop a suitable model. Not all situations can be evaluated by simulation. Only situations that contain uncertainty can be evaluated by simulation, because without random components all simulation experiments will produce the same answer. Simulations generate ways to solve problems. So, beforehand it is necessary to know in advance the solution or solution approach to be tested (Simatupang, 1994).

**Production**

Capacity is the result of production or processing volume (throughput), or the number of units that can be handled, received, stored, or produced by a facility in a given period of time (Heizer and Render, 2009). Capacity often determines capital requirements and thus affects a large part of fixed costs. Capacity also determines whether demand can be met, or whether existing facilities will be redundant. If the facility is too large, some of the facility will be idle and additional costs will be charged to existing production. If the facility is too small, customers and the market as a whole will be lost. Therefore, with the aim of achieving a high level of utilization and a high rate of return on investment, the determination of the size of the facility is very decisive.

Capacity is the level of optimum production capability of a facility, usually expressed as the amount of output in a certain period of time (Rangkuti, 2005). Operations managers pay attention to capacity because, first, they want to have sufficient capacity to meet consumer demand, second, capacity affects operating cost efficiency, third, capacity is very useful in knowing output planning, capacity maintenance costs, and is very decisive in the analysis of investment needs.
Promodel

Promodel is closely related to resource utilization, optimization of production capacity, productivity, production scheduling and inventory levels. By modeling the important elements of a production system and inventory levels. By modeling the important elements of a production system such as the ones above, it is possible to experiment with various strategies and operation designs to get the best results. What needs to be considered is how the operating system, material flow, logical operation, operator work and operator work trajectory. Automatic failure correction will help promodel beginners in creating a system simulation model. In promodel, during the simulation you can observe the animation of the ongoing activity and the results of the simulation will be displayed in the form of a graphic whose shape can be changed, in terms of colour, title, appearance and appearance (Benson, 1997).

Method

Identification of System Elements

Identification of system elements is carried out only in the multi plate at PT CMP. The elements in the system to be studied consist of entities, attributes, resources, activities, status and events. Entity is an object that will be observed in the system, which is in the form of multi plate. While the attribute of the multi plate itself is in the form of the identity of the entity in the form of a steel sheet. The resources involved in the multi plate consist of cutting machines, punch machines, corrugation and curving machines, operators. Then the activities of the system itself are in the form of moving raw materials, semi-finished goods, and finished goods. The status of the machine and operator is either idle or busy. While the events in the multi plate are in the form of incoming and outgoing.

Data Processing Techniques Data

Processing techniques used include the manufacture in three stages of the model form, which consists of a conceptual model, a logic model, and a simulation model. The conceptual model describes the system conceptually by explaining its interactions, entities and so on in the form of verbal language or graphics depicted in the conceptual model in the form of verbal language and representative diagrams. Next, after creating a conceptual model, is to create a logic model, which is a model that explains the logic or chronology of events that occur in the multi plate, from semi-finished raw materials to finished materials and simulation logic that describes the sequence of the assembly process through programming in system simulation. The next stage is to create a simulation model of the multi plate software Promodel Student Version 7.5

Results and Discussion

Production Process Manufacture Multi Plate 424

Products multi plate 424 This is one of the products produced by PT CMP which is located in the Bekasi area, West Java. PT CMP is one of the companies that implement a system based on Make to Order, which generally carries out the production process based on orders from consumers or distributors. Usually, consumers place orders in large quantities and these consumers have a deadline for the company to complete the order.

The next stage after the cutting process, then the next is the punch (perforation). Process Punch in the manufacture of multi plate 424 this is done with care and precision by punching 8 holes for 1 multi plate 424. This perforation process must match one steel with steel so that later it does not cause problems when assembled with other components and does not harm consumers. Perforation on multi plate 424 This is done by 6 operators and takes 1 minute 45 seconds for 1 multi plate 424 perforating.

The next stage after the cutting process is the punching. Process punch in the manufacture of multi plate 424 this is done with care and precision by punching 8 holes for 1 multi plate 424. This perforation process must match one steel with steel so that later it does not cause problems when assembled with other components and does not harm consumers.
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The next process after punching is the corrugation /forming process (wavy). Process corrugation is used to form the steel plate into semi-finished goods (corrugated). This process takes 1 minute 42 seconds for a single corrugation. This process is carried out by 4 work operators who must have high accuracy so that the product does not experience defects or the wrong position of the material.

The next stage after the bending process, in this stage the semi-finished steel product will be bent with a curving. The purpose of this stage is to bend the steel plate to get a semicircular shape. This process takes 1 minute 25 seconds for one curving. This process is carried out by 3 work operators who must be careful so that the product does not experience defects or get out of the specified material crossing path.

After the multi plate 424 starting from the process of sending raw materials to the process to the curving is complete, it can be seen that each manufacturing process has a different time, this is what will be investigated. Due to the imbalance between the manufacturing process time and the limited machine capacity, of course one of the machines will experience a bottleneck if the distance between each processing time is very different.

<p>| Table 1. Production Capacity Multi plate 424 / Hours |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|</p>
<table>
<thead>
<tr>
<th>Type</th>
<th>Thick</th>
<th>Size</th>
<th>Cutting (Niagara)</th>
<th>Punch (Cincinnati 3)</th>
<th>Corrugasi (Verson)</th>
<th>Curving (Cincinnati 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pcs</td>
<td>Pcs</td>
<td>Pcs</td>
<td>Pcs</td>
</tr>
<tr>
<td>424</td>
<td>3.0</td>
<td>2910</td>
<td>1060</td>
<td>81</td>
<td>34</td>
<td>35</td>
</tr>
<tr>
<td>524</td>
<td>3.0</td>
<td>2910</td>
<td>1295</td>
<td>81</td>
<td>32</td>
<td>34</td>
</tr>
<tr>
<td>624</td>
<td>3.0</td>
<td>2910</td>
<td>1530</td>
<td>81</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>426</td>
<td>3.0</td>
<td>3140</td>
<td>1080</td>
<td>68</td>
<td>32</td>
<td>34</td>
</tr>
<tr>
<td>626</td>
<td>3.0</td>
<td>3140</td>
<td>1530</td>
<td>68</td>
<td>28</td>
<td>30</td>
</tr>
</tbody>
</table>

Source: PT CMP, 2018

Model Simulation

Simulation is a description of the simulation logic model which is translated into computer language bsi. Simulation of the multi plate 424 created using the software Promodel Student Version 7.5. Capacity Production Multi plate 424 this is 648 pcs per day with working time 8 hours/day.

Production process simulation multi plate 424 This provides some information about the production process carried out, namely in the form of entities, locations, and resources. An entity is an object that is being observed in the system, which includes raw materials, semi-finished materials, and finished goods. There are two simulations, namely the existing system simulation and the proposed system, all of which are programmed into the Promodel Student Version 7.5.

The graph above describes the comparison of total entries and schedule time. The results obtained are that the schedule time changes with the total material entries that enter the production process. The results of the schedule time on the existing system are 21037.28 minutes and the schedule time in the proposed simulation are 18390.22 minutes, which means the time required to complete the multi plate has improved in terms of decreased production time. This is because total entries that enter the punch reduced from the existing system of 648 materials to only 630.
Figure 3. Number of Corruption Decisions per Year

materials that are entered and processed on the punch and also causes the total entries in the following machines to be different from the existing system.

Figure 4. Comparison Graph of Batch Machine Punch and Corrugation

The above graph describes the comparison of the batch Machine Punch in real system simulations or production proposal simulations. The results of the graph provide an explanation that the schedule time in each simulation is influenced by batch (stack) of material on the punch machine. Starting from a batch (stack) on punch of 34 stacks which was improved to only 30 stacks.
Conclusion

Visualization of the simulation of the existing system of the multi plate was carried out for 8 working hours in accordance with what is contained in PT CMP. The machines that are included in this simulation process are in accordance with what is in the company where the machines have their respective capacities. The results that can be obtained from this real system simulation with a total product that can be produced in one day or 8 working hours are 630 pcs multi plate 424.

The production simulation process at PT CMP uses a comparison of existing simulations and proposed simulations resulting in an increase in production time from multiplate 424, the schedule time for the existing system is 21037.28 minutes and the proposed simulation is 18390.22 minutes, which means the time required to complete the multi plate 424 production process has improved in terms of decreased production time. This is because total entries that enter the punch reduced from the existing system of 648 materials to only 630 materials. Likewise, the results of batches (stacks) on the punch have improved the number of stacks in each production based on the schedule time obtained.

Suggestion

The suggestions given aim to improve or improve on further writing so that further research can provide even better results. Suggestions for further research, to develop and perfect the simulation model of this paper by using several other forms of models. The advice given to PT CMP is to modify the batch (stack) of each machine used to modify the amount of material transported by forklift to be moved to the next process.

References