

Improvement of Production Quality with Improved Scheduling of PT. Jaya Baru Mandiri with Hodgson Algorithm Method

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ABSTRACT

PT. Jaya Baru Mandiri company is a manufacturing company engaged in the manufacture of machinery spare parts. One of the spare parts products that are often made is mainshaft, for the purposes of palm oil mills. In the process of making mainshaft, there is still often a delay (lateness). So that in this study, it was done to improve the scheduling of the production process in order to deliver the product to consumers in a timely manner. To clarify the production process, the method that will be used in this study is hodgson algorithm method, shortest processing time (SPT). Hodgson's algorithmic method serves to minimize the number of tardy jobs in the scheduling of production machines. The purpose of hodgson's algorithm scheduling is to improve the efficiency of scheduling the ideal production process as well as minimize unnecessary waste of time with the improvements recommended in this study. It is expected that the production process of PT. Jaya Baru Mandiri can improve its production process effectively and efficiently.

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1. Introduction

To win the competition between companies is getting tighter. Every company is vying to improve its corporate image. Various ways are also done by the company both in improving the quality of production, technology and innovative products. In manufacturing industry, production quality plays a vital role for the company. Therefore, an effective and efficient management system is required.

PT. Jaya Baru Mandiri located in Malindo-KIM1 complex, Medan. Is a manufacturing company engaged in the manufacture of machinery spare parts. In conducting its business processes, PT. Jaya Baru Mandiri implements a make to order system. How to order at PT. Jaya Baru Mandiri is by way of customer showing examples of spare parts or showing pictures of the desired spare parts. Although the company's system is make to order, the majority of spare parts produced are mainshaft. Like most manufacturing companies, PT. Jaya Baru Mandiri also does not escape obstacles, contained in the production process. One of the obstacles that often occur is the delay in the delivery of products, This is due to the lack of optimal production process and production scheduling.

PT. Jaya Baru Mandiri is well aware of the obstacles faced so, PT. Jaya Baru Mandiri always make continuous improvement both in terms of technology and service to consumers. To improve the production process on the manufacture of mainshaft in PT. Jaya Baru Mandiri then the company needs a settlement to reduce delays during the production process by improving the scheduler using hodgson algorithm method, so that the company can solve the problem.

2. Literature Review

Scheduling

Widodo (2018), Junaedi, D., Mas'ud, M. I. (2018) stated that scheduling is a timing on the machine that includes allocating facilities and equipment. Scheduling is useful for determining the order of work, namely:

- a. Scheduling function is to process the product according to the desired time, predicting the readiness of each resource needed.
- b. Based on the production flow, scheduling is classified into flow shop and job shop.

Setiawan (2014) stated that production scheduling is a way to allocate available production resources (materials, machinery, and operators), to determine the time of operation and when the operation should be completed in doing a number of jobs. With good scheduling is expected to complete product orders on time, meet the specifications that have been set together, maximasi throughput, minimization of production costs, reduction of makespan, reduce WIP (Work in Process), increase utilization of production facilities as well as to maximize revenue.

Shortest Processing Time

Setiawan (2014) states the sorting of jobs in the order of the process time is not decreased known as sorting shortest processing time (SPT) for obvious reasons, but this is also known by other variations of names such as Shortest Operation Time.

3. Methodology

Types of Research

This type of research is a case study, thus it is expected to solve the problem through the collection of data and information collected at PT. Jaya Baru Mandiri. The data and information that will be used in this study are:

- Finding the root cause
- Collecting primary data and observation data, researchers collect data through objects that want to be studied directly from the researched company.
- Collect secondary data, obtained directly from company documents.

Research Location

Our research will be conducted in branch. Jaya Baru Mandiri located on Jl. Sumatra Island, Malindo-KIM1 complex no.6 Medan. As well as the research time in the range of November 2020 – January 2021.

Research Object

The object of this research is the improvement of the quality of work in PT. Jaya Baru Mandiri is focused on mainshaft products which include manual lathe, CNC lathe, manual milling machine, crane, inter-machine distance, lead time as well as machine scheduling process.

Flowchart Research

The flowchart of this research is:

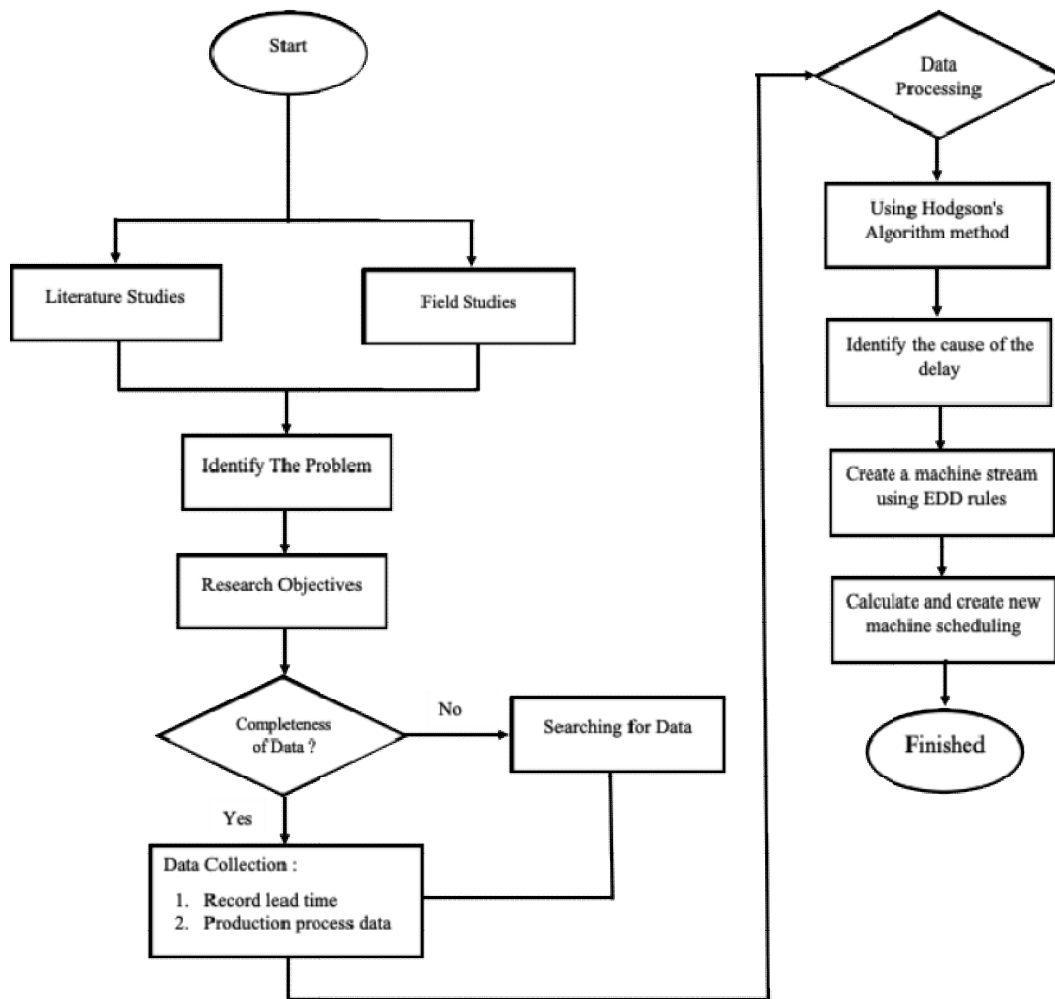


Figure 1. Flowchart Research

4. Results and Discussion

Production Process Job Scheduling

To be able to solve problems related to scheduling, the production process job scheduling is done. After collecting production process time data from January 2019 – December 2019, the most dense production is in October, where the production process is still experiencing delays in completion. Therefore, researchers will create a new production scheduling using Hodgson algorithm method combined with Shortest processing time (SPT) method, to minimize tardiness and makespan.

Table 1. Job scheduling data recapitulation

Job	Machine 1 Manual lathe center	Crane	Machine 2 CNC Lathe	Crane	Machine 3 Manual lathe drat	Crane	Machine 4 CNC Lathe	Crane	Machine 5 Milling	Crane	Sum
1	333	28	701	28	390	28	880	28	188	28	4320
2	166	14	351	14	195	14	440	14	94	14	8640
3	415	35	877	35	488	35	1100	35	235	35	2880
4	250	21	526	21	292	21	660	21	141	21	2880
5	172	14	382	14	222	14	488	14	118	14	5760
6	83	7	176	7	97	7	220	7	47	7	2880

At the company PT. Jaya Baru Mandiri, the production process on the machine is parallel where the production machine has a sequence of production processes that can not change and connect with each other. However, for cranes will be counted separately with other machines, because there is only one crane as a means of transport to move products from production machines to other production machines.

Division and Preparation of Job Data

In the first stage, separate the production process job data on the lathe with the crane. The production job time data used in the production process is the amount of time data calculated in minutes.

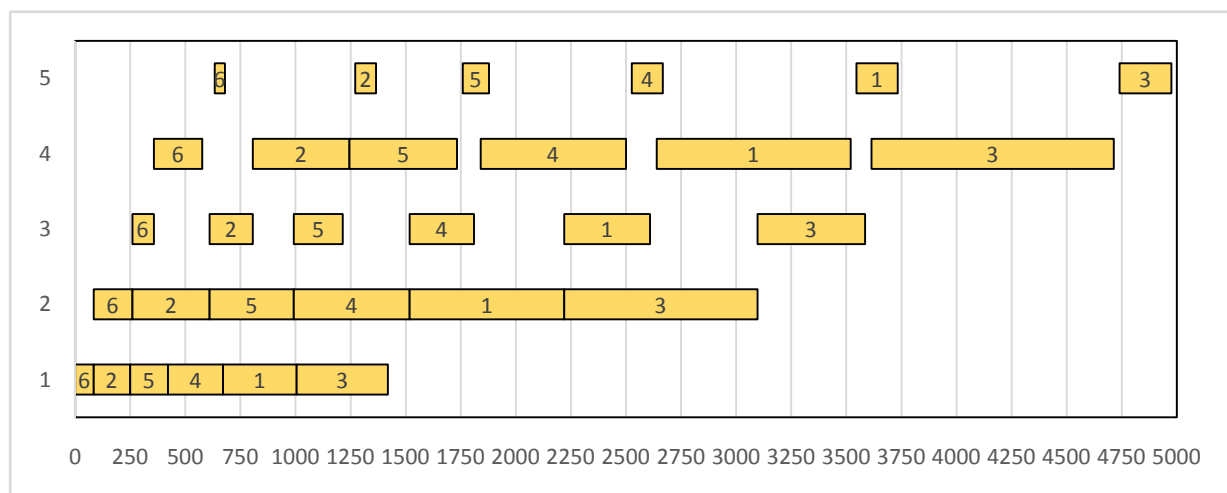
Table 2. Recapitulation of production process jobs on the lathe

Job	Machine 1 Manual lathe center	Machine 2 CNC Lathe	Machine 3 Manual lathe drat	Machine 4 CNC Lathe	Machine5 Milling	Sum
1	333	701	390	880	188	4320
2	166	351	195	440	94	8640
3	415	877	488	1100	235	2880
4	250	526	292	660	141	2880
5	172	382	222	488	118	5760
6	83	176	97	220	47	2880

After that, sort the job from the smallest production process time to the largest, the smallest job order is job6, job2, job5, job1, job4, job1,job3. From the order of the job using hodgson's algorithm method which will be compiled into a gantt chart.

Table 3. Recapitulation of the order of the job of the production process on the lathe

Job	Machine 1	Machine 2	Machine 3	Machine 4	Machine 5	Sum
6	83	176	97	220	47	2880
2	166	351	195	440	94	8640
5	172	382	222	488	118	5760
4	250	526	292	660	141	2880
1	333	701	390	880	188	4320
3	415	877	488	1100	235	2880



Graph 1. Recapitulation gantt chart of production process on the lathe

After the job sequence is arranged into a gantt chart, then continue sorting the cranes using the SPT method or better known as shortest processing time.

Table 4. Recapitulation of production process jobs on the crane

Job	Crane	Crane	Crane	Crane	Crane
6	7	7	7	7	7
2	14	14	14	14	14
5	14	14	14	14	14
4	21	21	21	21	21
1	28	28	28	28	28
3	35	35	35	35	35

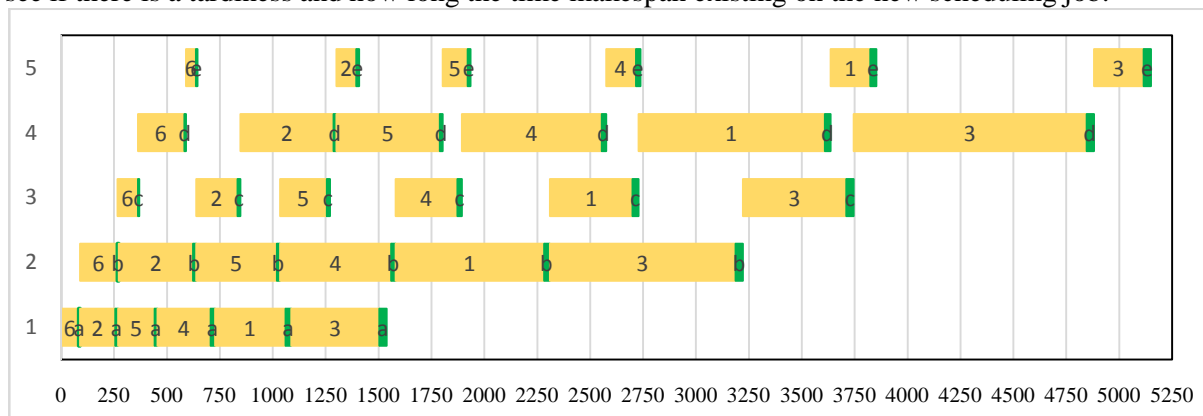
Because there is only one crane in the company, so to carry out 6 jobs multiplied by 5 shifts, the crane must be burdened to 30 jobs. Every transfer of production products from the first machine to the next machines that use cranes, later the order of transfer of those jobs on the crane will be given the order to a, b, c, d and e.

Table 5. Recapitulation of the order of the production process job on the crane

Job	Crane	Job	Crane	Job	Crane
6a	7	5a	14	1a	28
6b	7	5b	14	1b	28
6c	7	5c	14	1c	28
6d	7	5d	14	1d	28
6e	7	5e	14	1e	28
2a	14	4a	21	3a	35
2b	14	4b	21	3b	35
2c	14	4c	21	3c	35
2d	14	4d	21	3d	35
2e	14	4e	21	3e	35

Merging Job Data

After sorting the job data that is on the crane using the SPT method, then combine the two data into a gantt chart scheduling a new production job, where later the results of the gantt chart will only see if there is a tardiness and how long the time makespan existing on the new scheduling job.



Graph 2. Recapitulation of new scheduling results of the production process

After compiling the new job scheduling data using a combination of Hodgson algorithm method and SPT (Shortest Processing Time) method. To find out if there is Lateness (delay) in each job, then every Completion time (completion time) and due date (deadline) in each job will be calculated as follows:

$$\begin{aligned}Li_{\text{job 6}} &= C_i - d_i \\ &= 644 \text{ minutes} - 2880 \text{ minutes} \\ &= -2236 \text{ minutes}\end{aligned}$$

$$\begin{aligned}Li_{\text{job 2}} &= C_i - d_i \\ &= 1409 \text{ minutes} - 8640 \text{ minutes} \\ &= -7231 \text{ minutes}\end{aligned}$$

$$\begin{aligned}Li_{\text{job 5}} &= C_i - d_i \\ &= 1935 \text{ minutes} - 5760 \text{ minutes} \\ &= -3825 \text{ minutes}\end{aligned}$$

$$\begin{aligned}Li_{\text{job 4}} &= C_i - d_i \\ &= 2737 \text{ minutes} - 2880 \text{ minutes} \\ &= -143 \text{ minutes}\end{aligned}$$

$$\begin{aligned}Li_{\text{job 1}} &= C_i - d_i \\ &= 3852 \text{ minutes} - 4320 \text{ minutes} \\ &= -468 \text{ minutes}\end{aligned}$$

$$\begin{aligned}Li_{\text{job 3}} &= C_i - d_i \\ &= 5150 \text{ minutes} - 2880 \text{ minutes} \\ &= 2270 \text{ minutes}\end{aligned}$$

The calculation above shows the positive Lateness value in job 3, which is 2270 minutes. So it is known that the positive value that occurs in job 3 is Tardiness (positive late) and the total time to complete the entire production process (makespan) is 5150 minutes.

5. Conclusion

In this research, it can be concluded that from the preparation of new scheduling by using a combination of Hodgson algorithm method with Shortest processing time (SPT) method which is then compiled and merged into a Gantt chart, has minimized the number of job delays and reduced time makespan. In the development of future research, it is necessary to add several other scheduling methods in comparison, in order to allow for a smaller time than previous scheduling methods.

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