This research was conducted at PT. Tritunggal Putra Perkasa, which manufactures a wide range of shoes. Subject matter in this research is applying the method of approach to the simulation of production scheduling in the Arena. This is done because the company often experience delays in order, so that the fulfillment of consumer needs can not be met. Process in the manufacture of shoes include process of cutting, printing, sewing, assembling and packaging. Before using ARENA simulation, this research compares the first production scheduling between conventional by using method of the CPM (Critical Path Method), then use the simulation Arena. Scheduling production of the company in March with the arrival of as much as five orders. This company spent 36 days with 3 days delay experience with sequencing work of A-B-C-D-E, delays occurred in the work of c. results from application of the CPM method i.e. spent 36 days but not delay occurs with sorting jobs A-B-C-D-E. After that is done the application of simulated scheduling in the production Arena, so take only 34 days with sorting jobs A-B-C-D-E. So the company will not experience the delay and gain the trust of the buyer.

Keywords: Conventional, CPM, Simulation, Arena

1. INTRODUCTION

In the globalization as it is today, the industry can be a service industry as well as industrial products that have high system complexity. This requires the company to plan production systems is more effective and efficient. Production system that is effective and efficient able to improve existing resources, reducing waiting time, reduce some of the delay on work that has a deadline of completion, and to squeeze production costs so the company will gain (Assauri, 2004). To maximize production process naturally done with attention to factors such as raw materials, labor, work environment, as well as the decision adopted by the company to process the operations of the production, so it needed a system modeling.

Models play an important role for the company as it can save cost, time, or other precious commodities but it can not be risk of damage to the system. With such a model is needed in the application of real system is hindered because of the cost, time, or not able to meet the market demand in the production process, a product undergoes a queue for the next production process, so that semi-finished product buildup occurs.

According to McLeod (2010), the system is a group of elements that are integrated to achieve the goal desired, a real system can be realized by determining factor variables and parameters. Whereas, the model is a simple representation of something real. It is for special conditions need to be build and study models in lieu of a real system.

PT. Tritunggal Putra Perkasa is one of the companies that produce shoes with different models. In addition, to producing shoes with patent brand PT. Tritunggal Putra Perkasa son of mighty, this company also manufactures shoes from the order buyer. The uncertainty of the order of the buyer, causing scheduling production
company was not effective, so the cause is not able to meet the market demand. PT. Tritunggal Putra Perkasa has only one line, resulting in the production process should alternate between producing shoes order buyer and brand company patents. To overcome these problems there has to be a simulation modeling system for scheduling production. This model approach using simulation with software Arena.

Research conducted Wahyani & Ahmad (2010), explains that in the existing production system with random input data analyzed by simulation of the Arena so that the known existence of the bottle neck, for it must be the existence of a standard on every production process.

2. A REVIEW OF THE LITERATURE
2.1. The Production Process

The production process is a set of transformation activities that transform inputs (material, man, method, money, machine, information, and environment) into outputs (products, services, and waste) that has a added value.

The production process can be categorized into two types, namely:

1. The production process according to the purpose of the operation (Pujawan, 2010):
   a. Engineering to Order (ETO) is the Booker asks manufacturers to make products that began the process of design.
   b. Assembly to Order (ATO) is a manufacturer of a particular combination of assemble thresholds have been set that can be strung together for many different types of products.
   c. Make to Order (MTO) is a manufacturer of a product to directly fulfill orders from consumers.
   d. Make to Stock (MTS) is a manufacturer make items completed and placed in preparation before orders are accepted for consumers in anticipation of consumer demand in the event of an increase in arrived.

2. The production process according to the flow of operations and Product Variations (Pujawan, 2010):
   a. Flow Shop is the conversion process where each unit of output in successive takes part through the same sequence of operations on the special machines, usually placed along the path of the production. This type of process is typically used to design products that have a broad base, required the preparation of form production process flow is usually an MTS shop.
   b. Job shop is the conversion process where units – the unit for different orders will follow a different order also through work centers grouped by function. The volume of production of each type of product, production lot variations, long production of each product is long, and there is no specific production pathway.
   c. Batch is the process that produces many variations of products and volume, long production for each product, and one production pathway can be used for several types of products. On these systems, the manufacturing of products with a different type will result in the substitution of equipment production.
   d. Project is the creation of a type of complex products with a definition of the sequence of tasks regularly will need resources and time are limited by the settlement. In project types, several functions affect the production such as planning, design, procurement, marketing, the addition of a personal or machine (which is usually conducted separately on job shop and flow shop) should I integrate my compliance with the order timeline of completion, so that it reached the settlement.
2.2. Production Scheduling

Scheduling is a process of allocating the engine resources to select a set of tasks that are carried out in a given period. The sense of the above can be divided into two different meanings. Scheduling is sorting product manufactured thoroughly worked on several machines (Ginting, 2009). So, the production scheduling is a form of ordering products or services, work well on multiple machines as well as the allocation of resources that support the production process takes place.

Production scheduling has some activity in the production systems, which have a specific purpose (Herjanto, 2001), namely:

1. Loading
   Loading aims to plan between the requested requirements with existing capacity.
2. Sequencing
   Sequencing aims to make the priority of the workmanship in processing orders.
3. Dispatching
   Dispatching command aims to provide employment to any machine or other facilities.
4. Updating Schedule
   Implementation of production schedule usually there are always new problems that are different from the moment of creation, then schedule the schedule should be updated when there are new issues that need to be accommodated.
5. Control performance of production scheduling by way of:
   a. Monitor progress achievement of order fulfillment in all sectors.
   b. Redesign sequencing when there are errors or there is a top priority of the new.

2.3. Simulation

According to Kakiay (2004), stating that the simulation is a system which is used to solve problems in real life full of uncertainty by using a particular method or model and emphasis on the use of computers to get the solution. By performing simulations, will be able to provide an alternative and also a solution to solving the problem that is being researched. Simulation models describe the relationship between the input and output of a complex system. The most important thing when doing a simulation is doing to the problem of mapping a complex system.

The main advantage of the method of simulation are as follows (Law & Kelton, 2000):

1. A model that has been developed can be used over and over again to analyze the new model.
2. A model that has been developed can be used over and over again to analyze the new model.
3. Simulation allows to estimate performance of the system is reviewed in the desired condition.
4. Alternative to the draft system can be compared to a simulation to see which one is best according to the desired requirements.
5. In the simulation we can maintain better research conditions than when performed on the system directly.
6. Simulation allows us to do a study of a system with a long period of time in a short time.

2.4. CPM (Critical Path Method)

Critical Path Method (CPM) is a technique to analyze network activity or activity when executing a project in order to predict the total time. In addition, CPM
can determine the quickest time so that the project can be completed and only had the fewest errors. According to Gray and Larson (2006), CPM is the basic techniques to determine the sequence and time of activity, which in turn can then be used to estimate the time of completion of the activities as a whole.

CPM (Critical Path Method) has a few terms:

- **ESD (Earliest Starting Date)** is the fastest time a job can begin.
- **EFD (Earliest Finishing Date)** is the fastest time a job can be completed.
- **LSD (Latest Starting Date)** is the time of the slowness of a job begins.
- **LFD (Latest Finishing Date)** is at most time a job must have completed

Basic assumptions in calculating the CPM (Critical Path Method) are:
1. The project has only one initial event (start) and a terminal event (the finish).
2. Fastest time of occurrence of the initial event is day zero.
3. The slowest time of the occurrence of the event is the terminal LS = ES.

### 2.5. Arena

Arena is simulation software that uses the microsoft windows system consisting of block – the block module. Software based on object oriented arena. This software is made by the company Rockwell who can into the science of engineering industry, from manufacturing to science the science of supply chain (including logistics, warehousing, and distribution). Software ARENA can also be used in simulating system of customer service to internal business processes.

In the arena will be simulated models have been set up previously with the primary or secondary input data as a resource to operate (Wahyani & Ahmad, 2010). Provide an alternative arena and templates are interchangeable from model simulation and model simulation analysis graphs that can be combined in creating a model – model simulation that is quite extensive and varied.

Special arena software to resolve the problem – the problem of discrete system simulation. Advantages of arena is having the capability of processing statistical data. Using this software will save you big expenses before making changes or solve a model.

In running the simulation using software Arena, in entering the process needed some actual data into the making of the animated model. For it to become an election some basic panel process as images that represent the actual simulation process into the software Arena. Panel basic process used in the manufacture of model simulation consists of a variety of modules to run the command simulation.

### 3. RESEARCH METHODOLOGY

#### 3.1. Identification and formulation of the problem

Phase identification and formulation of these problems concerns the determination of the specific area of an industry that made the object of research in this line production at PT. Tritunggal Putra Perkasa. It is the basis in the identification and formulation of this problem is based on the background that wants to canvassed earlier.

#### 3.2. Data Collection

The data collection phase is divided into study the field and study of literature. Fieldwork is a stage involving data collection in the field. Data that question is general data company, the product and its specifications, production machines, the number of operators, the production floor layout, the number of
monthly and annual production, the production process and production time. While the study of literature collection.

3.3. Data Processing
Data processing in this research are translated into 3 production scheduling method that is scheduling the production of conventionally, production scheduling with CPM, scheduling and production with the model simulation arena.

3.4. Conventional Production Scheduling
This stage, the production scheduling is carried out in accordance with the fact that already applied in the company. Data that is processed is adapted to consumer demand.

3.5. Production Scheduling With CPM
Production scheduling with CPM is performed to find the critical path that has the longest time sequence.

3.6. The making of a Model Simulation
Before his modelling through the simulator, then the production process created in the conceptual model that is an illustrative image display that describes the flow of processes and data. In this conceptual model each process is represented by a block process, output (data stream out) of each of these blocks will be shown on the display as blocks of information, or be stored on blocks of data storage for later processed back to the input (incoming data streams) on the input data block. On the block display of data can be obtained in the form of productive time.

3.7. Verification
Verification refers to the how to build a model correctly. At this stage the conventional model compared to the models that are created on the computer, where the model on a computer should be a description of conventional models. For that model should be built gradually with the go into details.

3.8. Run Simulation
This stage is the process of running a simulation of the model have been made before. The approach that many are running simulations to stable condition is reached. Another approach that is running simulations for the period of time that is set on its own, for example in one month or one year. The last approach is to collect as many samples to do hypothesis testing.

3.9. Validation
Validation refers to how to build the model are correct. This stage is used to determine that the model has to represent accurately the actual system. Validation is usually reached after calibration of the model, namely a series of process of iteration in comparing the models with the actual system. This process is repeated continuously until retrieved the right model. A valid model is a model that gives the output averaged with the same output averaged an actual system.
3.10. Conclusions and Suggestions

This stage is the final stage of research. Of analysis conducted is expected to provide information for the management of the production scheduling is more structured.

4. DISCUSSION

The jobs that are necessary in the production process the manufacture of shoes include:

1. Cutting
   Ingredients of the Department of material to be cut according to the pattern or design which has been determined based on the classification of the order. The result of the process the Department will go to the Department of printing but there are some components that go directly to the Department of sewing.

2. Printing
   The process of printing is the process of silk screen and embos some components of shoes. The part that is in place and is generally part of the insole, whereas the part on the sablon and embos part quarter, tongue, Visa, the back counter, and others.

3. Sewing
   Ingredients of Department cutting of pieces, sewn in the sewing, shaped until being transferred to the upper part of the assembling.

4. Assembling
   Assembling Department working on Assembly process of shoe upper and sole (bottom) combined with a process that is done in this Department became the product of shoes.

5. Packing
   The process of packaging is the final process of some production processes, in this process include the snapping insole, shock and sumpal paper granting, as well as cleaning shoes, mounting the hangtag, inserted into the inner and outer shoes.

4.1. Conventional Scheduling System PT.Tritunggal Putra Perkasa

Table 1: Purchase Order Period March 2017

<table>
<thead>
<tr>
<th>Job</th>
<th>Buyer</th>
<th>Article</th>
<th>PO Date</th>
<th>Due Date</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Natzuno</td>
<td>Borneo</td>
<td>01 Maret</td>
<td>09 Maret</td>
<td>1000</td>
</tr>
<tr>
<td>B</td>
<td>Air Pro</td>
<td>Diego</td>
<td>09 Maret</td>
<td>24 Maret</td>
<td>1800</td>
</tr>
<tr>
<td>C</td>
<td>Little M</td>
<td>Owen 6</td>
<td>10 Maret</td>
<td>22 Maret</td>
<td>3300</td>
</tr>
<tr>
<td>D</td>
<td>Deira</td>
<td>Roberta 03</td>
<td>21 Maret</td>
<td>31 Maret</td>
<td>1500</td>
</tr>
<tr>
<td>E</td>
<td>Natzuno</td>
<td>Baldwin</td>
<td>23 Maret</td>
<td>29 Maret</td>
<td>800</td>
</tr>
</tbody>
</table>
Table 2. Data Completion Of Job Orders Periode March 2017

<table>
<thead>
<tr>
<th>Job</th>
<th>PO Date</th>
<th>Due Date</th>
<th>Finish Date</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>01 Maret</td>
<td>09 Maret</td>
<td>09 Maret</td>
<td>1000</td>
</tr>
<tr>
<td>B</td>
<td>09 Maret</td>
<td>24 Maret</td>
<td>20 Maret</td>
<td>1800</td>
</tr>
<tr>
<td>C</td>
<td>10 Maret</td>
<td>22 Maret</td>
<td>27 Maret</td>
<td>3300</td>
</tr>
<tr>
<td>D</td>
<td>21 Maret</td>
<td>31 Maret</td>
<td>31 Maret</td>
<td>1500</td>
</tr>
<tr>
<td>E</td>
<td>23 Maret</td>
<td>29 Maret</td>
<td>29 Maret</td>
<td>800</td>
</tr>
</tbody>
</table>

In doing scheduling, the company uses the rules of First Come First Served (FCFS). With the FCFS method, job comes first is processed first, and the last job come, processed after first job comes complete. But it could be a job come first have a time limit longer than job that comes last. The company is not paying attention to the due date for a product that was down the order. So, these companies often experience a delay.

Table 3. The scheduling results with FCFS

<table>
<thead>
<tr>
<th>Job</th>
<th>Finish Date</th>
<th>Finish Schedule</th>
<th>Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>11</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

4.2. CPM Scheduling System

Completion of the work in putting together a diagram of the network's first known work which should be done in advance so there are no delays.

Table 4. Long Work Each Department

<table>
<thead>
<tr>
<th>Job</th>
<th>Cutting (Hour)</th>
<th>Printing (Hour)</th>
<th>Sewing (Hour)</th>
<th>Assembling (Hour)</th>
<th>Packing (Hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>3</td>
<td>21</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>3</td>
<td>24</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>8</td>
<td>6</td>
<td>37</td>
<td>21</td>
<td>5</td>
</tr>
<tr>
<td>D</td>
<td>7</td>
<td>4</td>
<td>26</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>3</td>
<td>2</td>
<td>14</td>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>
Based on CPM calculation tables so the sequence of activities is A-B-C-D-E so as not to experience a delay. Critical path of this activity is the starting job A to D, has the longest completion time IE 36 days and have slack (looseness) of 0 days.

4.3. Production Scheduling with ARENA Simulation Approached

Before doing the modeling simulations must create a model conceptually. Conceptual model here is a depiction of the concept model of the shoe-making industry at PT. Trinity Putra Perkasa. A conceptual model is composed of 2 kinds, namely process flow and activity cycle diagram (ACD).
Picture 3. Process Flow

Picture 4. Activity Cycle Diagram Manufacture of shoes

Picture 5. Alternative Simulation Arena Schedule C
Table 6. Conventional Validation Table and Simulation

<table>
<thead>
<tr>
<th>Job</th>
<th>Konvensional</th>
<th>Job</th>
<th>Simulasi</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>A</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>C</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>11</td>
<td>B</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>D</td>
<td>7</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>E</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td></td>
<td>34</td>
</tr>
</tbody>
</table>

With experienced delays in job C for 3 days while using the simulation arena did not experience delays and have slack (time allowances) for 2 days.

5. LID
5.1. Conclusion

PT. Tritunggal Putra Perkasa is a company engaged in the field of national-scale shoe. The company is also working with several buyers who have the popular shoe brand Water Pro, Little M, Nevada, and Cole.

The conclusions of the research to the production scheduling at PT. Tritunggal Putra Perkasa using 3 methods i.e. conventional, Critical Path Method (CPM) and simulation approaches the Arena are:

Table 7. The Results Of The Comparison Production Scheduling

<table>
<thead>
<tr>
<th>Job</th>
<th>Konvensional</th>
<th>Job</th>
<th>CPM</th>
<th>Job</th>
<th>Arena Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>A</td>
<td>6</td>
<td>A</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>C</td>
<td>11</td>
<td>C</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>11</td>
<td>B</td>
<td>7</td>
<td>B</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>D</td>
<td>8</td>
<td>D</td>
<td>7</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>E</td>
<td>4</td>
<td>E</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>36</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delays</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

So the order scheduling the production of conventionally is A-B-C-D-E which takes over 36 days with experienced delays for 3 days. Calculation of the CPM are correct there is no schedule experienced delays because it was in sequencing
started from job A-B-C-D-E but the time used to produce shoes in the presence of the order of 5 buyer takes as much as 36 days.

While using the simulated approach Arena overall faster time obtained i.e. 34 days compared to conventional production scheduling already applied in the company of PT. The mighty son of Trinity with the sequence of jobs A-B-C-D-E. Thus, the company PT. Trinity will not experience a loss of confidence in the buyer.

5.2. Suggestion

Can the author convey advice against the results of this research are:

1. When receiving the order, the company must first check the description of the due date of the paper PO, so the company is no longer experiencing delays for order fulfillment.
2. The addition of time for each production department should be more detailed, allowing the company to easily determine which orders will be completed first.

BIBLIOGRAPHY