

Planning Production Capacity Optimisation with Rough Cut Capacity Planning

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ABSTRACT

PT. XYZ is a manufacturing company that produces polyethylene plastic. In some periods, the company is not able to meet consumer demand as requests exceed available production capacity. This study aims to determine the work centre that is experiencing a shortage of production capacity and production capacity planning is proposed as an alternative work centre to optimise production capacity at minimal cost using Rough Cut Capacity Planning (RCCP). This type of research is descriptive. Data was collected through interviews and observations and used to perform capacity planning, i.e. the company's policy of data, company resource data, cost data, and historical demand data. Data processing begins with forecasting consumer demand while RCCP is used to determine the work centre that is experiencing a shortage of production capacity. The proposed production capacity is used as an alternative work centre in increasing production capacity. The results from this study, including the estimated plastic demand for the coming 12 months are 434 766 Kg; There are four work centres that are experiencing a shortage of production capacity at the company, which is cutting manual work centre, work centre cutting machines, sealing work centre and work centre printing; fulfilment capacity planning alternative is a recommendation that is considered to be the most optimal. The results of the proposed production capacity planning show that all estimates of consumer demand can be met and will increase the company's revenue by 31.54%.

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INTRODUCTION

Consumer demand for a product can be fulfilled entirely in the master production schedule if supported by production

capacity according to production requirements. Master production schedule can be realised easily if consumer demand is constant, but in fact companies often experience fluctuations due to unstable demand. According to the 2014 data released by Central Statistics Agency in 2014, the average index of industrial production on annual basis in Indonesia is quite volatile. This means that the level of industrial production in Indonesia has not been stable and has fluctuated from year to year.

According to Reid & Sanders, *“Capacity planning is the process of establishing the output rate that can be achieved by a facility. Planning for capacity is important if a company wants to grow and take full advantage of demand”* (2013, p. 334). According to Liske (2012) (in Hutagalung, Rambe, & Nazlina, 2013) if capacity planning is executed well, it can meet the demand of existing customers as well as be able to increase the company’s revenue. Ria Amalia (2012) (in Hutagalung, Rambe, & Nazlina, 2013) opines that consumer demand can be met by adding machines at the work centre that is experiencing a shortage of capacity.

PT XYZ is a manufacturing company engaged in the manufacture of plastics. A type of plastic that is produced by this company are plastic polyethylene which is usually used for packaging, for example, food and beverages, vehicle parts, as well as other objects. The Company’s B2B (Business to Business) system where plastic products are produced and supplied

only to a few companies have formed a partnership. Companies often encounter obstacles to determine the optimum amount of production due to fluctuating demand. In addition, the company faces difficulty in meeting the demand of consumers when demand soars as the production capacity of the company is limited. If this continues, the company will cease to make profits as well undermine consumer confidence.

Rough Cut Capacity Planning (RCCP) is an approach to planning production capacity for medium-term and long-term. The RCCP provides capacity needs for labour departments, individuals, or work centres based on workload data. This technique is used to explain/verify capacity in each work centre which compares the required engine load with the available capacity in each work centre. The RCCP asks the question: ‘Do we have enough equipment, people, material and time to meet sales and execute current operating plan?’. If the answer is no, some rethinking is required. *“RCCP also used to sanity check and validate the quantities and dates in the master schedule before it is released by the master scheduler.”* (Proud, 2007, p. 37). This study will use the RCCP approach to help resolve the problem of production capacity at PT XYZ.

Angalakuditi & Kurnool (2013) argued that the process of capacity planning is the process of determining the needs of people, machines, and physical resources to achieve a company’s production. With the shortage of capacity or excess capacity, the benefits of planning and control systems

for effective manufacturing will not be met. It requires a Master Production Schedule (MPS). The RCCP is used to test the MPS offered at work places (also known as work centres in this paper) and departments.

This study aims to determine the work centre that is experiencing a shortage of production capacity and production capacity planning is proposed as an alternative to optimise production capacity but with minimal production costs by using Rough Cut Capacity Planning (RCCP).

LITERATURE REVIEW

Rough cut capacity planning (RCCP) is a quick way to assessing whether the MPS is achievable. It provides a way for the master scheduler to assess the feasibility of any proposed changes to the plan. An RCCP can quickly intervening assess the feasibility of any MPS changes by Comparing load scenarios with particular capacity bottlenecks or, in overall terms, by using the known actual availability of capacity. (Harrison, 2011, p. 52).

According to Proud *“Rough cut capacity planning helps to identify the material and personnel shortages, the lead-time constraints, and the capacity issues that make it possible to create a supply (production) plan and master schedule that can be executed with every expectation of success. In short, rough cut capacity planning makes it possible (1) to test the validity of a supply (production) plan and master schedule before doing any detailed material/capacity planning, and*

(2) to initiate action for making mid- to long- range capacity adjustments.” (2007, p. 401)

The RCCP is defined as *“the process of conversion of production plans and / or MPS to the capacity needs related to critical resources such as labor, machinery and equipment, warehouse capacity, the capacity of suppliers of material and financial resources.”* (Gaspersz, 2005, p. 85).

“Rough Cut Capacity Planning is the conversion of production scheduling Home (MPS-Master production Schedule) to the energy needs of core resources, and then determine whether scheduling the main possible within the determinants of production capacity.” (Najy, 2014, p. 54). In short, according to Proud (2007, p. 400), *“rough cut capacity planning makes it possible (1) to test the validity of a supply (production) plan and master schedule before doing any detailed material/capacity planning, and (2) to initiate action for making mid- to long-range capacity adjustments.”* With RCCP, barriers to implementing a plan can be identified quickly by the team leader and master scheduler without wading through all the details. They only need to focus on the key or important resources within the company. Key resources can include labour, equipment, materials, floor space, the ability of the supplier, and, in some cases, money.

Rough cut capacity planning process contains three basic steps (Proud, 2007, p.404), namely:

1. Calculate the capacity needed for achieving the production plan and master schedule.
2. Comparing the required capacity with planned capacity.
3. If possible, adjust plans and / or capacity so that both become balanced.
4. If the rough cut capacity planning finds that the planned capacity is not able to support the plan due to resource issue, the information will then be given to the management and planners who will then make alternative capacity planning.

Based on the above steps, the validation process begins when data from the production plan and / or master schedule is entered into the rough cut capacity planning system. In order to meet the production plan, modules rough cut capacity planning software is used determine the required capacity needed based on information from the production plan and resource profile. After that, the required capacity is compared with the producer's and supplier's planned capacity and capabilities to determine whether there is sufficient capacity or not. If deemed adequate, the production plan is considered realistic and will be used to create a master schedule and a detailed plan of the material/capacity. If key resources of the planned capacity cannot support the plan, then the scheduler management and teachers must either change the production plan or increase the capacity of the resources.

There are three techniques that can be used to perform calculations for Rough Cut Capacity Planning, namely:

1. Approach total factor (Capacity Planning Approach Using Factor Overall, CPOF).

The CPOF requires three inputs, namely MPS, the total time required to produce a product, and the proportion of time for the use of resources. The CPOF multiplies the total time of each family to the number of MPS to obtain the total time required to achieve the MPS mill. Total time is then divided into time use of each resource by multiplying the total time of the proportion of the use of resources.

2. Approach the list of labour (Bill of Labor Approach, BALL)

The required capacity is obtained by multiplying the time of each component listed in the workforce with a number of products from MPS.

3. Approach the source profile (Resource Profile Approach, RPA)

When the resource capacity problems have been identified and analysed, the next step is to evaluate potential solutions. First, determine if the action is really needed for each resource. The challenge is to have the necessary capacity equal to the capacity planned between acceptable limits.

In a situation that is not balanced, there are three options for action: (1) Modifying the production plans in accordance with the capacity, (2) Adjust the capacity to

achieve the required capacity, (3) Perform a combination of both actions. The second option is used more often (Proud, 2007, p. 155).

RESEARCH METHODOLOGY

This research was conducted between September 2014 and January 2015 with PT. XYZ, a plastic manufacturing factory. The instruments used in data collection are literature research of books and the internet as well as field research through interviews and observations. The data collected was used to perform capacity planning; data included the company's policy of data, company resource data, cost data, and historical demand data.

Optimisation criteria required to design aggregate planning on PT. XYZ include:

a. Forecasting

Variables used in this study are used to forecast demand for plastic products in PT. XYZ, where forecasting is done for next year based on demand for plastic in the previous year.

b. Rough Cut Capacity Planning (RCCP) and alternative solutions

Variables used in this research is used to calculate the rough cut capacity planning and to determine the most efficient alternative solutions. The following are needed to do the calculations for RCCP:

- Data Company Policy

The company policy in this study is the policy of the company related to

the company's production activities. Data below relates to the policy in PT. XYZ:

1. Normal working days: Monday-Friday.
2. Normal working hours for workers in the factory: 8 hours/day
3. Overtime hours for workers in the factory: max. 2 hours/day on Monday-Friday
4. Payment of wages: Normal wage rate applies for normal working days, wages for overtime on Monday-Friday is 1.5 times the normal wage rate while wages for overtime during holidays is twice the normal wage rate.

- Data Resources Company

company's resources used in this study relate to the company's production activities. There are five main work centres at PT. XYZ in the production process, namely blowing, cutting manual, cutting machines, sealing and printing. Data below relates to the production resources at PT. XYZ:

1. The number of machines and labour force available:
 - Blowing: five machines and five workers
 - Cutting machines: two machines and two workers
 - Cutting manual: null machine and six workers

- Sealing: two machines and two workers
- Printing: two machines and two workers
- 2. Time set up machines
 - Blowing: 0.5 hours
 - Cutting machines: 0.25 hours
 - Cutting manual: 0.25 hours
 - Sealing: 0.25 hours
 - Printing: 0.25 hours
- 3. The capacity of the machines
 - Blowing: 50kg/hours
 - Cutting machines: 70 kg/hours
 - Cutting manual: 10 kg/hours
 - Sealing: 70 kg/hours
 - Printing: 40 kg/hours
- 4. Operation time
 - Blowing: 0.02 hours/kg
 - Cutting machines: 0.0142 hours/kg
 - Cutting manual: 0.1 hours/kg
 - Sealing: 0.0142 hours/kg
 - Printing: 0.025 hours/kg

• Cost Data

In this study, cost data include costs used to provide alternative solutions for the fulfilment of the company's production capacity. Here are the data costs associated with production activities at PT. XYZ:

1. Normal wages: Rp10,000/hr.; part time wages: Rp7,000/hr
2. Overtime wages: Rp15,000/hr on normal working days; Rp20,000/hr on holidays.
3. Engine maintenance costs: Rp50,000/machines/months

4. The price of new machine:
 - Blower machine: Rp120 million/machines
 - Cutting machine: Rp80 million/machines
 - Sealer machine: Rp7 million/machines
 - Printing machine: Rp20 million/machines

Data processing will begin with forecasting based on historical demand data to obtain demand forecasting for plastic for the following year. Forecasting demand will be made based on the type of time series forecasting. There are seven forecasting models used; which are naïve, moving average, weighted moving average, exponential smoothing, exponential smoothing with trend, linear regression, and multiplicative decomposition. Once the data is processed and results obtained, the next stage is to compare each of the forecasting methods used to obtain results which are considered the most accurate. The method of forecasting is done by comparing the calculation results of MAD (Mean Absolute Deviation) and MSE (Mean Squared Error). Forecasting method chosen is one that has the smallest value of MAD, and MSE for having the lowest error rate or error. Forecasting results of the selected method will be used as a reference for further research activities.

The next stage in the research is to perform capacity planning by calculating the rough cut capacity planning using the results of demand forecasting future periods as a basis for planning. The RCCP

calculation will be performed on each work centre to find out if there is a shortage of production capacity. The RCCP would provide an alternative plan for the company to produce in order to meet consumer demand as well as the use of corporate resources effectively and efficiently. The parameter required is the capacity requirement and availability of resources. Both of these parameters will be compared to determine the production shortfall at each work centre in the company.

The next stage after the data is processed is to do the calculations for alternative solutions. Alternative solutions offered are different for each work centre and tailored to the needs and policies of the company. Alternatives offered include overtime, part-time employees, purchase of new machines, and a mixed strategy. A comparison of the alternatives that have been calculated is undertaken. Alternatives chosen are those that minimise production costs, optimise production capacity, and in accordance with the policy of the company. Selected alternatives are recommended for the company to overcome the problem of meeting consumer demand.

RESULTS AND DISCUSSION

Forecasting is done to determine the demand forecast for the period October 2014 to September 2015 using data from 21 previous periods starting from January 2013 until September 2014. Of the seven forecasting done (naïve method, moving average, weighted moving average, exponential smoothing, exponential

smoothing with trend, linear regression, and multiplicative decomposition), it was found that the Multiplicative Decomposition Value Mean Absolute Deviation (MAD) and Mean Squared Error (MSE) methods can be used as a basis for further research. Calculation and comparison of forecasting results for each method are done with the help of POM-QM software for Windows 3. Historical demand data and forecasting results of plastic products using multiplicative decomposition method can be seen in the following table.

Table 1
Demand for Plastic Products

| Month | Demand (Kg) |
|--------|-------------|
| Jan-13 | 27391 |
| Feb-13 | 37925 |
| Mar-13 | 30396 |
| Apr-13 | 30459 |
| May-13 | 38234 |
| Jun-13 | 34995 |
| Jul-13 | 30003 |
| Aug-13 | 32658 |
| Sep-13 | 37804 |
| Oct-13 | 27961 |
| Nov-13 | 38108 |
| Des-13 | 25064 |
| Jan-14 | 32750 |
| Feb-14 | 30695 |
| Mar-14 | 31581 |
| Apr-14 | 31447 |
| May-14 | 37504 |
| Jun-14 | 32772 |
| Jul-14 | 38991 |
| Aug-14 | 39432 |
| Sep-14 | 35029 |
| Total | 701199 |

Source. The results of processing data, 2015

Table 2
Forecasting of Plastic Products

| Month | Forecasting (Kg) |
|--------|------------------|
| Okt-14 | 33737 |
| Nov-14 | 36975 |
| Des-14 | 34072 |
| Jan-15 | 37340 |
| Feb-15 | 34406 |
| Mar-15 | 37705 |
| Apr-15 | 34741 |
| May-15 | 38070 |
| Jun-15 | 35075 |
| Jul-15 | 38435 |
| Aug-15 | 35410 |
| Sep-15 | 38800 |
| Total | 434766 |

The RCCP table contains a comparison between the available capacity and the capacity required at each work centred. Capacity required can be calculated using the equation:

$$\text{Capacity requirement} = (a \times d) + (b \times c)$$

- a: setup time (hours)
 b: the amount of demand forecasting results (Kg)
 c: the operating time (hours / unit)
 d: number of working days / month (days)

While the available capacity can be calculated using the equation:

$$\text{Capacity available} = d \times e \times f$$

- d: number of working days / month (days)
 e: number of hours / days (hours)
 f: the number of machines available production

Of the five work centres at PT. XYZ, namely blowing, cutting manual, cutting machine, sealing, and printing, four work centres experience a shortage of capacity in cutting manual, cutting machine, sealing, and printing. Table 3 shows the results of the calculation of capacity requirements and available capacity in the four work centres that experienced a shortage of capacity.

Table 3
Capacity Requirements and Availability

| Work Centre | Month | Capacity Requirement (Hours) | Capacity Available (Hours) | Description |
|-----------------------|----------|------------------------------|----------------------------|--------------|
| Cutting Manual | Oct 2014 | 1017.86 | 1104 | Sufficient |
| | Nov 2014 | 1114.25 | 960 | Insufficient |
| | Dec 2014 | 1027.66 | 1056 | Sufficient |
| | Jan 2015 | 1125.45 | 1008 | Insufficient |
| | Feb 2015 | 1036.68 | 864 | Insufficient |
| | Mar 2015 | 1136.65 | 1056 | Insufficient |
| | Apr 2015 | 1047.73 | 1056 | Sufficient |
| | May 2015 | 1147.35 | 1008 | Insufficient |
| | Jun 2015 | 1057.50 | 1008 | Insufficient |
| | Jul 2015 | 1158.05 | 960 | Insufficient |
| | Aug 2015 | 1067.30 | 960 | Insufficient |
| | Sep 2015 | 1169.25 | 1008 | Insufficient |

TABLE 3 (continue)

| Work Centre | Month | Capacity Requirement (Hours) | Capacity Available (Hours) | Description |
|------------------------|----------|------------------------------|----------------------------|--------------|
| Cutting Machine | Oct 2014 | 341.10 | 368 | Sufficient |
| | Nov 2014 | 372.53 | 320 | Insufficient |
| | Dec 2014 | 344.18 | 352 | Sufficient |
| | Jan 2015 | 376.41 | 336 | Insufficient |
| | Feb 2015 | 346.50 | 288 | Insufficient |
| | Mar 2015 | 380.29 | 352 | Insufficient |
| | Apr 2015 | 350.83 | 352 | Sufficient |
| | May 2015 | 383.67 | 336 | Insufficient |
| | Jun 2015 | 353.90 | 336 | Insufficient |
| | Jul 2015 | 387.04 | 320 | Insufficient |
| Aug 2015 | 356.98 | 320 | Insufficient | |
| Sep 2015 | 390.92 | 336 | Insufficient | |
| Sealing | Oct 2014 | 484.82 | 368 | Insufficient |
| | Nov 2014 | 530.05 | 320 | Insufficient |
| | Dec 2014 | 489.32 | 352 | Insufficient |
| | Jan 2015 | 535.48 | 336 | Insufficient |
| | Feb 2015 | 493.07 | 288 | Insufficient |
| | Mar 2015 | 540.91 | 352 | Insufficient |
| | Apr 2015 | 498.82 | 352 | Insufficient |
| | May 2015 | 545.84 | 336 | Insufficient |
| | Jun 2015 | 503.32 | 336 | Insufficient |
| | Jul 2015 | 550.78 | 320 | Insufficient |
| Aug 2015 | 507.82 | 320 | Insufficient | |
| Sep 2015 | 556.21 | 336 | Insufficient | |
| Printing | Oct 2014 | 343.12 | 368 | Sufficient |
| | Nov 2014 | 374.75 | 320 | Insufficient |
| | Dec 2014 | 346.22 | 352 | Sufficient |
| | Jan 2015 | 378.65 | 336 | Insufficient |
| | Feb 2015 | 348.56 | 288 | Insufficient |
| | Mar 2015 | 382.55 | 352 | Insufficient |
| | Apr 2015 | 352.91 | 352 | Insufficient |
| | May 2015 | 385.95 | 336 | Insufficient |
| | Jun 2015 | 356.00 | 336 | Insufficient |
| | Jul 2015 | 389.35 | 320 | Insufficient |
| Aug 2015 | 359.10 | 320 | Insufficient | |
| Sep 2015 | 393.25 | 336 | Insufficient | |

Source. The results of processing the data, 2015

In the table above, it can be seen that the company is unable to meet the required capacity so that the production process is not optimal.

Suggestions have been made in the proposal to the production capacity planning work centres that experienced a shortage of production capacity in order to meet consumer demand in full. There are several alternative strategies that can be offered to tackle the problem of shortage of production capacity at the work centre 4. Alternative strategies are offered, among others, overtime, purchase of new machines and increase the number of workers, hiring part timers and a mixed strategy.

In the work centre for cutting manual, two alternative solutions to cover the shortage of production capacity was made: overtime and increasing the number of part-time workers. Table 4 below shows the results of a cost comparison between these two alternatives.

Table 4
Comparison of Alternative Strategies Work Centre of Cutting Manual

| No | Alternatives Strategy | Cost |
|----|-----------------------|--------------|
| 1 | Overtime | Rp17,707,200 |
| 2 | Part-time workers | Rp8,263,360 |

Source. The results of processing the data, 2015

From the table above, it can be seen that the alternative strategy to employ part-time workers to overcome the shortage

of production capacity at the work centre cutting manual has a lower cost compared with the alternative strategy of using overtime hours.

In the work centre of cutting machines, only one kind of calculation to overcome the shortage of production capacity, namely alternative overtime. Below is a table of the alternative charge 5 results:

Table 5
Comparison of Alternative Strategies Work Centre of Cutting Machine

| No | Alternatives Strategy | Cost |
|----|-----------------------|-------------|
| 1 | Hour overtime | Rp6,063,406 |

Source. The results of processing data, 2015

To meet the shortage of production capacity at the work centre cutting machine, it is preferable for PT. XYZ to impose alternative overtime.

In the work centre of sealing, calculation of three kinds of alternative solutions to overcome the shortage of production capacity is made: vi alternative overtime, alternative engines and increasing the number of part time workers, and alternative mixed strategy. Alternative mixed strategy is a combination of the use of the melting clock and the purchasing of new machinery. Table 6 below shows results of cost comparisons among the three alternatives.

Table 6
Comparison of Alternative Strategies Work Centre of Sealing

| No | Alternatives Strategy | Cost |
|----|-----------------------|--------------|
| 1 | Hour overtime | Rp39,388,544 |
| 2 | Buy a new machine | Rp36,685,981 |
| 3 | Mixed Strategy | Rp21,128,204 |

Source. The results of processing data, 2015

From the table above, it can be seen that the alternative mixed strategy to overcome the shortage of production capacity has a lower cost compared with other alternatives.

In the work centre of printing, calculation of 2 kinds of alternative solutions to overcome the shortage of production capacity is to alternate overtime and increase the number of machines and part-time employment.

Table 8
Recommendations for Alternative Strategies

| No | Work Centre | Recommendations/Alternative | Cost |
|--------------|-----------------|-----------------------------|--------------|
| 1 | Cutting manual | Part-time workers | Rp8,263,360 |
| 2 | Cutting machine | Overtime | Rp6,063,406 |
| 3 | Sealing | Mixed strategy | Rp21,128,204 |
| 4 | Printing | Overtime | Rp6,376,050 |
| Total | | | Rp41,831,020 |

Source. The results of processing data, 2015

With the additional production cost of Rp41,831,020, - within one year, PT. XYZ can optimise its production capacity and meet consumer demand. The company will also increase the amount of revenue in the first year of Rp7,766,703,000 to Rp10,217,001,000, - by a margin of 31.54%.

Table 7 below shows the results of a cost comparison between these two alternatives:

Table 7
Comparison of Alternative Strategies Work Centre Printing

| No | Alternatives Strategy | Cost |
|----|-----------------------|--------------|
| 1 | Overtime | Rp 6,376,050 |
| 2 | Buy a new machine | Rp 9,392,153 |

Source. The results of processing data, 2015

From the table above, it can be seen that the strategy of using overtime hours as an alternative will result in lower costs as compared with the alternative strategy of adding capacity.

The results of the alternative recommendation for four work centres in PT. XYZ can be seen in the following table:

CONCLUSIONS AND RECOMMENDATIONS

PT. XYZ is a manufacturing company that produces polyethylene plastic. In some periods, the company is not able to meet consumer demand as demand exceeds production capacity.

Rough Cut Capacity Planning (RCCP) is an approach to planning production capacity for medium-term and long-term. This technique is used to explain/verify capacity of each work centre where a comparison is made between the required engines load and the available capacity in each work centre. In this study, we used a rough cut capacity planning approach to help resolve the problem of shortage of production capacity at PT XYZ.

Optimisation criteria required to design aggregate planning on PT. XYZ include forecasting, Rough Cut Capacity Planning (RCCP) and also alternative solutions. There are seven methods of forecasting compared with forecasting the amount of plastic demand, namely Naïve Method, Moving Average, Weighted Moving Average, Exponential Smoothing, Trend with Exponential Smoothing, Linear Regression, and Multiplicative Decomposition. The best forecasting method will be measured by the value of forecasting error, namely MAD and MSE that shows the smallest value. Data processing results show that forecasting method Multiplicative Decomposition has the smallest value of MAD and MSE, which is the most accurate forecasting method. Decomposition Multiplicative forecasting results shows plastic demand for following year.

Forecasting results will be used as a basis for further data processing in the calculation of capacity requirements by using Rough Cut Capacity Planning. Therefore, the calculation of the production capacity planning with a rough cut capacity

planning method (RCCP) would enable us to know where the work centre is having problems, namely shortage of production capacity which poses an obstacle to the company's entire production process.

Based on the calculation of rough cut capacity planning that has been done, it was found that from the existing five work centres in PT. XYZ, four experienced the problem of shortage of production capacity, namely the cutting manual work centre, cutting machines work centre, sealing work centre and printing work centre. Alternative suggested solutions have adapted to the needs of each work centre, company policies, available resources, and the most minimum cost. By implementing alternative suggested solutions, the company could increase its income and optimise production capacity to meet the demand of the consumer.

Data shows that the best alternative solution for cutting manual work centre is to hire additional part-time workers; the best alternative solution for cutting machines work centre is to apply the overtime hours for employees of the cutting machine; the best alternative solution for sealing work centre is mixed strategy consisting of the application of overtime hours, buying new machines, and employ part-time workers; and the best alternative solution for printing is to apply the overtime hours for employees of the printing. By implementing alternative solutions offered in each work centre, the company will also increase the amount of revenue in the first year from Rp7,766,703,000, to Rp10,217,001,000 by a margin of 31.54%.

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