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Analysis of production capacity planning to meet the consumer request using the Rough Cut Capacity Planning (RCCP) method in PT. Maccon Generasi Mandiri Makassar, Indonesia

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Abstract

Maccon Generasi Mandiri Makassar company is one of a manufacturing company engaged in the production of light brick AAC (Autoclaved Aerated Concrete). PT. Maccon Generasi Mandiri Makassar has a production capacity of 15024 m^3 in a month or 180288 m^3 in a year. However, with this capacity, the company is often unable to meet high consumer demand of 181450 m^3 in a year due to less than optimal engine performance, a number of hours of work and an unbalanced workforce in the producing light brick of ACC (Autoclaved Aerated Concrete). This requires the company to plan the optimal production of capacity in order to fulfill the consumer demand in a timely and appropriate amount so that the expected of company profits will be increased. The purpose of this research is to plan production capacity in the future based on the demand rate of the consumer using the Rough Cut Capacity Planning (RCCP) with the method is Bill of Labor Approach (BOLA) technique. Based on the data processing which has been done, the recommended made were a combination of engine additions and working time. This is realized to fulfill the lack of production capacity. For the January Period = 19872 hours/month, February = 19008 hours/month, March = 19872 hours/month, April = 19008 hours/month, May = 18144 hours/month, June = 18144 hours/month, July = 19872 hour/month, August = 18144 hours/month, September = 17280 hours/month, October = 18144 hours/month, November = 18144 hours/month, December = 17280 hours/month.

Keywords: Production schedule; Capacity planning; Light brick; RCCP; Bill of Labor

1. Introduction

The capacity of the maximum capability of a system or production unit to complete a work target. Knowing the optimal production unit capacity will benefit its application. Production capacity that can be produced within a certain period of time is using available resources [1]. Production capacity planning is the process of selecting resource requirements such as machine, labor in accordance with the company production planning [2].

Maccon Generasi Mandiri Makassar company is one of a manufacturing company engaged in the production of light brick AAC (Autoclaved Aerated Concrete) with the brand Maccon AAC (MAC). Maccon Generation Mandiri company conducts the production process using a mixer machine, which functions to mix cement, silica sand, lime, water, and some additives. Then put into the molding machine (mold). after being cut using a vertical shaped cutting machine measuring 20 cm and horizontal 60 cm and thickness 10 cm. After that, the oven was conducted by using an autoclave machine. With this process, the company is able to produce brick with a production capacity of 72 m^3/hours. PT. Maccon Generasi Mandiri Makassar has a production capacity of 180288 m^3/year. But with that capacity, this company

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often does not meet high consumer demand of 181450 m^3/year. Because it lacks optimal machine performance, the number of hours worked and labor is not balanced in producing light bricks ACC (Autoclaved Aerated Concrete).

Based on the background, for that, I conducted a production capacity planning analysis study of the consumer demand by using the Rough Cut Capacity Planning (RCCP) method at Maccon Generasi Mandiri Makassar company, in the hope that the company can make the right production planning can meet consumer demand.

2. Methodology

2.1. Time and Place of Research

The place of research in this writing is done in PT Maccon Generasi Mandiri Indonesia located in JL. Pangeran Diponegoro No. 95 AF, Makassar, South Sulawesi. The research was conducted in January 2019. The time of research is for one month.

2.1.1. Type and Sources of Data

Data used in this research is quantitative data, that is data obtained directly from PT Maccon Generasi Mandiri Makassar is a data on the number of work stations, labor, working hours, demand data, and time of each work station process.

2.1.2. Data Source

The data used in this study are as follows:

- Primary data, the results of data processing that have been carried out in this study are standard time data, forecasting data, master production schedule data, capacity data available, and required data capacity.
- Secondary data, ie data obtained from the documents and materials related reports or closely associated with this research namely production data PT. Maccon Generasi Mandiri Makassar.

2.2. Method of Collecting Data

Methods of data collection in the research are as follows:

Field research

- Observation of data collection is done by observing the object observed on PT. Maccon Generasi Mandiri Makassar on the production department.
- Interviews of data collection by conducting a question and answer directly to the production department staff PT. Maccon Generasi Mandiri Makassar.

2.3. Approach to Research Methods

The method used in this study is the Rough Cut Capacity Planning (RCCP) method with a Bill Of Labour Approach (BOLA) technique. Rough Cut Capacity Planning (RCCP) is a method is a plan to test the availability of production capacity available in the Master Production Schedule (MPS) [3, 4, 5]. Bill of Labour Approach (BOLA) technic is the number of needs needed by multiplying the time matrix with the production matrix [6]. The data needed is:

- Determination of MPS
- Determination of matrices namely standard time matrix and production matrix
- RCCP = (Time Matrix) x (Productions Matrix).

3. Results and discussion

The Product Used In This Research Is Light Brick Aac (Autoclaved Aerated Concrete) With The Maccon Brand AAC (MAC). Through 3 work stations namely Mixer, Cutting Machine, and Autoclave Machine.

Before data processing, data collection is carried out first such as time data for each work station, data on the number of working days, data on the number of hours worked, data on the number of workers and product demand data in January-December. The data used in this study are data on the number of workers as shown in Table 1, data for List of Working Hours as in Table 2 and data for Light Brick demand as shown in Table 3.

Table 1 Data Number of Labour

No	Work Centre	Labour
1	Mixer	12
2	Cutting	12
3	Autoclave	9
Total		33

Table 2 List of Working Hours

Shift	Working Hours (Jam)	Break (Jam)
Morning	08.00-12.00 13.00-16.00 13.00-15.00	12.00-13.00
	13.00-16.00 21.00-24.00 19.00-23.00	
Afternoon	16.00-20.00 05.00-08.00	20.00-21.00
	21.00-24.00	
Night	00.00-04.00	04.00-05.00
	05.00-08.00	

Table 3 Light Brick Demand Data

Period 2018	Month	Demand (unit)
1	January	16800
2	February	15600
3	March	14850
4	April	16200
5	May	15900
6	June	16100
7	July	14300
8	August	13400
9	September	13000
10	October	14200
11	November	15400
12	December	15700
Total		181450

The data on labor time at the Work Center (WC) is 10 minutes on the WC Mixer, 8 minutes on the WC Cutting and 240 minutes on the WC Autoclave.

3.1. Calculating the standard time of each work station

For calculation of cycle time measurement, normal time and standard time of each production process taken from the average time of each production process of each work station carried out by the company, the production process includes the process of Mixer, Cutting, and Autoclave. The results of the calculation of the standard time for each work station obtained the standard time at the Mixer work station = 19 minutes, the cutting work station = 9.57 minutes and the Autoclave work station = 47.85 minutes

3.2. Forecasting

Forecasting is the process of estimating future needs in a period of time by looking at the level of consumer demand for a product [7]. Where in this study the demand data was taken from January to December 2018 which was obtained directly from the company. Based on the results of data processing with the Linear Regression forecasting method using the POM-QM software application for windows as attached, then get the forecasting results as in Table 4.

Table 4 Light Brick Forecasting Data

Period	Month	Forecasting (unit)	Period	Month	Forecasting (unit)
1	January	15963	7	July	15045
2	February	15810	8	August	14892
3	March	15657	9	September	14739
4	April	15504	10	October	14586
5	May	15351	11	November	14433
6	June	15198	12	December	14280
The number of forecasting results from January to December = 181458					

3.3. Master Productions Schedule

The master production schedule is a production plan using the relationship between the quantity of each type of product at a certain period [8, 9]. The details are as follows:

Gross needs are taken from the results of the demand request from January to December 2018.

- POH * (Project on Hand), namely inventory owned
- The initial POH is 0 units
- Net needs are obtained from gross needs minus POH. And can be seen in table 5.

Table 5 Master Production Schedule

Month	Gross Needs (Unit)	POH*	Net
January	15963	0	15963
February	15810	0	15810
March	15657	0	15657
April	15504	0	15504
May	15351	0	15351
June	15198	0	15198
July	15045	0	15045
August	14892	0	14892
September	14739	0	14739
October	14586	0	14586
November	14433	0	14433
December	14280	0	14280

3.4. Production Matrix

The demand production matrix is obtained from the results of net needs on the Master Production Schedule (MPS), where the results of the production schedule are obtained from the sum of the gross needs (units) with POH (Projects in Hand) which is needed or purchased. Can be seen in Table 6.

Table 6 Master Production Schedule

Period	Light Brich (Unit)	Period	Light Brich (Unit)
January	15963	July	15045
February	15810	August	14892
March	15657	September	14739
April	15504	October	14586
May	15351	November	14433
June	15198	December	14280

3.5. Standardd Time Matrix

The standard time matrix is the results of the standard time of each work station or in the production process, namely the process of Mixer, Cutting and Autoclave. The description of the standard time matrix is as in Table 7.

Table 7 Standard Time Matrix

No	Work Centre	Standart Time (Minute)	Standart Time (hours)
1	Mixer	11,94	0,999
2	Cutting	9,57	0,159
3	Autoclave	47,85	0,797

3.6. Available Production Time

In this study, a calculation analysis was also carried out to determine the available capacity as shown in Table 8.

Table 8 Capacity Available

Period	Mixer	Cutting	Autoclave	∑Capacity Available
1	5796	5796	4347	15939
2	5544	5544	4158	15246
3	5796	5796	4347	15939
4	5544	5544	4158	15246
5	5292	5292	3969	14553
6	5292	5292	3969	14553
7	5796	5796	4347	15939
8	5292	5292	3969	14553
9	5040	5040	3780	13860
10	5292	5292	3969	14553
11	5292	5292	3969	14553
12	5040	5040	3780	13860

Available production time is used for the production time needed and the production available [10, 11]. Management determines in one year production time is available 258 days, in one day as many as 21 working hours.

TPA= NW x WH x WD x UT x EF

Where: TPA = Production time available; NW= Number of working; WD= Working day;

UT=Utilization; EF=Efficiency

3.7. Production Time Planning with *Rough Cut Capacity Planning* (RCCP) Method

RCCP is planning capacity requirements to test the feasibility of production master schedules [12]. For the Rough Cut Capacity Planning method with the Bill Of Labor Approach (BOLA) technique, standard time data (hours) are needed in the light brick production process. Furthermore, the total capacity needed to produce light brick per month is to multiply the production matrix with the standard time matrix (hours) [6].

Example of calculating the capacity requirements of each machine in July 2018, namely:

RCCP= Time Matrix x Production Matrix ; RCCP= $TM_{every\ machine}$ X PM_{month}.

Based on the above formulation, the capacity requirements can be determined as shown in Table 9.

Table 9 Capacity Needed

Per-2019	Mixer	Cutting	Autoclave	∑Capacity Required
1	3286	2625	13159	19070
2	3213	2567	12869	18650
3	3141	2509	12578	18228
4	3068	2451	12287	17807
5	2995	2393	11996	17385
6	2923	2335	11706	16963
7	2850	2277	11415	16542
8	2777	2219	11124	16120
9	2705	2161	10834	15700
10	2632	2103	10543	15278
11	2560	2045	10252	14857
12	2487	1987	10200	14674

3.8. Proposed Production Capacity Planning

Production Capacity Planning the recommended made were a combination of engine additions and working time. In this alternative, there will also be an additional three employees from the initial labor.

January Period = Working Day x Working Hours x Labor

The following is a comparison between the capacity required (CR) and the capacity available (CA) after the Machine and Working Hours as shown in Table 10.

From graph 1. It can be seen that after planning production capacity with the addition of machinery and working hours there is no longer a lack of production capacity, meaning that the available capacity can be met for each period.

Table 10 Comparison of Capacity Available and Capacity Required

Period	∑ Capacity Available (Hour)	∑Capacity Required (Hour)
1	19872	19070
2	19008	18650
3	19872	18228
4	19008	17807
5	18144	17385
6	18144	16963
7	19872	16542
8	18144	16120
9	17280	15700
10	18144	15278
11	18144	14936
12	17280	14674

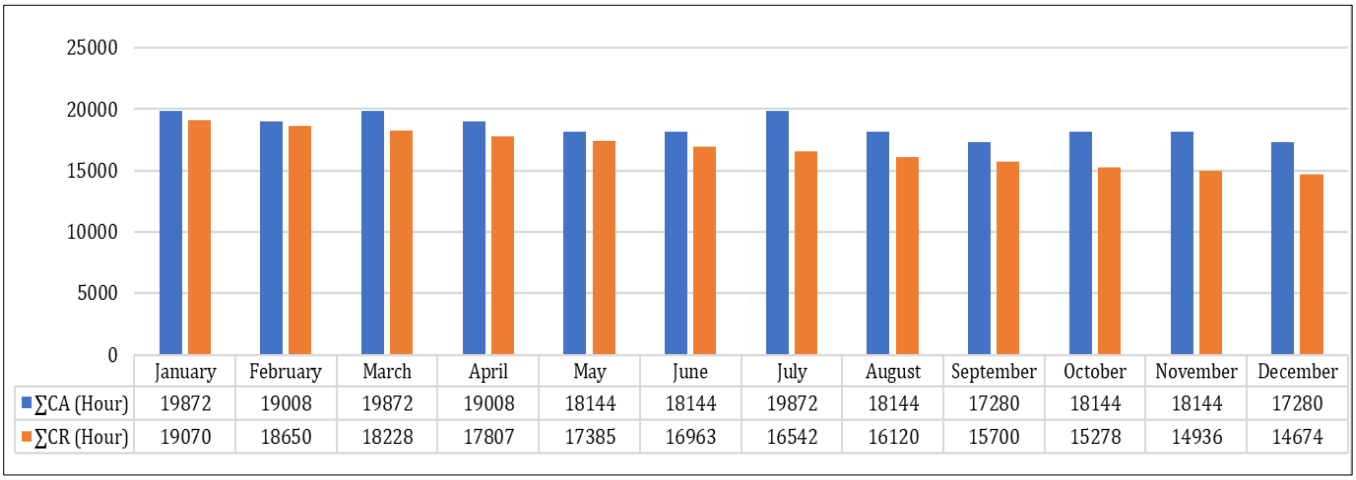

Figure 1 Comparison of available capacity and required capacity after machine addition and working hours

4. Conclusion

From the results of data processing, conclusions can be drawn as follows that based on the results of the production capacity planning analysis using the Rough Cut Capacity Planning (RCCP) method with a Bill of Labor Approach (BOLA) technique. Based on the data processing which has been done, to planning production capacity in the future based on the pace of consumer demand that is the recommended made were a combination of engine additions and working time. This is realized to fulfill the lack of production capacity. For the January Period = 19872 hours / month, February = 19008 hours / month, March = 19872 hours / month, April = 19008 hours / month, May = 18144 hours / month, June = 18144 hours / month, July = 19872 hour / month, August = 18144 hours / month, September = 17280 hours / month, October = 18144 hours / month, November = 18144 hours / month, December = 17280 hours / month.

Recommendations

Suggestions for this research are to support the optimal production plan for the company then suggestions that might benefit the company for the future are by adding machines and increasing working hours because if it is only done by adding machines, it will cost a lot.

Compliance with ethical standards

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Disclosure of conflict of interest

In writing this scientific article, all authors do not have a conflict of interest.

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