ANALYSIS OF SUGAR PRODUCTION CAPACITY IN PG MOJO SRAGEN

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ABSTRACT

This study aims to analyze the planning of sugar production capacity is efficient or not in PG Mojo Sragen. Although the level of sugar production capacity in a particular year still exceeds capacity and also lacks capacity. The production capacity planning analyzed includes the available capacity and the required capacity of each station, namely the refining station, evaporation, cooking, turning, Waste Water Treatment Plant (WWTP), and stamfloor (sugar packaging place). The analysis method used is RCCP (Rought Cut Capacity Planning). The results showed that the comparison of the efficiency of each workstation which was said to be inefficient was found at the evaporation workstation, WWTP, and stamfloor. The three stations have lower available capacity compared to the higher required capacity. This research is expected to provide insight for PG Mojo Sragen to increase available capacity through better alternatives.

KEYWORDS

Production capacity planning, available capacity of each work station, required capacity of each work station, RCCP (Rought Cut Capacity Planning).

INTRODUCTION

Sugar is one of the staple foods that has an important and strategic position in Indonesia. Sugar is a natural sweetener obtained from sugar cane plants and is commonly used by some people as an additive to food and drinks (Soejana, 2021). The Central Bureau of Statistics recorded its consumption at 5,326,097 tons per capita per year. Sugar consumption is higher, in 2022 the consumption is 6,480,054 tons per capita per year. Mojo Sugar Factory (PG Mojo): PT Sinergi Gula Nusantara is one of the producers that contribute to national sugar production. The Indonesian sugar industry, especially PG Mojo Sragen, faces major challenges in terms of production capacity and planning. PG Mojo Sragen faces several complex challenges related to production capacity, planning, and production scheduling.

Capacity planning involves determining the amount of capacity required, taking into account the desired level of risk associated with meeting forecasted demand. Capacity itself refers to the highest level of production that can be achieved in a period of time, i.e. the maximum amount of output that can be produced during that period (Widiyanto, 2018).

The amount of available production capacity is the amount of time capacity that the company provides to complete product demand. The amount of production capacity required is the amount of time capacity required by the company to complete product demand. PG Mojo Sragen is expected to overcome the challenges of production capacity and planning so that it can meet the increasing demand, maintain a balance between supply and demand, and increase competitiveness in the industry.

Efforts to ensure optimal and efficient capacity planning at PG Mojo Sragen aim to make the best use of available resources and reduce production costs at the right time. The problems being faced will enable PG Mojo Sragen to take the necessary strategic steps to improve the efficiency of capacity planning and production schedules, thereby increasing the competitiveness of the sugar market.

RESEARCH METHOD

Place and Time of Research

The researcher took the location at PG Mojo Sragen. This research was conducted for 6 months, from February to July. In this study, researchers used a qualitative approach with a case study method, namely research that takes a particular object and the results of the study apply to the case itself so that generalized conclusions cannot be drawn, namely at PG. Mojo Sragen: PT Sinergi Gula Nusantara, Jalan Kyai Mojo No. 1 Sragen, Mojo District, Sragen Regency. The reason for determining the place in PG. Mojo Sragen: PT Sinergi Gula Nusantara is the only factory still operating in Solo raya, and the only oldest factory in Central Java, the location may be chosen because it is easily accessible to researchers in terms of transportation, PG Mojo Sragen may have historical data or information needed for the research being conducted, so it is the right choice to conduct research.

Data Type and Source

This type of research is a type of research known as field research. Field research is research conducted in the field or research site, namely a location chosen as a place to study objective symptoms that occur at that location (Oktaviani, 2019) Researchers use two data sources related to the subject matter to be revealed, namely primary data sources and secondary data sources.

1. Primary Data

   Primary data is research data taken from original sources either in the field in the form of interviews or by observation or observation of the subjects and objects studied through questionnaires. Primary data that will be obtained or collected are data related to the number of machines, machine working hours, percentage of machine usage, system efficiency, available production capacity (hours), number of working days (days), number of working hours (hours), number of workers in the company (people), required production capacity (hours), workstation process time (hours), and total production demand (units) at PG Mojo Sragen.
2. Secondary data

   Secondary data is research data obtained from agencies related to the research topic, both in the form of archives and literature data sources such as books, journals and notes related to the research topic. Secondary data in this study were obtained from the Sragen Regency Central Statistics Agency (BPS) in 2023 and at PG Mojo Sragen. The secondary data of this research includes sugar production data, the number of workers per production section, employee working hours, machine capacity, and journals that support to find theoretical data about capacity planning and scheduling of sugar production.

Data Collection Techniques

1. Interviews were conducted with resource persons, namely the head of production or the production section and the plant section to obtain data on real objects related to capacity planning at PG Mojo Sragen: PT Sinergi Gula Nusantara.

2. Documentation, is a method used to obtain primary and secondary data. Documentation is also needed in obtaining primary data (number of machines, machine working hours, percentage of machine usage, system efficiency, available production capacity (hours), number of working days (days), number of working hours (hours), number of workers in the company (people), required production capacity (hours), workstation process time (hours), and number of production requests (units) and secondary data (sugar production and journals that support to find theoretical data on capacity planning and sugar production scheduling).

Data Analysis Methods

The methods for analyzing data in this study are as follows.

1. RCCP (Rought Cut Capacity Planning) Method
   (Erlangga *et al.*, 2023) Rough Cut Capacity Planning (RCCP) is a process that converts a production plan or MPS into an estimate of the capacity requirements of critical resources, such as labor, machinery, and equipment.
   a. Available capacity
      Can be calculated using the following equation:
      $$Ca = d \times h \times f$$
      Description:
      Ca = Available production capacity (hour)
      d = Number of working days (days)
      h = Number of working hours (hour)
      f = Number of workers in the company (people)
   b. Required capacity
      Can be calculated using the following equation:
      $$Cr = Fn \times Wp$$
      Description:
      Cr = Required production capacity (hour)
      Fn = Total production demand (unit)
      Wp = Workstation processing time (hour)

A comparison of Ca (available capacity) and Cr (required capacity) can be used to determine whether a production process is efficient or inefficient:

It is said to be efficient when:

Ca = Cr: Means an ideal situation, where all resources are used optimally and there is no waste.

It is said to be inefficient when:

1. Ca < Cr: Means that the production process cannot meet customer demand or production targets. This leads to output shortages, order delays, and customer dissatisfaction.
2. Ca > Cr: Means that there is an excess of unused output. This can lead to wastage of resources, such as unused labor and machinery costs, and can also lead to inventory buildup.

RESULT AND DISCUSSION

1. Measurement of Production Capacity Planning at PG Mojo Sragen by calculating Ca (Available Production Capacity).
   The amount of available production capacity is the amount of time capacity provided by the company to complete product demand. Calculation of the results of available capacity at the refining section workstation from June to August 2021 and 2022:

Ca = d x h x f
Ca = 24 x 24 x 40
Ca = 23,040 hours

The following results of the calculation of available capacity in each milling season are presented in Table 4.4.

Table 4.4 Available Capacity Calculation Result

Period	Available Capacity					
	Rafining (hour)	**Vaporization (hour)**	**Cooking (hour)**	**Turning (*Centrifugal*) (hour)**	**Waste Water Treatment Plant (hour)**	***Stamfloor* (hour)**
June 2021	23.040	6.912	32.832	23.040	2.304	14.976
July 2021	23.040	6.912	32.832	23.040	2.304	14.976
August 2021	23.040	6.912	32.832	23.040	2.304	14.976
June 2022	23.040	6.912	32.832	23.040	2.304	14.976
July 2022	23.040	6.912	32.832	23.040	2.304	14.976
August 2022	23.040	6.912	32.832	23.040	2.304	14.976
June 2023	24.768	8.064	33.984	24.196	2.304	16.128
July 2023	24.768	8.064	33.984	24.196	2.304	16.128
August 2023	24.768	8.064	33.984	24.196	2.304	16.128
June 2024	24.768	8.064	33.984	24.196	2.304	16.128
July 2024	24.768	8.064	33.984	24.196	2.304	16.128
Amount	**262.080**	**81.792**	**366.912**	**259.220**	**25.344**	**170.496**
Average	**23.825**	**7.436**	**33.356**	**23.565**	**2.304**	**15.500**

Source: Primary Data Processed (2024)

Based on Table 4.4 above, the workstations in the refining section from June to August from 2021 to 2024 with a total of 262,080 hours and an average of 23,825 hours, the evaporation workstation with a total of 81,792 hours and an average of 7,436 hours, the cooking workstation with a total of 366. 912 hours and an average of 33,356 hours, round work station with a total of 259,220 and an average of 23,565 hours, WWTP (Waste Water Treatment Plant) with a total of 25,344 hours and an average of 2,304 hours, and at the stamfloor work station (sugar packaging place) with a total of 170,496 hours and an average of 15,500 hours. It is concluded that from Table 4.4 that the highest amount of available capacity from each station is in the cooking workstation section 366,912 hours and the highest average of 33,356 hours.

The amount of production capacity required is the amount of time capacity required by the company to complete the product request. The following is the formula for calculating the required capacity results:

Cr = Fn x Wp

Description:
Cr = Required production capacity (hours)
Fn = Total production demand (unit)
Wp = Workstation processing time (hour)

The following is the calculation of the results of the capacity required at the evaporation workstation from June to August 2021 and 2022:

Cr= Fn x Wp
Cr = 575 x 24
Cr = 13,800 hours

The results of the calculation of the required capacity at each workstation can be seen in Table 4.5.

Table 4.5 Results of Required Capacity Calculation

Period	Capacity Required					
	Rafining (hour)	Vaporization (hour)	Cooking (hour)	Turning (*Centrifugal*) (hour)	Waste Water Treatment Plant (hour)	*Stamfloor* (hour)
June 2021	16.560	16.560	16.560	16.560	16.560	16.560
July 2021	16.560	16.560	16.560	16.560	16.560	16.560
August 2021	16.560	16.560	16.560	16.560	16.560	16.560
June 2022	16.560	16.560	16.560	16.560	16.560	16.560
July 2022	16.560	16.560	16.560	16.560	16.560	16.560
August 2022	16.560	16.560	16.560	16.560	16.560	16.560
June 2023	14.760	14.760	14.760	14.760	14.760	14.760
July 2023	14.760	14.760	14.760	14.760	14.760	14.760
August 2023	14.760	14.760	14.760	14.760	14.760	14.760
June 2024	13.800	13.800	13.800	13.800	13.800	13.800
July 2024	13.800	13.800	13.800	13.800	13.800	13.800
Amount	**171.240**	**171.240**	**171.240**	**171.240**	**171.240**	**171.240**
Average	**15.567**	**15.567**	**15.567**	**15.567**	**15.567**	**15.567**

Source: Primary Data Processed (2024)

Based on Table 4.5, it can be seen that the capacity required in the June to August period from 2021 to 2024 for the purification, evaporation, cooking, rotation, WWTP, and stamfloor workstations has results with the same number and average value, namely 171,240 hours and an average of 15,567 hours.

Table 4.6 Comparison of the Capacity of Each Refining Workstation

Workstation	Period	Available Capacity (hour)	Capacity Required (hour)	Explanation
Rafining	June 2021	23.040	16.560	Efficient
	July 2021	23.040	16.560	Efficient
	August 2021	23.040	16.560	Efficient
	June 2022	23.040	16.560	Efficient
	July 2022	23.040	16.560	Efficient
	August 2022	23.040	16.560	Efficient
	June 2023	24.768	14.760	Efficient
	July 2023	24.768	14.760	Efficient
	August 2023	24.768	14.760	Efficient
	June 2024	24.768	13.800	Efficient
	July 2024	24.768	13.800	Efficient

Source: Primary Data Processed (2024)

Based on Table 4.6 above at the refining workstation with the results of the calculation of planning capacity efficiency from the comparison between available capacity and required capacity in the period June to August from 2021 to 2024, it is said to be efficient, because the available capacity is higher in value and the required capacity is less, so capacity planning can be fulfilled.

Table 4.7 Comparison of Capacity of Each Evaporation Workstation

Workstation	Period	Available Capacity (hour)	Capacity Required (hour)	Explanation
Evaporation	June 2021	6.912	16.560	Inefficient
	July 2021	6.912	16.560	Inefficient
	August 2021	6.912	16.560	Inefficient

June 2022	6.912	16.560	Inefficient
July 2022	6.912	16.560	Inefficient
August 2022	6.912	16.560	Inefficient
June 2023	8.064	14.760	Inefficient
July 2023	8.064	14.760	Inefficient
August 2023	8.064	14.760	Inefficient
June 2024	8.064	13.800	Inefficient
July 2024	8.064	13.800	Inefficient

Source: Processed Primary Data (2024)

Based on Table 4.7 above, the evaporation workstation with the calculated results of planning capacity efficiency from the comparison between available capacity and required capacity in the period of June to August 2021 to 2024 is said to be inefficient, because the available capacity is lower in value and the required capacity is higher, so the capacity planning cannot be fulfilled.
The comparation result of the workstations can be seen in Table 4.8.

Table 4.8 Comparison of Capacity of Each Cooking Workstation

Workstation	Period	Available Capacity (hour)	Capacity Required (hour)	Explanation
Cooking	June 2021	32.832	16.560	Efficient
	July 2021	32.832	16.560	Efficient
	August 2021	32.832	16.560	Efficient
	June 2022	32.832	16.560	Efficient
	July 2022	32.832	16.560	Efficient
	August 2022	32.832	16.560	Efficient
	June 2023	33.984	14.760	Efficient
	July 2023	33.984	14.760	Efficient
	August 2023	33.984	14.760	Efficient
	June 2024	33.984	13.800	Efficient
	July 2024	33.984	13.800	Efficient

Source: Processed Primary Data (2024)

Based on Table 4.8 above, the cooking workstation with the calcused results of planning capacity efficiency from the comparison between available capacity and required capacity in the period of June to August 2021 to 2024 is said to be efficient, because the available capacity is higher in value and the required capacity is lower, so the capacity planning can be fulfilled.
The comparation result of the workstations can be seen in Table 4.9.

Table 4.9 Coparison of Capacity of Each Centrifugal (Spinning) Workstation.

Workstation	Period	Available Capacity (hour)	Capacity Required (hour)	Explanation
Centrifugal (*Spinning*)	June 2021	23.040	16.560	Efficient
	July 2021	23.040	16.560	Efficient
	August 2021	23.040	16.560	Efficient
	June 2022	23.040	16.560	Efficient
	July 2022	23.040	16.560	Efficient
	August 2022	23.040	16.560	Efficient
	June 2023	24.196	14.760	Efficient
	July 2023	24.196	14.760	Efficient
	August 2023	24.196	14.760	Efficient
	June 2024	24.196	13.800	Efficient
	July 2024	24.196	13.800	Efficient

Source: Processed Primary Data (2024)

Based on Table 4.9 above, the centrifugal (spinning) workstation with the calculated results of planning capacity efficiency from the comparison between available capacity and required capacity in the period of June to August 2021 to 2024 is said to be efficient, because the available capacity is higher in value and the required capacity is lower, so the capacity planning can be fulfilled.
The comparation result of the workstations can be seen in Table 4.10.

Table 4.10 Comparison of Capacity of Each Wastewater Treatment Plant (WWTP) Workstation.

Workstation	Period	Available Capacity (hour)	Capacity Required (hour)	Explanation
WWTP	June 2021	2.304	16.560	Inefficient
	July 2021	2.304	16.560	Inefficient
	August 2021	2.304	16.560	Inefficient
	June 2022	2.304	16.560	Inefficient
	July 2022	2.304	16.560	Inefficient
	August 2022	2.304	16.560	Inefficient
	June 2023	2.304	14.760	Inefficient
	July 2023	2.304	14.760	Inefficient
	August 2023	2.304	14.760	Inefficient
	June 2024	2.304	13.800	Inefficient
	July 2024	2.304	13.800	Inefficient

Source: Processed Primary Data (2024)

Based on Table 4.10 above, the WWTP (Wastewater Treatment Plant) workstation with the calculated results of planning capacity efficiency from the comparison between available capacity and required capacity in the period of June to August 2021 to 2024 is said to be inefficient, because the available capacity planning cannot be fulfilled.
The comparison results of the workstations can be seen in Table 4.11.

Table 4.11 Comparison of Capacity of Each Stamfloor Workstation

Workstation	Period	Available Capacity (hour)	Capacity Required (hour)	Explanation
Stamfloor	June 2021	14.976	16.560	Inefficient
	July 2021	14.976	16.560	Inefficient
	August 2021	14.976	16.560	Inefficient
	June 2022	14.976	16.560	Inefficient
	July 2022	14.976	16.560	Inefficient
	August 2022	14.976	16.560	Inefficient
	June 2023	16.128	14.760	Efficient
	July 2023	16.128	14.760	Efficient
	August 2023	16.128	14.760	Efficient
	June 2024	16.128	13.800	Efficient
	July 2024	16.128	13.800	Efficient

Source: Processed Primary Data (2024)

Based on Table 4.11 above, the stamfloor (sugar packaging) workstation with the calculated results of planning capacity effiency from the comparison between available capacity and required capacity in the period of June to August 2021 and 2022 is said to be inefficient, because the available capacityis lower in value and the required capacity is higher, so the capacity planning cannot be fulfilled. The period of June to August 2023 and 2024 is said to be efficient, because the available capacity is higher and the required capacity is lower, so the capacity planning can be fulfilled.

CONCLUSION

This study identifies sugar production capacity planning at PG Mojo Sragen, which is the oldest factory in Central Java. Based on the test results, it is known that sugar production capacity includes available capacity and required capacity. The results showed that both capacities have different efficiency figures.

A comparison of Ca (available capacity) and Cr (required capacity) can be used to determine whether a production process is efficient or inefficient:

It is said to be efficient when:

Ca = Cr: Means an ideal situation, where all resources are used optimally and there is no waste.

It is said to be inefficient when:

1. Ca < Cr: Means that the production process cannot meet customer demand or production targets. This leads to output shortages, order delays, and customer dissatisfaction.
2. Ca > Cr: Means that there is an excess of unused output. This can lead to wastage of resources, such as unused labor and machinery costs, and can also lead to inventory buildup.

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