

PLANNING AND PRODUCTION CONTROL USING AGGREGATE PLANNING METHOD AT CV. ANTARTIKA IN DENPASAR

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ABSTRACT

Planning and production control using the Aggregate Planning method is carried out to determine the optimal level of production over the medium term, namely 12 months, under fluctuating demand. This study was conducted on the ice tube products of CV. Antartika using the Aggregate Planning method. The study results indicate that the estimated number of products to be produced next year is 32,499 tons, based on the forecast using the Moving Average method, which yielded the smallest standard error estimate of 420.94. The aggregate planning strategy using the Level Strategy resulted in a total estimated production planning cost of IDR 5,129,455,000. This total cost is lower compared to the total production cost using the Chase Strategy for ice tube products. The theoretical implication of this research serves as an additional reference for academics studying aggregate production planning, particularly those employing Level Strategy and Chase Strategy. The practical implication of this research provides the company with considerations for production planning and control over the medium term.

Keywords: Aggregate planning, production control, forecasting, Chase Strategy, Level Strategy 40

INTRODUCTION

A company is an institution that aims to create wealth through the business it runs (Mulyadi, 2007). Companies need to make good production planning strategies to ensure that the amount of production can meet the estimated demand and determine the best plan so that it can meet existing demand. Production planning and control aims to minimize production costs, maximize profits and customer service, forecast product demand, monitor actual demand, compare forecast results with actual demand, and improve the forecasting process if there is a deviation. In determining the best plan, one of the things that companies need to pay attention to is how to determine the analysis of production planning and control optimization with the minimum total production cost so that the company obtains the highest possible profit.

The goals desired by each company are to achieve the company's target in the form of maximum profit with the minimum cost and meet consumer demand on time (Martha and Yudi, 2018). Consumer demand is the desire of consumers to buy an item or product at various price levels during a certain period of time which is influenced by several factors, namely: the price of the item itself, the price of other goods that are closely related to the item, household income and average income of the community, patterns of income distribution in society, community tastes, population and predictions about conditions in the future. (Sukirno, 2013:76).

Production planning is an activity to evaluate past and present facts and anticipate future changes and trends to determine the right production strategy and scheduling to

achieve the target of meeting demand effectively and efficiently. Production planning consists of three levels of planning based on the time period, namely long-term, medium-term, and short-term planning. (Eunike, 2018:5).

Long-term planning is planning with a time period of more than one year. Long-term planning is usually related to strategic planning, while medium-term planning usually has a time period of between three and eighteen months. Medium-term planning is prepared based on long-term planning which then needs to be further described into short-term planning which has a time period of one day to one year (Heizer & Render, 2016:606).

Aggregate planning is a planning that is categorized into medium-term planning to plan a master production schedule for one year (Juliantara, 2020). Aggregate planning is usually carried out by operations managers who are concerned with determining production, inventory, and labor levels to meet fluctuating demand (Riananda, 2024). Aggregate planning provides the best way to meet demand estimates in the next 3-18 months, by adjusting regular and overtime production levels, inventory levels, labor levels, subcontracting and backorder levels, and other variables (Mortezaei et al., 2013).

Basically, the purpose of aggregate planning according to Herjanto (2015:158) is to develop a comprehensive production plan that can meet market demand according to existing capacity at minimal cost. To obtain minimal costs and maximum profits in accordance with the objectives of aggregate planning, in carrying out aggregate planning, the company must choose several strategies that are right for the company. Strategies that can be used to meet fluctuating customer demand are: Chase Strategy and Level Strategy. (Sultana et al., 2014).

Chase strategy is one of the approaches in production planning that aims to adjust production capacity directly to market demand fluctuations. This strategy can be achieved by changing the workforce level. This strategy has the advantage of being able to avoid large storage costs, and is more responsive to market demand, but this strategy also has disadvantages, namely instability in the number of workers which will cause unrest in the workforce, the cost of recruitment and termination of employment periodically and is not suitable for products that require a long production period (Jayakumar et al., 2017).

Level strategy is a strategy that prioritizes constant production, hoarding inventory when demand is low, and using the inventory when demand is high. This strategy results in high storage costs and only applies to products that have a relatively long selling period. Choosing the right strategy for a company requires calculating aggregate planning by looking at the minimum total costs generated. Aggregate planning calculations can be done using several methods, namely: heuristic (Amri et al., 2012), simulation (Gansterer, 2015), fuzzy multi-objective linear programming (Yarandee et al., 2011), and transportation (Ayustina et al., 2023).

Several research results on production planning show that aggregate production planning can minimize costs. This research was conducted by Amri et al., (2012). The same results were also obtained by Susanti (2019), (Hairiyah, 2018) (Fajar, 2017), (Haslindah, 2016), (Suparno, 2018), (Hairiyah, 2018) Simon (2013) (Turkay M et al., 2016), (Jamalnia, 2013) (Sillekens 2011) (Sitompul, 2011), (Modarres M, Izadpanahi E, 2016)

(Albert et al., 2012) (Sadeghi, 2012) (Hafezalkotob et al., 2019) (Hahn & Brandenburg, 2018) (Juliantara, 2020).

CV. Antarctica is a company that produces and supplies tube ice needs in Bali. The demand for tube ice fluctuates in each certain period of time, resulting in the company having to have the right aggregate planning in order to make costs efficient and production effective. The demand for tube ice products where the demand fluctuates can be seen in Table 1.

Table 1. Tube Ice Sales Data January – December 2023	
Month	Quantity (Tonnage)
January	3,162
February	2,315
March	2,099
April	2,587
May	2,228
June	2,567
July	2,890
August	3,021
September	3,442
October	2,790
November	3,011
December	2,679

Source: CV.Antarctica, 2023

Based on Table 1, it is known that sales of CV. Antarctica tube ice fluctuated with the highest sales in September 2023 with sales of 3,442 tons, while CV. Antarctica's lowest tube ice sales occurred in March with sales of 2,099 tons. To adjust production capacity in facing fluctuating tube ice demand, optimal production planning and control are needed.

Based on the problems above, it will be studied regarding "Planning and Production Control Using the Aggregate Planning Method at CV. Antarctica in Denpasar."

RESEARCH METHODS

This research is a descriptive research with a quantitative approach. According to Sugiyono (2017) descriptive research with a quantitative approach aims to describe a phenomenon, event, symptom, and incident that occurs factually, systematically and accurately.

This research was conducted at CV. Antarctica located at Jl. Pidada V no. 9, Ubung, Denpasar, Bali.

The types of data used in this study are qualitative and quantitative data.

- 1) Qualitative data is data in the form of sentences, words or images (Sugiyono, 2016:23). Qualitative data used in this study is a general description of CV. Antarctica and the types of raw materials used in the production of CV. Antarctica tube ice.
- 2) Quantitative data is data in the form of numbers or data that can be calculated (Sugiyono, 2016: 23). Quantitative data in this study are product sales data for 2023 CV. Antarctica, data on the amount of production per month, production time, number of workers, production costs, overtime costs, storage costs.

The data sources used in this study are primary and secondary data. Primary data were obtained from interviews with company owners while secondary data were obtained from product sales data in 2023, inventory data, production volume data, number of workers during production time, overtime costs, production costs, and storage costs.

The method of data collection in a scientific research is intended to obtain relevant, accurate and reliable materials. The data collection methods used in this research are:

- 1) Interview
Interview is one of the methods of searching and collecting data which is done by asking questions directly to the supervisor of the production department of CV. Antarctica which is expected to provide information from explanations of opinions, attitudes and beliefs of informants about things that are relevant to the focus of the research.
- 2) Observation
Observation is one of the methods of searching and collecting information through careful and systematic observation and recording of production and production control in a company. In this study, observation was carried out by directly observing and observing the production process taking place in the company and studying the information contained in the company in the form of archives, books, documents and writings that support the research. The documents used in this study are sales data archives for the 2023 period from CV. Antarctica.

The technique used in analyzing the data in this study is descriptive and quantitative techniques that describe the forecasting process up to aggregate production planning. The steps in analyzing the data in this study are:

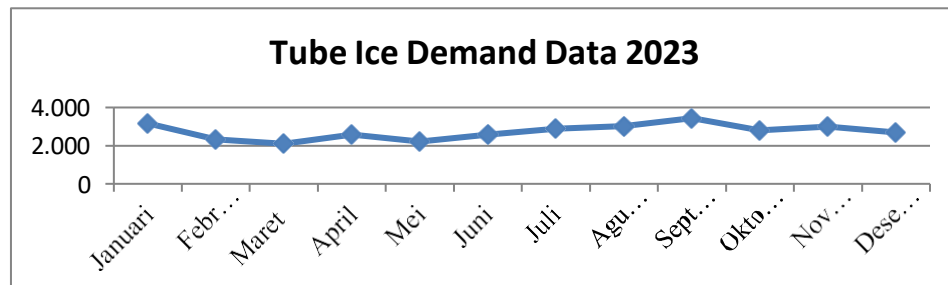
- 1) Making demand forecasts for the period 2024 using time series analysis forecasting, Exponential Smoothing and Moving Average with the help of POM QM for Windows Version 5.2 software.
- 2) Select the forecast result with the smallest error value (standard error estimate)
- 3) Create aggregate production planning using graphical methods using forecast results with the smallest error rate as input.
- 4) Develop several alternative aggregate planning strategies and calculate the total costs of these alternatives.
- 5) Choosing the most profitable strategy for the Company.

RESULTS AND DISCUSSION

Data Analysis Results

Product Demand Forecasting

Figure 1 graph of demand data for tube ice products from January 2023 to December 2023.



Source: Primary Data processed, 2024

Figure 1. Data Pattern of Demand for Tube Ice Products January – December 2023.

Based on the graph in Figure 1, it is known that the demand pattern for tube ice products fluctuates, so a forecast is needed. The forecast that will be carried out is the demand forecast for January to December with the forecasting techniques used are Time Series, Moving Average, and Exponential Smoothing. The following is a table that presents a comparison of the standard error estimate values from the results of the demand forecasting of the three methods.

Table 2. Comparison of standard error estimate values for the Time Series, Moving Average and Exponential Smoothing methods.

Method	Standard Error Estimate Value
Time series	486.36
Moving Average	420.94
Exponential Smoothing	488.61

Source: Appendix 5, 6 and, 7

From the results of demand forecasting calculations with the help of POMQM for Windows Version 5.2 software, it shows that the forecasting results with the Moving Average method are better than the Time Series method and the Exponential Smoothing method, because it has the smallest forecasting error as indicated by a value of 420.94 in the standard error estimate value.

Aggregate Planning

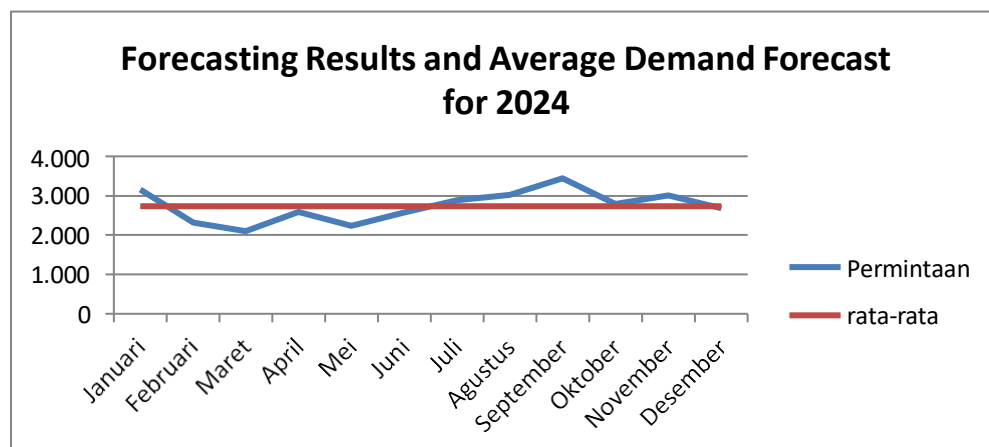
Aggregate planning analysis in this study uses the graphical method with a strategy Leveland Chase. The forecast results for January 2023 to December 2023 using the times series method are presented in Table 3.

Table 3. Forecasting demand for tube ice from January 2024 to December 2024

Month	Request (Tonnage)
January	2,315
February	3,162
March	2,738
April	2,207
May	2,343
June	2,407
July	2,397
August	2,728
September	2,955
October	3,231
November	3,116
December	2,900
Total	32,499

Source: Primary Data processed, 2024

Based on Table 3, it is known that the estimated demand for January 2024 to December 2024 is 32,499 tons, so that the aggregate planning calculation is carried out by comparing 2 strategies. The following is a table of demand results and average demand per month.



Source: Processed Primary Data, 2024

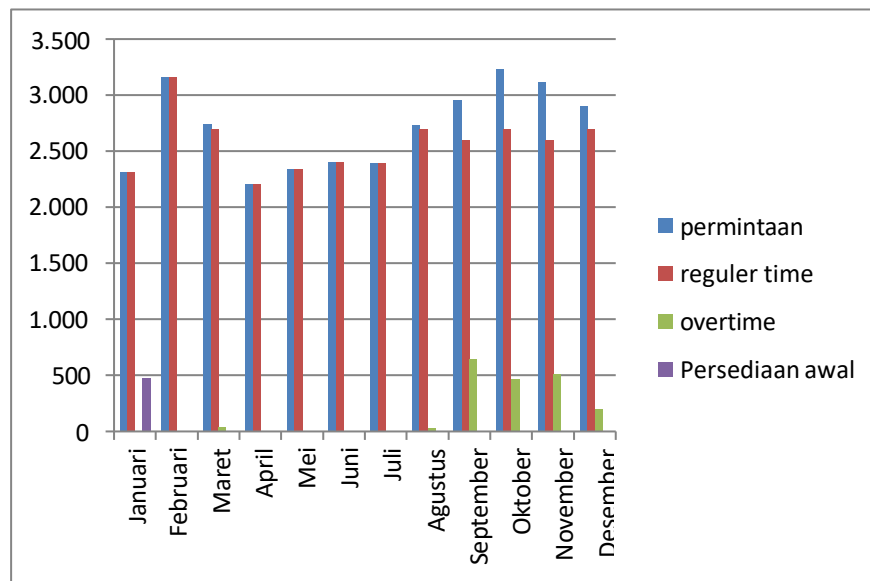
Figure 2. Demand forecast and average demand graph

Based on Figure 2 shows that the demand forecast is different from the average monthly demand. Demand in February, March, April, May, June, and July is below the average monthly demand, while in January, August, September, October, November, December is above the average monthly demand. The following strategies can be used to meet the demand forecast, namely, chase strategy and level strategy.

Aggregate planning with chase strategy

Aggregate planning with chase strategy is an aggregate planning that tries to achieve the output level of each period that meets the demand forecast for that period

using regular time and overtime. The following is a table of aggregate planning using chase with strategy.



Source: Primary Data processed, 2024

Figure 3. Aggregate Planning Chart with Chase Strategy

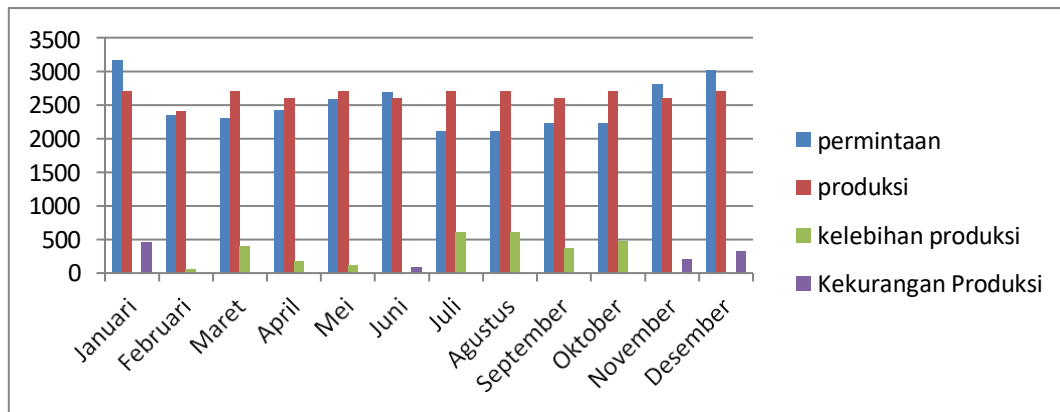
Based on Figure 3, it can be seen that in fulfilling demand in February, March, April, May, June, and July, regular production is used, namely production when production has met the production amount. Demand in January, August, September, October, November, December is fulfilled using regular and overtime production, while in January it is fulfilled using initial inventory and regular production, so that the production costs in this strategy are as follows:

Regular cost	:	Rp.4,855,883,000
Overtime cost	:	Rp. 487,725,000
Total	:	Rp.5,353,583,000

Source: Appendix 8

Aggregate planning with level strategy

Aggregate planning with *level strategy* is aggregate planning with a constant production level from one period to another. Aggregate planning with a level strategy can be done by changing the inventory level where managers can increase inventory during periods of low demand to meet high demand in the future. The following is a table of aggregate planning with a level strategy.



Source: Primary Data processed, 2024

Figure 4. Aggregate planning with level strategy

Based on Figure 4, it can be seen that in February, March, April, May, July, August, September, and October there was excess production so that in those months there was an increase in inventory, while in the demand for January, June, November and December there was a shortage of production so that the inventory in the previous month was taken to meet the demand in December 2024 so that the production costs in this strategy are as follows:

Regular cost	:	Rp. 5,118,120,000
Inventory Carrying Cost	:	Rp. 11,335,000
Total Cost	:	Rp. 5,129,455,000

Source: Appendix 9

Based on aggregate planning calculations with *level strategy* shows the lowest planning costs compared to the chase strategy which can be seen in the table below.

Table 4. Comparison of aggregate planning costs using chase strategy and level strategy

Strategy	Total cost
Chase Strategy	Rp. 5,353,583,000
Level Strategy	Rp. 5,129,455,000

CONCLUSION

Based on the results of data analysis and discussion that has been done, it can be concluded that the estimated amount of tube ice production for January to December 2024 is 32,499,000 kg/year, which is based on the forecast results using the Moving Average method. This method is used because the Moving Average method provides the smallest error results with a value of 420.94. Aggregate planning that provides the lowest production costs is aggregate planning with Level Strategy with a total cost of Rp. 5,129,455,000.

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