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Research Article

Analysis of Determining Production Patterns to Minimize Production Costs Ashadewi Gayatri's Home Industry in The District Sawangan, Depok City, West Java

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Abstract: *Determining production patterns is an important aspect of production planning. Inappropriate production patterns will result in increased additional production costs which can have an impact on increasing product selling prices. On the other hand, if the production pattern used by the company is correct, production effectiveness can be formed by itself. This research aims to determine the appropriate production pattern to minimize additional production costs that may arise due to decisions regarding production patterns. This research uses secondary data sourced from Ashadewi Gayatri's internal records for the 2023 period. The data analysis method used in this research is the Incremental Cost method with the addition of Monte Carlo simulations to accommodate future fluctuations. Based on the results of the research analysis, it can be concluded that the appropriate and efficient production pattern to be implemented in Ashadewi Gayatri's home industry is a wavy production pattern with the smallest incremental cost value, namely Rp. 2,544,000.*

Keywords: *Incremental Cost, Monte Carlo Simulation, Production Pattern.*

I. INTRODUCTION

Management is the art of managing an organization to achieve its goals through the process of planning, organizing, directing and supervising all production resources effectively and efficiently (Naim & Asma, 2019:2). A manager also studies all aspects of an organization's operations. Basically, production operations management is a series of activities, including planning, management and supervision of production raw materials, labor, machine performance, and so on related to the production process. A manager is also required to be sensitive to requests that will arise in order to be able to develop business strategies and prepare all the needs needed to maintain the existence and survival of the company.

One activity that can be done to predict demand is to carry out simulations. Simulations are carried out to accommodate fluctuations in the number of requests that will arise in the future. Predicting demand is important because, through this, the company can manage its production process and determine the right production pattern. The right production pattern is an important basis for planning the production process, such as planning raw materials, planning the need for human resources and planning other supporting facilities. Ashadewi Gayatri is a home-based business that provides the manufacture of various paper-based *packaging.* This home industry is starting to develop rapidly at a time when many other businesses are losing money due to the pandemic. When researchers made observations, it was discovered that as the number of orders received increased, the overtime costs incurred by Asadewi Gayatri also increased. The following is data on employee overtime costs obtained from the Ashadewi Gayatri Depok company financial report in 2023:

Table 1 Costs Overtime Employees (in rupiah)

Month	Overtime Type		Total
	Evening	Sunday	
Jan	2,160,000	770,005	2,930,005
Feb	6,240,000	376,615	6,616,615
Mar	14,520,000	2,043,175	16,563,175
Apr	15,620,000	2,677,160	18,297,160
May	1,590,000	812,970	2,402,970
Jun	295,000	1,101,765	1,420,765
Jul	0	536,880	536,880

Aug	1,235,000	105,750	1,340,750
Sept	260,000	286,500	546,500
Oct	195,000	186.120	381.120
Nov	130,000	88,830	218,830
Dec	650,000	412,425	1,062,425
Total Overtime Costs 2023			**52,299,195**

Source: *Ashadewi Gayatri's salary slip, 2023*

Based on this data, overtime costs in certain months experience a significant increase. This happens because in certain months there are religious holidays which result in a quite significant increase. This forces Ashadewi Gayatri employees to work overtime so that consumer demand can be met. Based on the problems that occurred at Ashadewi Gayatri's industrial house and the differences in methods in several previous studies, the researcher decided to conduct research related to production patterns using the simulation-based Incremental Cost method at Ashadewi Gayatri's Depok industrial house. The analysis process in this research is focused on best-seller products because these products are the products that have the most influence in the production process. The Incremental Cost method was deliberately chosen by researchers because this method is the simplest calculation method, so the results of this research can be understood and applied easily for small and medium industries such as Ashadewi Gayatri Depok and other academics.

The problem formulation of this research can be described as follows: What is the appropriate production pattern to minimize additional production costs in Ashadewi Gayatri's home industry, Depok City? The aim of this research is as follows: To find out the right type of production pattern to minimize additional production costs in Ashadewi Gayatri's home industry, Depok City. The production pattern is the distribution of annual production into smaller periods, such as monthly or quarterly, in order to anticipate sales plans (Efendi, Pratiknyo, & Sugiono, 2019: 116). There are three alternative production patterns that companies can implement based on their business needs and conditions, namely constant production patterns, wavy production patterns and moderate production patterns. These three alternative production patterns have their respective advantages and disadvantages. Incremental Costs or incremental costs are costs that arise as a result of choosing another alternative. In selecting an alternative production pattern there are definitely advantages and disadvantages. Inaccuracy in selecting these alternatives can result in additional costs such as storage costs, overtime costs, subcontracting costs and labor turnover costs.

Simulation is an analytical method that aims to create an "imitation" of a system that has random properties, where if other models are used, it becomes very mathematically complex or too difficult to develop (Cahyo, 2008: 13). Simulation is used as modeling of an existing system. Monte Carlo simulation is a simulation technique that uses random elements when there is opportunity (Heizer & Render, 2005:476). The basis of this method is an experiment on the element of chance (probabilistic in nature) using random sampling. The advantage of the Monte Carlo simulation method is that it is easy to understand as a method that has statistical tests. This simulation is a simple simulation method because it can be built quickly using Microsoft Excel.

II. LITERATURE REVIEW

(Priawan, 2010), examined the production pattern of woven gray cloth in the weaving department at PT. Iskandar Indah Printing Textile Surakarta. To determine sales patterns in the future period, this research uses the Least Square Method of forecasting. As a result, it was found that the moderate production pattern was the most appropriate production pattern to be implemented with an additional cost of Rp. 95,549,622,-.Different results were found in research (Pangastuti, 2011) at PT. Primissima Yogyakarta. The research results show that the most appropriate production pattern for the company is a wavy production pattern. This research also carries out forecasting like previous research to determine sales patterns. Research results stated that wavy production patterns were also found in research (Ningtias, Adji, & Wijianto, 2018) and research (Nomeni, Foenay, & Amtiran, 2021).

However, different results were again found in research (Ernawati & Gupta, 2019), which examined production patterns at PT. Satyaloka Tirta Amerta Bangli in 2018. The results of the research show that the moderate production pattern implemented by the company is inefficient because it has the highest incremental costs of the three existing alternatives. Thus, this research proposes a constant production pattern which has the minimum additional costs. From the differences in findings in several studies above, it can be learned that efficient production patterns for each company are not necessarily the same because there are many factors that influence it. These factors include cost patterns, sales patterns and production capacity. Based on this, researchers are interested in analyzing efficient production patterns using the Incremental Cost method in the Ashadewi Gayatri Depok home industry. As a differentiator from other research, this research will use the Monte Carlo Simulation method to simulate future sales.

III. RESULTS AND DISCUSSION

Ashadewi Gayatri is a home industry that operates in the field of providing packaging products made from paper. The marketing system used by Ashadewi Gayatri tends to be focused on online purchasing systems using marketplaces such as Shopee and messaging applications such as WhatsApp. The financial management system implemented in this home industry is a simple financial recording system using the Microsoft Excel application as the main recording application. Ashadewi Gayatri's home industry is a class of business that produces semi-finished goods into finished goods. This is because the process of cutting the pattern on the paper has been carried out by a printing company that has collaborated with Ashadewi Gayatri. So, Ashadewi Gayatri just needs to carry out the finishing process, such as folding, glueing the product and packaging the product so it is ready to send. Ashadewi Gayatri currently has 5 employees.

The database used in this research includes sales data, production data, employee overtime data, and cost pattern data for Ashadewi Gayatri Depok's home industry. The database recording uses Microsoft Excel. Based on the 2023 sales database, the *best-seller product* in the 2023 period is the Kraft Jar Box product measuring 10.5x10.5x23 cm with the product code MGK-S with sales of 36,077 pcs.

Figure 2. Best-Seller Products 2023

Source: *Ashadewi Gayatri, 2023*

The Monte Carlo simulation process was carried out using the Microsoft Excel application. The following are the results of the MGK-S product sales simulation for the 2024 period:

Table 2 Results Simulation MGK-S Sales 2024

Month	Number of Sales
January	1655
February	4619
March	10754
April	12752
May	4666
June	1395
July	2934
August	1186
September	2375
October	2325
November	1888
December	1844

Source: *Monte Carlo simulation of 2024, 2023 MGK-S sales*

The results of the simulation are used in calculating production patterns. Production pattern calculations are carried out on three alternative patterns, namely constant production patterns, moderate production patterns and wavy production patterns. The initial inventory of MGK-S products is estimated at 1000 units.

a. Constant Production Pattern

In the constant production pattern, the production amount is obtained based on the median value of the number of MGK-S sales in the January-December 2024 period, namely 4,033 units per month. In the temporary estimate table for constant production patterns for March-November 2024, there are negative round numbers. This shows that in March-

November 2024, there will be product shortages due to soaring demand. So, the policy taken to overcome this is to work overtime to cover product inventory shortages. Meanwhile, a positive round number indicates the emergence of storage costs due to products entering the inventory warehouse. The emergence of overtime costs and storage costs in a constant production pattern causes this pattern to have an *incremental cost* of Rp. 12,327,250.

b. Moderate Production Pattern

In the moderate production pattern, the production amount is obtained based on the quarterly average value of the number of MGK-S sales in the January-December 2024 period, namely 5,675 units in the first quarter, 6,271 units in the second quarter, 2,165 units in the third quarter, and 2,019 units in the third quarter. IV quarter. In the temporary estimate table for moderate production patterns there are negative numbers in the second quarter of April-May 2024. So, the policy taken is to work overtime. Meanwhile, a positive round number indicates the emergence of holding costs. The incremental cost value in this moderate production pattern is IDR. 5,353,699.

c. Wavy Production Pattern

In a wavy production pattern, the amount of production follows the number of sales from the simulation. As a result, in the temporary estimate table for wavy production patterns, there are no negative numbers. The ending inventory column contains positive integer numbers. This shows that there are only holding costs that arise in the wavy production pattern. So, *the incremental cost value* in this wavy production pattern is IDR. 2,544,000. Based on the analysis of production patterns in Appendix 5, it can be seen that the comparison of Incremental Cost values for each alternative production pattern is as follows:

Table 3. Comparison of *Incremental Cost Values*

Additional cost components	Constant Production Pattern	Wavy Production Pattern	Moderate Production Pattern
Saving Fees	Rp1,520,676	Rp2,544,000	Rp3,828,508
Overtime expense	Rp10,806,574	Rp0	Rp1,525,191
Subcontracting Costs	Rp0	Rp0	Rp0
LTO fees	Rp0	Rp0	Rp0
Total	Rp12,327,250	Rp2,544,000	Rp5,353,699

Source: *Production Pattern Calculation, 2024*

Based on these calculations, it can be concluded that the corrugated production pattern has the smallest additional costs, namely Rp. 2,544,000 . This shows that the corrugated production pattern is the most appropriate production pattern to minimize additional production costs in Ashadewi Gayatri's home industry, Depok City.

IV. CONCLUSION

Based on the results of the analysis, it can be concluded that the corrugated production pattern is the most appropriate production pattern to minimize additional production costs in Ashadewi Gayatri's home industry, Depok City. This is because the corrugated production pattern has the smallest incremental cost value, namely IDR 2,544,000.

A) Suggestion:

a. Owner Ashadewi Gayatri

The results of the Monte Carlo simulation can be used as recommendations for Ashadewi Gayatri during the future production process. The formulation in the Microsoft Excel application regarding the entire calculation flow can also be used continuously by changing the number of daily fluctuations in the monthly demand distribution column according to the latest data and re-activating the *Randbetween function* in the random number column. Then, automatically, sales predictions for the next period will appear. The results of this simulation can be used by Ashadewi Gayatri to prepare supplies for the future.

b. Next research

For future researchers who address similar topics, this research can be carried out using other more complex forecasting or simulation methods with a minimal level of error accuracy. So, it can be useful for the object under study and all related parties.

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