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AGGREGATE PLANNING USING OVERTIME AND ADDING NUMBER OF EMPLOYEES TO MEET THE CONVECTION INDUSTRY'S DEMAND

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Abstract

The research aimed to propose the implementation of prediction (forecast) using the approaches of overtime and adding the number of employees in convection industry. This study uses a descriptive type of research with time series method. The research data is quantitative data, which is processed by forecasting methods through Zaitun Time Series, as well as aggregate planning. The data collection techniques are such as interviews, documentation and observations. The results show that the best methods to calculate the prediction in Convection Industry are the Decomposition Multiplicative and Decomposition Additive methods. Conducting aggregate planning in Convection Industry with overtime approach for the Wool Peach product(s) costs about Rp 38,689,840,000; for the Max Mara product(s) it costs about Rp 8,344,647,000; while for the Rayon product(s) it costs about Rp 10,769,950,000. Meanwhile, conducting aggregate planning in Convection Industry with the approach of adding the number of employees for the Wool Peach product(s) costs about Rp 38,630,470,000; for the Max Mara product(s) it costs about Rp 8,343,099,000; while for the Rayon products(s) it costs about Rp 10,768,180,000. Convection Industry is recommended to apply the approach of adding the number of employees so as to increase production rather than using the overtime approach (ARRR, AR).

***Keywords**: aggregate planning, overtime, addition of employees*

INTRODUCTION

The textile and textile product (*TPT*) industry is one of the sectors which contributes greatly to the national economy. Along with the size of this sector, it is also directly proportional to the targeted market demand. The amount of the market demand must also be followed by optimal production, which can lead to a loss of potential income to textile companies.

From the existing news, it is explained that the Secretary General of the Indonesian Filament Yarn and Fiber Producers Association (APSyFI) - Redma Gita Wirawasta - states that industrial utilization is currently at 65% in the beginning of the third quarter of 2021, and it is estimated that throughout the quarter, it can be leveraged up to 70%. This shows that the government is optimist in encouraging the textile and garment businesses in Indonesia; which in turn will also increase the enthusiasm of the textile and garment industries in Indonesia Lestari (2021).

On a national scale, there are many textile companies which contribute to this sector. One of them is Convection Industry; which is one of the industrial companies engaged in the textile sector, one of which is located in West Java. They mainly produce fabric materials for various kinds of fashion products. Their main product is fabric that is made of 100% polyester combined with rayon and cotton; which is renowned both

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domestically and internationally under the brands of Wool Peach, Max Mara, or Rayon. These fabrics are designed and produced as 'ready-to-wear' (or some other garments as well), and are then sent to consumers. The reason for choosing Convection Industry as our research object is because of the problems which exist in their operational field, which is also one of the most important aspects for companies engaged in manufacturing.

With so many requests, sometimes Convection Industry cannot meet the market demands. Based on the data of the demand from the period of January 2018 - December 2019, the amount of the demands is much larger than the amount of the production conducted by the company. For the Wool Peach product(s); on the period of January 2018 - December 2019, the total of the demand is 3,985,561 units - where the company only producing 2,079,243 units. Therefore, there is a shortage of 1,906138 units for the Wool Peach product(s). While for the Max Mara product(s); on the same period, the total of the demand is 744,726 units - where the company only producing 388,553 units. Therefore, there is a shortage of 356,173 units for the Max Mara product(s). Lastly, for the Rayon product(s); still on the same period, the total of the demand is 1,120,664 units - where the company only producing 584,694 units. Therefore, there is a shortage of 535,970 units for the Rayon product(s). It can be seen that there is a lot of shortage; so that the company does not able to get maximum profit.

LITERATURE REVIEW

According to Cheraghalikhani (2019), in a condition where the company is having troubles regarding demand which cannot be met; there are actually two methods which can be used and are mutually sustainable, namely forecasting and aggregate planning. Forecasting is an activity to predict the value in the future by analyzing the basic knowledge or values in the past which have been prepared firsthand Assauri (2016:72). The reason in using this method is to discover the company's production range in the upcoming period, so that there will be no error(s) in the production process. Another research by Nugraha (2020) titled "Aggregate Planning Method as Production Quantity Planning and Control to Minimizing Cost" has also found that aggregate planning can serve as the solution for both production planning and frugality.

The theoretical foundation used in this research consists of management, operational management, production, aggregate planning, as well as forecasting. Management is an activity to control and regulate all of the activities within the company, which can help the company in achieving its goals (Robbins & Coulter, 2016). According to Wolniak (2020), the operation function is responsible for the production process and for providing services. The basic role of operational management in a company is its transformation role in the process of converting inputs (such as raw materials) into finished goods and services Domingues and Machado (2017), Fiorentino (2018). As a result, this management is directly responsible for plenty of decisions within the company, as well as in the activities which arouse troubles in product design or delivery Peinado (2018). Both design and operational management are greatly influencing the amount of the consumption of material resources in producing decent goods or provide services to customers. In this way, people have to ensure that there is sufficient inventory to be produced based on the quantity which needs to be sent to the customers, as well as to ensure that the product is indeed what the customers want Wilson (2018).

Alamsyah (2020) states that production is an activity of converting and processing production resources into either goods or services which have been planned before. While Sumolang (2017) describes the factors of production into 4; which are resources, labor, capital and entrepreneurship.

Aggregate planning is one of the most critical areas of planning which is conducted in production system design Nam and Logendran (1992) and has attracted a considerable amount of interest from practitioners and academics Shi and Haase, (1996).

Forecasting is an activity to predict the value in the future by analyzing the basic knowledge or values in the past which have been prepared before Assauri (2016). According to Hudaningsih (2020) forecasting is thinking about a quantity, for instance, the demand for one or more products in the upcoming period. Auliasari (2019) also suggests that forecasting is important in a decision-making process. It is a method which is able to help companies in using their resources; which in turn can help them to reduce their costs (apply frugality).

In the research, forecasting is used to analyze the right method to predict the future demand. In addition, based on the existing problems, the writer will also use aggregate planning to plan the production system; in order to meet the demand. According to Heizer, Render and Munson (2017), aggregate planning aims to plan demand and minimize the costs in that certain period. The strategy in planning the production system can be by using overtime approach, or by adding the number of employees. The benefit of this study for a company is the achievement of the target of production - so that the demand can be met with minimal costs. It is certain that before one can apply aggregate planning on a research; forecasting must be carried out prior to that.

The aggregate planning approach used in the research is overtime and the addition of employees. This is because this Convection Industry feels that through sub-contracting, there can be a possibility that other companies will figure out the quality standards of this company. Moreover, an approach such as the addition of machines is impossible to be used, since 90% of the production are done by humans. Therefore, the company chooses to add more employees (or maximize them) compared to having to work with external parties.

The formulations of the problems that will be discussed are: (1) how to calculate forecasting in this Convection Industry using overtime approach? (2) How to determine aggregate planning in this Convection Industry using overtime approach? (3) How to determine aggregate planning in this Convection Industry by adding the number of employees? The purpose of this study is to propose the implication of forecasting and aggregate planning to convection industry using the approaches of overtime and adding the number of employees.

MATERIALS AND METHODS

This is a descriptive research using quantitative research method, as well as time horizon in the form of time series. The unit of analysis in this study is Convection Industry. The researcher uses quantitative data that will be managed by forecasting methods through Zaitun Time Series and Aggregate Planning. Secondary data is used as the main source (i.e historical data in the form of books, company financial reports and the company sales starting from January 2018 - December 2019). The data collection technique is conducted through interviews, documentation and observations.

The forecasting analytical method in this research will be conducted through Zaitun Time Series 0.1.4. After the processing phase by using this software, each of the forecasting method will produce MSE and MAPE values. After that, the researcher will compare each of the results from the MSE and MAPE values. In order to find out which method is the most appropriate, the researcher will compare the smallest MSE and MAPE values among the above methods. The smaller the MSE and MAPE values; the higher the forecasting accuracy will be. Meanwhile, the aggregate planning method will use QM software for Windows V5. According to Heizer, Render, and Munson (2017), aggregate planning can be conducted by choosing two strategies, which are the chase and level strategies. Some elements which are necessary in calculating aggregate planning are production capacity - where it consists of regular production capacity, production capacity, as well as additional number of employees and (allowed) overtime.

The design of the implication of the research results consists of collecting the 'demand data' for the last two years, predict the future demand by using forecasting method, conducting aggregate planning using the forecast data from the period of 2018 and 2019 (due to the COVID pandemic in 2020 so that the sales data is considered to be invalid), as well as recommending the best alternative strategy in solving the problems in Convection Industry; so that the predicted demand can be met with minimum cost.

RESULTS AND DISCUSSIONS

Demand Data for Processing

In order to have good forecasts, the researcher requires the Convection Industry's demand data for rice in the period of 2018 and 2019. The data for the period of 2020 and 2021 cannot be included, since the sales are not running according to the expected trend due to the pandemic - hence inaccurate prediction. Up to this day, The convection industry still sells three types of fabric (i.e Wool Peach, Max Mara and Rayon). Table 1 shows the demand data.

Table 1. *Convection Industry Fabric Demand*

YEAR	MONTH	WOOL PEACH	MAX MARA	RAYON
2018	January	178078	35458	52492
	February	189428	39704	44563
	March	183718	29503	38554
	April	172132	32844	37433
	May	135769	40083	36628
	June	148235	33298	34333
	July	172305	28468	38726
	August	189486	29498	50088
	September	212491	40124	55028
	October	155078	30878	51727
	November	149240	27922	44563
	December	170948	29613	38519
2019	January	189457	30538	52498
	February	172092	36628	64918
	March	166189	28233	63198
	April	154876	24771	48323
	May	136448	22828	39767
	June	160626	31683	48243
	July	166480	32827	51008
	August	162925	32028	52728
	September	143468	25122	42027
	October	149126	22845	38928
	November	160511	28267	44793
	December	166457	31568	51583

Source: Convection Industry (2021)

The demand data from the Convection Industry's is used to predict next year's demand forecasts. In this process, the researcher requires a series of processes to calculate the most accurate forecasting data with minimum error rate. From table 1, the historical pattern shows a similar "upward and downward trend". All three charts move up in June and at the end of the year. From the demand data, the researcher chooses the seasonal forecasting method. In Zaitun Time Series, there are two choices of methods to calculate the seasonal index, which are Additive Decomposition and Multiplicative Decomposition - as well as Double Exponential Smoothing and Triple Exponential Smoothing. The researcher will then choose one method which has the smallest MSE and MAPE values to forecast the three examined products. The results of the calculations of Wool Peach product(s) are shown in Table 2.

Table 2. *The Results of the Forecasting Calculation of Wool Peach Product(s)*

Forecasting Methods	MSE Values	MAPE Values
Decomposition Additive	283915141	7.702
Decomposition Multiplicative	283910676	7.701
Double Exponential Smoothing	413147114	10.186
Triple Exponential Smoothing	706797589	12.593

Source: Zaitun Time Series (2022)

From Table 2, the best forecasting method for Wool Peach product(s) is Decomposition Multiplicative. The forecasting results are provided Table 3. The forecasting calculations of Max Mara products are in Table 4. It shows that the best forecasting method for Max Mara product(s) is Decomposition Additive. Therefore, Table 5 shows the forecasting results with Decomposition Additive methods. Lastly, the forecasting calculations of Rayon product(s) is provided in Table 6. It is found that the best forecasting method for Rayon product(s) is Decomposition Additive, as seen in Table 7.

Table 3. *The Forecasting Results of Wool Peach Product(s) with Multiplicative Decomposition Method*

Months	Demand Forecasts
January 2020	177542
February 2020	175955
March 2020	175596
April 2020	174016
May 2020	173651
June 2020	172077
July 2020	171705
August 2020	170138
September 2020	169759
October 2020	168199
November 2020	167813
December 2020	166261

Source: Zaitun Time Series (2022)

Table 4. *The Results of the Forecasting Calculation of Max Mara Product(s)*

Forecasting Methods	MSE Values	MAPE Values
Decomposition Additive	16501458	11.445
Decomposition Multiplicative	16518325	11.470
DoubleExponential Smoothing	25244439	14.617
TripleExponential Smoothing	63857085	22.647

Source: Zaitun Time Series (2022)

Table 5. *The Forecasting Results of Maxmara Product(s) with Decomposition Additive Method*

Months	Demand Forecasts
January 2020	34849
February 2020	35265
March 2020	34117
April 2020	34533
May 2020	33385
June 2020	33801
July 2020	32653
August2020	33068
September 2020	31920
October 2020	32336
November 2020	31188
December 2020	31604

Source: Zaitun Time Series (2022)

Table 6. *The Results of the Forecasting Calculation of Rayon Product(s)*

Forecasting Methods	MSE Values	MAPE Values
Decomposition Additive	60700107	14.048
Decomposition Multiplicative	60694020	14.050
Double Exponential Smoothing	74323876	15.855
Triple Exponential Smoothing	285808288	26.827

Source: Zaitun Time Series (2022)

Table 7. *The Forecasting Results of Rayon Product(s) with Decomposition Additive Method*

Months	**Demand Forecasts**
January 2020	43515
February 2020	43919
March 2020	44056
April 2020	44461
May 2020	44596
June 2020	45003
July 2020	45137
August2020	45545
September 2020	45677
October 2020	46087
November 2020	46218
December 2020	46629

Source: Zaitun Time Series (2022)

Another required data is the data which related to production and capacity. Table 8 shows the Convection Industry's production and capacity data. The data related to employees' data are required. Table 9 is a table of Convection Industry's the operational costs data. Finally, Table 10 concludes that the employees' salary (per unit).

Table 8. *Convection Industry's Employees' Data*

Wool Peach	100 units per hour	160.000 units per month
Max Mara	20 units per hour	32.000 units per month
Rayon	25 units per hour	40.000 units per month

Source: Convection Industry (2021)

Table 9. *Convection Industry's Employees' Data*

Number of Employees	30 people
Workhours (per day)	8 hours
Employee division	10 people in Wool Peach 10 people in Max Mara 10 people Rayon
Employees' salary	3.600.000 / people
Salary (per hour)	225.000

Source: Convection Industry (2021)

Table 10. *Convection Industry Employees' Salary Data (Per Unit)*

Wool Peach	225 *rupiah* per unit
Max Mara	1.125 *rupiah* per unit
Rayon	643 *rupiah* per unit

Source: Convection Industry (2021)

Based on the Convection Industry's policy, it is explained that for each overtime, employees will be given a daily allowance of Rp. 75,000,00. Meanwhile, regarding the addition of employees, Convection Industry can only add a maximum of five employees. With this addition, the total production capacity will also increase, therefore it will increase sales almost instantly; hence the zero expense in adding the number of employees. Another required data are the ones related to regular costs. Table 11 provides the Convection Industry's operating costs data.

Table 11. *Convection Industry's Operating Costs Data*

	SALARY / UNIT	MATERIAL	OTHERS	**COGS**
WOOL PEACH	225.00	16,800.00	1,702.50	**18,727.50**
MAX MARA	1,125.00	17,900.00	1,902.50	**20,927.50**
RAYON	642.86	17,200.00	1,784.29	**19,627.14**

Source: Convection Industry (2021)

Table 12. *Overtime Cost*

	SALARY / UNIT	MATERIAL	OTHERS	OVERTIME	**COGS**
WOOL PEACH	225.00	16,800.00	1,702.50	83	**18,810.83**
MAX MARA	1,125.00	17,900.00	1,902.50	17	**20,944.17**
RAYON	642.86	17,200.00	1,784.29	29	**19,939.17**

Source: Convection Industry (2021)

The Processing of Aggregate Planning

The researcher conducts aggregate planning through two approaches, which are sub-contracting and adding the number of machines. Each of them is investigated based on two strategic options (i.e Level Strategy or Chase Strategy). The research is carried out using POM-QM software for Windows. The following is the result of the processing by using both methods.

The overtime approach is conducted by increasing the working hours of the employees (every day) by two hours - with the addition of overtime costs of Rp 75,000,00 - since it will increase the COGS costs of the product as follows:

1. Regular cost from Wool Peach product(s) = Rp 18.728 / unit.
2. Overtime cost from Wool Peach product(s) = Rp 19.144 / unit.
3. Holding cost from Wool Peach prouct(s) = 5% from the Regular cost = Rp 936 / unit.
4. Shortage cost or the costs in case the product cannot be produced = the selling profit which is as much as Rp 1.544/unit.

From that data, the results of the aggregate planning calculation are provided in Table 13.

Table 13. *The Results of the Calculation of Overtime Aggregate Planning for Wool Peach Product(s)*

	Demand	Regular Capacity	Overtime Capacity	Regular Production	Overtime Production
January	177542	160000	40000	160000	17542
February	175955	160000	40000	160000	15955
March	175596	160000	40000	160000	15596
April	174016	160000	40000	160000	14016
May	173651	160000	40000	160000	13651
June	172077	160000	40000	160000	12077
July	171705	160000	40000	160000	11705
August	170138	160000	40000	160000	10138
September	169759	160000	40000	160000	9759
October	168199	160000	40000	160000	8199
November	167813	160000	40000	160000	7813
December	166261	160000	40000	160000	6261
Total (units)	**2062712**	**1920000**	**480000**	**1920000**	**142712**
				18728 /unit	19144 /unit
Subtotal Costs				**35,957,760,000.00**	**2,732,079,000.00**
Total Cost					**38,689,840,000.00**

Source: Data processing using QM for Windows (2022)

Table 13 conclude that in January, the company will get a demand of 177,542 units - with a regular capacity of 160,000 units and an overtime capacity of 40,000 units. In January, the company must produce 160,000 units and produce 17,542 units from the overtime (or around eight working days). It can be seen that the total production cost incurred to meet the consumers' demand is as much as Rp 38.689.840.000.

The approach of adding the number of employees is conducted by increasing the number of employees by five (people) with the same salary; but without having overtime. Therefore, it will not increase the COGS cost of the following products:

1. Regular cost from Wool Peach product(s) = Rp 18.728/unit.
2. Holding cost from Wool Peach prodduct(s) = 5% from the Regular cost = Rp 936/unit.
3. Shortage cost or the costs in case the product cannot be produced = the selling profit which is as much as Rp 1.544/unit.

Table 14. *The Results of the Calculation of Adding the Number of Employees Aggregate Planning for Wool Peach Product*

	Demand	Regular Capacity	Overtime Capacity
January	177542	192000	177542
February	175955	192000	175955
March	175596	192000	175596
April	174016	192000	174016
May	173651	192000	173651
June	172077	192000	172077
July	171705	192000	171705
August	170138	192000	170138
September	169759	192000	169759
October	168199	192000	168199
November	167813	192000	167813
December	166261	192000	166261
Total (units)	2062712	2304000	2062712
			18728 /unit
Subtotal Costs			38,630,470,000
Total Cost			38,630,470,000

Source: Data processing using QM for Windows (2022)

Table 14 shows that the total production cost incurred to meet the consumers' demand is as much as Rp 38.630.470.000. The overtime approach is conducted by increasing the working hours of the employees (every day) by two hours - with an additional of Rp 75,000,00 overtime costs. Therefore, it will increase the COGS cost of the product as follows:

1. Regular cost from Wool Peach product(s) = Rp 20.928/unit.
2. Overtime cost from Wool Peach product(s) = Rp 20.944/unit.
3. Holding cost from Wool Peach product(s) = 5% from the Regular cost = Rp 1.046/unit.
4. Shortage cost or the costs in case the product cannot be produced = the selling profit which is as much as Rp 1.053/unit.

Table 15. *The Results of the Calculation of Overtime Aggregate Planning for Max Mara Product(s)*

	Demand	Regular time Capacity	Overtime Capacity	Regular time production	Overtime production	Units increase	Units decrease
January	34849	32000	8000	32000	2849	0	0
February	35265	32000	8000	32000	3265	0	0
March	34117	32000	8000	32000	2117	0	0
April	34533	32000	8000	32000	2533	0	0
May	33385	32000	8000	32000	1385	0	0
June	33801	32000	8000	32000	1801	0	0
July	32653	32000	8000	32000	653	0	0
August	33068	32000	8000	32000	1068	0	0
September	31920	32000	8000	31920	0	0	80
October	32336	32000	8000	32000	336	80	0
November	31188	32000	8000	31188	0	0	812
December	31604	32000	8000	31604	0	416	0
Total (units)	398719	384000	96000	382712	16007	496	892
				20928 /unit	20944 /unit	0 /unit	0 /unit
Subtotal Costs				8,009,397,000.00	335,250,600.00	-	-
Total Cost							**8,344,647,000.00**

Source: Data processing using QM for Windows (2022)

Table 15 conclude that in January, the company will get a demand of 34,849 units - with a regular capacity of 32,000 units and an overtime capacity of 8,000 units. In January, the company must produce 32,000 units and produce 2849 units with overtime (or around 7 working days). It can be seen that the total production cost incurred to meet the consumers' demand is as much as Rp 8,344,647,000.00.

The approach of adding the number of employees is conducted by increasing the number of employees by five (people) with the same salary - but without overtime. Therefore, it will not increase the COGS cost of the products:

1. Regular cost from Wool Peach product(s) = Rp 18.728/unit
2. Holding cost from Wool Peach product(s) = 5% from the Regular cost = Rp 936/unit
3. Shortage cost or the costs in case the product cannot be produced = the selling profit which is as much as Rp 1.544/unit

Therefore, the results of the aggregate planning calculation are provided in Table 16.

Table 16. *The Results of the Calculation of Adding the Number of Employees Aggregate Planning for Max Mara Product(s)*

	Demand	Regular time Capacity	Overtime Capacity	Regular time production	Overtime production	Units increase
January	34849	35200	34849	0	0	0
February	35265	35200	35200	65	351	0
March	34117	35200	34117	0	0	1083
April	34533	35200	34533	0	416	0
May	33385	35200	33385	0	0	1148
June	33801	35200	33801	0	416	0
July	32653	35200	32653	0	0	1148
August	33068	35200	33068	0	415	0
September	31920	35200	31920	0	0	1148
October	32336	35200	32336	0	416	0
November	31188	35200	31188	0	0	1148
December	31604	35200	31604	0	416	0
Total (units)	398719	422400	398654	65	2430	5675
			20928 /unit	1053 /unit	0 /unit	0 /unit
Subtotal Costs			8,343,031,000.00	68,445.00	-	$0
Total Cost						**8,343,099,000.00**

Source: Data processing using QM for Windows (2022)

It can be seen that the total production cost incurred to meet the consumers' demand is as much as Rp 8,343,099,000. The approach of adding the number of employees is conducted by increasing the number of employees by five (people) with the same salary - but without overtime. Therefore, it will not increase the COGS cost of the following products:

1. Regular cost from Wool Peach product(s) = Rp 19.910 / unit
2. Overtime cost from Wool Peach product(s) = Rp 19.939/ unit
3. Holding cost from Wool Peach product(s) = 5% from the Regular cost = Rp 996 / unit
4. Shortage cost or the costs in case the product cannot be produced = the selling profit which is as much as Rp 890/unit.

Table 17. *The Results of the Calculation of Overtime Aggregate Planning for Rayon Product(s)*

	Demand	Regular time Capacity	Overtime Capacity	Regular time production	Overtime production
January	43515	40000	10000	40000	3515
February	43919	40000	10000	40000	3919
March	44056	40000	10000	40000	4056
April	44461	40000	10000	40000	4461
May	44596	40000	10000	40000	4596
June	45003	40000	10000	40000	5003

July	45137	40000	10000	40000	5137
August	45545	40000	10000	40000	5545
September	45677	40000	10000	40000	5677
October	46087	40000	10000	40000	6087
November	46218	40000	10000	40000	**6218**
December	46629	40000	10000	40000	6629
Total(units)	540843	480000	$120,000	$480,000	60,843.00
				19910 /unit	19939 /unit
		Subtotal Costs		9,556,799,000	1,213,149,000
Total Cost					**10,769,950,000**

Source: Data processing using QM for Windows (2022)

Table 17 shows that in January, the company will get a demand of 43.515 units – with regular capacity of 40.000 units and overtime capasity of 10.000 units. In January, the company must produce 40.000 units and produce 3.515 units with overtime. The total production cost incurred to meet the consumers' demand is as much as Rp 10.769.950.000.

The approach of adding the number of employees is conducted by increasing the number of employees by five (people) with the same salary - but without overtime. Therefore, it will not increase the COGS cost of the following products:

1. Regular cost from Wool Peach product(s) = Rp 19.910 / unit
2. Holding cost from Wool Peach product(s) = 5% from Regular cost = Rp 936 / unit
3. Shortage cost or the costs in case the product cannot be produced = the selling profit which is as much as Rp 1.544 / unit

The results of the aggregate planning calculation are shown in Table 18. The total production cost incurred to meet the consumers' demand is as much as Rp 10,768,180,000. From the forecasting and aggregate planning tests results, the explanation is provided in Table 19.

Table 18. *The Results of the Calculation of Adding the Number of Employees Aggregate Planning for Rayon Product(s)*

	Demand	Regulartime Capacity	Regular time production	Units increase
January	43515	67200	43515	0
February	43919	67200	43919	404
March	44056	67200	44056	137
April	44461	67200	44461	405
May	44596	67200	44596	135
June	45003	67200	45003	407
July	45137	67200	45137	134
August	45545	67200	45545	408
September	45677	67200	45677	132
October	46087	67200	46087	410
November	46218	67200	46218	131
December	46629	67200	46629	411
Total (units)	**540843**	**806400**	**540843**	**3114**
			19910 /unit	0 /unit
Subtotal Costs			10,768,180,000	0
Total Cost				**10,768,180,000**

Source: Data processing using QM for Windows (2022)

Table 19. *The Recommended Forecasting Results*

Product(s)	The recommended forecasts
Wool Peach	Decomposition Multiplicative
Max Mara	Decomposition Additive
Rayon	Decomposition Additive

Source: Data processing using Zaitun Time Series (2022)

Looking at the results of this forecast, it can be concluded that the best forecasting method the one with 'seasonality or decomposition'. This is in accordance with a research conducted by [1]Adenomon and Oyejola (2014); that found the results that the best forecasting to measure seasonal data is forecasting with a decomposition approach - since this forecasting is created to forecast time-series data - which shows the presence of trend patterns and seasonal effects. The decomposition method is a forecasting method which uses four main components in predicting future values. It tries to separate time series data into several patterns and identify each component separately. These components are trend, cyclical, seasonal and error factors.

However, if longer historical data is drawn, then it will be possible that the data formed is an increasing trend; so that later, Convection Industry can use other methods depending on how far the historical data is drawn. For the results of aggregate planning, the explanation is seen in Table 20. It can be concluded that the addition of employees is the best recommendation for meeting excessive demands.

Table 20. *Aggregate Planning Result*

Product(s)	Overtime	Adding the Number of Employees
Wool Peach	Rp 38,689,840,000	Rp 38,630,470,000
Max Mara	Rp 8,344,647,000.00	Rp 8,343,099,000
Rayon	Rp 10.769.950.000	Rp 10,768,180,000

Source: Data processing using QM for Windows (2022)

The Implication of the Results of the Study

By looking at the results of this study, an explanation can be made regarding the theoretical implications, just like what has been done by previous researches by Cheraghalikhani (2019), Nugraha (2020), and Nugroho and Emaputra (2021); which figured out that forecasting is indeed the best method to predict future demands. Furthermore, this study also in accordance with previous researches by Fajar and Lestari (2017) and Oeyetal (2020), discovered the fact that aggregate planning can indeed serve as the solution for companies in solving problems regarding to the amount of demands that exceeds production capacity.

From the research results, the two approaches of aggregate planning can be implemented by the company, because both do not have significant differences. However, in its implementation, there are several factors which must be considered by the company. For the overtime approach, the shortcomings which can arise are the welfare of employees' lives, work-life balance, as well as increased workload and work stress. However, with the overtime approach, the company does not need to pay for the training of new employees, and it is certain that they will be able to adapt easily to the company's way of working. Meanwhile, for the approach of adding the number of employees, the shortcomings which can arise are the tendency of conflict between employees, high recruitment costs, as well as the time which must be spent for evaluating and analyzing the new employees. However, with this approach, the company supports its surrounding social conditions by adding business fields, able to use the part-time system, as well as able to increase the competition between the employees in the company.

CONCLUSIONS

The best forecasting calculation for Convection Industry is by using Decomposition Multiplicative and Decomposition Additive methods. Aggregate planning for Convection Industry with overtime approach for Wool Peach product(s) costs about Rp 38,689,840,000; for Max Mara product(s) it costs about Rp 8,344,647,000.00; and for Rayon product(s) it costs about Rp 10.769.950.000. Aggregate planning for Convection Industry with the approach of adding the number of employees for Wool Peach product(s) costs Rp 38,630,470,00000; for Max Mara product(s) it costs about Rp 8,343,099,000; and for Rayon product(s) it costs about Rp 10,768,180,000.

For conviction industry, it is best to use forecasting methods with seasonal or decomposition additive (or multiplicative) - since it is already proven that both methods produce the lowest error rate compared to the other methods. However, for the long term with further historical data, Convection Industry can use linear forecasting method. Regarding the costs, Convection Industry is recommended to apply the approach of adding the number of employees so as to increase production rather than using the overtime approach, since the production costs produced will be lower. However, from an operational point of view, Convection Industry can also apply overtime approach if in the future; the approach of adding the number of employees is still unable to meet the consumers' demands.

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