

Proposed Aggregate Planning for Overcoming Overstock and Shortage at La Crème

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Keywords	Abstract
Aggregate Planning, Inventory Imbalance, Forecasting, Fashion, Safety Stock	The fashion industry is known for its volatility, characterized by rapid trend cycles and short product life spans, which pose operational challenges for businesses like La Crème, a B2B wholesaler in Indonesia. With over 300 SKUs and a production capacity of 6,000 pieces per week, La Crème serves a wide network across Southeast Asia and the Middle East. However, the company faces inefficiencies in supply-demand balance, leading to overstock and shortage issues that hurt profitability and customer satisfaction. In 2023, production volume dropped significantly, highlighting flaws in inventory planning. This research aims to develop a structured aggregate production planning model to mitigate these imbalances while enhancing service levels and cost efficiency. Using a mixed-method case study approach, quantitative data includes historical sales and production records, while qualitative insights are gathered from interviews and observations at La Crème's facilities. The study evaluates forecasting accuracy through methods like Linear Trend and Moving Average, revealing that effectiveness varies by SKU. The core analysis involves simulating four production planning models over three months: chase strategy, level strategy with stockouts, subcontracting, and overtime. Results indicate that the Level Strategy with Subcontracting is the most effective, achieving the lowest total cost while maintaining service levels. This study emphasizes the importance of data-driven planning to align forecasted demand with production capacity, ultimately promoting agility and improved financial outcomes for La Crème.



INTRODUCTION

Operating in a very volatile environment where trends come and go incredibly fast, products have shorter life spans, and there is a continual demand for faster fulfilment, the fashion industry is a very challenging industry. The constant shift in trends often occurs on a monthly basis. According to Wen, Choi and Chung (2019) this place is highly complicated and challenging for supply chains to remain agile, continuously adapt while also being cost-efficient. Broadly, the industry is categorized into two key segments: business-to-business (B2B) and business-to-consumer (B2C). According to McKinsey & Company's State of Fashion report (2023), the global fashion market is valued at over USD 1.5 trillion, with major players investing heavily in digital transformation, data-driven planning, and sustainability initiatives. However, despite these advancements, persistent inefficiencies particularly inventory-related challenges such as overstock and stockouts continue to undermine profitability, resulting in lost sales opportunities, high markdowns, and environmental waste (Archetti & Bertazzi, 2021; Becerra et al., 2022; Fassnacht et al., 2024; Jobira et al., 2022; Omar et al., 2020).

In Indonesia, the fashion industry stands as one of the most dynamic pillars of the national creative economy, contributing approximately 18% to the sector's overall GDP (Kemenparekraf, 2020). According to projections by Statista (2024), the Indonesian fashion

market is expected to surpass USD 7.72 billion, with apparel as its primary driver by 2025. Further studies by Sugih and Soekarno (2015) discover that this growth is fueled by population growth, rising income per capita, increase in purchasing power especially during peak season, and increasing interest in fashion. However, despite its expansion, operational inefficiencies continue to persist. The absence of structured demand forecasting systems and standardized inventory management practices remains a significant barrier to scalability, particularly among small and medium-sized enterprises (SMEs) (Choi, 2020d, 2020b, 2020a, 2020c; Wen et al., 2019). Supply chains are frequently manually administered that are highly susceptible to disruptions, resulting in persistent mismatches between production outputs and the actual market demand.

It is a challenge to balance responsiveness, while being cost efficient. As previously mentioned, fashion products have relatively short life cycles and demand can be highly seasonal. For example, typically the demand for clothing surge ahead of Ramadan and Eid each year as customers purchase new outfits for the festivities. This seasonality, along with evolving trends due to the ever changing consumer behaviour, makes demand volatile and difficult to forecast. Moreover, the operational infrastructure, from fabric sourcing to manufacturing and logistics can be less predictable in emerging markets, adding lead time uncertainties and capacity constraints to the challenge.

Within the business-to-business (B2B) segment, enterprises play a crucial role by producing and supplying resell able products to retailers, resellers or distributors, thereby forming the operational backbone of the broader fashion ecosystem. B2B wholesalers are instrumental in facilitating the production and distribution of apparel across an extensive network of retail outlets, ensuring that manufactured goods are efficiently channeled towards consumer markets. These manufacturers range from large-scale manufacturers to small and medium enterprises. Among these manufacturers is La Crème, a wholesale fashion business based in Indonesia.

La Crème is no exception to these challenges. In terms of production capacity, the company produces between 2,000 to 6,000 pieces weekly across more than 300 SKUs, offering variations in sizes and colors to meet diverse reseller demands. La Crème experienced a significant year-over-year decline in recent years. La Crème has consistently faced operational inefficiencies due to overstock and shortage. Between May and December 2022, the company produced 191,047 units. However, in the full year of 2023 the output dropped to 112,163 units. This decrease highlights underlying inefficiencies within the company's production planning and inventory management systems. Particularly issues related to overstock and frequent product shortages. These shortages have led to missed sales opportunities, damaging the brand's credibility and reducing repeat purchases. The lack of a robust production and inventory planning system has significantly affected the company's ability to sustain a balanced supply chain and fulfill market demand.

Prior studies by Regina et al. (2021) emphasize the significance of structured sales and operations planning in mitigating inventory imbalances, which is particularly relevant for La Crème. To effectively resolve these inefficiencies, a holistic approach is necessary that addresses both internal production constraints and external variability in supply and demand. This research aims to optimize inventory policies and implement aggregate planning techniques to enhance overall operational performance.

The objectives include analyzing how inventory imbalances influence La Crème's business performance, pinpointing the underlying factors contributing to overstock and shortage, and proposing suitable strategies to address these challenges. The scope of the research is specifically confined to one supplier branch located in Pekalongan, out of seven garment supplier branches, and will concentrate on five product categories: RK 22, 51 V2S, 77 V2S, 31 C2S, and LC 50, from a total of eight categories. The study utilizes internal historical

data from a nine-month period, spanning January to September 2024, with detailed simulations conducted over a three-month timeframe from October to December 2024. The analysis will be conducted solely from an operational perspective, ensuring a focused examination of the issues at hand.

METHOD

This research employs a mixed-method approach, integrating both qualitative and quantitative methodologies to address the research objectives effectively. The qualitative component involves semi-structured interviews with internal stakeholders, including production and warehouse departments, as well as garment suppliers, to gain insights into operational challenges. Surveys, internal document reviews, and field observations at the garment facilities further enrich the qualitative data. The quantitative aspect focuses on analyzing historical production and sales data, particularly for forecasting and inventory management. The research design begins with establishing the study's background and identifying the problem context, followed by a theoretical foundation based on existing literature related to aggregate planning and inventory management. Data collection incorporates a case study approach, blending qualitative and quantitative methods, where quantitative data includes historical company records and sales figures to identify trends, while qualitative data is gathered through interviews and observations to validate findings. The data analysis involves statistical techniques such as time series analysis, forecast accuracy testing, and scenario-based strategy comparisons. Various forecasting methods, including moving averages and exponential smoothing, are utilized to enhance demand predictions. The core of the study develops several aggregate planning scenarios, including chase strategies and level strategies with stockouts, subcontracting, and overtime, to optimize production plans. Each strategy is evaluated based on cost implications, service level performance, and production feasibility. This comprehensive approach seeks to align production capacity and inventory levels with anticipated demand, ultimately providing actionable recommendations for La Crème to improve inventory balance and enhance operational efficiency.

RESULTS AND DISCUSSION

Analysis

As a wholesaler company, La Crème manufactured various kinds of products that have various process flows. As a B2B fashion wholesaler with SKU complexity, make-to-stock and pre-order model, custom labelling and production of 3,000-6,000 units weekly, this research will only focus on several product categories. The researcher applied ABC classification of products based on product types and their contribution to overall value. The analysis utilized historical sales and inventory data from July to September 2024. The production data will only focus on two facilities, the cutting and sewing team in Jakarta and Garment T in Pekalongan.

Fishbone Analysis

The problem analysis data is obtained from a combination of field observations, historical data and interviews with key stakeholders. The analysis is described using the fishbone analysis as below:

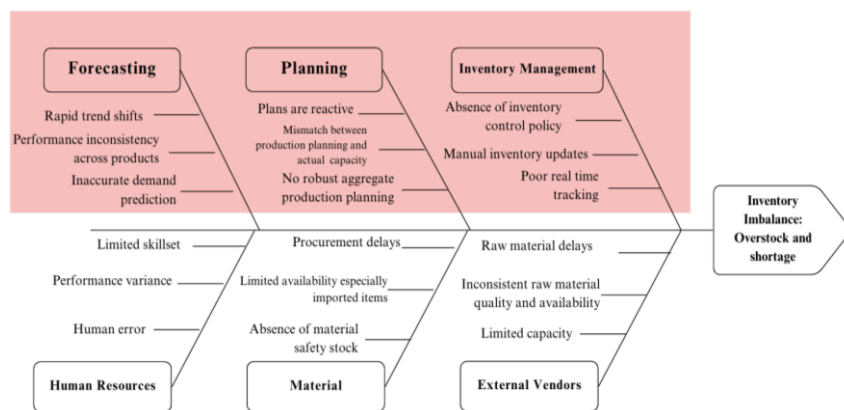


Figure 1. Fishbone Analysis

The fishbone diagram from above illustrates La Crème’s recurring inventory imbalance, the problem of overstock and shortages comes across a combination of issues across forecasting, planning, inventory management, human resources, materials and external vendors. However, the most critical root causes lie within the red-highlighted area which is the planning that is also connected with forecasting and inventory management. These three components form the core of supply and operations planning are tightly interrelated. Inaccurate demand forecasting, reactive planning without the proper aggregate production planning and the absence of real-time inventory management resulted in the misalignment of production and stock availability. Addressing the issues within the red-highlighted zone is therefore essential, as it represents the core issue of La Crème.

Existing Production Planning

This section provides an overview of La Crème’s existing production planning practices. Which involves the production process of five selected product categories, it undergoes five main stages. The production process happened between Jakarta and Pekalongan. While the company has an existing system in place for scheduling and fulfilling production orders, planning tends to lack integration and is based on managerial judgement. The following analysis further illustrates where the existing processes are lacking.

Production Performance

From Appendix A,B,C,D and E, the first stage is the design planning, in this stage it involves weekly ideation session driven by trend projections and pattern development and sample prototyping. Usually, the trends are gathered from basic research or gathered from customers' requests on certain fabric and styles after that the design will then be developed accordingly. The second stage would be the cutting and pattern stage, during this stage is where fabrics undergo inspection, then continue to pattern layout planning and finish off with mass fabric cutting. The process also incorporates outsourcing cutting partners with the standardized templates to ensure consistency of sizing. The third stage is the manufacturing process or the tailoring and sewing stage. Since most of the garment facilities are located outside Jakarta, these raw cut fabrics will be delivered to each facility in Pekalongan using cars, which takes around five to six hours delivery time. Once the raw cut fabrics arrive in each facility, the tailors could then start sewing it into finished garments. In each stage also includes multiple quality checking to maintain the standards. After the manufacturing process has been conducted, it will go towards the final finishing and quality control stage. The process of ironing, thread trimming, packaging and final quality assurance to check for defects in Pekalongan will be conducted here. Once everything is set, these ready to sell goods will be deliver back to Jakarta which will take another six to seven hours delivery time to La Crème’s

warehouse. In the warehouse, it will undergo the process of product sorting, storage and fulfilment. Some of these products will be bring to the store, and distributed for online orders or direct store pickups.

The flowchart includes specific time metrics per batch, the average daily operations typically running from 08:00-21:00. The flowchart reveals significant variations in complexity, task duration and bottlenecks across different product categories. The longest time to produce would be 31 C2S which has the longest lead time of 4,286 minutes for 204 pieces. There process involves overlock stitching, rubber band application, pocket sewing and others. Comparatively products such as 51 V2S and LC 50 have shorter duration but still experience delays and bottlenecks. The common bottlenecks that happen is in the quality control and finishing product stage as well as the manufacturing process of gathering the accessories for each product category. These bottlenecks and buffer have high risk of inventory accumulation. This also indicates that there are external dependencies for the process like purchasing zipper which adds variability in the process.

From the Table ABC Classification it shows the comparative review of historical sales vs production for the selected 5 product categories, showing clear shortage or overstock patterns and emerging trends. For Category A, highlighted yellow, 77V2S, initially it was underproduced, then followed by an aggressive production increase to catch up with the demand. However, the overcorrection may have led to excess inventory in December. For 31C2S the sales trend is consistent and growing, however shortage happens from July-September, with a risk of overstock in October where the production does not align with the demand volume which may lead to excess holding costs if not sold fast enough. Next category B, highlighted green, for 51 V2S, the sales are volatile with a low and inconsistent production trend. This indicates there’s a weak production planning. Lack of production in key months could lead to stockouts if inventory safety stock is minimal. For RK 22, the sales trend is rising and peaking then fluctuates, the trend shows that there is rising demand however is not met with proactive production. There’s an indication where missed production opportunity during peak demand periods, where risk of unfulfilled orders and high shortage cost. Finally, for Category C, highlighted blue, LC 50 products have a low but gradually increasing sales trend. The major overproduction in July creates overstock inventory, even though there is no immediate shortage risk, but poor warehouse planning may lead to markdowns, high deadstock risk and high overstock costs.

Operation and Production Metrics

Table I. Indicator for The Inventories of La Crème for One Product

Indicator	Value
Operation Time: Setup Time and Run Time	8 hours + 8 hours
Flow Time	5 days
Throughput Rate	1/14
Total Average Value of Inventory (3 months)	Rp. 1,500,000,000
Day Sales Outstanding	14 days
Days Inventory	30 days
Payables Period	30 days
Asset Turnover	0.5
Productivity Rate	10.197368
- Outputs (units produced)	1550
- Inputs (labor hours)	152
Utilization Rate	87.5
- Actual time utilized (sewing machines in use)	7
- Available time (total time of the resource available)	8
Lead Time	
- Cutting	2 days
- Sewing	16 days
- Finishing (Packaging + Labeling)	1 day

Cycle Time	
- Total Time Taken for Production	19
- Number of Units Produced	84

Source: processed data

The table above summarizes key operational metrics that reveal La Crème’s current production performance. Operating with an 8-hour setup and run time extended over a five day flow cycle, the system achieves a throughput rate of 1/14. This results in a relatively low productivity level at 10.19% This indicates that there are inefficiencies in the movement of units through the production system.

Inventory remains high, with an average value approximately Rp. 1,500,000,000 over a three-month period. Additionally, inventory days are typically around 30 days, which is aligned with the company’s payable period of 30 days. This suggests that there’s a limited working capital leverage. Furthermore, the asset turnover ratio is recorded at 0.5, which further indicates underutilization of overall assets. However, sewing machine utilization is quite high at 87.5%, the lead time for completing one purchase order averages 19 days, with cycle time per unit approximately 0.23 days. These figures highlight that the company is in need for more agile production planning, especially when addressing the complexities of high SKU variety.

Lead Time Breakdown

Shown from Table 2 that the lead time for La Crème is approximately 31 days, exceeding the company limit of 14 days.

Current Forecasting Method

Currently, La Crème relies on a subjective judgement-based approach to forecasting, primarily driven by the intuition of managerial and sales team supported by historical data of sales quantity of the month before. Rather than utilizing systematic data analysis or formal forecasting tools, production and sales estimates are made based on past trends, visual stock monitoring and management’s personal expectations of future demands. While this method offers flexibility and speed in decision-making, it lacks accuracy and consistency that often leads to mismatches between production output and actual market demand, which in turn contributes to both inventory shortages and overstock. As La Crème expands its product range and customer base, this informal method becomes increasingly proven inadequate to handle the complexity of operations and the rapidly shifting customer trend.

Current Production Plan for 5 Products Categories

Description	OCT	NOV	DEC
Sales Plan	1,900	2,000	2,100
Safety Stock	600	600	600
TOTAL (Sales Plan + Safety Stock)	2,500	2,600	2,700
Beginning Inventory	1,956	1,210	1,210
Production Requirement (Sales Plan + Safety Stock – Beginning Inventory)	3,256	2,610	2,710
Actual Production	2,952	1,741	1,911
Actual Sales	1,519	1,974	2,244
Ending Inventory (Beginning Inventory + Actual Production – Actual Sales)	3,389	977	877
Working Days	22	21	20
Cost of Production	132,840,000	78,345,000	85,995,000

Source: processed data

Table 2 shows the current production plan that La Crème set up for the 5 products categories. During the period of October to December, La Crème encountered fluctuating inventory imbalances. In October and December, the company faced significant overstock conditions, where production volumes substantially exceed demand and sales. Specifically, October ended with an inventory surplus of 1,889 units, while December closed with 877 units

still in stock. This accumulation led to holding costs of IDR 9,445,000 in October alone (1,889 units × IDR 5,000). These conditions highlight inefficiencies in demand forecasting and inventory management, leading to high storage expenses.

In contrast, November showed a different result, where 869 units were underproduced relative to the demand requirement. This production deficit resulted to a stockout cost of IDR 21,725,000 (869 units × IDR 25,000), indicating lost sales opportunities. It can be concluded that there are mismatches and gap between planning and fulfillment. October the company was under plan, while November the production was slightly over plan, and December there was under forecasting due to unexpected demand.

The findings reveal that the current approach is far from optimal. Planning tends to be reactive and there is no real time inventory data which results in frequent mismatches between supply and actual market needs.

Proposed Model Implementation

This section presents the proposed model implementation based on the key findings from the previous analysis. The proposed models are developed to address the root causes of imbalance identified in La Creme’s current system and are aimed at creating a more structured, responsive and data-driven planning process. The proposed model will start from evaluating a more accurate demand forecast, capacity calculation, followed by inventory planning performance through the calculation of safety stock, then the aggregate planning simulation, conclude by cost comparison and analysis.

Forecasting Evaluation

The researcher conducted all forecasting computations using Minitab statistical software, leveraging its built-in functions for time series analysis, including moving averages and exponential smoothing models, to streamlines the forecasting process. Using Minitab, the historical demand data for La Crème were inputted in the software, and the software’s time series module was used to generate forecasts for the upcoming 3 months, based on the aggregate planning time frame. The software automatically computed forecast accuracy metrics, such as Mean Absolute Deviation (MAD) and Mean Squared Error (MSE). Doing so, the researcher is able to compare the performance of each forecasting models. After evaluating the models, the final chosen forecasting technique was used to produce the demand forecast for each month of the planning horizon. These finalized forecasts serve as the primary demand inputs for the aggregate planning models. The forecast was also reviewed against qualitative insights to ensure robustness. The researcher input the historical sales data as below to the Minitab software:

Table 3. La Crème 5 Product Category Sales from April - September 2024

No.	Product Name	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Product 1	RK 22	42	79	104	96	282	523	172	95	353
Product 2	77 V2S	969	750	731	1032	945	852	776	1037	1110
Product 3	51 V2S	307	382	280	151	276	133	96	176	220
Product 4	31 C2S	250	282	413	505	399	436	376	329	452
Product 5	LC 50	123	74	98	81	112	176	99	337	109

Source: processed data

Inputted into the software shows the results as below:

Table 4. Product Category: RK 22 Error Result

Forecasting Method	MAD	MAPE	MSD
Linear Trend	69.94	67.43	6,781.85
Single Exponential Smoothing	71.24	48.91	8,538.56
Moving Average	141	43.7	36,648.10
Time Series Decomposition	84.06	77.31	8,449.83

Source: processed data

Table 5. Product Category: 77 V2S Error Result

Forecasting Method	MAD	MAPE	MSD
Linear Trend	103.6	12.1	12,306.80
Moving Average	155	17.1	31,037.30
Single Exponential Smoothing	107	12.9	14,798.80
Time Series Decomposition	113.2	13.2	13,591.60

Source: processed data

Table 6. Product Category: 51 V2S Error Result

Forecasting Method	MAD	MAPE	MSD
Trend Analysis	51.56	23.29	3,470.07
Single Exponential Smoothing	75.85	42.37	8,696.80
Moving Average	96.40	56.20	11,675.20
Time Series Decomposition	49.44	20.02	3,312.41

Source: processed data

Table 7. Product Category: 31 C2S Error Result

Forecasting Method	MAD	MAPE	MSD
Trend Analysis	52.11	13.43	3,296.74
Single Exponential Smoothing	67.36	16.46	6,488.79
Moving Average	95.10	21.40	12,567.80
Time Series Decomposition	52.11	13.54	3,238.91

Source: processed data

Table 8. Product Category: LC 50 Error Result

Forecasting Method	MAD	MAPE	MSD
Trend Analysis	25.889	24.23	822.546
Single Exponential Smoothing	30.75	28.99	1,386.17
Moving Average	26.88	17.99	1,712.94
Time Series Decomposition	27.867	24.407	929.679

Source: processed data

The table illustrates the performance of various forecasting methods, evaluated based on Mean Absolute Deviation (MAD), Mean Squared Deviation (MSD) and Mean Absolute Percentage Error (MAPE). The results highlight distinct error patterns across different methods and products, guiding the selection of the most suitable forecasting approach for each case. RK 22 shows the lowest MAPE using Moving Average (43.7%) and the lowest MAD with Linear Trend (69.94), but Moving Average had the highest MSD at 36,648.1, indicating wide error spread. 77 V2S performs best with Linear Trend, showing a low MAPE of 12.1% and the lowest MAD (103.6), making it the most accurate for forecasting. 51 V2S yields the best result with Time Series Decomposition, where the MAPE is 20.02% and the MSD is only 3,312.41, offering a more stable error distribution. 31 C2S presents consistent results between Trend Analysis and Time Series Decomposition, both yielding MAD around 52 and MAPE just above 13%, suggesting either method could be used effectively. LC 50, a C-class product, achieves the best accuracy using Moving Average with the lowest MAPE (17.99%) and a relatively low MAD (26.88), making it the optimal method for this product. Therefore, the forecasting result that will be use is as below:

Forecast Result

Table 9. Forecast Result from October-December 2024

Product Name	October (10)	November (11)	December (12)
RK 22	489	575	660
77 V2S	910	919	928
51 V2S	124	86	48
31 C2S	519	558	597
LC 50	147	158	168

Source: processed data

Table 9 presents the final demand forecast results for the five product categories for the period of October to December 2024. These projections are derived from forecasting analyses

conducted using Minitab software, where multiple forecasting methods were evaluated. While the table reflects statistically generated forecasts, the figures shown have been judgmentally adjusted to reflect managerial insights, seasonal context, and operational constraints. This adjustment is necessary due to La Crème’s highly dynamic demand environment where historical data alone may not fully capture upcoming periods, resellers behaviors and market seasonality particularly during end of year period. Moreover, these numbers serve as a realistic planning baseline as they also account for La Crème’s fabric usage efficiency, where the roll to unit conversion can be adjusted to meet targeted outputs.

Capacity Calculation

Table 10. La Crème’s Production Capacity in Garment T

Description	Value
Working Hours	8 hours
2 x Break time (1 hour each)	2 hours
Friday Prayer Break	1.5 hours
Maximum Overtime	5 hours
Machine Maintenance / Others	1 hour
Operator Availability	8 workers
Effective Working Time	4 hours per unit
Working Days per Month	Average 21 days/month
Total Available Labor Hours/Month	8 workers x 8 hours/day = 1344 hours/month
Average Time per Unit	~24.29 minutes
Average Cycle Time	~22.1 minutes
Average Monthly Capacity	~3,320 units

Source: processed data

La Crème’s production capacity in Garment T is determined by 8 operators working an 8-hour shift per day shows the total available labor time reaches 1,344 hours monthly, with 2 hours allocated for breaks, 1.5 hours break every Friday during Friday prayer, and 1 hour for machine maintenance. This leaves an estimated effective working time of 4 hours per unit. Production is carried out over 20 to 22 working days each month. To meet high demand, a maximum of 5 hours overtime per day may be utilized when necessary. Taking into account an average cycle time of approximately 22.1 minutes and an average production time per unit of 24.29 minutes, the average monthly capacity is around 3,320 units per month.

Inventory Planning Performance

The company currently uses the basis of subjective judgement to determine the safety stock which is 10% out of the total stock for each SKUs. When inventory reaches this number, the company will reproduce the item again. This method is a planning-reactive approach, with miscalculation of safety stock, it is very prone to misalignment with demand.

Business Solution

Forecasting Method Selection

Safety Stock Policy

Table 11. Safety Stock Probabilistic Calculation

Product Category	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024	Z-Score (95%)	Standard Deviation	Safety Stock	Lead Time (months)	Variable Demand with Constant Lead Time
RK 22 CV	49	91	42	79	104	96	282	513		1.64	162.23	266	0.47	181.75
51 V2S	129	131	268	307	382	280	151	276	123	1.64	93.98	154	0.47	105.29
77 V2S	525	630	1784	965	750	731	1032	945	852	1.64	358.87	589	0.47	402.05

31 C2S	251	368	367	218	282	413	505	399	436	1.64	89.47	147	0.47	100.24
LC 50 LR	136	91	123	74	98	81	112	176		1.64	33.45	55	0.47	37.47
TOTAL												1210		

Source: processed data

To determine each product category’s safety stock, a probabilistic method has been used as above. There are various methods in determining the company’s safety stock, one of the methods is using a probabilistic model. Below is the formula

$$\text{Safety stock} = Z \times \sigma \times \sqrt{LT}, \text{ with a Z-value of 1.64 for a 95\% service level.}$$

Using the Z-Score of 1.64, with a variable demand and constant lead time. Using the demand data from January - September 2024 (9 months). This model assumes consistent productivity, with no machine breakdowns and predictable supplier lead times. From the result above, the company could finally determine the safety stock policy which is different for each product category, however this policy will be re-evaluated every three months following the different demand data. Previously the safety stock was only 120 pcs from a managerial judgement, now it is based on probabilistic calculations where each product category has a different safety stock that is calculated based on the targeted service level.

Aggregate Planning Simulation

Capacity Calculation

Table 12. Demand and Capacity Context

Description	October	November	December
Beginning Inventory	1,956	1,210	1,210
Demand Forecast	2,201	2,296	2,401
Safety Stock (<i>Probabilistic</i>)	1,210	1,210	1,210
Production Requirement	1,456	2,296	2,401
Ending Inventory	1,210	1,210	1,210

Source: processed data

The demand forecast for the sum of five categories was 2,201 units in October, 2,296 in November, and 2,401 in December, totalling a total of 6,898 units for the quarter. The workforce consisted of eight tailors and production required an average of three hours per unit. La Crème’s beginning inventory was 1,956 units, and a probabilistic safety stock of 1,210 units per month was targeted. The company operates 22 working days in October, 21 in November, and 20 in December, with a 63 days total. Standard labor capacity is 8 hours per worker per day (no work on weekends), and each unit requires about 4 labor-hours of work. Key cost parameters were provided (per unit or per worker): hiring and training cost IDR 1,500,000, layoff cost IDR 2,000,000, inventory holding cost IDR 5,000 per unit per month, shortage (backorder) cost IDR 18,000 per unit short, subcontracting cost IDR 23,000 per unit, regular labor cost IDR 150,000 per hour, and overtime cost IDR 200,000 per hour (approximately 1.33× regular rate). These inputs set the stage for evaluating how each strategy balances the trade-off between capacity, inventory, and backlog costs in aggregate planning.

Table 12 illustrates cost components for each aggregate plan strategy. Plan 1’s expenses are primarily driven by regular labor for production costs and some hiring cost. In contrast, Plan 2’s cost is the most cost efficient. It combines low regular labor expense with moderate shortage costs. Plan 3 similarly cost efficient as Plan 2 with minimal labor expenses and limited subcontracting cost. Notably, Plan 4 incurs the highest costs due to its heavy reliance on overtime wages. Across all plans, inventory holding costs were kept at a minimum but still with the utilization of safety stock that will act as a buffer, no layoff expenses were also incurred, because the industry that La Crème is operating in is very volatile with workforce, which means that there is an increasing need for workforce retention.

Chase Strategy

Table 13. Production Plan 1: Exact Production; Vary Workforce

Description	October	November	December	Total
Production Requirement	1,456	2,296	2,401	
Production Hours Required (4 hours/unit)	5,823	9,184	9,604	
Working Days per Month	22	21	20	
Hours per Month per Worker (8 hrs/day)	176	168	160	
Workers Required	33	55	60	
New Workers Hired	0	22	5	
Hiring Cost	IDR 0	IDR 33,000,000	IDR 7,500,000	IDR 40,500,000
Workers Laid Off	0	0	0	
Layoff Cost (Workers Laid Off)	IDR 0	IDR 0	IDR 0	IDR 0
Straight Time Cost	IDR	IDR	IDR	IDR
	873,423,234	1,377,600,000	1,440,600,000	3,691,623,234
Grand Total				IDR
				3,732,123,234

Source: processed data

The table presents Production Plan 1, that implements an exact production strategy but by adjusting monthly workforce levels to meet the fluctuating production requirements. In October, the production of 1,456 units required 5,823 labor hours, fulfilled by 33 workers working at full capacity of 176 hours each, with no new hires or layoffs. As demand increases in November and December of 2,296 and 2,401 units, it requires 55 and 60 workers respectively. Consequently, La Crème will need to hire 22 new workers in November and 5 new workers in December, incurring a total hiring cost of IDR 40,500,000. There were no layoffs across the period. The straight time costs sum up to IDR 3,691,623,234, bringing the total cost of this plan to IDR 3,732,123,234. While this approach ensures high responsiveness, to demand variations and eliminates shortage risks, it also has the highest significant labor cost due to the constant workforce adjustment.

Level Strategy with Stockouts

Table 14. Production 2: Constant Workforce; Vary inventory and stockout

Description	October	November	December	Total
Beginning Inventory	1,956	107	-1,853	
Working Days per Month	22	21	20	
Jam Produksi Tersedia (Hari Kerja x 8 jam x 8 pekerja)	1,408	1,344	1,280	
Produksi Aktual (Jam Produksi ÷ 4 jam/unit)	352	336	320	
Demand Forecast	2,201	2,296	2,401	
Persediaan Akhir (Persediaan Awal + Produksi - Permintaan)	107	-1,853	-3,934	
Shortage Cost	IDR 0	IDR 46,335,000	IDR 98,360,000	IDR 144,695,000
Safety Stock	1,210	1,210	1,210	
Safety Stock	0	0	0	
Inventory Cost	IDR 0	IDR 0	IDR 0	

Source: processed data

This table above illustrates the second plan calculation using the constant workforce and vary inventory and stockout strategy. The initial inventory of 1,956 units in October was insufficient to meet the high demand forecast of 2,201 units with a shortage of 107 units. By November the plan resulted in significant stockout worsening in December. The cost implications in this strategy would be the shortage costs, inventory costs and labor costs. The shortage costs were accumulated to IDR 144,695 million that reflects in severe unmet demand. While this plan avoids workforce adjustments, its inability to scale production to meet demand leads to escalating stockouts and costs. This indicates that there is a need for more adaptive strategies to mitigate the shortages without over relying on inventory buffers.

Level Strategy with Subcontract

Table 15. Production 3: Constant Low Workforce; Subcontract

Production Plan 3: Constant Low Workforce; Subcontract	October	November	December	Total
Production Requirement	1,456	2,296	2,401	
Working Days per Month	22	21	20	
Production Hours Available (Working Days × 8 Hrs/Day × 8 Workers)	1,408	1,344	1,280	
Actual Production (Prod. Hours Available ÷ 4 hr per Unit)	352	336	320	
Units Subcontracted (Requirement – Actual Production)	1,104	1,960	2,081	
Subcontracting Cost (Units × Subcontract Rate)	IDR 25,385,224	IDR 39,200	IDR 41,620	IDR 25,466,044
Straight Time Cost	IDR 211,200,000	IDR 201,600,000	IDR 192,000,000	IDR 604,800,000
Total Cost				IDR 630,266,044

Source: processed data

Production Plan 3 adopts a strategy of maintaining a constant low workforce (8 workers) and leveraging subcontracting to cover any gaps in production capacity. The strategy maintains a constant workforce of just 8 workers throughout the period for the limited internal production capacity of 1,408 hours in October, 1,344 hours in November, and 1,280 hours in December. Despite this capacity constraint, the plan relies on subcontractors for La Crème to outsource the monthly units that the firm could not produce internally. There is a required output of 1,456 on October, 2,296 on November and 2,401 on December. This plan keeps fixed labour costs minimal at IDR 604,800,000 but yield subcontracting expenses.

Level Strategy with Overtime

Table 16. Production 4: Constant Workforce; Overtime

Production Plan 4: Constant Workforce; Overtime	October	November	December	Total
Beginning Inventory	1,956	107	0	
Working Days per Month	22	21	20	63
Production Hours Available (Working Days × 8 Hrs × 8 Workers)	1,408	1,344	1,280	
Regular Shift Production (Prod. Hours ÷ 4 hrs/unit)	352	336	320	
Demand Forecast	2,201	2,296	2,401	6,898
Units Available before Overtime (Beginning Inventory + Regular Prod. – Demand)	107	-1,853	-2,081	
Units Overtime	0	1,853	2,081	
Overtime Cost (Units Overtime × Hrs × 5 Hr/Unit)	IDR 0	IDR 2,223,600,000	IDR 2,497,200,000	IDR 4,720,800,000
Safety Stock	1,210	1,210	1,210	
Excess Units (Units Available – Safety Stock)	0	0	0	
Inventory Cost (Excess Units)	IDR 0	IDR 0	IDR 0	IDR 0
Straight Time Cost	IDR 211,200,000	IDR 201,600,000	IDR 192,000,000	IDR 604,800,000
Total Cost				IDR 5,325,600,000

Source: processed data

Production Plan 4 employs a fixed workforce strategy and leverages overtime labor to handle demand fluctuations. While maintaining a steady labor pool of 8 tailors, the available working hours per month follow a standard schedule 1,408 hours in October, 1,344 in November, and 1,280 in December translating into regular shift production outputs of 352, 336, and 320 units respectively. In October, the company was able to meet the demand using beginning inventory and regular shift production, resulting in a surplus of 107 units before overtime. However, in November and December, the beginning inventories were too low to absorb demand spikes, leading to negative balances of 1,853 units and 2,081 units respectively before applying overtime. To close this gap, the company used overtime labor to fulfill exactly the shortfall quantities, resulting in overtime production of 1,853 units (Nov) and 2,081 units (Dec). The cost of this overtime labor was significant:

- 1) IDR 2,223,600,000 in November
- 2) IDR 2,497,200,000 in December
- 3) Total overtime cost: IDR 4,720,800,000

Combined with the consistent straight time cost of IDR 604,800,000, the total production cost for this plan reached IDR 5,325,600,000.

Cost Comparison and Analysis

Table 17. Comparison of Four Plans

Comparison of Four Plans	Cost Component	Plan 1	Plan 2	Plan 3	Plan 4
	Hiring	IDR 40,500,000	IDR 0	IDR 0	IDR 0
	Layoff	IDR 0	IDR 0	IDR 0	IDR 0
	Excess Inventory	IDR 0	IDR 0	IDR 0	IDR 0
	Shortage	IDR 0	IDR 144,695,000	IDR 0	IDR 0
	Subcontract	IDR 0	IDR 0	IDR 25,466,044	IDR 0
	Overtime	IDR 0	IDR 0	IDR 0	IDR 4,720,800,000
	Straight Time	IDR 3,691,623,234	IDR 604,800,000	IDR 604,800,000	IDR 604,800,000
	Total Cost	IDR 3,732,123,234	IDR 749,495,000	IDR 630,266,044	IDR 5,325,600,000

Source: processed data

From the previous table, it illustrates the comparison of all four plan scenarios. The first plan shows how it has the high in hiring cost and straight time cost compare the other three plans. This indicates that this plan would be suitable if the firm aims to avoid subcontracting and don't have a high volatility workforce. Moving on to the second plan where there is shortage cost with similar straight time cost with the third plan. Even though it is moderately low in total cost, however this plan is not ideal unless the firm has a major constraint of cash flow. Next, the third plan, which has the lowest total cost across the four other plans. The third plan leverages subcontractors to fulfil demand but still manages to have low additional cost of IDR 630 million. This third plan indicates that this is the most cost-efficient and balanced plan. Finally, the fourth plan which is the most expensive plan due to its high overtime cost. Even though this plan guarantees zero shortage with high service level, it turns out the overtime cost itself would reach IDR 4,720 billion on its own.

Recommended Aggregate Plan

From Figure 17, the researcher observes the following total costs (in IDR):

- 1) Plan 1 (Chase) - approximately Rp 3.73 billion total cost for the quarter
- 2) Plan 2 (Level + Stockouts) - about Rp 0.71 billion (a small fraction of Plan 1's cost)
- 3) Plan 3 (Level + Subcontract) - about Rp 0.63 billion (the lowest of all plans in this simulation)
- 4) Plan 4 (Level + Overtime) - approximately Rp 5.33 billion (the highest cost)

Plan 4's cost is over 8 times higher than Plan 2's cost, and Plan 1 costs about 5 times more than Plan 3. Plan 3 is the most economical method to meet demand, closely followed by Plan 2, however, Plan 2's low cost comes at the expense of not actually delivering much of the demand, hence it's a deceptive savings achieved by losing sales, which would likely be unacceptable for La Crème's business. Plan 1 and Plan 4 both meet demand fully, but their costs are several multiples higher than Plan 3. This difference is driven by the cost components each plan incurs.

After a comprehensive evaluation of all four aggregate production planning models, Plan 3: constant low workforce with subcontracting emerges as the most effective model for

La Crème given its current operational structure, financial constraints and production flexibility. It avoids inventory loss and stockouts seen in Plan 2, without the complexity and costs of hiring in Plan 1. This makes it a strong candidate for short-term demand fluctuation management, particularly when subcontracting partners are dependable. Based on the cost and performance evaluation, Plan 3 emerged as the most balanced and practical strategy. It allowed La Crème to meet all customer demand while maintaining stable internal operations and controlling overall costs. By outsourcing excess production, the company can avoid the burdens of constant hiring or unsustainable overtime. Since becoming cost efficient in La Crème is a priority, the Plan 3 of using subcontractors is the best choice. If on-time, the in-house delivery is preferred and the budget is more flexible, plan 4 ensures no shortage but it is very costly.

La Crème currently employs a stable workforce of 8 tailors with limited flexibility to hire or lay off staff each period, plan 3 operates within this fixed manpower constraint without requiring any hiring or layoff, ensuring labor consistency. The company faces regular short-term fluctuations in demand which cannot be met solely by internal capacity, which can be addressed through controlled subcontracting, as well as no overtime dependency.

There are many reasons why the new proposed scenario creates significant positive impact compared to the former aggregate planning that is currently used. The first reason is that regarding the inventory balance, before the existing scenario shows overstock in October and risk of shortage in December. While the new scenario allows La Crème to be more balanced with a flexible output, that results in a lower holding cost but with higher service level. The total production capacity of the current plan is around 1008 pcs across three months for the five product categories while the proposed plan could achieve more than 6,153 pcs where it shows a more efficient use of capacity. The holding costs are higher because the inventory stays balanced with the demand, where it does not exceed 2,063 units compared to the current plan that exceeds 3,389 units. The service level becomes higher, this also improves La Crème's ability to fulfil peak season demand, which results in an improvement in brand reliability and trust.

Implementation Plan & Justification

To address the production shortage and cost inefficiencies identified in previous analysis, La Crème is recommended to implement Production Plan 3, which utilizes a constant internal workforce with subcontracting flexibility. The implementation plan will be conducted using the 5W 1 H method.

5W+1H Implementation Plan

What

La Crème will implement the level strategy with subcontracts, it is a hybrid production system that combines in-house production capacity with subcontractors to handle demand exceeding internal capacity.

Why

Because this model is able to address three critical challenges in achieving the company's goal. The first one would be the risk mitigation, it could avoid the risk of shortages by leveraging the complimenting the internal capacity with the third parties' capacity. Secondly, it offers the most stable operations as it avoids inefficiencies of adjusting workforce or handling high overtime costs. La Crème has a volatile workforce where hiring and firing is not that easy to do. Thirdly, compared to other scenarios, this proves to be more economical while being able to maintain the product quality and having reliable inventory.

Who

The key stakeholders that will be involved in the implementation plan are all of the department within the organisation. The head of department will have the biggest role, as it will lead the strategic oversight, approves budget allocations and ensures the alignment across all departments. Next, the production department role is to oversees the daily workflow, balances the internal and external production as they will directly deal with the subcontractors and execute the production under the new system. Thirdly, the head of design and pattern maker will need to make sure that the subcontractors follow the design specifications and quality standards. Fourthly, the finance department role would be to handle the subcontractor payments, track and monitor budget and costs during the process. Fifthly, the operations department role would be to coordinate the material flows between the in-house and subcontractor production facility making sure it runs smoothly as well as managing the inventory. Finally, the sales and marketing department would provide the demand forecast data and communicate and get involved in the production planning. To successfully implement this strategy, it requires a collaborative workflow balancing the internal control and external scalability.

When

To fully conduct the plan, it requires several stages of implementation. The first stage would be the preparation stage which will be conducted from Mid-September 2025, where La Crème should finalize the subcontractor agreements, train staff and refine the demand forecasting data to create the weekly production plan. Second stage would be the pilot testing which will be conducted in October 2025, on this stage La Crème shall launch 5 product categories using the new system and evaluate the scalability and subcontractor performance. There should be a ranking system to fully analyze the performance of each subcontractor. It is expected by November 2025, La Crème will expand this new system to all product lines using the new adjustment from the pilot stage. There shall always be a gradual evaluation during this implementation process for a continuous improvement, for instance by updating the demand forecast data every three months.

Where

The implementation plan will be conducted in La Crème's in-house facility in Jakarta with the core tailor team and the local subcontractor's facility which will be in Pekalongan. How to execute this implementation plan, it requires several things to be conducted. Firstly, La Crème should secure their internal capacity at 336-352 units per month, based on 8 tailors, with daily working hours of 8 hours and 21 working days. Secondly, La Crème shall continue to refine and evaluate their demand forecasting models using historical data and market trends accordingly. Thirdly, calculate how much of the units needs to be produced by the subcontractors by subtracting the forecasted demand with internal capacity. Fourthly, distribute and delegate the production with the subcontractors under strict deadlines and quality checks. Fifthly, monitor the performance through weekly reviews of output, cost and quality and adjust accordingly. Finally, conduct a quarterly review for a comprehensive evaluation in December 2025 for 2026.

CONCLUSION

La Crème is an Indonesian - based company that operates under a B2B wholesale model. Established in 2018 under Pasadena Group, the company produces women's ready-to-wear fashion products. These products are sold without labels for resellers, boutique owners, corporate buyers and white-label clients across Southeast Asia and the Middle East to be resell. Its offline store is located in Central Jakarta, Indonesia. Over the years, the company has been experiencing an inventory imbalance where shortages and overstock problems. For instance, in June and July 2022, the production volumes reached 41,834 and 46,851 units, whereas demand was far behind at only 23,947 and 20,640 units respectively. This led to thousands of

pieces piling up in storage, unsold which carries cost. The company had to bear more than IDR 220 million in extra costs just to store and manage those unused items. On the contrary, there were also periods when La Crème didn't produce enough. April 2023 serves as a particularly severe example, during which only 3,052 pieces were produced while demand surged to 23,869 units. This translated into over 20,000 missed sales opportunities within a single period. The potential revenue loss from this gap exceeded IDR 1.4 billion of potential revenue. The overstock and shortage conditions impact the operational and financial of La Crème resulting in inefficiencies across operations as well as impacting profitability and the customers' trusts. Operating in a very dynamic industry where trends shift rapidly, it is very crucial for companies like La Crème to be agile especially in their operations management. To understand the root causes of these issues, the researcher conducted several analyses. From historical data, surveys and case studies of the company, the researcher analyzes the data to identify the pattern, review the existing data related reports, mathematical modelling and statistical analysis. The researcher researched thoroughly on the current demand forecast, measured the forecasting error based on MAD, MAPE and MSD, continued the calculation and selection of aggregate planning strategy. From this analysis the researcher found out that the root causes contributing to the overstock and shortage within La Crème's production system is the absence of a robust aggregate production planning. Therefore, the most effective strategy for minimizing overstock and shortage in La Crème's business is aggregate production planning using the level strategy with subcontractors. From the analysis the researcher conducted four scenario analyses of aggregate production planning. The first scenario is the chase strategy, second scenario is the level strategy with overtime, third scenario is level strategy with subcontractors and the fourth scenario is the level strategy with stockouts. Out of the four scenarios, the most cost efficient proven for La Crème is the level strategy with subcontractors.

REFERENCES

- Archetti, C., & Bertazzi, L. (2021). Recent challenges in routing and inventory routing: E-commerce and last-mile delivery. *Networks*, 77(2). <https://doi.org/10.1002/net.21995>
- Becerra, P., Mula, J., & Sanchis, R. (2022). Sustainable inventory management in supply chains: Trends and further research. *Sustainability (Switzerland)*, 14(5). <https://doi.org/10.3390/su14052613>
- Choi, T.-M. (2020a). Customer service management in fashion retail supply chains. In *Fashion retail supply chain management*. <https://doi.org/10.1201/b16811-6>
- Choi, T.-M. (2020b). Fashion retail supply chain management – Concluding remarks. In *Fashion retail supply chain management*. <https://doi.org/10.1201/b16811-11>
- Choi, T.-M. (2020c). Fashion retail supply chain management – An introduction. In *Fashion retail supply chain management*. <https://doi.org/10.1201/b16811-5>
- Choi, T.-M. (2020d). Inventory models and coordination in fashion retail supply chains. In *Fashion retail supply chain management*. <https://doi.org/10.1201/b16811-7>
- Fassnacht, F. E., White, J. C., Wulder, M. A., & Næsset, E. (2024). Remote sensing in forestry: Current challenges, considerations and directions. *Forestry*, 97(1). <https://doi.org/10.1093/forestry/cpad024>
- Jobira, T., Abuye, H., Jemal, A., & Gudeta, T. (2022). Assessment of knowledge, practices, and challenges of pharmaceuticals inventory control among pharmacy professionals working in selected public health facilities of West Arsi Zone, Oromia, Ethiopia. *Health Services Insights*, 15. <https://doi.org/10.1177/11786329211066403>
- Kemenparekraf. (2020). *Infografis data statistik indikator makro pariwisata & ekonomi kreatif*. https://bankdata.kemenparekraf.go.id/upload/document_satker/5baa176056e524cfaa5086f5d69b2747.pdf
- McKinsey & Company. (2023, November 29). *The state of fashion 2024: Finding pockets of growth as uncertainty reigns*. Retrieved December 16, 2024, from <https://www.mckinsey.com/industries/retail/our-insights/state-of-fashion>

- Omar, I. A., Jayaraman, R., Salah, K., Debe, M., & Omar, M. (2020). Enhancing vendor managed inventory supply chain operations using blockchain smart contracts. *IEEE Access*, 8. <https://doi.org/10.1109/ACCESS.2020.3028031>
- Regina, G., Wilson, Z., Aurora, S., & Nurcahyo, R. (2021). Improving small apparel company's production planning using demand forecasting and material requirement planning. <https://www.ieomsociety.org/proceedings/2021india/79.pdf>
- Statista. (2024). *Fashion - Indonesia | Statista market forecast*. <https://www.statista.com/outlook/emo/fashion/indonesia#recommerce>
- Sugih, I. L., & Soekarno, S. (2015). Lesson learned from Indonesian biggest fashion retailer company to encourage the development of small fashion business. *Procedia - Social and Behavioral Sciences*, 169, 240–248. <https://doi.org/10.1016/j.sbspro.2015.01.307>
- Wen, X., Choi, T.-M., & Chung, S. H. (2019). Fashion retail supply chain management: A review of operational models. *International Journal of Production Economics*, 207. <https://doi.org/10.1016/j.ijpe.2018.10.012>