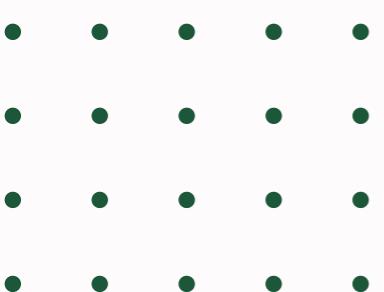


TEAM FINAL PROJECT

Rougit Cosmetics International

Team 6

Ana Laura Correa Cabrales
Yunsik Choung
Siriphan Mongpho
Tangina Parvez
Zaynab Zennour



Overview

Rougir Cosmetics International is a global beauty and personal care company that produces and distributes a wide range of cosmetic products. The company faces several production challenges, such as high production costs, low manufacturing efficiency, and long production lead times.

To address these issues, the company implemented a production optimization program to streamline its manufacturing operations and reduce costs.

01



Rougir Cosmetics International needed help to meet anticipated demand for the next quarter due to capacity issues.

02



CEO proposed using RCI's analytics-based linear programming model to determine how much of the projected product demand could be subcontracted.

03



Rougir Cosmetics' production optimization program aimed to identify inefficiencies and waste, eliminate bottlenecks, and improve overall production efficiency.

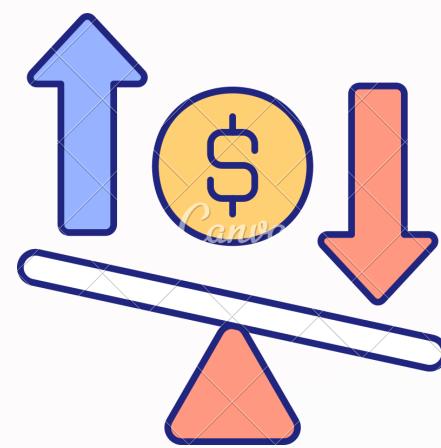
04



The proposal demonstrated RCI's responsiveness to changing market conditions and commitment to data-driven decision-making. However, the board's caution highlighted the need to balance short-term capacity constraints with long-term strategic goals.

PROBLEM

Rougir Cosmetics International has insufficient internal capacity to meet the projected demand, which may lead to lost sales and decreased customer satisfaction.



Balancing quality and cost in production.



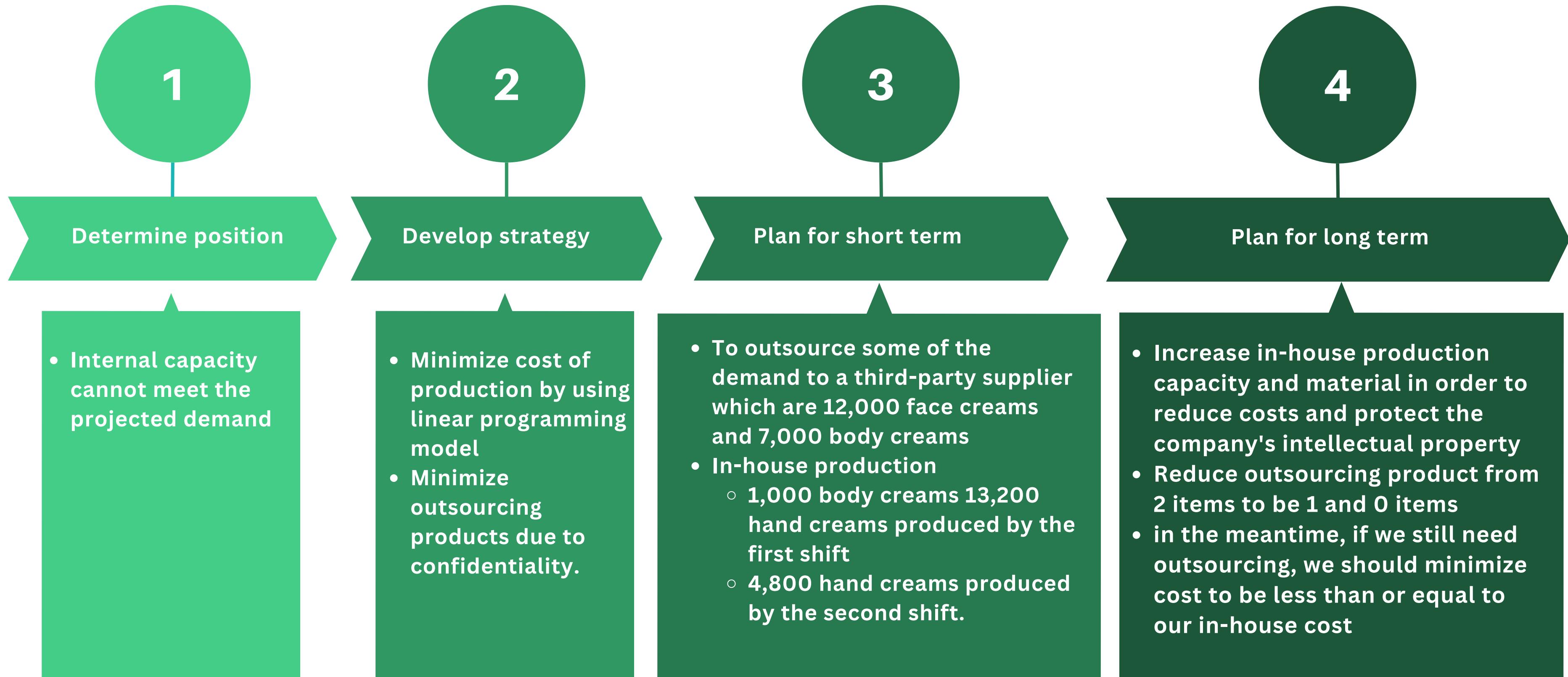
Optimizing production capacity, raw materials, quality control, and shift scheduling.



Reducing waste, maintaining high-quality standards, and increasing profitability.

STRATEGY

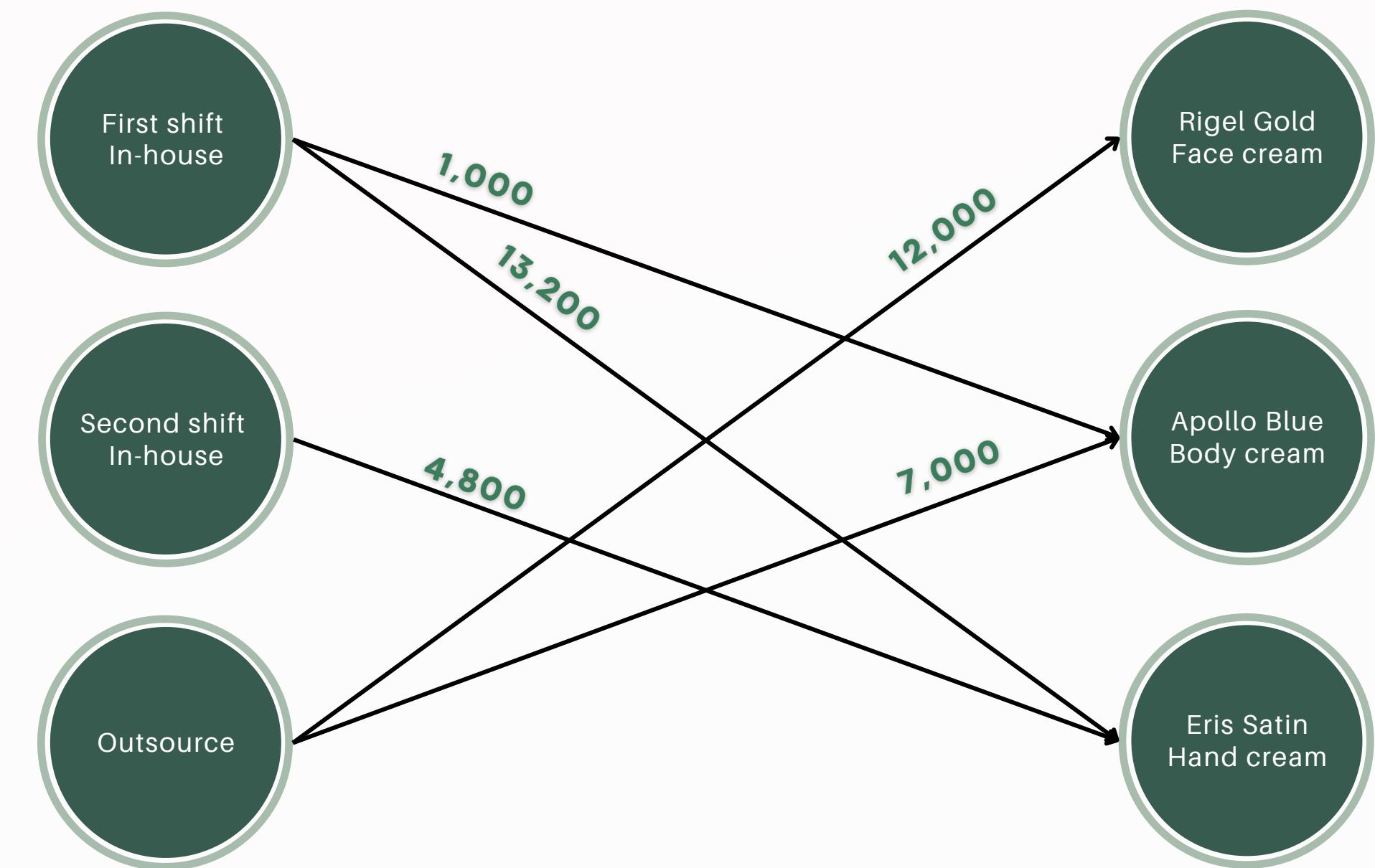
4-Step Strategy map



The production mix

| | <i>Face cream</i> | <i>Body cream</i> | <i>Hand cream</i> |
|----------------------------------|-------------------|-------------------|-------------------|
| <i>First shift In-house</i> | - | 1,000 | 13,200 |
| <i>Second shift In-house</i> | - | - | 4,800 |
| <i>Outsource</i> | 12,000 | 7,000 | ✗ |
| <i>Demand</i> | 12,000 | 8,000 | 18,000 |

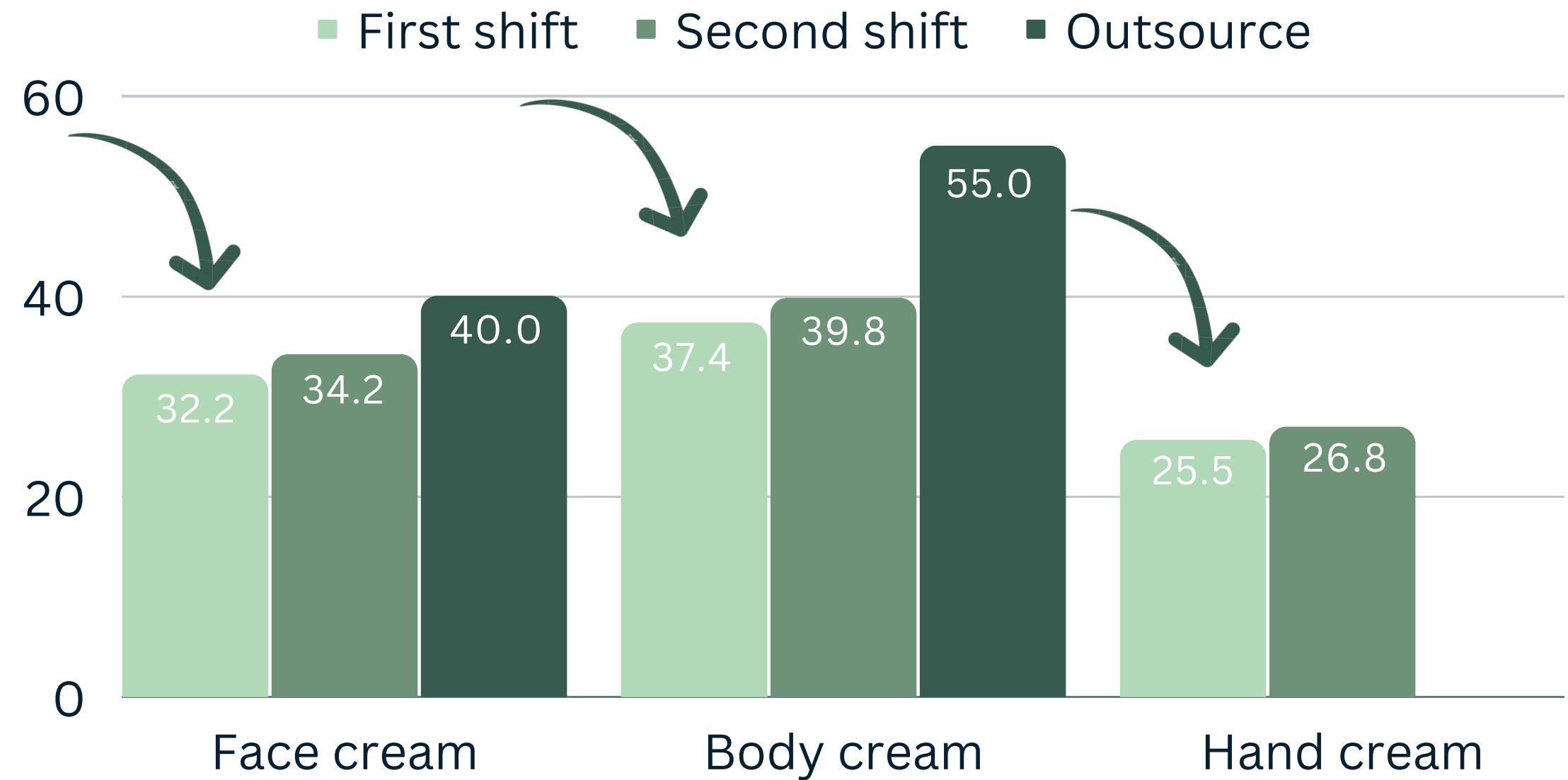
Network flow



Key highlights:

- The production mix of Rougir Cosmetic International will outsource the majority of its products, which are 12,000 face creams and 7,000 body creams.
- On the other hand, they should produce body cream and hand cream themselves, which are 1,000 body creams and 13,200 hand creams produced by the first shift and 4,800 hand creams produced by the second shift.

COST OF PRODUCT



Key highlights:

- Outsourcing causes high product costs, which are \$40 for face cream and \$50 for body cream
- The efficiency shift is the first shift because we have the lowest costs of production, which are 32.2, 37.4, and 25.5 for face cream, body cream, and hand cream, respectively

Suggestions:

- Our short-term solution is to outsource some of the demand to a third-party supplier
- For a long-term solution, expand the production, especially on the first shift, to meet the requirement at the lowest cost; if the demand is variable, we can use contract employment

Short-long term Solution

Save -\$224,050
▼ -16.38%

Short-term solution Model

| Model | FC1 | BC1 | HC1 |
|--------------------------------------|-------|------|-------|
| Inhouse Manufacturing | | | |
| Number of cartons per product shift1 | 0 | 1000 | 13200 |
| Number of cartons per product shift2 | 0 | 0 | 4800 |
| Subcontract | FCO | BCO | |
| Number of cartons per product | 12000 | 7000 | |

| Minimizing Total Cost | \$ 1,368,100.00 |
|----------------------------------|-----------------|
| Face cream in-house first shift | - |
| Body cream in-house first shift | 24,550.00 |
| Hand cream in-house first shift | 173,250.00 |
| Face cream in-house Second shift | - |
| Body cream in-house Second shift | - |
| Hand cream in-house Second shift | 69,300.00 |
| Face cream out source | 480,000.00 |
| Body cream out source | 385,000.00 |
| Purified Water | 132,000.00 |
| Oil | 58,500.00 |
| Scents + Colors | 22,500.00 |
| Emulsifiers | 23,000.00 |

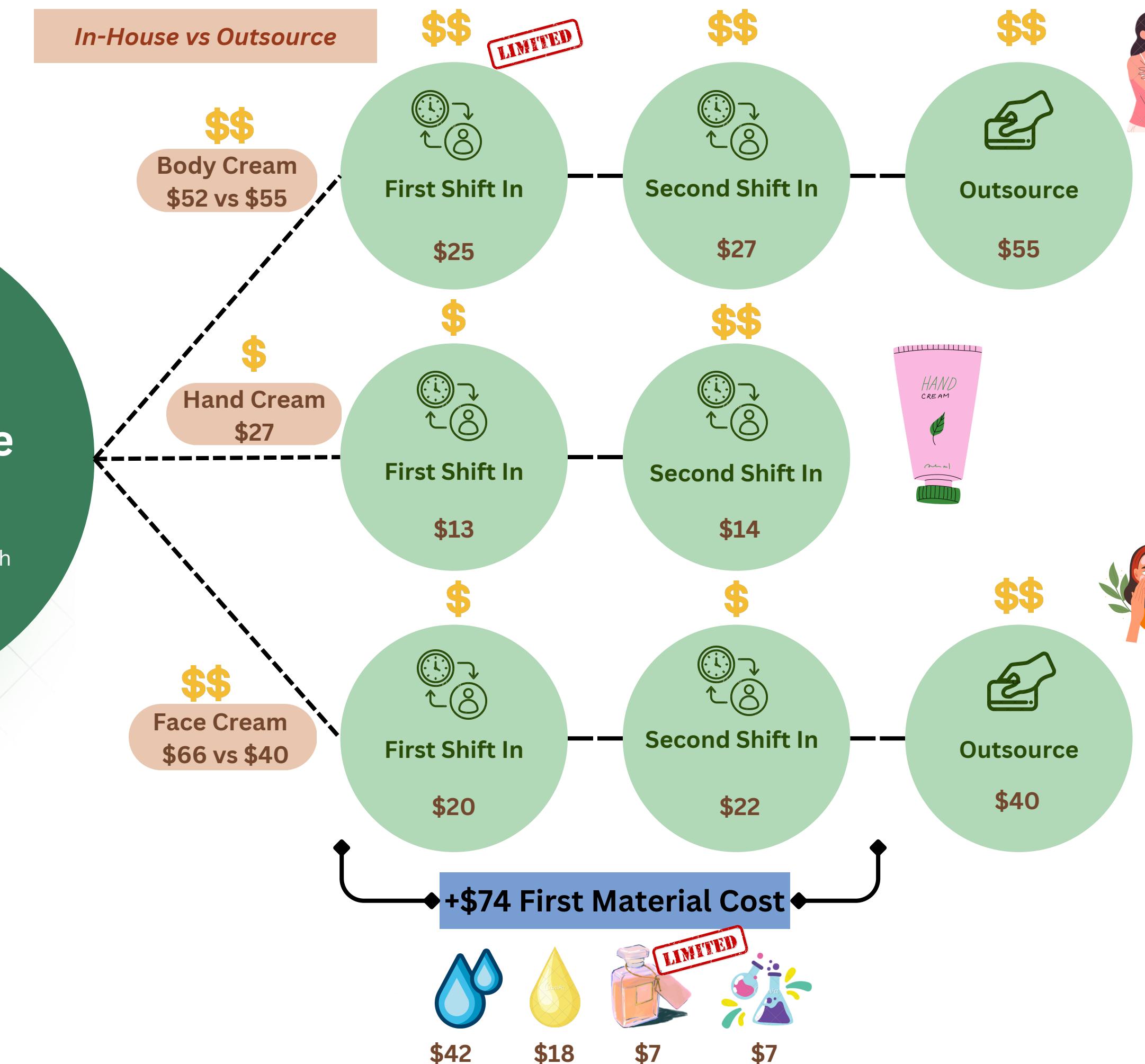
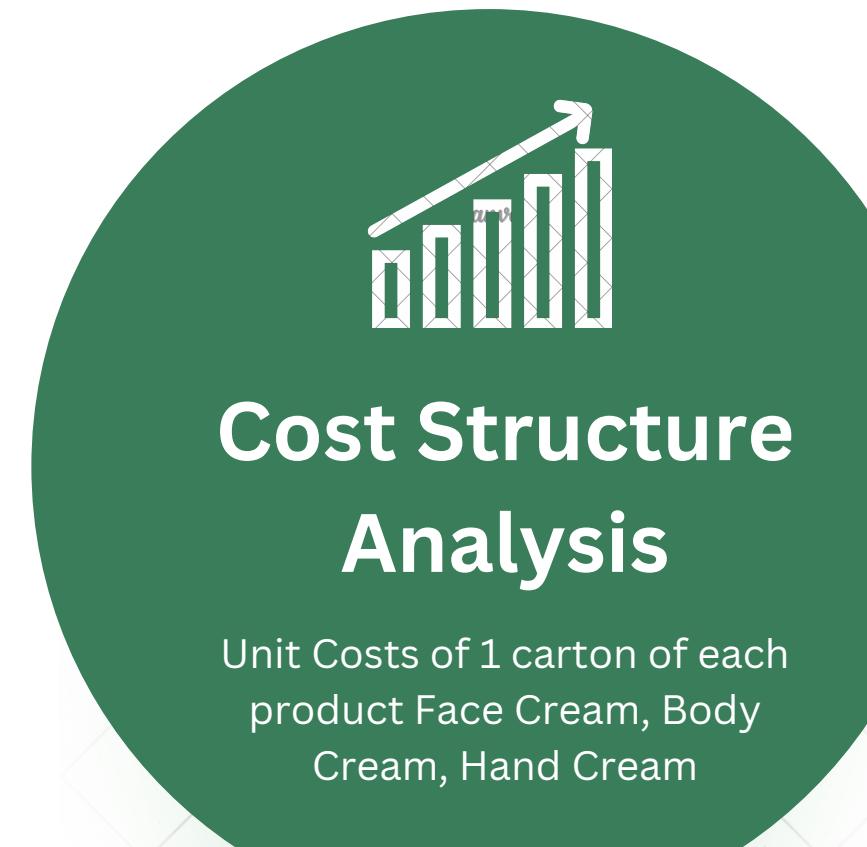
| Labor First Shift (hours/carton) | Constraints | Capacity |
|-----------------------------------|-------------|------------|
| Stage 1 | 15000 | <= 15,000 |
| Stage 2 | 7600 | <= 10,000 |
| Labor Second Shift (hours/carton) | | |
| Stage 1 | 4800 | <= 13,500 |
| Stage 2 | 2400 | <= 9,000 |
| Materials (pounds/carton) | | |
| Purified Water | 132000 | <= 200,000 |
| Oil | 39000 | <= 50,000 |
| Scents + Colors | 7500 | <= 7,500 |
| Emulsifiers | 11500 | <= 15,000 |

Long-term solution Model increase capacity on first shift and the material

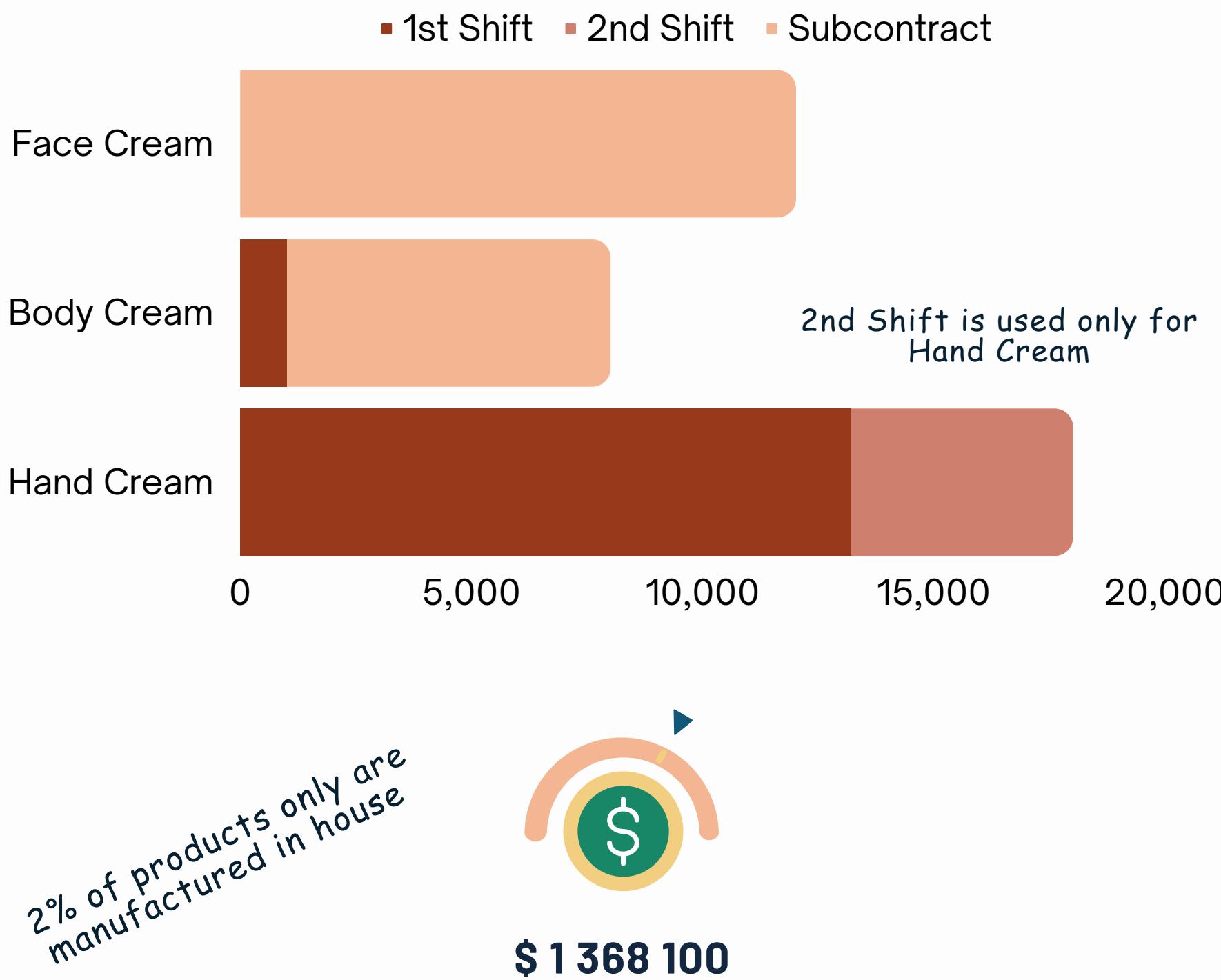
| Model | FC1 | BC1 | HC1 |
|--------------------------------------|-------|------|-------|
| Inhouse Manufacturing | | | |
| Number of cartons per product shift1 | 12000 | 8000 | 18000 |
| Number of cartons per product shift2 | 0 | 0 | 0 |
| Subcontract | FCO | BCO | |
| Number of cartons per product | 0 | 0 | |

| Minimizing Total Cost | \$ 1,144,050.00 |
|----------------------------------|-----------------|
| Face cream in-house first shift | 241,800.00 |
| Body cream in-house first shift | 196,400.00 |
| Hand cream in-house first shift | 236,250.00 |
| Face cream in-house Second shift | - |
| Body cream in-house Second shift | - |
| Hand cream in-house Second shift | - |
| Face cream out source | - |
| Body cream out source | - |
| Purified Water | 270,000.00 |
| Oil | 108,000.00 |
| Scents + Colors | 46,800.00 |
| Emulsifiers | 44,800.00 |

| Labor First Shift (hours/carton) | optimizing capacity | Case Capacity |
|-----------------------------------|---------------------|---------------|
| Stage 1 | 50400 | 15,000 |
| Stage 2 | 26600 | 10,000 |
| Labor Second Shift (hours/carton) | | |
| Stage 1 | 0 | 13,500 |
| Stage 2 | 0 | 9,000 |
| Materials (pounds/carton) | | |
| Purified Water | 270000 | 200,000 |
| Oil | 72000 | 50,000 |
| Scents + Colors | 15600 | 7,500 |
| Emulsifiers | 22400 | 15,000 |



What-if Scenarios



Fully In-House ? ↑

- Max In-House : 3%
- Extra Capacity needed in Stage 1 at the same cost
- Cost : \$1 368 183



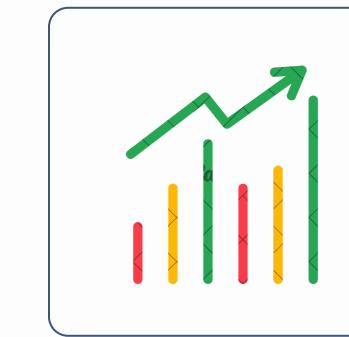
Fully Outsource? ↑

- Hand Cream is the only In-House product
- Body Cream and Hand Cream are outsourced
- Cost : \$1 383 388



Maximize capacity Use ↑

- Additional 4% of production vs Initial demand
- Storage logistics and constraints to be considered
- Cost : \$1 438 899



Ressources revamping ↓

- With only +1 pound of Scents, total cost will go down by \$51
- +1hour surplus in Stage 1 (1st Shift) will minimise cost by \$1
- Cost : \$1 312 046 (+1100 pound of Scents)
- Cost : \$1 361 800 (+4800 hours in 1st Shift Stage 1)
- Cost : \$1 306 085 (+4800 hours and +1100 pound of Scents)



Recommandations



Continuous Improvement

- In short term, adopt the optimal allocation schedule plan for the quarter in order to minimise the total cost.
- Review and update the model parameters, such as holding costs and demand forecasts, to ensure that the model remains accurate and effective.



What-If Scenarios

- Long term, optimize its production and supply chain processes to reduce the total cost of production and carefully evaluate each option before making a decision (Make or Buy)
- Develop in-house capabilities, and consider alternative sourcing locations.
- Consider the impact of each option on its customers, employees (layoff), and stakeholders (Cut off supply).



Budget

- Determine the optimal pricing strategy that will maximize profit while ensuring that demand is met.
- Increase production efficiency



Invest

- Adjust inventory management policies, reducing costs while ensuring that they always have enough ingredients to meet the demand for products.





Recommendations



Continuous Improvement

- In short term, adopt the optimal allocation scheduling plan for the quarter in order to minimise the total cost.
- Review and update the model parameters, such as holding costs and demand forecasts, to ensure that the model remains accurate and effective.



Forecast Demand

- Determine the optimal pricing strategy that will maximize profit while ensuring that demand is met.
- Forecast and simulate future quarter's demand and establish the optimal production plan beforehand.
- Evaluate the sustainability and the profitability of inventory systems depending on demand forecast and inventory holding costs : Just-in- Time vs Safety Stock policy with minimum level of inventory.



What-If Scenarios

- Long term, optimize its production and supply chain processes to reduce the total cost of production and carefully evaluate each option before making a decision (Make or Buy).
- Develop in-house capabilities, and consider alternative sourcing locations with lower labor costs or better access to raw materials.
- Consider the impact of each option on its customers, employees (layoff), and stakeholders (Cut of supply).



Long Term Sustainability

- Adjust inventory management policies, reducing costs while ensuring that they always have enough ingredients to meet the demand for products (Optimal safety stock strategy).
- Increase production efficiency, streamline processes in bottlenecks and reduce waste (Lean manufacturing).
- Reduce lead times and stockouts (Efficient forecasting and planning, optimal inventory management).



Appendix

1. Objective Function of Linear Model

Min.

$$\begin{aligned} & FCD_1 \cdot 8.5 \cdot 1.5 + FCD_1 \cdot 9.25 \cdot 0.8 + FCD_2 \cdot 9.35 \cdot 1.5 + FCD_2 \cdot 10.175 \cdot 0.8 + \\ & BCD_1 \cdot 8.5 \cdot 1.8 + BCD_1 \cdot 9.25 \cdot 1 + BCD_2 \cdot 9.35 \cdot 1.8 + BCD_2 \cdot 10.175 \cdot 1 + \\ & HCD_1 \cdot 8.5 \cdot 1 + HCD_1 \cdot 9.25 \cdot 0.5 + HCD_2 \cdot 9.35 \cdot 1 + HCD_2 \cdot 10.175 \cdot 0.5 + \\ & FCS \cdot 40 + BCS \cdot 50 + \\ & ((FCD_1 + FCD_2) \cdot 8 + (BCD_1 + BCD_2) \cdot 6 + (HCD_1 + HCD_2) \cdot 7) \cdot 1 + \\ & ((FCD_1 + FCD_2) \cdot 1 + (BCD_1 + BCD_2) \cdot 3 + (HCD_1 + HCD_2) \cdot 2) \cdot 1.5 + \\ & ((FCD_1 + FCD_2) \cdot 0.5 + (BCD_1 + BCD_2) \cdot 0.3(HCD_1 + HCD_2) \cdot 0.4) \cdot 3 + \\ & ((FCD_1 + FCD_2) \cdot 0.5 + (BCD_1 + BCD_2) \cdot 0.7 + (HCD_1 + HCD_2) \cdot 0.6) \cdot 2 \end{aligned}$$

Decision Variables

FCD1: Number of Face Cream Produced by Inhouse First Shift

BCD1: Number of Body Cream Produced by Inhouse First Shift

HCD1: Number of Hand Cream Produced by Inhouse First Shift

FCD2: Number of Face Cream Produced by Inhouse Second Shift

BCD2: Number of Body Cream Produced by Inhouse Second Shift

HCD2: Number of Hand Cream Produced by Inhouse Second Shift

FCS: Number of Face Cream Produced by Subcontract

BCS: Number of Body Cream Produced by Subcontract

HCS: Number of Hand Cream Produced by Subcontract

Appendix

2. Constraints

Demand Constraints

- Face Cream Demand
- Body Cream Demand
- Hand Cream Demand

$$FCD_1 + FCD_2 + FCS \geq 12000$$

$$BCD_1 + BCD_2 + BCS \geq 8000$$

$$HCD_1 + HCD_2 \geq 18000$$

Materials Constraints

- Water Limits
- Oil Lemits
- scents and coiours Limits
- Emulsifiers Limits

$$(FCD_1 + FCD_2) \cdot 8 + (BCD_1 + BCD_2) \cdot 6 + (HCD_1 + HCD_2) \cdot 7 \leq 200000$$

$$(FCD_1 + FCD_2) \cdot 1 + (BCD_1 + BCD_2) \cdot 3 + (HCD_1 + HCD_2) \cdot 2 \leq 50000$$

$$(FCD_1 + FCD_2) \cdot 0.5 + (BCD_1 + BCD_2) \cdot 0.3(HCD_1 + HCD_2) \cdot 0.4 \leq 7500$$

$$(FCD_1 + FCD_2) \cdot 0.5 + (BCD_1 + BCD_2) \cdot 0.7 + (HCD_1 + HCD_2) \cdot 0.6 \leq 15000$$

Labour Constraints

- First Shift Stage 1
- First Shift Stage 2
- Second Shift Stage 1
- Second Shift Stage 2

$$(FCD_1 \cdot 1.5 + BCD_1 \cdot 1.8 + HCD_1 \cdot 1.0) \leq 15000$$

$$(FCD_1 \cdot 0.8 + BCD_1 \cdot 1 + HCD_1 \cdot 0.5) \leq 10000$$

$$(FCD_2 \cdot 1.5 + BCD_2 \cdot 1.8 + HCD_2 \cdot 1.0) \leq 13500$$

$$(FCD_2 \cdot 0.8 + BCD_2 \cdot 1 + HCD_2 \cdot 0.5) \leq 9000$$

Appendix

3. Analyzing Model

GAP

\$ -104,955.00

Scenario 1. ▼ -7.67%

Produce product with oursourcing partners and minimize cost.

| Minimized Cost | | | | \$1,368,100.00 |
|------------------|------------|------------|------------|----------------|
| Product Quantity | Face Cream | Body Cream | Hand Cream | |
| Direct 1st Shift | 0 | 1,000 | 13,200 | |
| Direct 2nd Shift | 0 | 0 | 4,800 | |
| Subcontract | 12,000 | 7,000 | | |

GAP

\$ -64,934.50

Scenario 2. ▼ -4.72%

Produce all products at least 3% inhouse to prevent
and exclose confidential manufacturing methods.

| Minimized Cost | | | | \$1,375,155.25 | | | |
|------------------|------------|------------|------------|----------------|-----------|-----------|--|
| Product Quantity | Face Cream | Body Cream | Hand Cream | % of Face | % of Body | % of Hand | |
| Direct 1st Shift | 360 | 400 | 13,740 | 3.0% | 5.0% | 76.3% | |
| Direct 2nd Shift | 0 | 0 | 4,260 | 0.0% | 0.0% | 23.7% | |
| Subcontract | 11,640 | 7,600 | | 97.0% | 95.0% | 0.0% | |

Alternative

| Minimized Cost | | | | \$1,263,145.00 |
|------------------|------------|------------|------------|----------------|
| Product Quantity | Face Cream | Body Cream | Hand Cream | |
| Direct 1st Shift | 400 | 8,000 | 0 | |
| Direct 2nd Shift | 9,000 | 0 | 0 | |
| Subcontract | 2,600 | 0 | 18,000 | |

Alternative

| Minimized Cost | | | | \$1,310,220.75 | | | |
|------------------|------------|------------|------------|----------------|-----------|-----------|--|
| Product Quantity | Face Cream | Body Cream | Hand Cream | % of Face | % of Body | % of Hand | |
| Direct 1st Shift | 2,331 | 3,887 | 4,506 | 19.4% | 48.6% | 25.0% | |
| Direct 2nd Shift | 1 | 2 | 13,494 | 0.0% | 0.0% | 75.0% | |
| Subcontract | 9,668 | 4,111 | | 80.6% | 51.4% | 0.0% | |

Appendix

4. Sensitivity Analysis

Main Scenario

- With only +1 pound of Scents, total cost will go down by \$5.
 - +1 hour surplus in Stage 1 (1st Shift) will minimise cost by \$1.