CASE ANALYSIS OF SPORT OBERMEYER

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Group 8

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Introduction

Klaus Obermeyer was always skilled at crafting things together to venture into the mountains surrounding him. Growing up in the Bavarian Alps, he made his own pair of skis by nailing his Sunday-best shoes to planks of wood. During a long journey to Aspen, Colorado, he inadvertently created Obermeyer's first product by sewing a parka out of a down comforter his mother gave him, which he later sold to his best friend. In 1947, Klaus founded Obermeyer with the mission of creating ski clothes and products that "make skiing safer and more fun," and has been making parkas in Aspen ever since.

Manufacturers in the outdoor industry, much like the explorers they outfit, face uncertainty each year. Innovations are typically incremental, competitors offer nearly identical products, and demand is unpredictable, influenced by arbitrary factors such as styling and color. With limited control over shifting customer tastes and similar offerings from rivals, success lies in efficient supply chain planning.

Accurate forecasting is critical. Overproduction leads to discounted sales, increased storage costs, or disposal expenses, while underproduction results in lost revenue, unmet demand, and potential customer dissatisfaction. Given the winter seasonality of ski products, Obermeyer must adopt a proactive supply chain strategy to effectively navigate these challenges in the year ahead.

No Limit initial order forecast

The Obermeyer Supply Chain

Overall, Obermeyer faces a complex supply chain with long lead times and minimum order quantity constraints for certain materials, which results in challenges with production scheduling. When considering the overall lead time for a parka style, Obermeyer's supply chain spans 18 months, from the beginning of the design process to the parka being placed on a retail shelf. Product styles are sometimes refined after receiving feedback from trade shows, but the most critical event in the supply chain is the Las Vegas Trade Show, where 80% of the year's purchases are made by outdoor retailers across the country. This event allows Obermeyer to finalize its production run. Retailers also have the option to place replenishment orders during the peak sales season, which are fulfilled using existing inventory.

The materials sourcing includes raw materials such as fabric, zippers, and insulation foam. These materials are sourced from global suppliers in countries including Austria, Germany, Japan, Korea, Switzerland, Taiwan, and the USA. They are then brought to workshops in Hong Kong and China, where they are assembled into the various product lines.

Supply Chain Risks

The production risks involve mitigating situations where Obermeyer overproduces unpopular items and underproduces high-demand items. There is a 24% profit margin per parka, but leftover inventory is sold at an 8% loss due to the need to discount unsold products. Overproduction leads to more items being sold at discounted prices, while stockouts of highly sought-after parkas result in lost revenue. Obermeyer's current risk mitigation strategies include pre-ordering greige fabric (fabric that has been woven or knitted but not yet dyed or printed), as well as dividing production between Hong Kong and China.

Hong Kong and China

Obermeyer's production in Hong Kong and China each offers distinct advantages. Overall, producing in China reduces costs but introduces risks associated with larger minimum order quantities, while production in Hong Kong allows for greater flexibility. Appendix 1.1 summarizes the key differences between Hong Kong and China, as detailed in Exhibit 8.

Initial analysis using the Newsvendor Model

The data from Exhibit 10 illustrates the use of the Delphi method and executive opinion. It includes demand forecasts for 10 women's parka styles, provided by a committee of 6 managers and executives at the company. However, our confidence in these predictions is reduced by the fact that judgmental forecasting models carry a high degree of uncertainty. The discrepancies between the various demand forecasts will require a statistical approach to minimize the associated risks. Given the winter seasonality of customer demand for these parkas, it is crucial to avoid overproduction or underproduction, as the window for correction is narrower than in other industries.

To determine the optimal production when the initial production commitment is exactly 10,000 units, the newsvendor model is the preferred method. This model is particularly suited for products with uncertain demand and a limited selling period, such as winter clothing and other seasonal items. It helps strike a balance between the costs of overproduction and underproduction by estimating the critical ratio of forecasted demand that production should ideally meet.

The critical ratio is calculated as follows:

$$CR = \frac{C_u}{C_u + C_o}$$

Where *Cu* is the lost profit from overproduction and running out of stock set at 24%, and *Co* is the lost profit from overproduction and not making optimal sales set at 8%.

$$CR = \frac{0.24}{0.24 + 0.08} = 0.75$$

For Obermeyer's women parkas the critical ratio is to meet forecasted demand 75% of the time. By computing the demand forecast mean and uncertainty standard deviation, we can calculate the optimal production quantity using the inverse cumulative distribution function CDF, this indicates the production quantity at which 75% of the possible demand outcomes are less than or equal to the recommended amount.

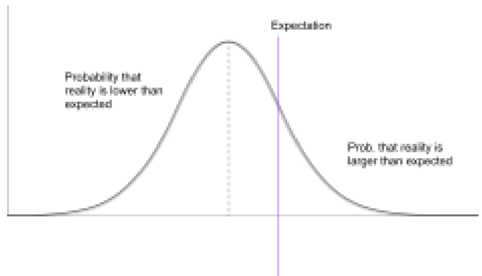
Using the optimal order quantity formula given in module 10.4 (given below), we can calculate the optimal order using a normally distributed demand with a mean as given in the forecast and a standard deviation as given in the problem statement, two times the standard deviation of the forecast. This optimal order value gives us a quantity (26,360) that far exceeds the targeted value "a minimum of 10,000" but presumably less than 20,000 as Klaus would like to place two separate orders. The table is on Appendix 1.2.

$$\frac{1}{n}\sum_{j=1}^{n}\pi(x_j) = \frac{1}{n}\sum_{j=1}^{n}\left[p\min(Q, x_j) + s(Q - x_j)^+ - cQ\right] \to E(\pi_Q)$$

One approach is to adjust the production quantities after calculating the quantity for each style to ensure that the total production across all styles adds up to exactly 10,000 units. This is possible because the case study specifies that there is no minimum order size requirement for the styles. The table can be found in Appendix 1.3.

If there were a minimum order size requirement, we would need to meet Hong Kong's minimum, which would increase the minimum production quantity for the Gail and Isis styles to at least 600 units each, resulting in a total slightly exceeding 10,000 units.

The product styles with the highest proportion of optimal production are the Anita and Seduced styles, each accounting for one-third of the total production. This suggests that these styles are being prioritized due to their anticipated demand and profitability, making them central to the production strategy. Another approach is to balance risk and return by considering the expected profit based on the probability that demand will exceed expectations, and the expected loss based on the probability that demand will fall short of expectations.



When demand exceeds the quantity ordered the expected profit can be calculated as follows:

*Expected Profit = Profit per unit * P(Demand > Order Quantity)*

When demand is lower than the quantity ordered the expected loss can be calculated as follows:

*Expected Loss = Loss per unit * P(Demand < Order Quantity)*

To balance the risk and reward, set the two equations equal:

*Profit per unit * P(Demand > Order Quantity) = Loss per unit * P(Demand < Order Quantity)*
*Profit per unit * (1 -P(Demand < Order Quantity)) = Loss per unit * P(Demand < Order Quantity)*
P(Demand < Order Quantity) = Profit per unit / (Profit per unit + Loss per unit)

Now, we maximize return on investment as the ratio of expected profit to invested capital. This means that return on investment becomes an objective function with the goal of maximization. We set a target return, which is the minimum return rate the company will accept, and use this to evaluate the profitability of the investment:

ROI = Expected Profit/Invested Capital

*L (Target ROI) = max (Expected Profit) - ((Target ROI) * (Invested Capital))*

In the equation above Target ROI * Invested Capital is the target return on investment of the invested capital. If L (Target ROI) is greater than zero then the expected profit is larger than the required return, so the investment is worthwhile, otherwise, the investment is not worthwhile.

Initially, we can disregard the individual prices and assume that the units cost the company a standard amount. This effectively shifts the focus to output efficiency. To calculate the return per unit, we use the following formula:

$$\lambda = \frac{Expected\ Profit}{Number\ of\ Units\ Produced}$$

The objective is to maximize this ratio, ensuring that each unit contributes the maximum amount to the ratio, taking production costs into account. Next, we evaluate feasibility:

$$L(\lambda) = Max\ Expected\ Profit - \lambda \sum Q_i$$

In the equation above, the maximum expected profit represents the best possible scenario, while the second expression represents the targeted return. If the expected profit exceeds the targeted return, the plan is feasible. Otherwise, the plan is not feasible, and adjustments must be made. In practice, a higher volume may reduce the targeted return, except when proportional profit scaling applies. Now, we solve for the optimal production quantity by slightly adjusting the previous formula:

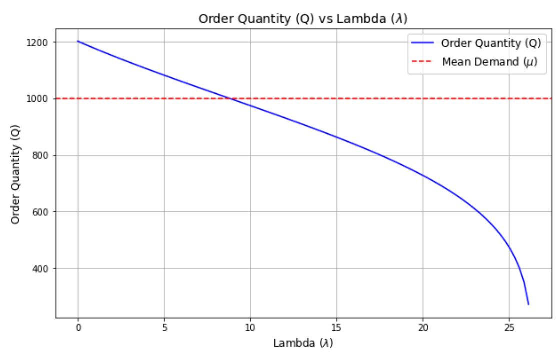
$$L(\lambda) = \sum Expected\ profit\ per\ unit(Q_i) - \lambda \sum Q_i$$

The first part of the equation represents the total profit, while the second part represents the total return. It's important to note that the problem is separable. In other words, the decision for each optimal quantity can be made independently for each product, simplifying the optimization process. We now adjust the critical ratio equation slightly to incorporate the value of lambda:

$$P(Demand\ <\ Order\ Quantity) = \frac{0.24p - \lambda}{0.24p + 0.08p} = 0.75 - \frac{\lambda}{.32p}$$

Then we calculate an adjusted z-score using the adjusted critical value (above). Therefore the quantity is:

$$Q_i = u_i + z\sigma_i$$



As a result, as lambda increases, the acceptable stock-out probability decreases; in other words, we become more risk-averse. In conclusion, as seen in the graph above (the example given is Gail), the result is smaller production quantities as lambda increases.

Now, we calculate lambda values by dividing expected profit by the number of units produced. This allows us to maintain the same ROI for smaller order quantities. We can use this to find the adjusted critical value, the adjusted z-value, and the order quantities. The table can be found in Appendix 1.4. The newsvendor model is well-regarded for its utility among seasonal product manufacturers, as it helps determine the optimal quantity of winter items to produce for a single season with uncertain demand—our primary concern—while accounting for lead time and production cycle constraints that impact peak sales and inventory levels.

While the newsvendor approach aligns with the realities of seasonal production, the model assumes a fixed salvage value for unsold items, meaning any leftover inventory is sold at the predetermined discount price specified in the case study. However, this assumption may not fully capture real-world dynamics, where Obermeyer might opt for even steeper discounts depending on the volume of inventory that needs to be cleared. Although the newsvendor model is well-suited for winter sports product planning, the guidelines for this assignment recommend using the Unit 10 method to determine the overall optimal production quantity, rather than restricting it to exactly 10,000 units.

HongKong Limited initial order forecast

Initial Analysis (without price consideration)
The fundamental procedures we follow are as follows:
Determine Demand: Analyze the sample data provided in Exhibit 10 to estimate the demand for each style.
Allocate Initial Production: As required by the challenge, the initial production total was set at 10,000 units. We based the distribution of these 10,000 units on the average projection for each style. The following formula determined each style's portion of the total: Style's Production Quantity = Average Forecast For the Style / Total Average Forecast for the Style) x 10,000.
Apply Risk Balancing Techniques: Use methods such as Expected Value (EV) or Expected Marginal Profit (EMP) to balance the risks of overproduction and stockouts, while accounting for demand uncertainty.
Maintain Flexibility: Reserve sufficient capacity for the second order to respond to actual demand more effectively.
Select Relevant Data: Extract the relevant columns - Style, Average Forecast, Standard Deviation, and 2x Standard Deviation - from Exhibit 10.
Format for Computation: Remove unnecessary rows and ensure that numerical data, such as forecasts and deviations, are correctly formatted for calculations.

This approach ensures that a larger share of the initial manufacturing is allocated to styles with higher anticipated demand. We rounded the calculated allocations to the nearest whole number, as manufacturing quantities must be integers.

Due to rounding, the total allocation may not exactly equal 10,000 units after adjustments. We identified the discrepancy between the 10,000-unit target and the rounded total. To ensure that popular styles are prioritized, we incrementally allocated the remaining units to styles with the highest average projections when the total fell short of 10,000. To ensure that total production precisely meets the 10,000-unit requirement, the resulting allocation assigns initial production units to each style in proportion to their anticipated demand. The table can be found in Appendix 1.5.

Proportional allocation reduces the risk of stockouts for popular items by ensuring that styles with higher demand are prioritized in the initial production phase. Since the second manufacturing step allows for adjustments, this approach maintains flexibility to address demand uncertainties through rounding and fine-tuning the totals.

The allocation ensures the business is prepared for dynamic demand updates following initial production while adhering to the requirement that total production equals 10,000 units. This systematic approach minimizes overproduction or stockouts by ensuring that the allocation is logical, demand-driven, and optimized.

Relating the calculations in Appendix 1.5 and decisions to the Hong Kong Case Study:

Minimum Commitment: We recommend starting with at least 600 units per style, as the minimum order quantity in Hong Kong is 600 units per style. Compared to China, where the minimum order quantity is 1,200 units, Hong Kong provides greater flexibility in minimum order numbers. This is particularly advantageous for designs with fluctuating or lower predicted demand, helping manage uncertainty effectively.
Adjustment for Demand Variability: By manufacturing in Hong Kong, Obermeyer mitigates the risk of overproduction by enabling more dynamic adjustments to production quantities as demand signals improve.
Reduced Commitment for Uncertain Styles: A conservative approach of 600 units aligns with Hong

Kong's operational efficiency for smaller production batches, especially for styles with high demand uncertainty (such as "Stephanie" or "Daphne," which have higher standard deviations). This minimizes financial risk by avoiding excessive inventory if actual demand falls short of projections.
Flexible Workforce: The case highlights Hong Kong's highly skilled and cross-trained workforce, which allows for faster adaptation to changing production needs. Producing in Hong Kong ensures that Obermeyer can respond swiftly if additional quantities are required later in the season for styles with erratic demand.
Initial Production: Obermeyer secures the ability to meet initial retail delivery deadlines by committing to the first phase of production in Hong Kong. This avoids the need for larger production batches required in Chinese facilities, reducing the risk of overcommitment.
Shorter Lead Times:As illustrated in the case, factories in Hong Kong ramp up production more quickly than those in China, ensuring timely delivery during the critical first months of the retail season. Therefore, producing the initial 10,000 units in Hong Kong aligns with strategic objectives to optimize "square-footage days" at retail stores, enhancing efficiency and profitability.

Initial Analysis (With Price Consideration)
The proportionate allocation approach does not optimize for profitability; it only takes minimum order limits and demand projections into account. To prioritize styles that meet the initial production criteria and contribute most to profitability, we will incorporate pricing and profit margins into the analysis. Based on the case study, Obermeyer earns a profit margin of 24% on every parka sold at wholesale. This means the profit for each style can be calculated as:
Profit per Unit = 0.24 × Wholesale Price
Each style's expected profit is determined by its anticipated price, profit margin, and demand:
Expected Profit = Average Forecast × Profit per Unit
Styles should be ranked based on anticipated profitability. Styles with higher profit contributions should be prioritized for larger initial production volumes, while ensuring that each style meets the minimum order quantity of 600 units. A total production commitment of at least 10,000 units must be maintained. For styles with greater forecast uncertainty, allocations should be conservative relative to their profitability. The table can be found in Appendix 1.6. Relating the calculations in Appendix 1.6 and decisions to the Hong Kong Case Study:
Minimum Order Flexibility: In line with Hong Kong's reduced minimum order quantity, the initial guideline starts with 600 units per style. This aligns with the case's emphasis on leveraging smaller batch sizes in the first production phase to effectively manage demand uncertainties.
Quick Response Capability: Hong Kong's highly skilled and cross-trained workforce enables rapid production ramp-up. This is particularly critical for high-margin styles like "Electra" and "Daphne," which are prioritized for profitability despite some level of demand unpredictability.
Mitigation of Uncertainty: The smaller batch sizes in Hong Kong help mitigate financial risks associated with overproduction, especially for styles with high forecast uncertainty, such as "Electra." As noted in the case study, unsold inventory results in an 8% loss of wholesale pricing, making this flexibility vital for minimizing inventory risks.
Prioritization of Higher-Margin Styles: Hong Kong's efficient production processes allow Obermeyer to focus on profitability by initially committing to high-margin styles like "Electra" and "Daphne," which have the greatest financial impact.
Reduced Lead Times: As highlighted in the case, Hong Kong manufacturing facilities have shorter lead times compared to Chinese facilities. This enables Obermeyer to deliver products earlier in the retail season, increasing "square-footage days" and enhancing visibility at retail locations.
Profit Amplification: This strategy directly supports profitability objectives by prioritizing high-margin styles that have greater sales potential at full price when delivered earlier to retailers.
Strategic Fit:The first 10,000-unit commitment from Hong Kong aligns seamlessly with Obermeyer's goal of balancing responsiveness, flexibility, and profitability. The ability to dynamically adjust production in response to demand signals ensures maximized profitability while minimizing inventory risks for high-margin styles.

China initial order forecast

Minimum Commitment: At least 600 units of each style must be manufactured.

Total Output Commitment: The total output must add up to 10,000 units or more.

Demand-Driven Allocation:

Distribute the extra units based on each style's average forecast.

a. **Initial Allocation**: Assign 600 units to each style first. For styles made in China, this ensures compliance with the minimum production requirement.

b. **Remaining Units**: Subtract the sum of the minimum commitments from the 10,000-unit production commitment:
Remaining Units = 10,000 − (600 × 10) = 4,000

c. **Proportional Allocation**: Distribute the remaining 4,000 units according to each style's relative average forecast.
Proportional Share for a Style = (Average Forecast for the Style / Total Average Forecast of All Styles) × Remaining Units

d. **Final Allocation**: Add the calculated proportional share to the 600 units already allocated to each style:
Initial Allocation for Style = 600 + Proportional Share

e. **Verification**: Ensure that the total allocation equals 10,000 units after rounding. If there is a discrepancy, incrementally add the remaining units to the styles with the highest average forecast until the total equals 10,000.

f. **Adjustment for Over-allocation**: If the total exceeds 10,000 units, reduce the allocation for styles with the lowest average forecast until the total is adjusted to 10,000.

As the goal is to maximize profit while balancing inventory levels, we need to consider various constraints by utilizing a binary variable, z, which determines whether a product has been ordered.

Additionally, we use M, a large constant value. If z equals 1, indicating that an order has been placed, then Q, the order quantity, can be any value greater than 600 or 1200. Conversely, when z equals 0, it forces Q to be 0.

$$M \cdot z_i \geq Q_i \geq 600 \cdot z_i$$

There are essentially two cases: In the first case, when z is 0, the order is not placed; in the second case, when z is 1, the order is placed. We can then use the same formulas explained in Section 1 to calculate the highest return on investment per unit (lambda) and use this to determine the optimal order quantity. In practice, this means that orders are only placed if they are profitable for the company, with z enforcing the minimum order quantity.

Interestingly, as lambda increases, the risk also increases, discouraging larger orders and leading to a balance in the order quantity (Q) to align profit with risk. In other words, when lambda is small, the ordered quantity is likely to be higher, and as lambda increases, the profitability per unit decreases, trending toward 600. This has a clear impact on expected profit, as it will decrease proportionally with the quantity ordered.

Moreover, as seen in section 2, it should be noted that to implement this allocation and order planning strategy, we need to incorporate the binary variable zz into the optimization model. This will ensure adherence to production constraints while striving for maximum profitability.

Implementation Approach:
As seen previously, this methodology enables an effective and demand-oriented allocation process tailored to maximize returns. By enforcing minimum production levels and distributing excess capacity proportionally, Sport Obermeyer ensures operational efficiency, profitability, and preparedness for demand variability.

Recommendations for Operational Changes

Obermeyer could implement several key operational changes to enhance the performance of its supply chain. These recommendations include improved forecasting, materials sourcing, production training, product revisions, and new logistics strategies.

Improve Forecasting

The biggest challenge in planning this year's supply chain is the lack of data to inform initial forecasting. Next year's production will be more accurately aligned with actual customer demand, as Obermeyer will have this year's sales data to improve forecasting predictions. However, if Obermeyer can incorporate a live, updated forecast based on sales data as it occurs, it could help determine when to switch between regular pricing and discount pricing within a season. Additionally, Obermeyer should consider adding a safety stock buffer for the most popular style to ensure it doesn't run out of stock.

Negotiate Better Procurement & Order Contracts

Materials sourcing: Obermeyer currently sources its materials from seven countries worldwide, including Austria, Germany, Japan, Korea, Switzerland, Taiwan, and the USA. The geographic complexity and long distances involved exacerbate production lead times. To reduce lead times and lower procurement and freight costs, Obermeyer should consider sourcing raw materials from suppliers located closer to China and Hong Kong. However, this trade-off may result in lower quality products.

Reduced MOQs: Negotiate smaller Minimum Order Quantities (MOQs) for production, particularly in China. Reduced MOQ contracts would enable Obermeyer to better adjust production quantities based on updated forecasts.

Retailer pre-orders: Encourage retailers to place orders before the Las Vegas Trade Show, providing earlier access to demand information for improved production planning.

Production Training

Better-trained workers can produce more parkas in less time. One advantage of labor in Hong Kong over China is that workers are more specialized, enabling them to perform a wider range of tasks and produce more parkas per week. If opportunities for training in China were introduced to allow workers to take on more tasks and increase weekly output, China could become more advantageous due to the added benefits of lower wages and a higher number of workers per production line.

Product revision

Raw material standardization: Obermeyer should consider simplifying its product line by standardizing raw materials across styles. This would reduce production complexity, take advantage of China's high-volume, less-specialized labor, and lower costs. Lower production costs would enable reduced prices and increased customer demand. Additionally, proactively stockpiling these standardized components would help minimize lead times and improve material procurement efficiency.
New 'light' parkas: Obermeyer could recycle excess materials into new products, like lightweight parkas and rain jackets, offering summer options while reducing waste and procurement costs.

New Logistics

While Aspen is integral to the company's history, sending all products to Denver post-production is an inefficient process. Denver, located in the center of the country, lacks optimal logistics networks for land or water transport. By moving reception and distribution to Seattle, Obermeyer could leverage superior port and interstate connections, and be closer to Hong Kong, China, and Anchorage, AK—the main cargo hub for US-bound goods. A Seattle-based logistics network would reduce freight time and costs after production.

Recommendation for Sourcing Country

Sport Obermeyer's management must consider the differences between China and Hong Kong in terms of operational risks, quality, costs, and flexibility to develop a successful sourcing strategy. They should adopt the following short- and long-term approaches to this decision:

Short Term Considerations:

- Hong Kong has an advantage in flexibility and managing demand uncertainty. It is better equipped to handle demand unpredictability in the early stages of production due to quicker ramp-ups and smaller minimum order quantities (600 units, compared to 1,200 units in China). In contrast, China is less flexible for initial manufacturing due to longer lead times and higher minimum order requirements.
- Hong Kong's strength in quality assurance lies in its highly skilled and cross-trained personnel, which results in lower repair rates (1–2%) compared to China's higher rates of around 10%. This is especially important for high-end products, where quality assurance is crucial in the early stages of production. In contrast, Obermeyer's reputation for premium skiwear could suffer in China due to higher repair rates, particularly if early production is rushed.
- Cost vs. Risk Tradeoff: Hong Kong's higher labor costs are offset by lower risks of inventory write-downs and overproduction. In contrast, China's cheaper labor costs (US$0.16/hour vs. US$3.84/hour) offer significant savings for higher production volumes of popular models.

For the first 10,000 units, choose Hong Kong to ensure high quality and flexibility. After the Las Vegas trade show, when demand becomes clearer, shift production of well-established styles to China.

Long Term Considerations:

- China's cost-effectiveness will continue to be a major factor in the long run, particularly when it comes to scaling up products with high demand. Repair rate issues might be lessened in Chinese factories by investing in quality control procedures and training. As Chinese manufacturing advances, Hong Kong ought to be saved for experimental or high-margin models where speed and flexibility are critical.
- There are long-term dangers associated with China's economic relations with the United States, including tariffs and quota limitations. As a backup plan, Obermeyer should expand its sourcing network to cover more low-cost areas (such India).
  To gain access to the required manufacturing capabilities in China, sign long-term contracts with quota brokers or government organisations.

- Balanced Approach: China manages bulk manufacturing, but Hong Kong should be a part of long-term sourcing for flexibility and dependability. This lessens reliance on a single nation and lessens disturbances.
- Obermeyer might eventually combine the cost advantages of China with operational enhancements by investing in automation or joint ownership of Chinese plants to boost quality and shorten lead times. More sourcing sites can be required as demand increases, particularly in global markets. To effectively service these markets, China and Hong Kong might also contribute to production distribution.

Recommended Sourcing Policies

For long-term considerations:

Primary Sourcing in China: Invest in quality control and training to reduce repair rates, while gradually increasing production of high-volume styles in China.

Strategic Use of Hong Kong: Continue using Hong Kong for quick-turnaround orders, small production runs, and styles with high profit margins or unpredictable demand.

Increase Regional Sourcing: Diversify risk by establishing connections with producers in other low-cost countries.

Automation and Process Optimization: Invest in technology to enhance productivity and quality in China and other countries, leveraging labor cost benefits while ensuring reliable output.

Obermeyer should use two different sourcing methods: China for cost-effective bulk production and Hong Kong for flexibility and initial manufacturing. In the long term, the company should invest in process improvements, expand its supplier network, and retain the flexibility to adapt to changing market conditions. This strategy ensures Obermeyer maintains its market leadership while balancing cost, risk, and responsiveness.

In conclusion, Sport Obermeyer must adopt a balanced, data-driven strategy to address demand uncertainty, cost efficiency, and operational flexibility. By leveraging the newsvendor model, the company can optimize initial production quantities, prioritizing high-demand and high-margin styles while remaining adaptable post-trade-show. Hong Kong's flexibility, quality, and shorter lead times make it ideal for initial production, while China's cost efficiency is suited for large-scale manufacturing of proven designs. Long-term success depends on diversifying sourcing locations, improving logistics by shifting distribution to Seattle, and investing in quality assurance and operational efficiency across both regions. This approach ensures profitability while mitigating risks inherent to seasonal and fashion-driven industries.

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Appendix

Appendix 1:1: is a summary of exhibit 8 detailing the major differences between Hong Kong and China.

Hong Kong	**China**
• Lower minimum order qty • More parkas produced per week • Less workers per line • Shorter working hours • Higher pay • More training	• Higher minimum order qty • Less parkas produced per week • More workers per line • Longer working hours • Lower wage • Less Training

Appendix 1:2: The optimal order value table.

Style	Average Forecast	Standard Deviation	2 x Std. Deviation	Sales Price	Cost	Under-stock	Over-stock	Critical Ratio	z-value	Q*
Gail	1,017	194	388	$74.80	$83.60	$26.40	$8.80	0.75	0.6745	1279
Isis	1,042	323	646	$67.32	$75.24	$23.76	$7.92	0.75	0.6745	1478
Entice	1,358	248	496	$54.40	$60.80	$19.20	$6.40	0.75	0.6745	1693
Assault	2,525	340	680	$61.20	$68.40	$21.60	$7.20	0.75	0.6745	2984
Teri	1,100	381	762	$83.64	$93.48	$29.52	$9.84	0.75	0.6745	1614
Electra	2,150	404	807	$117.64	$131.48	$41.52	$13.84	0.75	0.6745	2694
Stephanie	1,113	524	1,048	$90.44	$101.08	$31.92	$10.64	0.75	0.6745	1820
Seduced	4,017	556	1,113	$49.64	$55.48	$17.52	$5.84	0.75	0.6745	4768
Anita	3,296	1,047	2,094	$63.24	$70.68	$22.32	$7.44	0.75	0.6745	4708
Daphne	2,383	697	1,394	$100.64	$112.48	$35.52	$11.84	0.75	0.6745	3323
Totals										26360

Appendix 1:3: Scaled production quantities approach.

Style	Avg Demand	Std Dev	2x Std Dev	Price	Rec. Prod. Quantity
Gail	1017	194	388	$110	**486**
Isis	1,042	323	646	$99	**561**
Entice	1,358	248	496	$80	**642**
Assault	2,525	340	680	$90	**1,132**
Teri	1,100	381	762	$123	**612**
Electra	2,150	404	808	$173	**1,022**
Stephanie	1,113	524	1,048	$133	**690**
Seduced	4,017	556	1,112	$73	**1,808**
Anita	3,296	1,047	2,094	$93	**1,786**
Daphne	2,383	697	1,394	$148	**1,261**
Total	**20,001**	**4714**	**9428**	**$112 (avg)**	**10,000**

Appendix 1:4: Adjusted critical value, the adjusted z-value and find the order values.

Style	Price	Critical Ratio	Z-value	Q*	Max Profit	Lambda	Adjusted CR	Q*
Gail	$110	0.75	0.6745	1279	$ 22,596.49	1911%	0.2071	700
Isis	$99	0.75	0.6745	1478	$ 18,386.03	1367%	0.3186	737
Entice	$80	0.75	0.6745	1693	$ 22,120.19	1461%	0.1792	903
Assault	$90	0.75	0.6745	2984	$ 48,442.50	1955%	0.0712	1527
Teri	$123	0.75	0.6745	1614	$ 23,262.88	1590%	0.3459	798
Electra	$173	0.75	0.6745	2694	$ 75,358.22	3288%	0.1560	1334
Stephanie	$133	0.75	0.6745	1820	$ 21,629.80	1316%	0.4408	957
Seduced	$73	0.75	0.6745	4768	$ 66,282.81	1750%	0.0009	527
Anita	$93	0.75	0.6745	4708	$ 54,164.11	1529%	0.2364	1792
Daphne	$148	0.75	0.6745	3323	$ 64,088.80	2341%	0.2556	1467
Totals				26360	$ 416,331.83			10743

Appendix 1:5: Initial analysis without price consideration

Style	Average Forecast	Standard Deviation	2x Std. Deviation	Initial Allocation
Gail	1017	194	388	508

Isis	1042	323	646	521
Entice	1358	248	496	679
Assault	2525	340	680	1262
Teri	1100	381	762	550
Electra	2150	404	807	1075
Stephanie	1113	524	1048	556
Seduced	4017	556	1113	2010
Anita	3296	1047	2094	1648
Daphne	2383	697	1394	1191

Appendix 1:6: Initial analysis with price consideration

Style	Average_Forecast	Expected_Profit	Initial_Commitment
Electra	2150	89268	1289
Daphne	2383	84644.16	1254
Anita	3296	73566.72	1168
Seduced	4017	70377.84	1143
Assault	2525	54540	1021
Stephanie	1113	35526.96	874
Teri	1100	32472	851
Gail	1017	26848.8	807
Entice	1358	26073.6	801
Isis	1042	24757.92	792

Appendix 1:6: Analysis using ROI methodology with a minimum order of 600 (the same method is applied to the minimum order of 1200)

Style	Price	Average Forecast	2 x Std Deviation	Q*	Min Order	Lambda	Adjusted CR	Order?	M * Order	Q*
Gail	$110	1,017	388	1279	600	1911%	0.2071	1	10000000	700
Isis	$99	1,042	646	1478	600	1367%	0.3186	1	10000000	737
Entice	$80	1,358	496	1693	600	1461%	0.1792	1	10000000	903

Assault	$90	2,525	680	2984	600	1955%	0.0712	1	10000000	1527
Teri	$123	1,100	762	1614	600	1590%	0.3459	1	10000000	798
Electra	$173	2,150	807	2694	600	3288%	0.1560	1	10000000	1334
Stephanie	$133	1,113	1,048	1820	600	1316%	0.4408	1	10000000	957
Seduced	$73	4,017	1,113	4768	600	1750%	0.0009	1	10000000	600
Anita	$93	3,296	2,094	4708	600	1529%	0.2364	1	10000000	1792
Daphne	$148	2,383	1,394	3323	600	2341%	0.2556	1	10000000	1467
Totals				26360						10816