SCM 502 Final Project

Optimizing Graffitees' Inventory & Profits

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Background

Graffitees is a company specializing in transforming plain T-shirts into unique pieces of wearable art through customizable graffiti designs. Let us take a deeper look in their process:

Each T-Shirt is **produced** at the **cost of $15** by the supplier, KHG

Sourcing

KHG **sells each unit for $30** to Graffitees, who places an order of **1000 units per month**

Fixed Delivery Costs of $100 per order

The **customization** of each unit **costs** Graffitees **$5**

Graffitees then sells each unit at a price of $50 to the customer

The unsold inventory is sold by Graffitees at a 70% discount at the year end for the price of $15

Holding costs is $0.25 per unit per month

Background

Demand Distribution (Yearly):

Probability	Demand
0.1	7500
0.15	10000
0.2	12500
0.25	15000
0.2	17500
0.1	20000

Strategic Challenges:

- Ordering and inventory management based on intuition rather than a systematic approach.
- Distribution of risks and profitability issues with supplier.

Opportunities for Improvement:

- Optimization of ordering quantity and inventory management.
- Renegotiation of contract terms with KHG for equitable risk and benefit distribution.

Executive Summary

Project Goals:

- ➢ Change intuition-based inventory orders to data-driven strategies.
- ➢ Improve contractual terms with the supplier (KHG) to ensure a more equitable distribution of risks and benefits.

Strategies:

- ➢ **Data-Driven Inventory Optimization:**
  - Analyze demand distribution data to determine optimal order quantities and order frequencies.
  - Adjust inventory and order frequency to reduce overall fixed costs and holding costs.
- ➢ **Contract Renegotiation:**
  - Check current contract effectiveness and identify potential improvements.
  - Consider various contractual models, such as buyback and two-part tariff contracts, to enhance terms and conditions.
- ➢ **Evaluation:**
  - Evaluate financial performance and sales effectiveness by comparing the current operational metrics to those achieved with various optimization strategies, and select the most effective strategy for implementation.

Expected Benefits:

- ➢ **Operational Improvements:** Achieve greater inventory accuracy, reducing both holding costs and potential customer dissatisfaction.
- ➢ **Financial Outcomes:** Improve profit margins through better inventory cost management and more favorable supplier terms.
- ➢ **Market Position:** Strengthen standing in the market by responding more effectively to customer needs and boosting the efficiency of supply chain.

Current Scenario:

Average Inventory = 445 (as monthly demand is 1166, but they ordered only 1000, inventory is empty for 4 days a month)

Holding cost per year for a unit, H = 0.25*12 = $ 3

Total Profit of Graffitees = $ 109,965

Total Profit of supplier, KHG = $ 178,500

Expected sales = 11,250
Expected leftovers = 750
Expected Unsatisfied clients = 2,750

Regret of under ordering, $\mathbf{R_u}$ = Selling price + Future loss - cost price - Artwork cost = 50+15-30-5 = $ **30**
Regret of over ordering, $\mathbf{R_o}$ = Cost price + Artwork cost - Discounted price = 30+5-15 = $ **20**

They need to **ORDER MORE** as they have **HUGE UNSATISFIED DEMAND** and **HIGHER REGRET OF UNDER ORDERING**

Optimal Order Quantity per year to satisfy Service Level of 60% is 15,000 units

When OQ is 15000:

Average Inventory = 686 (as monthly demand is 1166, but they ordered 1250, carrying more inventory than the demand)

Total Profit of Graffitees = $ 136,742 (38%)

Total Profit of supplier, KHG = $ 223,125 (62%)

Expected sales = 13,000
Expected leftovers = 2,000
Expected Unsatisfied clients = 1,000

Despite increased profits, our procurement manager believes further enhancements can be achieved through strategic negotiations with the supplier

Optimal Scenario : When Graffitees and Supplier act as one entity

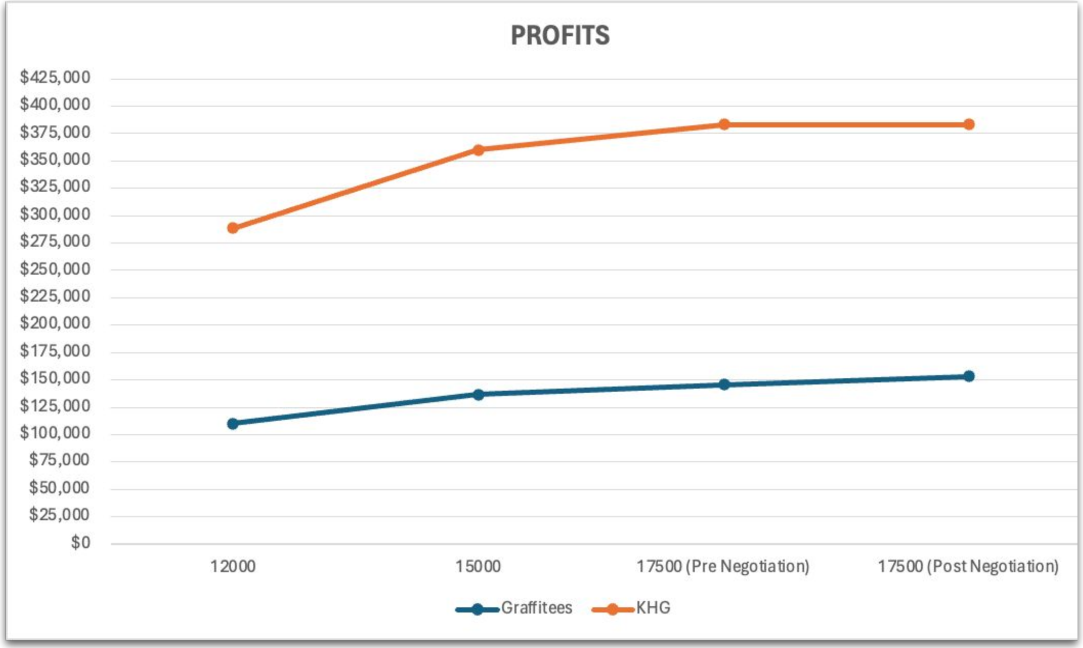
R_u= 50+15-15-5= 45 & R_o= 15+5-15= 5 ⟹ Service level = 90 % ⟹ Order Quantity = 17500

Expected sales = 13750
Expected leftovers = 3750
Expected Unsatisfied clients = 250

Profits at previous share:
Graffitees (38%) : **$ 145,705**
Supplier, KHG (62%) : **$ 237,730**

Contract to increase Graffitees share to 40%

Profits at new share:
Graffitees (40%) : **$ 153,374**
Supplier, KHG (60%) : **$ 230,061**



Total Supply Chain Profits = $ 383,436

Contract Terms

Buyback Contract:

Cost Price, **W^1 = $ 32.45**

Buy back price, **B = $ 29.39** ❌

($R_u = 50 + 15 - W^1 - 5$ & $R_o = W^1 - B$)
1. Service level = 0.9 = $(60-W^1) / (60-B)$
2. Profit of Graffitees with W^1 & B = 40% of Total supply chain profits

This won't be viable as it's not possible to negotiate with buy back price that is so close to the cost price.

Optimal Order quantity & Frequency:

Order Quantity, **Q = 730**

Number of Orders = **24**

Average Inventory of G = **((0.79/2)*Q + 0.21*Q) * 3**
(for Q when total order is 17500, 0.21*Q are leftovers)

Average Inventory of KHG = **(Q/2)*3**

1.8 Q + 1.5 Q = (17500/Q)* 100

Two part tariff contract:

Fixed cost for Graffitees, **W^o= $ 55**

Cost Price, **W^1 = $ 28.2** ✅

(W^o- Fixed delivery cost per order for G) | Note: (100 - W^o) is paid by KHG
1. IHC = AFC for Graffitees: 1.8*730 = (17500/730) * W^o
2. Profit of Graffitees with W^o & W^1 = 40% of Total supply chain profits

Total Quantity = 17500 | Q = 730 | W^1 = $ 28.2 | W^o = $ 55 | Profit of G = $ 153,374 & KHG = $ 230,061

Is Renegotiation Worthy? → Procurement Manager says **YESSS**!!

Current Scenario: Total Order Quantity = 12000	**Without Renegotiation:** Total Order Quantity = 15000	**Without Renegotiation:** Total Order Quantity = 17500	**After Renegotiation :** Total Order Quantity = 17500
Sales: 11,250	Sales: 13,000	Sales: 13,750	Sales: 13,750
Leftovers: 750	Leftovers: 2,000	Leftovers: 3,750	Leftovers: 3,750
Unsatisfied: 2,750	Unsatisfied: 1,000	Unsatisfied: 250	Unsatisfied: 250
Profits:	**Profits:**	**Profits:**	**Profits:**
Graffitees: **$ 109,965**	Graffitees: **$ 136,742**	Graffitees: **$ 145,705**	Graffitees: **$ 153,374**
KHG: $ 178,550	KHG: $ 223,125	KHG: $ 237,730	KHG: $ 230,061
Supply Chain:$ 288,515	Supply Chain: $359,867	Supply Chain: $383,435	Supply Chain: $383,435

24 % ↑ → 6.5 % ↑ → 5.5 % ↑

Overall, profits could see a **40% INCREASE** for Graffitees