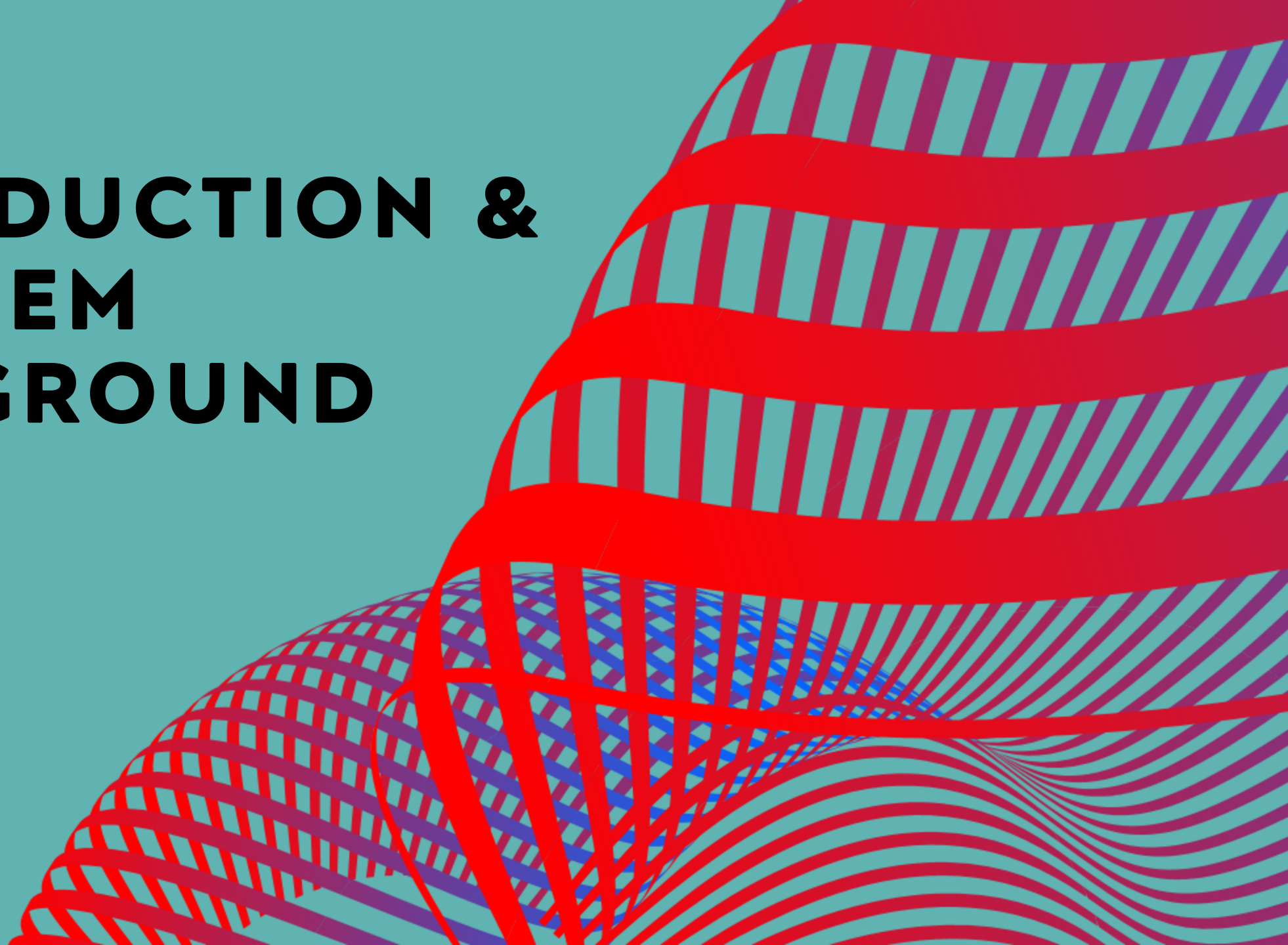A BUSINESS PROBLEM

THREAD ARTS NETWORK

TEAM: 312

MATT NORDWICK
MARY JOHN
YI-TING LIU
PRATHEEK NS

INTRODUCTION & PROBLEM BACKGROUND

BACKGROUND

THE PRODUCT

A small online business, run by Thread Art Network, specializes in producing three types of custom calendars: Basic, Portrait, and a new premium line called New Resins. These calendars are highly popular during the holiday season, and the company aims to maximize its profit while ensuring efficient use of resources and want to see is it worth investing on the 3rd new product.

CALENDAR

PORTRAIT
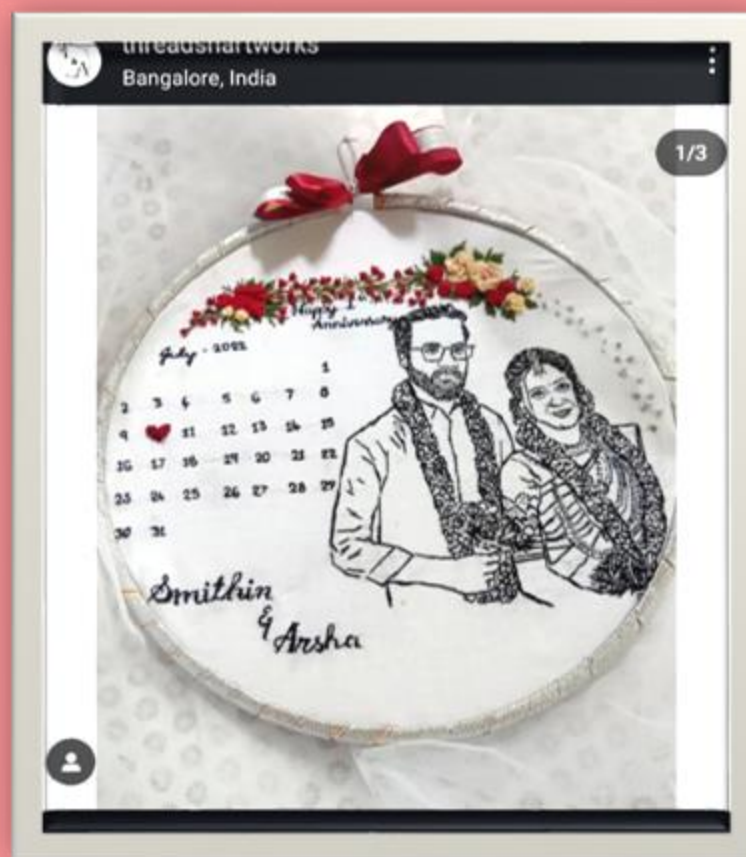
(NEW)RESIN

CHALLENGES

The production process requires careful balancing of costs, advertising, labor, and materials. Each calendar type has unique production requirements:

- **Basic Calendars** are affordable but require less time and effort to make.

- **Portrait Calendars** are more lucrative but are limited in the number that can be produced.

- **Resin Calendars** are high-profit, premium products but demand the most time and resources.

5

BUSINESS GOALS

- **Profit Goal**: Achieve a total profit of at least **$500** per month.

- **Time Limitation**: Production time must not exceed **40 hours per month**.

- **Basic Calendar Production**: Produce **at least 5 Basic Calendars** per month to meet minimum customer demand.

- **Portrait Calendar Limitation**: Production of **Portrait Calendars must be less than 10** per month.

- **Non-Negativity**: All production levels must not be nil.

DATA COLLECTION

We followed a primary data collection method where we collected directly from the source.

We collected the data by asking the person who is running the business.
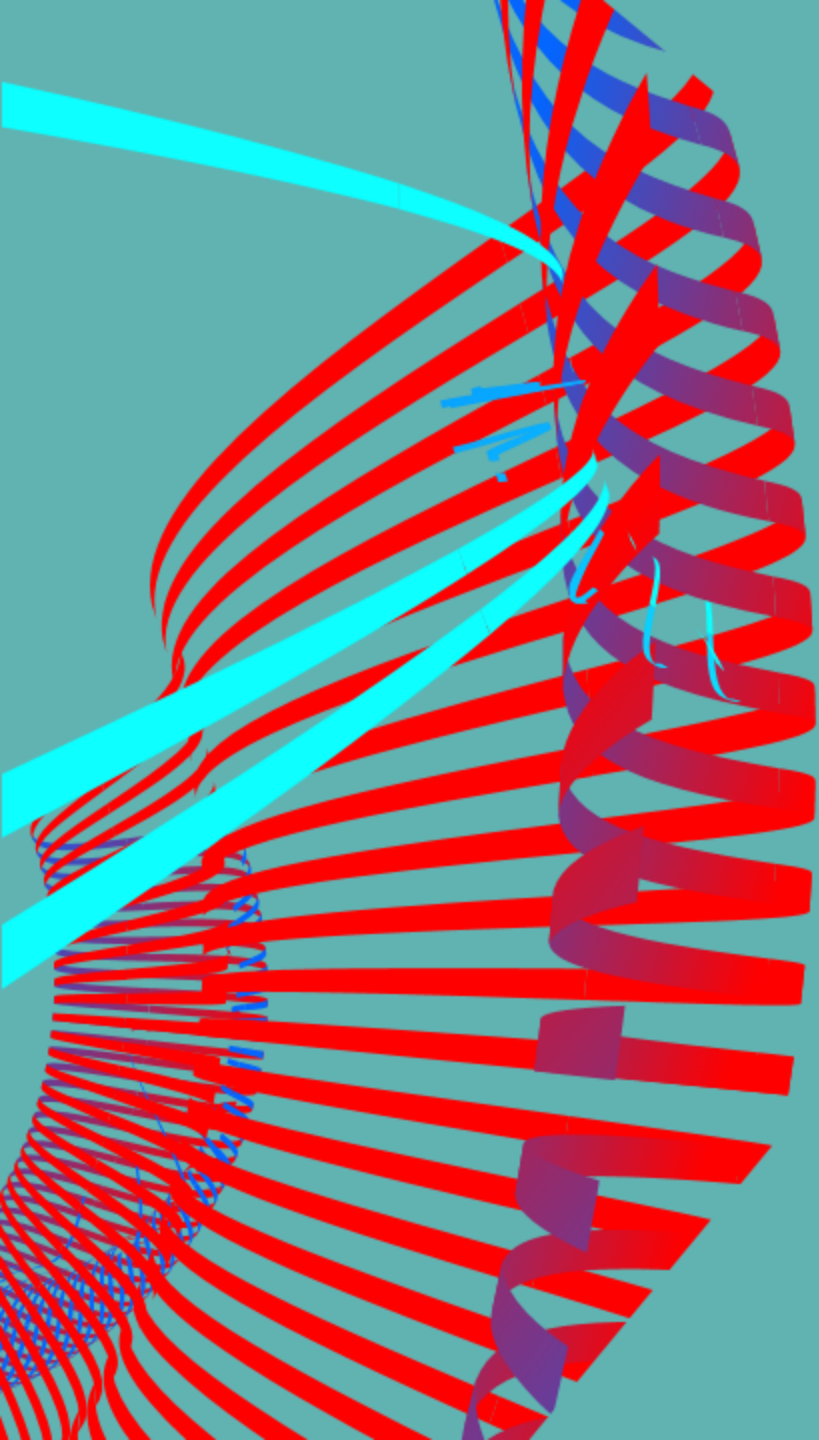
MODEL FORMULATION

INPUTS

$i \in \{1, 2, 3\}$:   Index to represent calendar types

(1: Basic Calendar/ 2: Portrait Calendar/ 3. Resin Calendar)

P_i: Price of each calendar i

H_i: Hours required to make one calendar i

m_i: Material cost of each calendar type i

a_i: Number of ads placed for each calendar type i

A: Advertisement cost per ad (=$10)

T: Total production time available (= 40 hr)

P: Profit goal (= $500)

OBJECTIVE

Maximize total profit:

$$\max \Sigma [(P_i - m_i)X_i - (a_i * A)], i \in \{1, 2, 3\}$$

DECISION

X_i: Number of units of calendar i to produce

CONSTRAINTS

1. $\Sigma (P_i - m_i)X_i - a_i * A \geq P$: The profit goal is to be greater than (P) $500

2. $\Sigma h_i * X_i \leq T$: Total time spend on making the goods (=40 hours)

3. $X_1 \geq 5$: The basic calendar constraint

4. $X_2 \leq 10$: The portrait calendar constraint

5. $X_3 \leq 2$: The resin calendar constraint

6. $X_1 \geq X_2$: The production of basic calendar to be less than or equal to portrait

7. $X_i \geq 0, i \in \{1, 2, 3\}$: The non-negativity constraint

MODEL SOLUTION

MODEL 1

BASIC CALENDAR | 8 calendars

PORTRAIT CALENDAR | 8 calendars

12

TOTAL PROFIT = $624/-

TOTAL HOURS SPEND= 40 HOURS

Products	Basic Calandar		Calandar Portrait			
Price	$ 30.00		$ 65.00			
Hours Required	2		3			
Material	$ 5.00		$ 7.00			
	$ 200.00		$ 464.00			
	$ 664.00					
Advertising, Orders Per Ad	Basic Orders	Portrait Orders	New			
	3	2	1.5			
Advertising Cost	$ 10.00	$ 10.00	10			
Ads Placed	2	1	1			
Total Ad cost	$ 20.00	$ 10.00	10			
	$ 40.00					
	-					
	Basic		Portrait			
Calandars To Make- Monthly	8		8			
Make Atleast per month	5	Make less than 10	10			
Cost	$ 40.00		$ 56.00			
Profit	$ 200.00		$ 464.00			
Total Profit	$ 624.00	>=	$500			
Time Spent	16		24			
Total Time spent in a month	40	<=	40			

MODEL 2

BASIC CALENDAR | 7 calendars

PORTRAIT CALENDAR | 7 calendars

RESIN CALENDAR | 1 calendars

TOTAL PROFIT = $631/-

TOTAL HOURS SPEND= 40 HOURS

Products	Basic Calandar		Calandar Portrait	New				Constraints		
Price	$ 30.00		$ 65.00	$ 100.00						
Hours Required	2		3	5						
Material	$ 5.00		$ 7.00	$ 10.00						
	$ 175.00		$ 406.00	$ 90.00						
	$ 671.00									
Advertising, Orders Per Ad	Basic Orders	Portrait Orders	New					Constraints	Hours per month	40
	3	2	1.5						Minimum Profit	$500
Advertising Cost	$ 10.00	$ 10.00	10							
Ads Placed	2	1	1							
Total Ad cost	$ 20.00	$ 10.00	10							
	$ 40.00									
	-									
	Basic		Portrait	New						
Calandars To Make- Monthly	7		7	1						
Make Atleast per month	5	Make less than 10	10	2						
Cost	$ 35.00		$ 49.00	$ 10.00						
Profit	$ 175.00		$ 406.00	$ 90.00						
Total Profit	$ 631.00	>=	$500							
Time Spent	14		21	5						
Total Time spent in a month	40	<=	40							

RECOMMENDATIONS AND CONCLUSIONS

RECOMMENDATION

ADOPT MODEL 2 STRATEGY

Although Model 2 introduces additional complexity by producing one Resin Calendar, its higher profit makes it the preferable choice.

DIVERSIFY MARKETING STRATEGIES

Increase advertising efforts (e.g., $10 per ad) to attract more customers, potentially raising sales volumes and profits further.

EXPLORE EXTENDING PRODUCTION TIME

If the monthly production time can be increased beyond 40 hours, it could further boost profits, particularly by increasing the output of high-profit items like Resin Calendars.
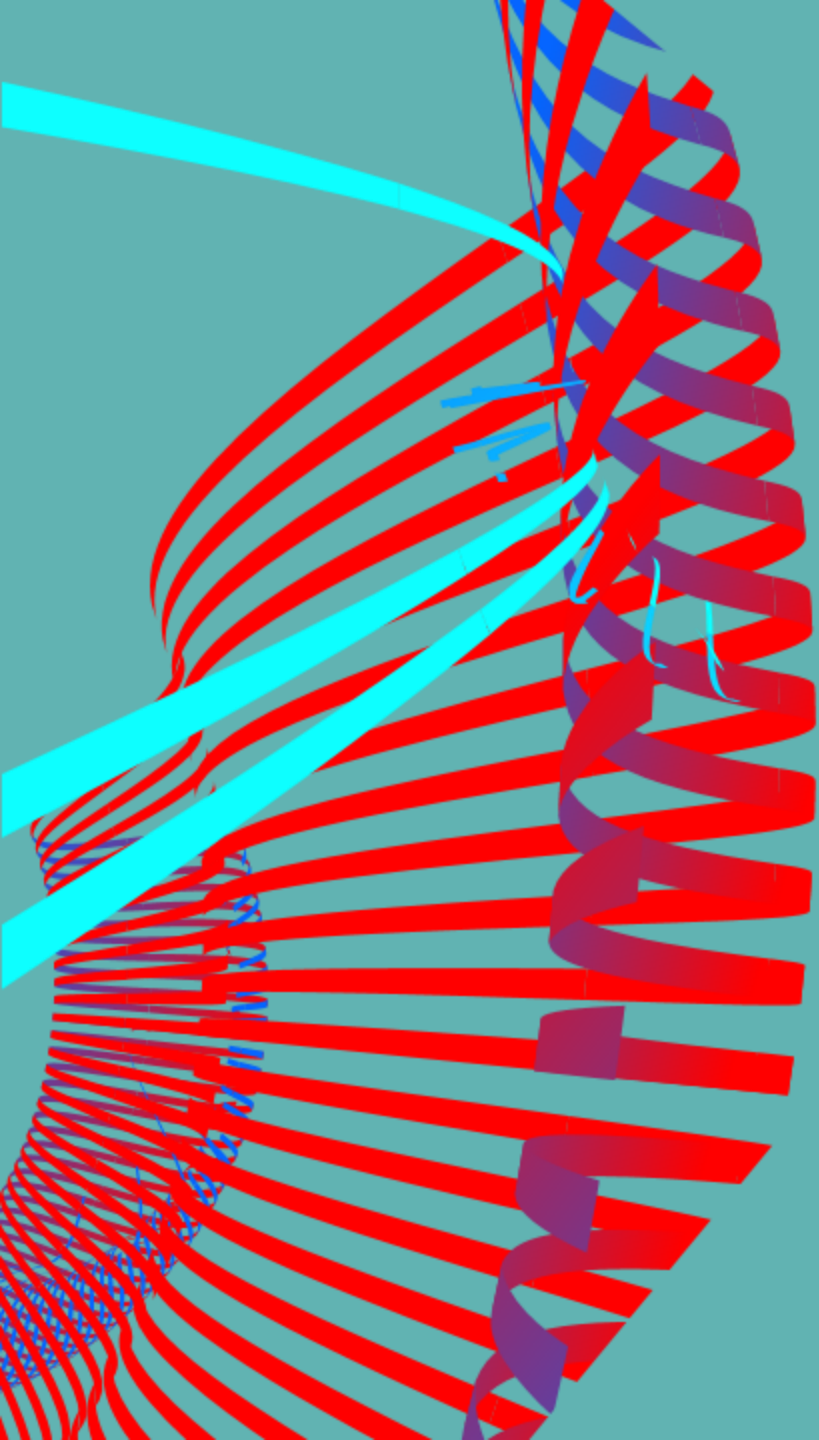
CONCLUSION

PERFORMANCE COMPARISON BETWEEN MODELS:

- Model 2 achieves a total profit of $631, which is $7 higher than Model 1's $624, indicating it better aligns with the goal of maximizing profit.

- Both models fully utilize the 40-hour production time limit, demonstrating efficient resource allocation.

PRODUCT MIX EFFECTIVENESS:

- Model 1 focuses solely on producing Basic and Portrait Calendars, simplifying production processes.
- Model 2 incorporates the production of Resin Calendars. Despite its lower quantity, its high unit price and profit contribution enhance the total profit.