

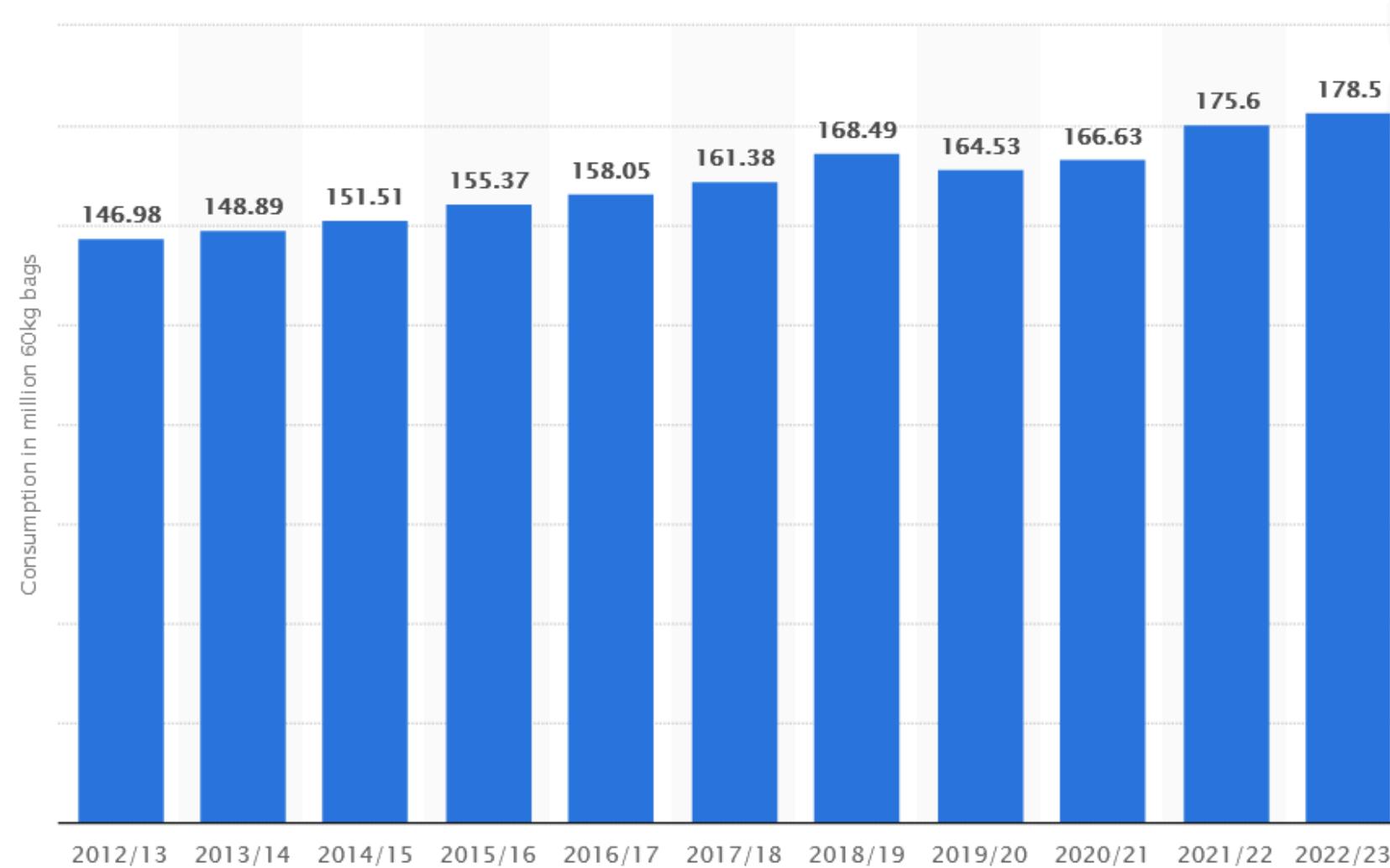
# Supply Chain Simulation Model Presentation

MNA1094 – Supply Chain Management  
Group U

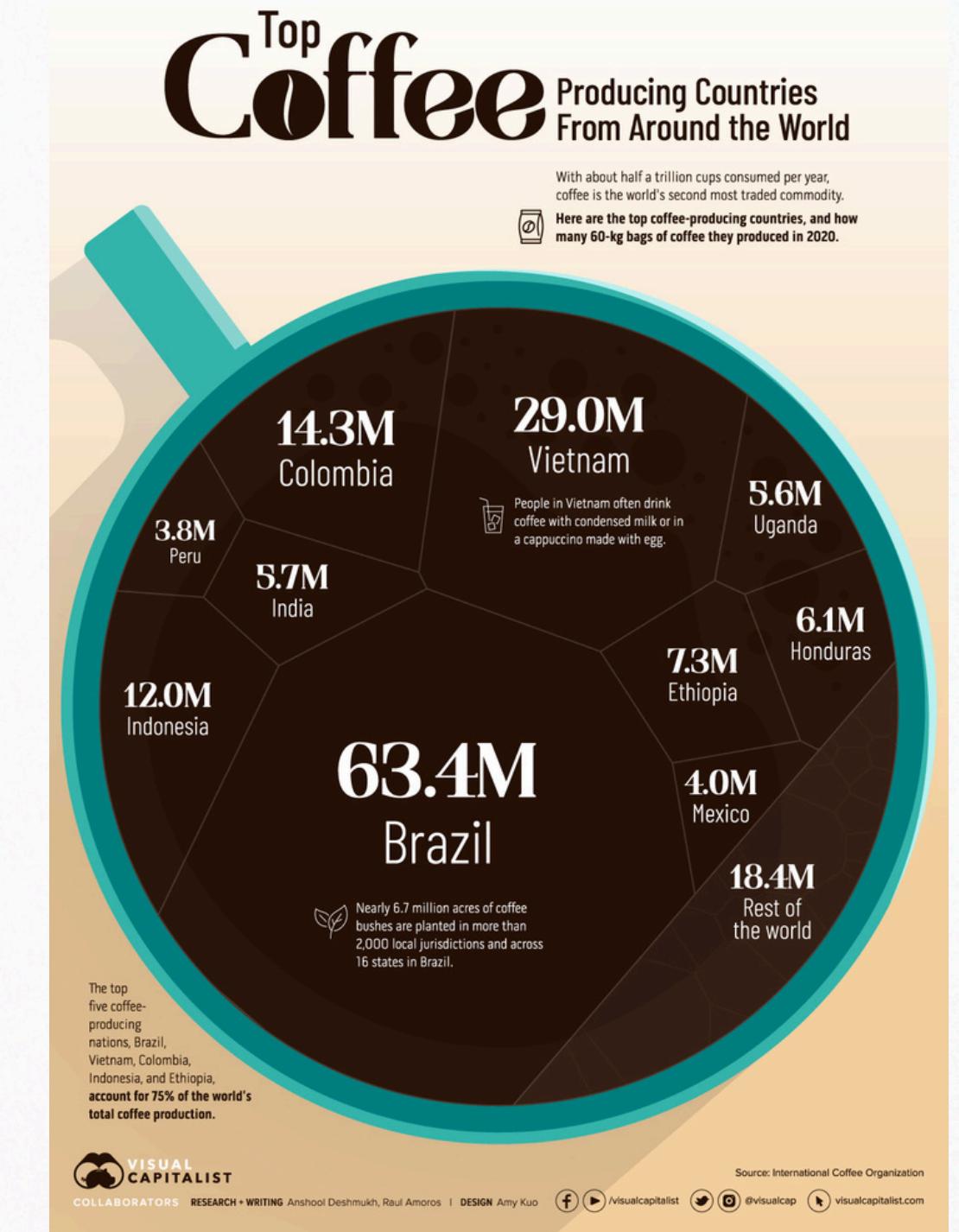
# Introduction



# Coffee production around the world

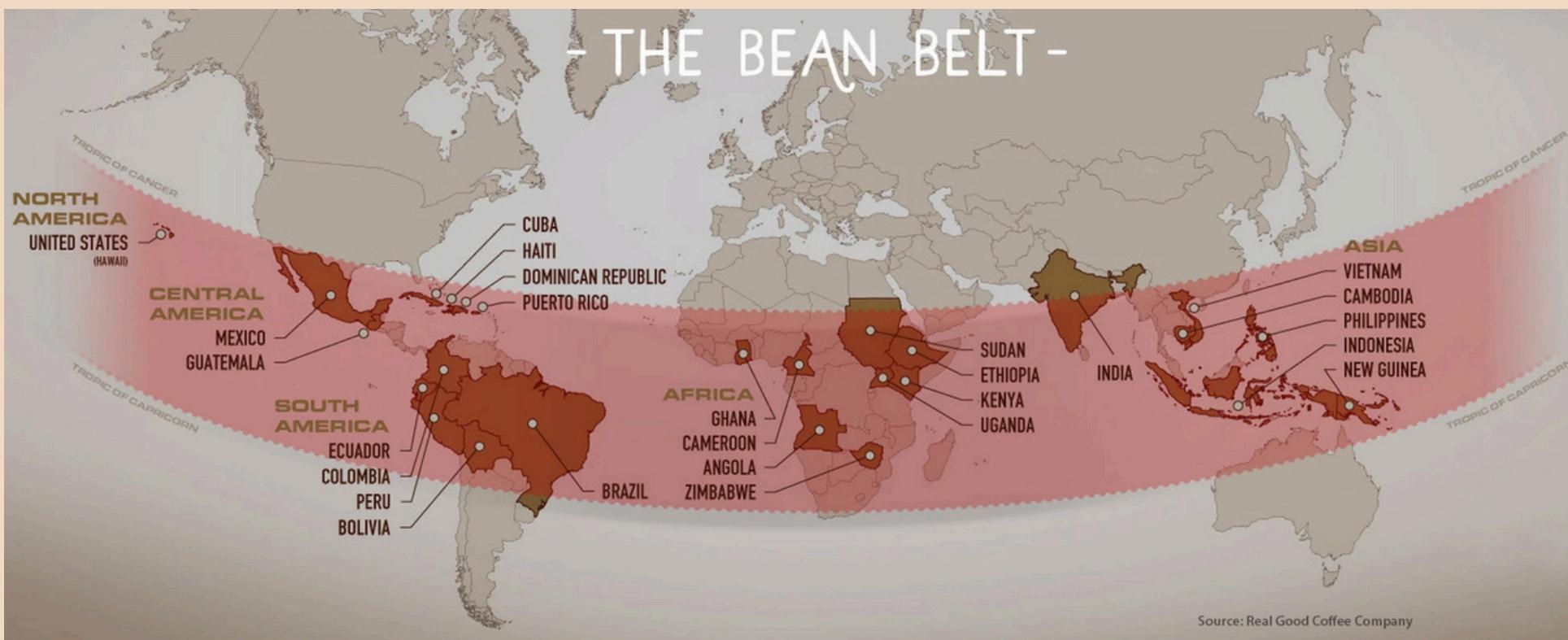


Statista. Available at: <https://www.statista.com/statistics/292595/global-coffee-consumption/>



Visual Capitalist. Available at <https://www.visualcapitalist.com/worlds-top-coffee-producing-countries/>

B



Visual Capitalist. Available at <https://www.visualcapitalist.com/worlds-top-coffee-producing-countries/>

# Supply Chain Overview



iStock. Available at <https://www.istockphoto.com/vector/stages-of-coffee-production-infographic-set-with-harvesting-hulling-and-drying-gm1471591018-502161277>

# Objectives of the Simulation



- Identify vulnerabilities
- Analyze weather effects
- Test resilience strategies

# The Coffee Production Process

## Cultivation

Growing coffee plants

## Harvesting

Picking coffee cherries

## Processing

Removing beans  
from cherries

## Roasting

Enhancing flavor

## Grinding & Brewing

Grinding & Brewing

# Simulation Model Overview

## Components

- Suppliers (Farm A and Farm B)
- Processing Facilities
- Logistics
- Distribution Channels
- Retailers

## Key Metrics

- Inventory Levels
- Costs
- Unmet Demand

## Test Scenarios

1. Worse Than Usual Weather
2. Better Than Usual Weather
3. Factory Strikes

# Model Design

## Data Inputs

- Demand Forecasts
- Inventory Levels
- Lead Times
- Cost Structures
- Weather Data
- Safety Stock

## Algorithms

- Production
- Inventory Management
- Demand Adjustment
- Cost Calculations

## Assumptions

- Static Cost Structure
- Predefined Weather Multipliers
- Inventory Capacity
- Lead Time

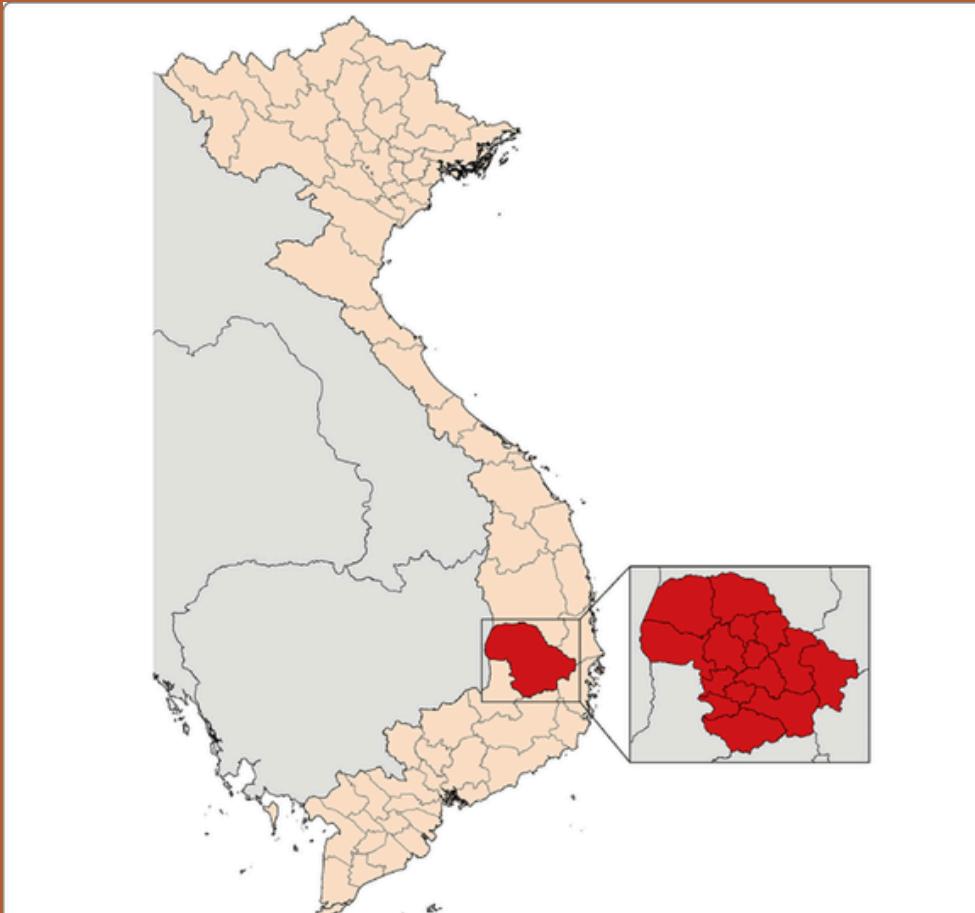
## Limitations

- Simplistic Weather Modelling
- Excludes real-time updates and disruptions
- Assumes Uniform Demand Patterns

# Testing Scenarios

H

Farms A  
Buon Ma Thuot, Dak Lak Province  
moderate and predictable rainfall



	Rainfall index (Original)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Farm A	0.5	0.5	0.6	0.8	1	1.2	1.2	1.1	1	0.9	0.9	0.7
Farm B	0.6	0.5	0.7	0.9	1.1	1.3	1.2	1	1	0.9	0.8	0.6

Farm B  
Da Lat, Lam Dong Province  
wetter microclimate with slightly higher  
rainfall.



# Test 1 – Worse than Usual Weather (Extended Monsoon)

H

## Rainfall Patterns:

Rainfall peaks in June and July for both farms.

Farm B consistently receives more rainfall compared to Farm A throughout the year.

Rainfall Index for Farm A: Peaks at 1.2.

Rainfall Index for Farm B: Peaks at 1.3.

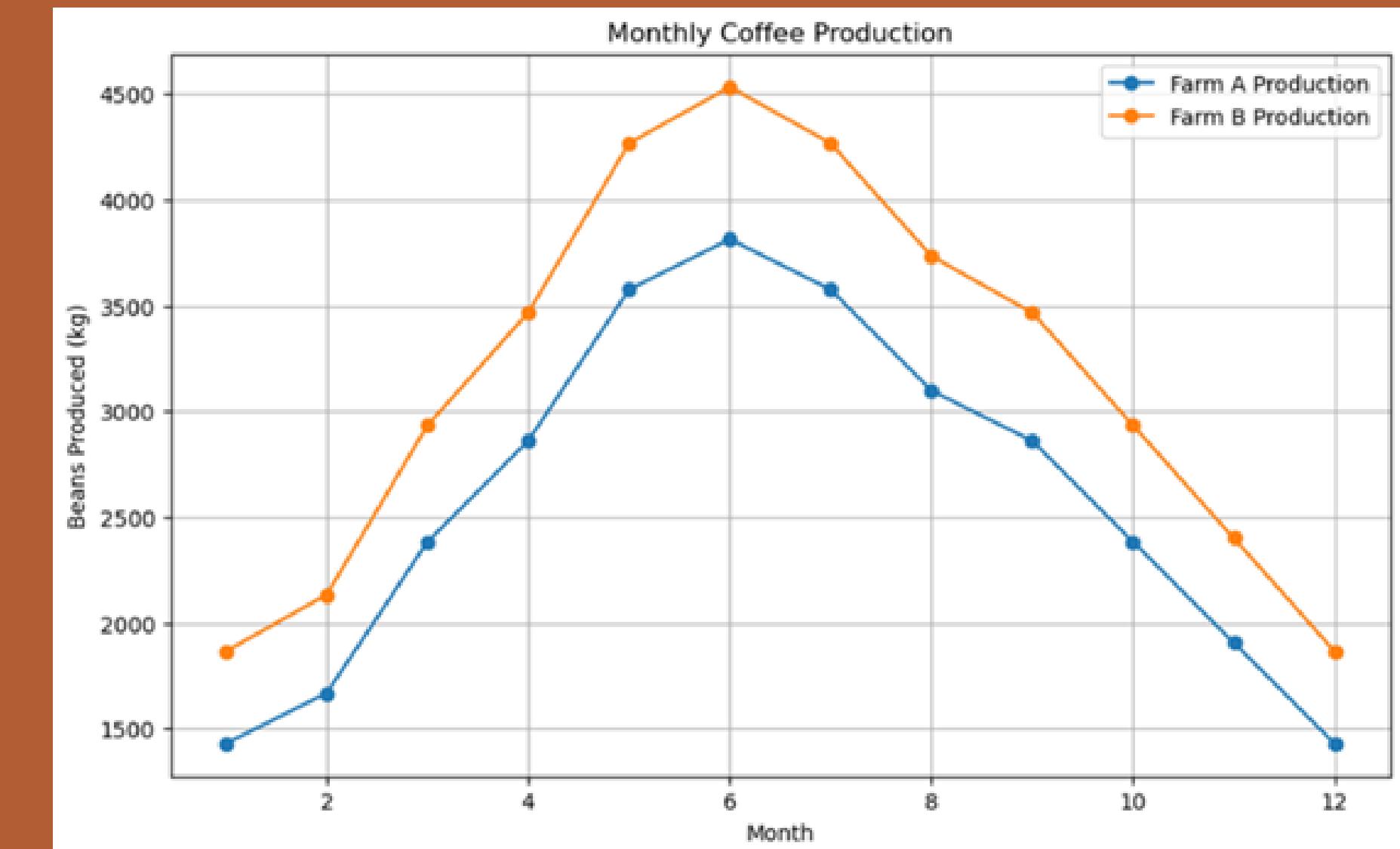
## Coffee Production Trends:

Coffee production mirrors rainfall patterns.

Peak production occurs in June and July, aligning with maximum rainfall.

Production starts to decline from September to December, corresponding with reduced rainfall.

	Rainfall index (Extended Monsoon)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Farm A	0.6	0.7	1	1.2	1.5	1.6	1.6	1.5	1.3	1.2	1	0.8	0.6
Farm B	0.7	0.8	1.1	1.3	1.6	1.7	1.6	1.4	1.3	1.1	0.9	0.7	



# Test 2 – Better than Usual Weather (Mild Monsoon)

H

## Rainfall Patterns:

Rainfall peaks earlier than in the extended monsoon scenario, with the highest levels in May and June.

## Rainfall Index:

Farm A: Peaks at 1.2.

Farm B: Peaks at 1.3, slightly higher than Farm A.

Both farms exhibit similar seasonal rainfall trends.

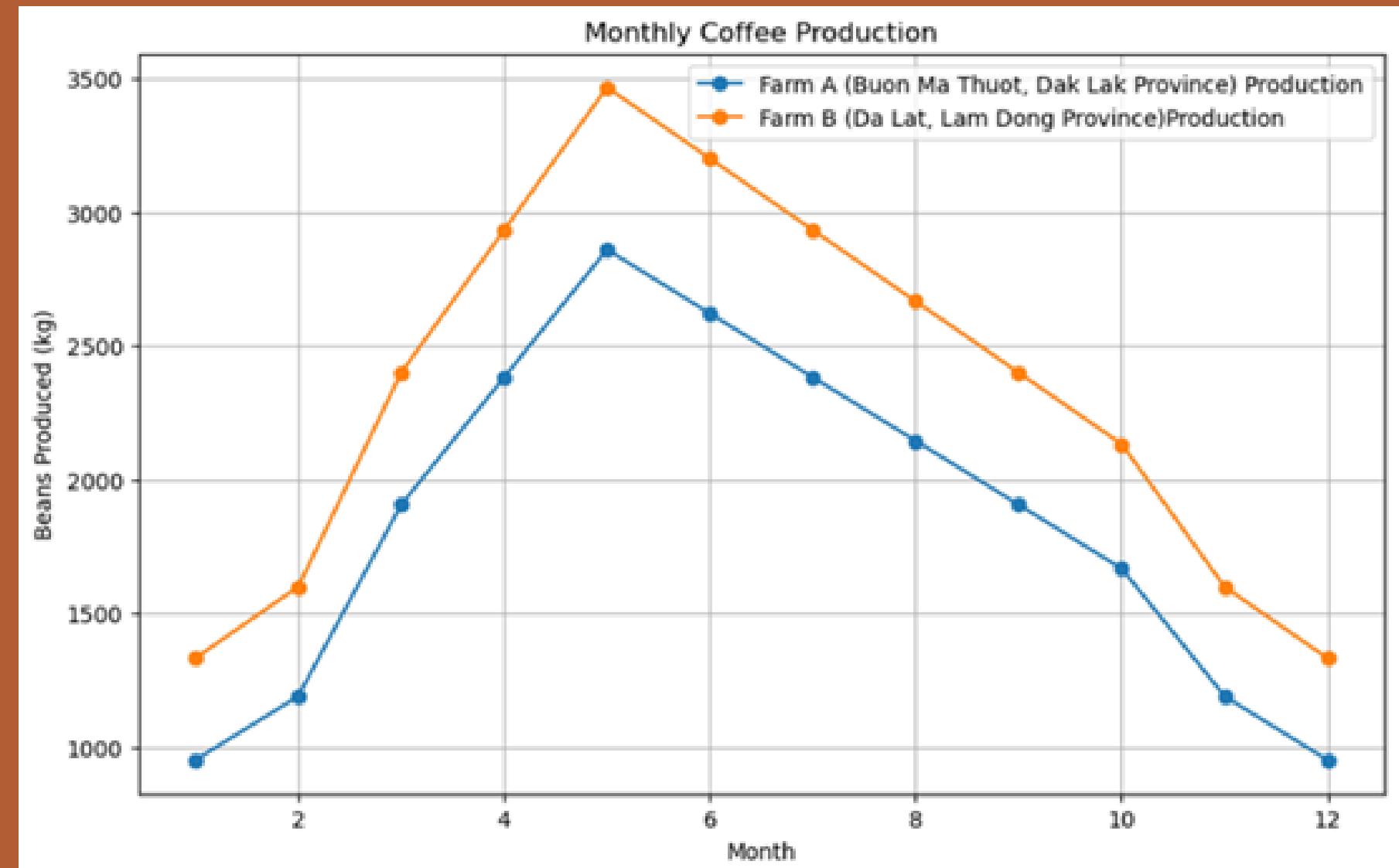
## Coffee Production Trends:

Coffee production aligns closely with rainfall, with peak yields in May and June.

Farm B again outperforms Farm A due to its higher rainfall levels.

The production gap between Farm A and Farm B narrows under mild monsoon conditions compared to the extended monsoon.

	Rainfall index (Mild Monsoon)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Farm A	0.4	0.5	0.8	1	1.2	1.1	1	0.9	0.8	0.7	0.5	0.4
Farm B	0.5	0.6	0.9	1.1	1.3	1.2	1.1	1	0.9	0.8	0.6	0.5



# Test 3 – Factory Strikes

H



## Pre-strike Period:

From January to April, inventory was steadily built up to meet demand. Production and supply operated normally during this phase.

## Strike Period:

Factory operations ceased in May and June. Inventories were completely depleted during these months to fulfil customer demand. Unmet demand spiked sharply, peaking in June, as production could not keep up.

## Post-strike Period:

After the strike ended, production resumed but at a slower recovery rate than pre-strike levels. Inventory buildup lagged, potentially due to increased demand or tighter production margins.

# PHYTON SIMULATION OVERVIEW

FOR THE SIMULATION MODEL WE USED SYPDER TO DEMONSTRATE DIFFERENT RESULTS

## DEMAND FLUCTUATIONS DUE TO WEATHER

### Original Weather pattern

```
# Sourcing details for farms
farm_a_details = {
    "location": "Dak Lak Province",
    "hectares": 8,
    "yield_per_hectare": 3.7, # Tonnes per hectare annually
    "annual_production": 28600, # kg annually
    "weather_pattern": [0.5, 0.5, 0.6, 0.8, 1.0, 1.2, 1.2, 1.1, 1.0, 0.9, 0.7, 0.5]
}

# Example seasonal factors
}

farm_b_details = {
    "location": "Lam Dong Province",
    "hectares": 10,
    "yield_per_hectare": 3.2, # Tonnes per hectare annually
    "annual_production": 32000, # kg annually
    "weather_pattern": [0.6, 0.5, 0.7, 0.9, 1.1, 1.3, 1.2, 1.0, 0.9, 0.8, 0.6, 0.5]
```

### Weather pattern in lower rain fall

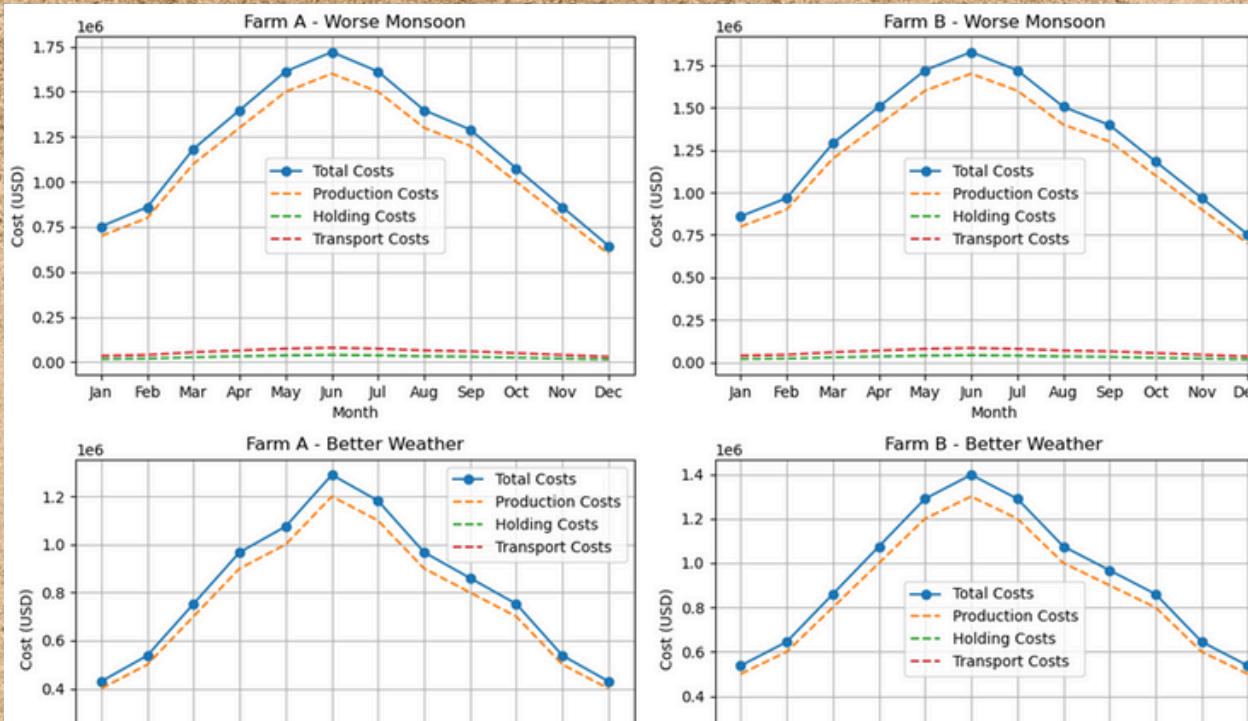
```
Farm A Rainfall Index (Better Monsoon)
[0.4, 0.5, 0.8, 1.0, 1.2, 1.1, 1.0, 0.9, 0.8, 0.7, 0.5, 0.4]

Farm B Rainfall Index (Better Monsoon)
[0.5, 0.6, 0.9, 1.1, 1.3, 1.2, 1.1, 1.0, 0.9, 0.8, 0.6, 0.5]
```

### Weather pattern in heavier rain fall

```
Farm A Rainfall Index (Worse Monsoon)
[0.6, 0.7, 1.0, 1.2, 1.5, 1.6, 1.5, 1.3, 1.2, 1.0, 0.8, 0.6]

Farm B Rainfall Index (Worse Monsoon)
[0.7, 0.8, 1.1, 1.3, 1.6, 1.7, 1.6, 1.4, 1.3, 1.1, 0.9, 0.7]
```



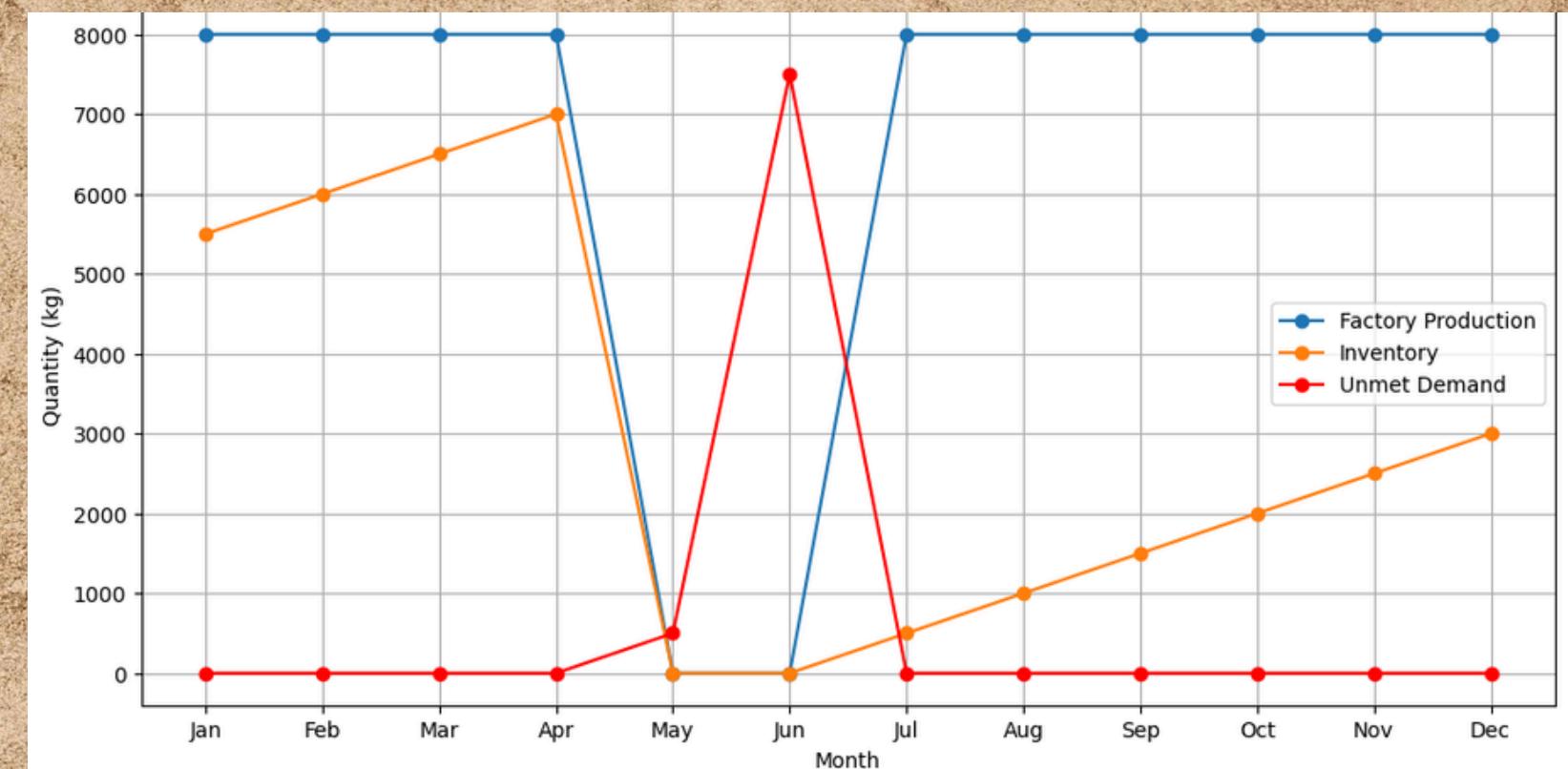
## DISRUPTION ON PRODUCTION DUE TO FACTORY STRIKE

```
# Define months
months = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oct', 'Nov', 'Dec']

# Parameters for simulation
factory_production = [8000] * 12 # Normal production (in kg per month)
factory_production[4:6] = [0, 0] # Simulating a 2-month factory strike (May, June)

# Demand across the supply chain
demand = [7500] * 12 # Constant monthly demand

# Initial inventory levels
inventory_processing = [5000] # Starting inventory (in kg)
processing_capacity = 8000 # Monthly processing capacity
```



# USER GUIDE

- OVERVIEW: SIMULATES VIETNAM'S COFFEE SUPPLY CHAIN TO IDENTIFY WEAKNESSES AND OPTIMIZE PERFORMANCE.
- KEY METRICS: TRACKS DEMAND, INVENTORY, ORDERS, COSTS, AND UNMET DEMAND.
- INPUT PARAMETERS: ADJUST DEMAND, STARTING INVENTORY, LEAD TIMES, AND SAFETY STOCK.
- DEFINE SCENARIOS: SIMULATE DEMAND CHANGES, DISRUPTIONS, OR ENVIRONMENTAL IMPACTS.
- RUN SIMULATION: ENTER DEMAND, PRODUCTION PLANS, AND SEASONAL ADJUSTMENTS.
- INTERPRET RESULTS: ANALYZE BOTTLENECKS, STOCKOUTS, AND SUPPLY CHAIN RESPONSIVENESS.

# Recommendations



- Implement predictive analytics for demand forecasting
- Strengthen inventory policies
- Develop resilience strategies for production halts
- Collaborate across the supply chain for adaptive logistics



# Conclusion



## Key Findings

- Importance of weather and demand fluctuations on the supply chain.
- Benefits of dynamic safety stock and shorter lead times.

## Importance of simulation

- Identifies bottlenecks and tests resilience strategies.

## Next steps

- Enhance the model with real-time data integration and broader disruption scenarios.

A close-up photograph of a pile of dark brown coffee beans. The beans are irregularly shaped and have a textured surface with visible creases and some lighter spots. They are densely packed, filling the frame.

Thank You.