



**ExxonMobil**

# **We Love Badminton**

Data Analytics Track

# Executive Summary



## PROBLEM

How might we optimize & predict chemicals product inventory to prevent inventory overflow



## OUR SOLUTION

Prescriptive strategies and actions identified through data analysis

Interactive dashboard for stakeholders to see real-time and unseen data insights or action suggestions, enhancing stakeholder meetings and decision-making.




## IMPACT

Supports data-driven decisions that could prevent annual operational losses, improving logistics efficiency and inventory health.



# Situation Analysis

## Stakeholder Groups




Orders stock from Manufacturer

Replenisher



Sells materials to Customers

Sales



Handles data and decision-making

Logistics Manager

Management Pain Points

1. Manual data insertion and graphing weekly

2. Numerous data sources

3. Biweekly stakeholder check-ups

4. Current visualization is hard to understand

## Operational Challenges

Inbound exceeding forecasted outbound

Inventory overflow, losses from D&D

Shelf life limits → downgrade losses of up to 50%

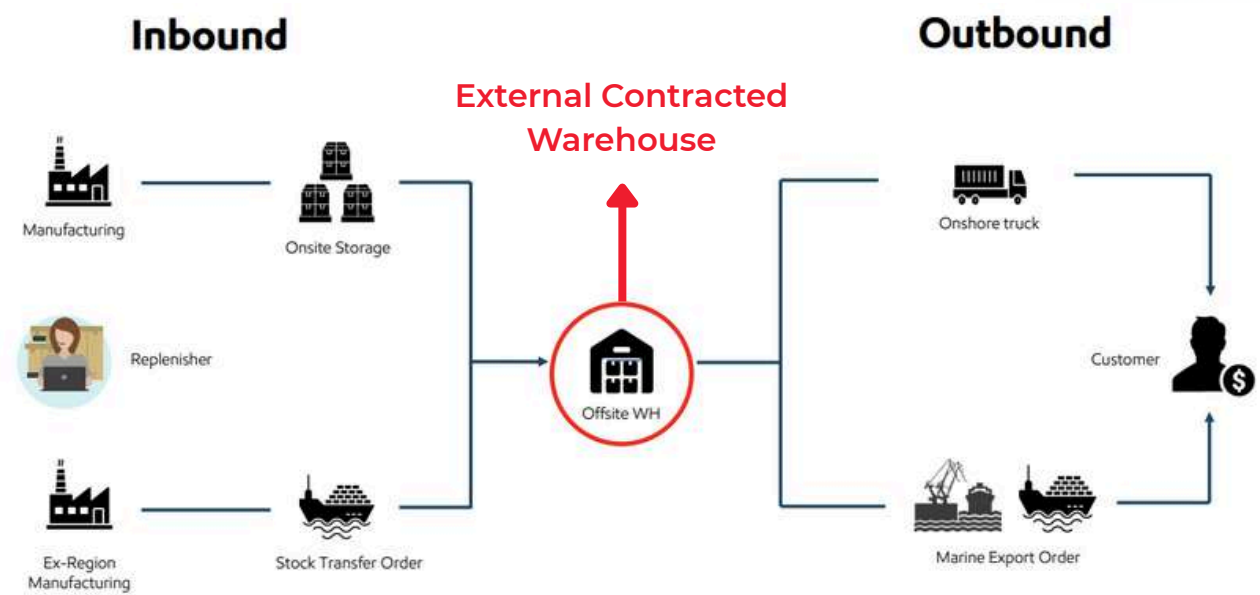
Understock of materials in warehouses

Losses from unused warehouse capacity

Failure to fulfill orders hurts reputation

Unexpected and uncontrollable events

Keep warehouse inventory percentages in a healthy range (70-80%) to minimize operational risks and losses



“

How might we simplify complex inventory data into clear, actionable insights that help planners maintain optimal warehouse levels and enable management to make timely, confident decisions?

”



# Data Preprocessing



1

Handle Missing Values

2

Combine Duplicate  
Records

3

Standardize Data Units  
(KT, MT, KG)

4

Create New Features

Ex. Combine Duplicate Records

The screenshot shows the Power BI Desktop interface with the 'Data' tab selected. The table 'Inventory' is displayed with the following data:

	A	B	C	D	E	F	G	H
	BALANCE_AS_OF_DATE	PLANT_NAME	MATERIAL_NAME	BATCH_NUMBER	UNRESRICTED_STOCK	STOCK_UNIT	STOCK_SELL_VALUE	CURRENC
14528	12/31/2024	CHINA-WAREHOUSE	MAT-0007	6003A7381	24750	KG	51728	CNY
14535	12/31/2024	CHINA-WAREHOUSE	MAT-0007	6003A7381	24750	KG	51728	CNY
28330								
28331								
28332								
28333								



An aerial photograph of a port area, showing numerous shipping containers stacked in neat rows. The containers are in various colors, including red, blue, green, and orange. The port is situated along a body of water, with a white wake visible from a ship moving through the water. The overall scene is bright and clear.

# Our Solution

SITUATION ANALYSIS

DATA PREPROCESSING

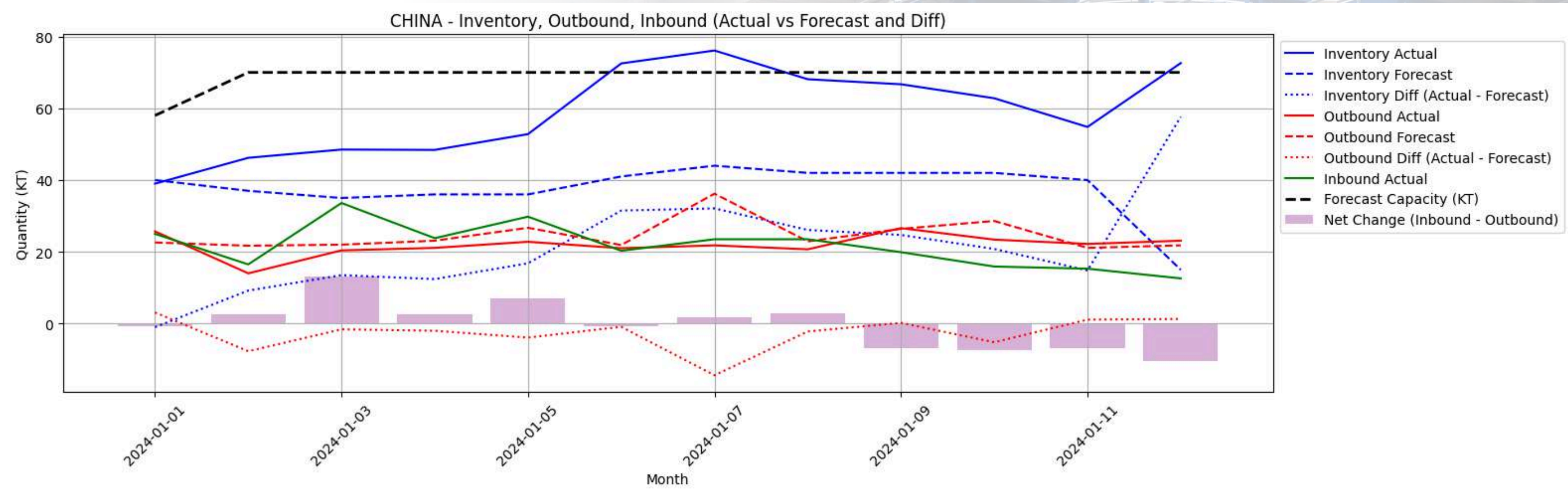
**INSIGHT**

DEMO

IMPACT



# Key Insights





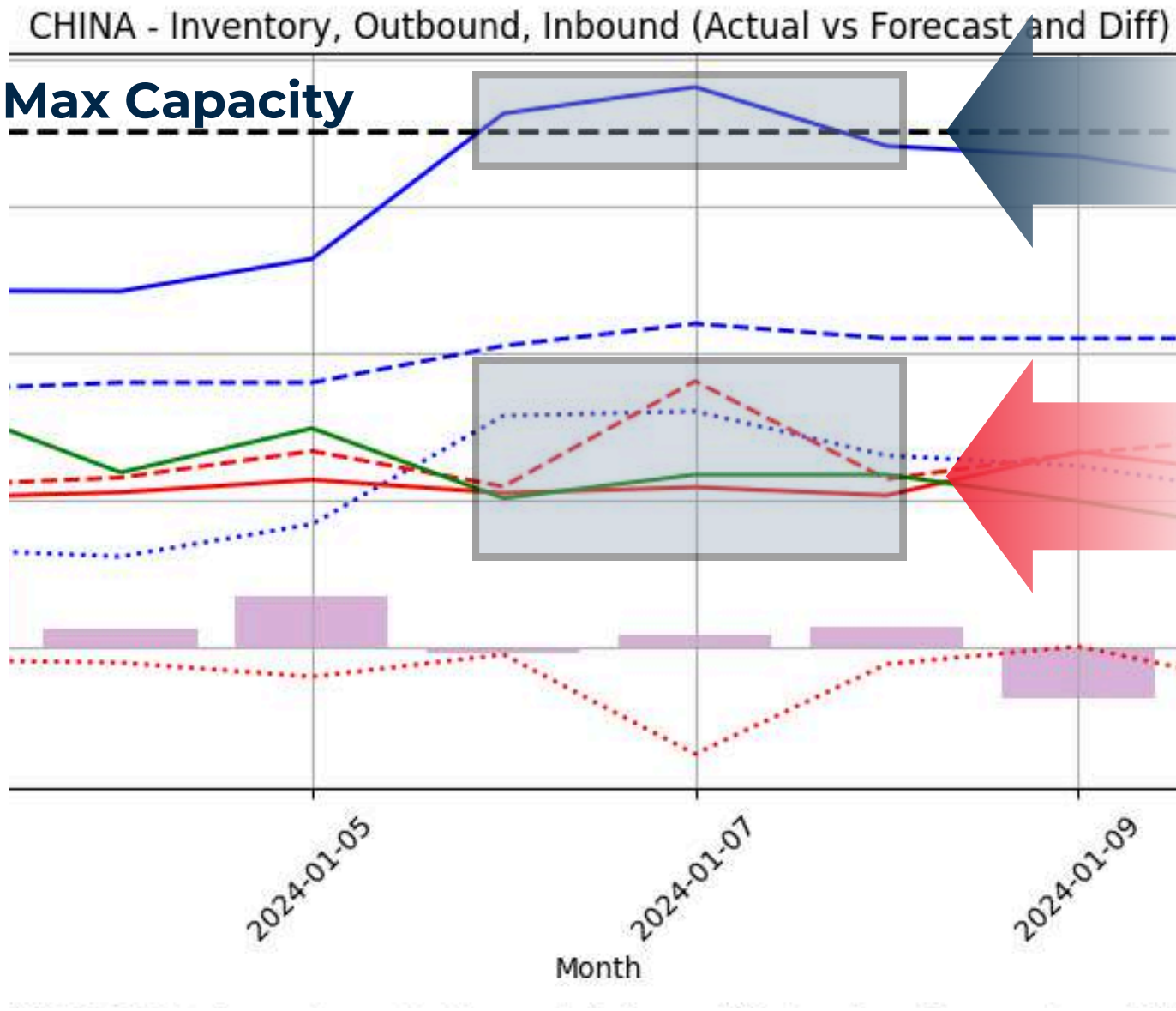
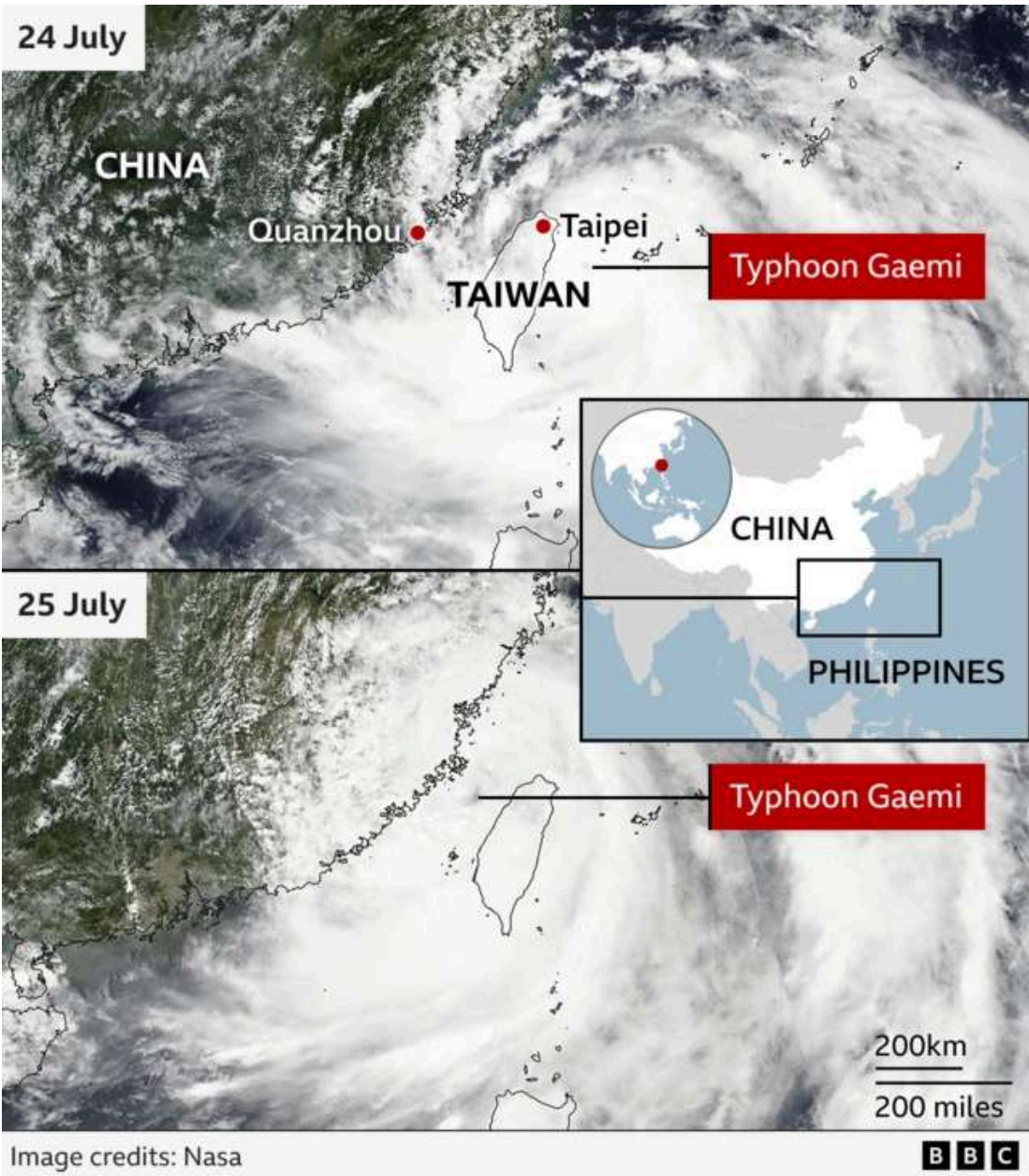
# Key Insights



June-August

Typhoon in China

Lower outbound than expected



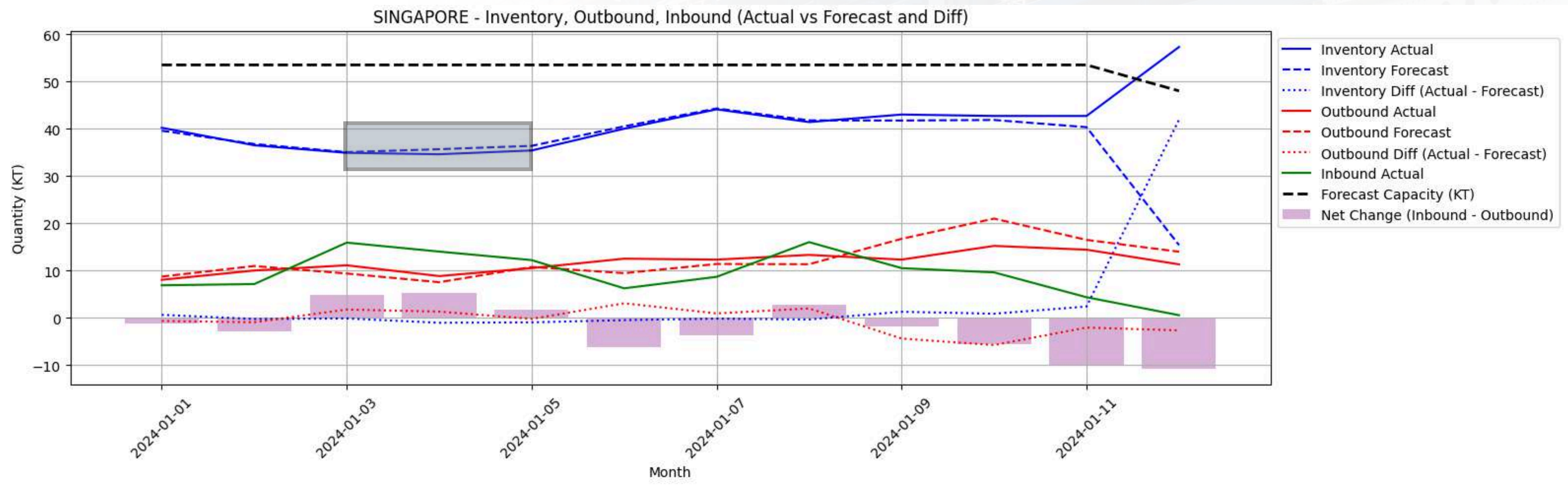
Inventory

Actual Outbound  
is significantly lower  
than forecast



# Key Insights

Significant unused capacity in Singapore warehouse during March-May





# Key Insights

## Action Plan

Pre-position materials scheduled for delivery from China (June–August) into Singapore during this low-utilization period.



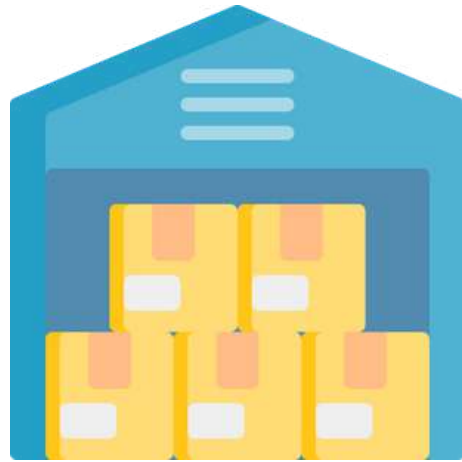
Improve service level and customer satisfaction



Reduce congestion at China warehouse during peak



# Key Insights



## SINGAPORE WAREHOUSE

Inventory Storage per MT per day is

**15 SGD  $\approx$  382 THB\***



## CHINA WAREHOUSE

Inventory Storage per MT per day is

**1.7 CYN  $\approx$  7.7 THB\***

\*Based on the exchange rate data as of 4 July 2025



# Key Insights

## CHINA WAREHOUSE STORAGE COST



Is nearly **50 times**  
cheaper than Singapore



Storing inventory in the China warehouse could potentially cut storage costs by over 50% compared to Singapore, presenting a strong opportunity to optimize inventory holding costs.

### Action Plan

Maximize usage of the Chinese warehouse while maintaining healthy inventory levels



# Key Insights

## Near-Expiry High Stock Batches

Several products have batches close to expiry while still holding large unrestricted stock volumes.



Inventory

Search (Cmd + Ctrl + U)

Comments Share

Analysis Tools

	A	B	C	D	E	F	G	H	I	J
1	BALANCE_AS_OF_DATE	PLANT_NAME	MATERIAL_NAME	BATCH_NUMBER	UNRESRICTED_STOCK	STOCK_UNIT	STOCK_SELL_VALUE	CURRENCY		
2	12/31/2023	CHINA-WAREHOUSE	MAT-0045	SCRAP	164	KG	211	CNY		
3	12/31/2023	CHINA-WAREHOUSE	MAT-0193	6024	0	KG	87666	CNY		
4	12/31/2023	CHINA-WAREHOUSE	MAT-0193	5755	70720	KG	414419	CNY		
5	12/31/2023	CHINA-WAREHOUSE	MAT-0193	3142	12240	KG	71726	CNY		
6	12/31/2023	CHINA-WAREHOUSE	MAT-0193	6734	2720	KG	15939	CNY		
7	12/31/2023	CHINA-WAREHOUSE	MAT-0311	SCRAP	4142	KG	25018	CNY		
8	12/31/2023	CHINA-WAREHOUSE	MAT-0374	5995C5416	1000	KG	6430	CNY		
9	12/31/2023	CHINA-WAREHOUSE	MAT-0374	8466C2971	15125	KG	97254	CNY		
10	12/31/2023	CHINA-WAREHOUSE	MAT-0374	8143C2373	32975	KG	212029	CNY		
11	12/31/2023	CHINA-WAREHOUSE	MAT-0046	9532	15125	KG	97254	CNY		
12	12/31/2023	CHINA-WAREHOUSE	MAT-0046	7052	21025	KG	125101	CNY		



# Key Insights

## Near-Expiry High Stock Batches

Several products have batches close to expiry while still holding large unrestricted stock volumes.

## The Challenge

Having large stocks nearing expiry, but couldn't visualize or prioritize them making action difficult.

## Our Solution

Built an interactive dashboard to highlight near-expiry batches, enabling clear, actionable insights.



# Key Insights

## Step 01

### Allowed fair comparison across warehouses

By created a **new cleaned inventory** dataset converting from CNY and SGD to Thai BAHT

Inventory\_cleaned

Search (Cmd + Ctrl + U)

Comments

Share

Home

Insert

Draw

Page Layout

Formulas

Data

Review

View

Automate

Get Data (Power Query)

Refresh All

Queries & Connections

Properties

Workbook Links

Organization

Stocks

Sort

Filter

Clear

Reapply

Advanced

Text to Columns

What-If Analysis

Group

Ungroup

Subtotal

Analysis Tools

K25296

fx

76393.53

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	BALANCE_AS_OF_DATE	PLANT_NAME	MATERIAL	BATCH_NUMBER	UNRESRICTED_STOCK	STOCK_U	STOCK_SELL_VALUE	CURRENCY	MONTH	EXCHANGE_RATE	SELL_VALUE_THB		
25296	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0419	7768B6917		0 KG	2997	SGD	2024-11	25.49	76393.53		
25297	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0419	4960C8279		0 KG	2942	SGD	2024-11	25.49	74991.58		
25301	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0374	6895C8007		0 KG	3051	SGD	2024-11	25.49	77769.99		
25340	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0072	8729D4335		0 KG	5899	SGD	2024-11	25.49	150365.51		
25341	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0072	3156D2747		0 KG	1931	SGD	2024-11	25.49	49221.19		
25342	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0072	9312D7249		0 KG	5899	SGD	2024-11	25.49	150365.51		
25409	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0301	7586A7573		0 KG	54720	SGD	2024-11	25.49	1394812.8		
25418	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0345	4253A		0 KG	1470	SGD	2024-11	25.49	37470.3		
25419	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0345	9693A		0 KG	4380	SGD	2024-11	25.49	111646.2		
25420	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0345	1734A		0 KG	4500	SGD	2024-11	25.49	114705		

SITUATION ANALYSIS

DATA PREPROCESSING

INSIGHT

DEMO

IMPACT



# Key Insights

## Step 02

### Merged inventory with expiry & batch status

Connecting cleaned inventory data with SHELF\_LIFE information from MaterialMaster by MATERIAL\_NAME

MaterialMaster File

1	MATERIAL_NAME	POLYMER_TYPE	SHELF_LIFE	DOWNGRADE_VALUE_LOST_PERCENT
2	MAT-0001	P-002	3	40
3	MAT-0002	P-001	8	15
4	MAT-0003	P-004	2	35
5	MAT-0004	P-002	3	35
6	MAT-0005	P-002	5	20
7	MAT-0006	P-002	8	20
8	MAT-0007	P-001	2	10
9	MAT-0008	P-002	3	20
10	MAT-0009	P-002	5	40
11	MAT-0010	P-002	5	50
12	MAT-0011	P-001	3	5
13	MAT-0012	P-001	2	15
14	MAT-0013	P-002	3	25
15	MAT-0014	P-001	3	20
16	MAT-0015	P-001	8	20
17	MAT-0016	P-001	5	5

Inventory\_cleaned File

1	BALANCE_AS_OF_DATE	PLANT_NAME	MATERIAL	BATCH_NUMBER
25296	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0419	7768B6917
25297	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0419	4960C8279
25301	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0374	6895C8007
25340	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0072	8729D4335
25341	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0072	3156D2747
25342	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0072	9312D7249
25409	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0301	7586A7573
25418	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0345	4253A
25419	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0345	9693A
25420	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0345	1734A
25533	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0122	9340A
25720	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0150	P8706C
25903	30/11/2024	SINGAPORE-WAREHOUSE	MAT-0065	5356C



# Key Insights

## Step 03

### Calculating Expired Month

We couldn't directly calculate EXPIRE\_MONTH from inbound data because it doesn't include batch numbers.

#### Inbound File

1	INBOUND_DATE	PLANT_NAME	MATERIAL_NAME	NET_QUANTITY_MT	
2	15/12/2023	SINGAPORE-WAREHOUSE	MAT-0354	23.375	
3	22/12/2023	SINGAPORE-WAREHOUSE	MAT-0413	1.375	
4	22/12/2023	SINGAPORE-WAREHOUSE	MAT-0413	23.375	
5	22/12/2023	SINGAPORE-WAREHOUSE	MAT-0413	24.75	
6	22/12/2023	SINGAPORE-WAREHOUSE	MAT-0413	19.25	
7	22/12/2023	SINGAPORE-WAREHOUSE	MAT-0413	5.5	
8	22/12/2023	SINGAPORE-WAREHOUSE	MAT-0413	12.375	
9	22/12/2023	SINGAPORE-WAREHOUSE	MAT-0413	12.375	
10	22/12/2023	SINGAPORE-WAREHOUSE	MAT-0413	24.75	
11	22/12/2023	SINGAPORE-WAREHOUSE	MAT-0413	24.75	
12	23/12/2023	SINGAPORE-WAREHOUSE	MAT-0105	24.75	
13	21/1/2024	SINGAPORE-WAREHOUSE	MAT-0304	2.5	
14	21/1/2024	SINGAPORE-WAREHOUSE	MAT-0304	20	
15	27/1/2024	SINGAPORE-WAREHOUSE	MAT-0374	24.75	
16	27/1/2024	SINGAPORE-WAREHOUSE	MAT-0374	20.625	
17	27/1/2024	SINGAPORE-WAREHOUSE	MAT-0374	4.125	

So instead, we used the **first appearance** of each batch in the inventory records as a proxy for the inbound date.

From there, we added the shelf life to **estimate the expiry month** for each batch.



# Key Insights

## Step 04

### Adding More Feature

We added features to show the weight of expired vs. unexpired stock per material, along with their percentage breakdown

MATERIAL_NAME	BATCH_NUMBER	PLANT_NAME	TOTAL_UNRESRICTED_STOCK	TOTAL_STOCK_PER_MATERIAL_TON	PERCENTAGE_SHARE
MAT-0001	V1055A	CHINA-WAREHOUSE	688.5	20117.325	3.42
MAT-0001	V1126A	CHINA-WAREHOUSE	167.9	20117.325	0.83
MAT-0001	V1214A	CHINA-WAREHOUSE	258	20117.325	1.28
MAT-0001	V1821A	CHINA-WAREHOUSE	606.55	20117.325	3.02
MAT-0001	V9551A	CHINA-WAREHOUSE	528.975	20117.325	2.63
MAT-0001	V9872A	CHINA-WAREHOUSE	259.5	20117.325	1.29
MAT-0002	N2130A	CHINA-WAREHOUSE	321.75	1821.7	17.66
MAT-0002	N2588A	CHINA-WAREHOUSE	253	1821.7	13.89
MAT-0002	N2666A	CHINA-WAREHOUSE	418.05	1821.7	22.95
MAT-0002	N3473A	CHINA-WAREHOUSE	99	1821.7	5.43
MAT-0002	N3861A	CHINA-WAREHOUSE	44	1821.7	2.42
MAT-0002	N4284A	CHINA-WAREHOUSE	123.75	1821.7	6.79
MAT-0002	N5378A	CHINA-WAREHOUSE	19.25	1821.7	1.06
MAT-0002	N5383A	CHINA-WAREHOUSE	198	1821.7	10.87
MAT-0002	N7330A	CHINA-WAREHOUSE	335.5	1821.7	18.42
MAT-0002	N9650A	CHINA-WAREHOUSE	9.4	1821.7	0.52
MAT-0003	2397	CHINA-WAREHOUSE	36.72	1233.52	2.98
MAT-0003	3466	CHINA-WAREHOUSE	117.504	1233.52	9.53
MAT-0003	3882	CHINA-WAREHOUSE	235.008	1233.52	19.05
MAT-0003	4443	CHINA-WAREHOUSE	7.344	1233.52	0.6
MAT-0003	5422	CHINA-WAREHOUSE	117.504	1233.52	9.53
MAT-0003	5541	CHINA-WAREHOUSE	12.24	1233.52	0.99
MAT-0003	5767	CHINA-WAREHOUSE	22.032	1233.52	1.79

batch\_analysis\_with\_ expiry\_and\_status File



# Key Insights

## Step 04

### Adding More Feature

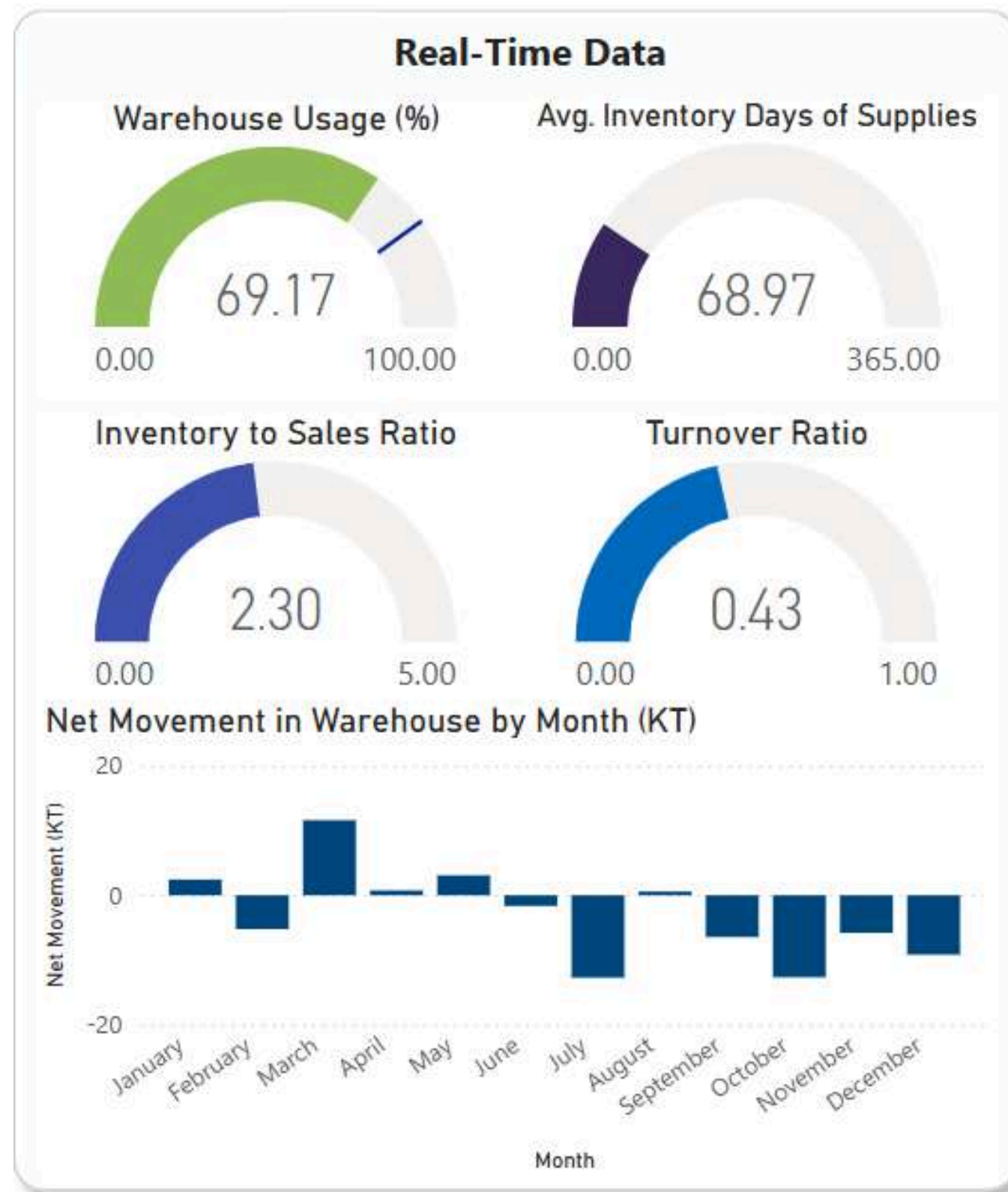
We also added inventory status for each record and predicted expiration month within one File

MONTHS_IN_WAREHOUSE	SHELF_LIFE_IN_MONTH	EXPIRED	FIRST_MONTH_APPEAR	EXPIRE_MONTH	LAST_MONTH_SEEN	INVENTORY_STATUS
3	3	FALSE	2024-05	2024-08	2024-07	ออกเมื่อ 2024-07
2	3	FALSE	2023-12	2024-03	2024-01	ออกเมื่อ 2024-01
6	3	TRUE	2024-07	2024-10	2024-12	ยังอยู่
6	3	TRUE	2024-07	2024-10	2024-12	ยังอยู่
2	3	FALSE	2024-04	2024-07	2024-05	ออกเมื่อ 2024-05
1	3	FALSE	2023-12	2024-03	2023-12	ออกเมื่อ 2023-12
1	3	FALSE	2024-12	2025-03	2024-12	ยังอยู่
3	3	FALSE	2024-06	2024-09	2024-08	ออกเมื่อ 2024-08
1	3	FALSE	2024-12	2025-03	2024-12	ยังอยู่
1	3	FALSE	2023-12	2024-03	2023-12	ออกเมื่อ 2023-12
3	3	FALSE	2024-05	2024-08	2024-07	ออกเมื่อ 2024-07
1	3	FALSE	2023-12	2024-03	2023-12	ออกเมื่อ 2023-12
1	3	FALSE	2023-12	2024-03	2023-12	ออกเมื่อ 2023-12
1	3	FALSE	2024-12	2025-03	2024-12	ยังอยู่
4	3	TRUE	2024-01	2024-04	2024-04	ออกเมื่อ 2024-04
4	3	TRUE	2024-04	2024-07	2024-07	ออกเมื่อ 2024-07
2	3	FALSE	2024-11	2025-02	2024-12	ยังอยู่

batch\_analysis\_with\_ expiry\_and\_status File



# Demo Warehouse Dashboard (Power BI)



## Warehouse Usage (%)

- Space utilization efficiency

## Average Inventory Days of Supplies

- Days inventory can cover demand

## Inventory to Sales Ratio

- Inventory value vs. sales

## Turnover Ratio

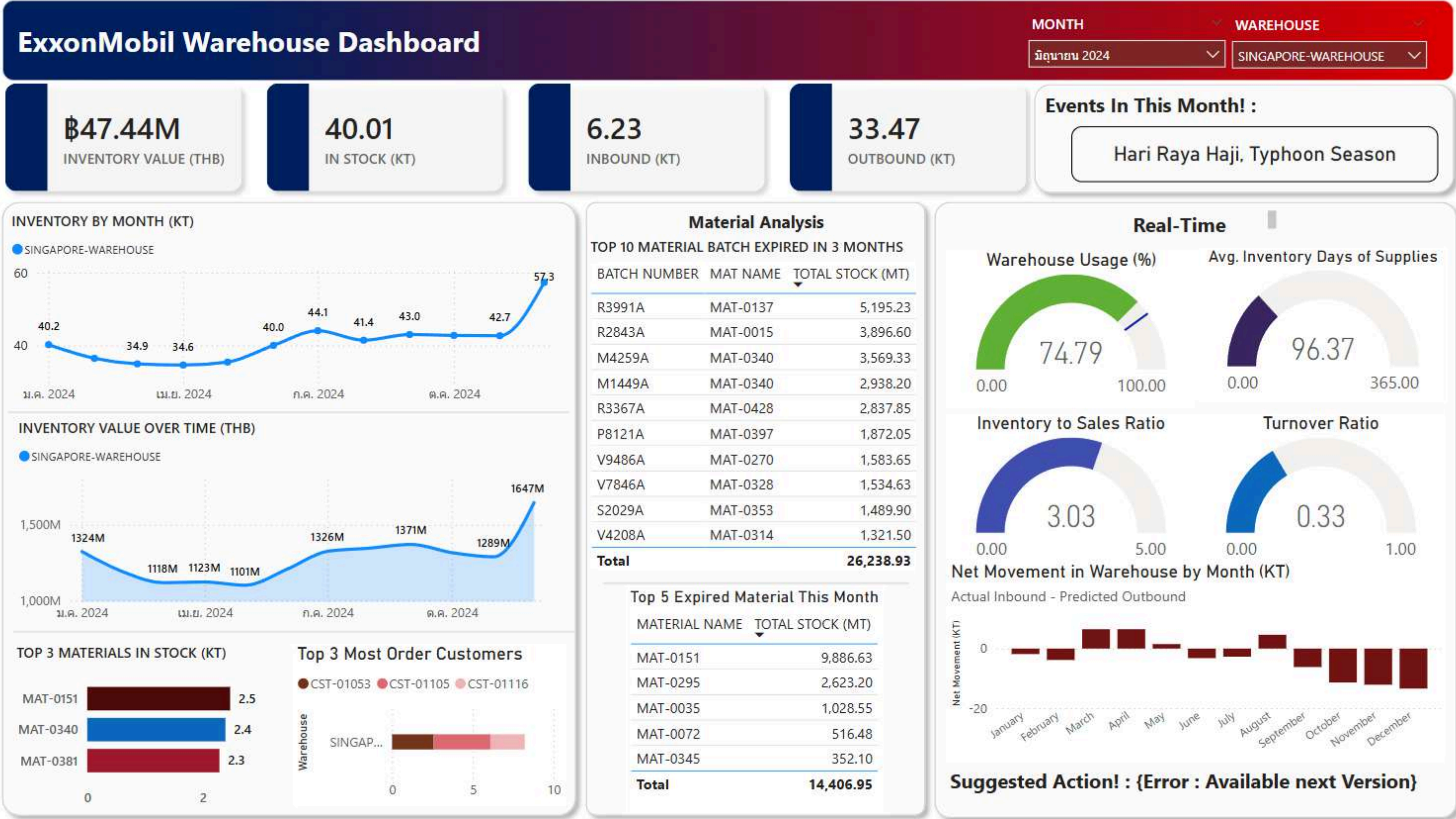
- Frequency inventory is sold/replaced

## Net Movement

- Inbound minus outbound stock movement



# Demo Warehouse Dashboard (Power BI)







Together, these insights help reduce overflow risk, optimize cost, and enable proactive planning.



# Challenges

## Lack of Insight Information

### **Inventory captured only month-end**

Misses intra-month fluctuations or daily stock movements

### **Limited Time Range Data**

Not enough history to train reliable forecasting models

### **Currency not consistently unified**

Needs normalization to compare cost accurately

### **Lack of Customers details**

Customer information only available in outbound



# Challenges

## Lack of Insight Information

**Action Plan**

Maximize usage of the Chinese warehouse while maintaining healthy inventory levels

Further operational data would be needed to validate this as a scalable strategy.

Product compatibility	Are all materials allowed in China warehouse?
Transfer Time	A long transfer time may delay product availability or cause missed sales opportunities.



# What's Next...



## **ML-based Forecasting**

Predict future demand, optimize stock levels



## **Anomaly Detection System**

Automatically flag inconsistencies (e.g. mismatch in stock vs flow)



## **Calendar-based Alerts**

Warn during holidays, storms, low-sales periods



## **Dynamic Cost Simulation**

Suggest optimal warehouse / transfer choices  
based on real-time costs



# Summary



A dashboard that helps all stakeholders take informed actions to prevent inventory overflow, reduce cost, and enhance visibility. With additional data, predictive features and anomaly alerts can unlock more business value.





**Thank  
You!**



# Color Material Slide



