THE
PREDICTIVE POINTERS

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ABSTRACT

This project develops a smart inventory management and sales prediction system for small and medium-sized businesses to maintain optimal stock levels and improve decision-making. By integrating a backend, database, and frontend, the system provides real-time monitoring, automated alerts, and predictive insights. Using Meta's Prophet model, it forecasts future demand from historical sales data. Through an intuitive dashboard, users can view detailed SKU-level and overall inventory analytics to enhance visibility and operational efficiency.

TOOGTON COMPANY'S BACKGROUND

Toogtons Innovator Co., Ltd. is a Thai apparel company founded in 2023 in Bangkok by Nirut Sae-Eia. The brand Toogtons (ทุกตอนส์) started from street sales and is now known for its ultra-soft "marshmallow" boxers and casualwear.

Nature of Business: Design, production, and online retail of comfortable undergarments and casualwear, primarily through Shopee, Lazada, and its official website, serving customers across Southeast Asia.

Mission: To redefine everyday comfort with soft, stylish, and accessible clothing.

Vision: To become Southeast Asia's leading comfortwear brand, recognized for innovation, quality, and customer-focused design.

TOOGTON

PAJARA COMPANY'S BACKGROUND

Pajara Company Limited is a Thai apparel company registered on 2 April 2014 and based in Bangkok.

Nature of Business: The company is engaged in the design, manufacture, wholesale and retail of outerwear and other garments for men, women and infants. Specifically, it provides production services for outer garments and retails licensed-character sleepwear and casualwear under the brand "Pajara Pajamas".

Mission: To deliver fashionable, comfortable genuine licensed sleepwear and casual apparel to a broad audience, combining recognized character-branding with accessible quality design.

Vision: To be a recognized leader in the Thailand apparel market for licensed-character and casual sleepwear by focusing on design, quality and distribution.

CONCEPTS & RELATED THEORIES

The model prediction consists of 2 parts; The data, and the prediction model.

First, the data collection goes through the generic data pipeline (Collection, Extract, Transform, Load, Normalization and Analysis). Once the data has been collected, transformed, it is gets put into a database.

The prophet model uses machine learning to preform time-series forecasting on the chosen products by using statistics to predict changes seasonally, which is typically used for Weather forecasting, seasonal cycles, and sales prediction.

PROBLEMS

1

LIMITED VISIBILITY

Without any real-time stock tracking, this leads to stockouts and missed sales

2

SUBOPTIMAL REORDERING

Inefficient reordering results in uneven stock levels that lack proper data insight

3

NO DEMAND PREDICITION

Without future predictions, future marketing decisions will be made without the insight given by the forecast

PROBLEMS

4

INEFFECTIVE SKU MANAGEMENT

Underperforming products slip by undetected without a proper management system

5

HIGH OPERATIONAL COSTS

Manually compiling sales and stock data is time-consuming, prone to error and costly

OBJECTIVES

01

INTERACTIVE INVENTORY DASHBOARD

A dynamic and customizable view of all stock levels and products

02

PREDICTIVE SALES FORECASTING

Historical sales data is utilized to predict future sales over a specific period of time

03

AUTOMATED LOW STOCK ALERTS

Users are notified when certain stock falls below a set threshold

04

DYNAMIC SKU CATEGORIZATION

Products are automatically classified into active and dead stocks

SCOPE

01

INTERACTIVE INVENTORY DASHBOARD

Use FASTAPI Backend and Nextjs frontend to develop it

02

PREDICTIVE SALES FORECASTING

Use Prophet model to predict with some accuracy

03

AUTOMATED LOW STOCK ALERTS

Display the low stock skus on the website

04

DYNAMIC SKU CATEGORIZATION

Perform proper ETL to group data into categories

BENEFITS

1 IMPROVED DATA VISUALIZATION

With the cleaned data users will have an easier time parsing the data and gaining new insights from it

2 AUTOMATED LOW STOCK NOTIFICATION SYSTEM

Users can now more efficiently and optimally reorder stock

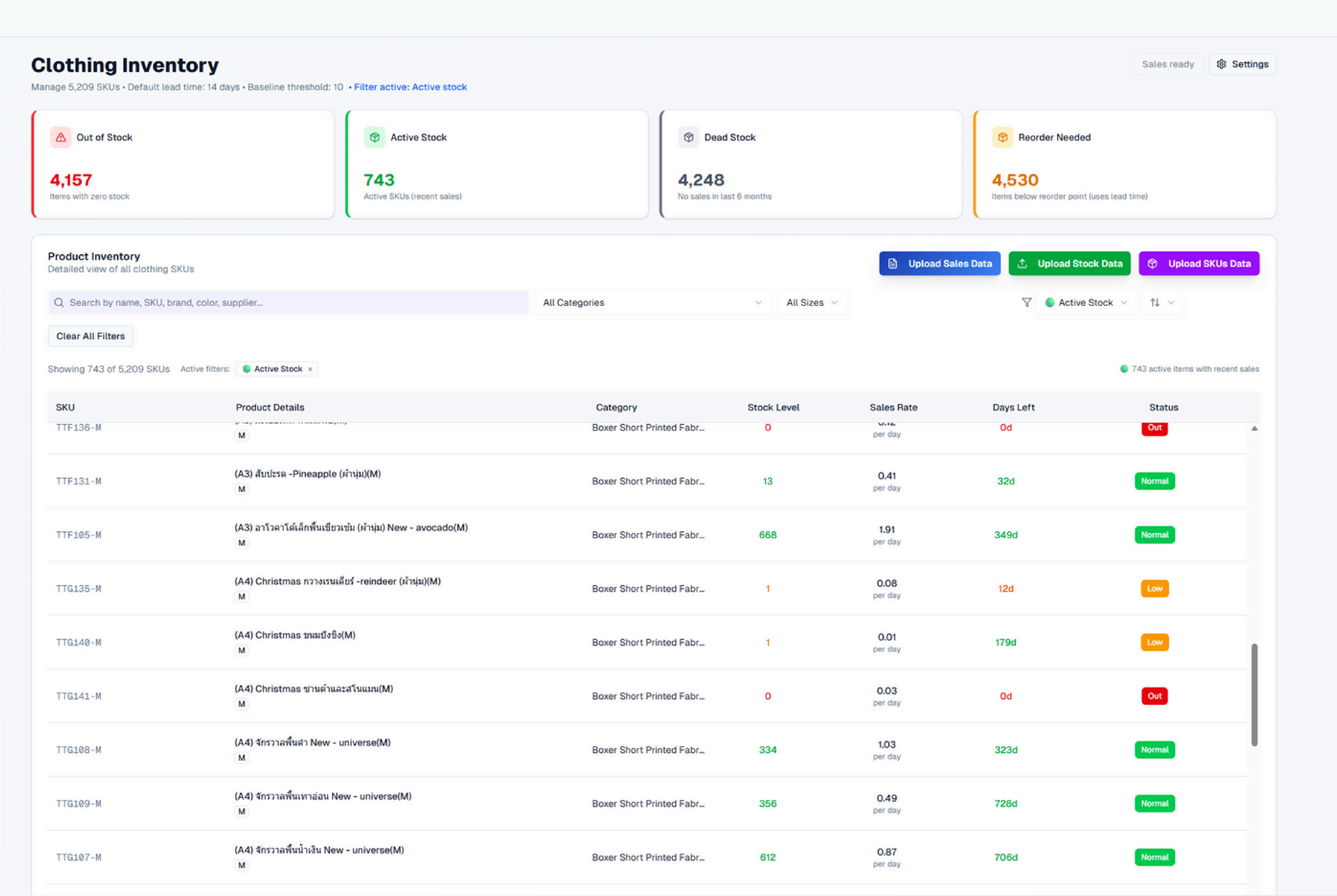
3 SALES FORECASTING AND ANALYSIS

With the use of sales forecasting, users are able to have an idea of future sales that may benefits their future decsions

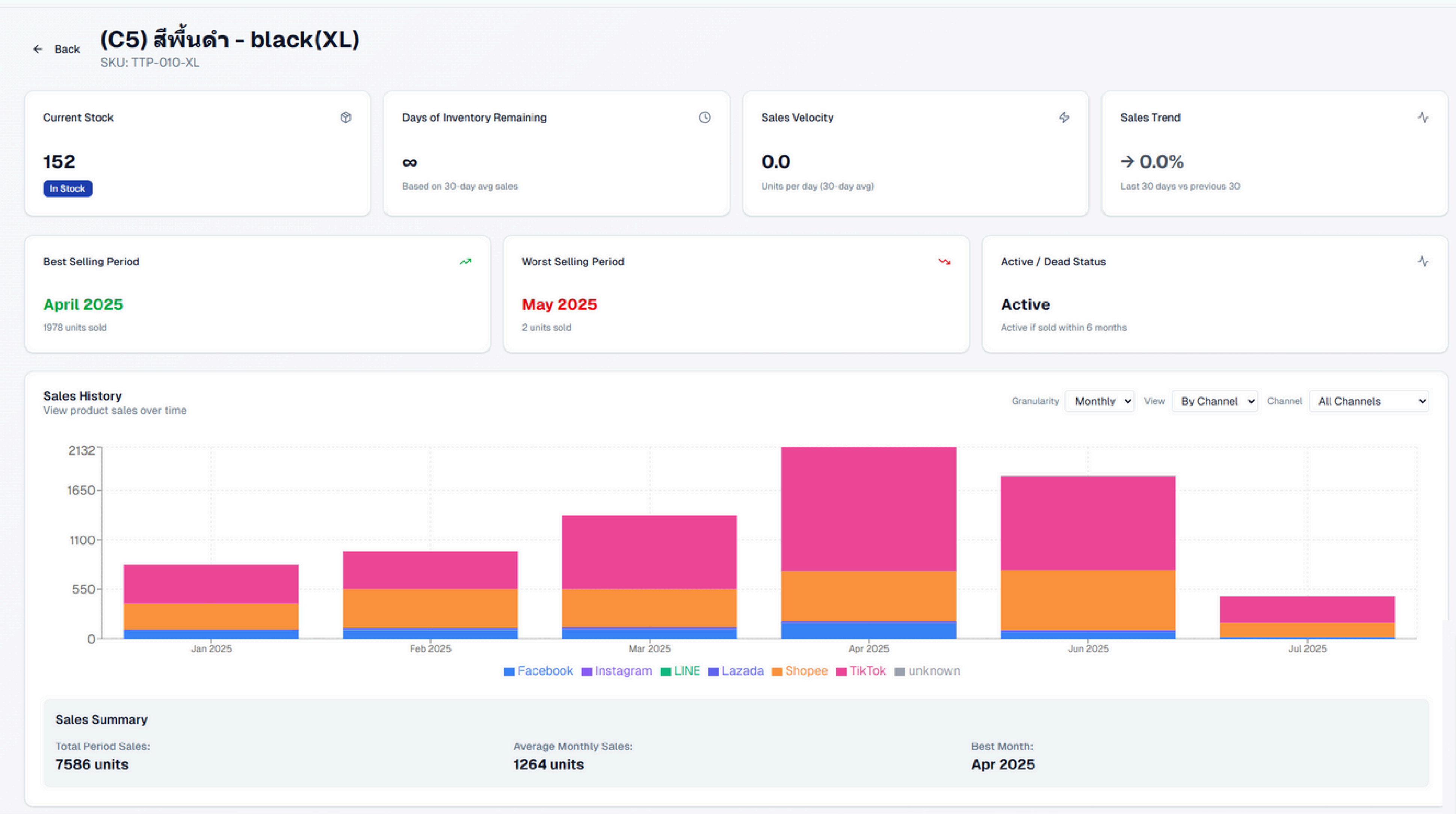
INTRODUCTION

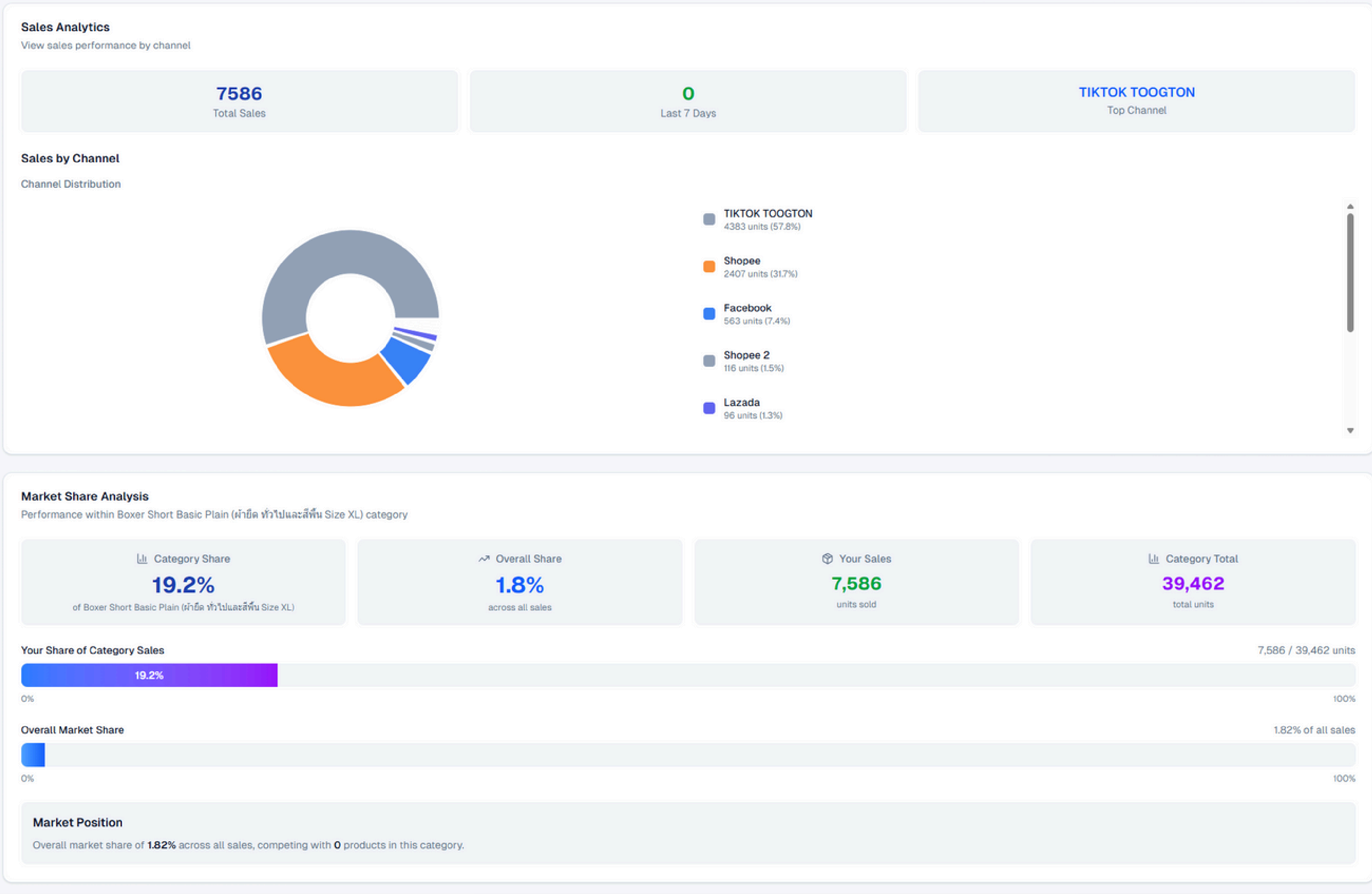
- Our website provides businesses with real-time stock tracking and sales forecasting

STOCK MANAGEMENT

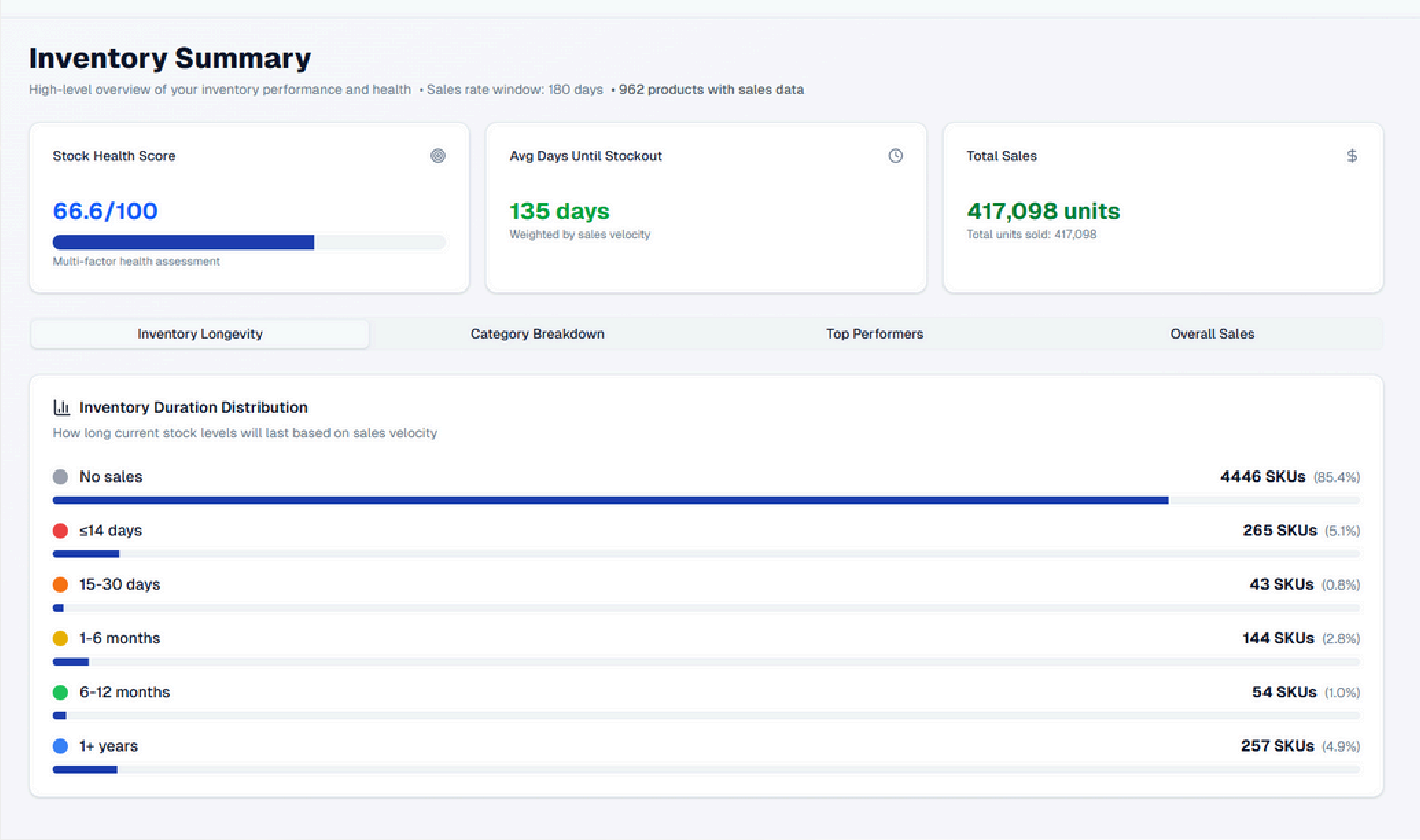


DETAILED PRODUCT VIEW

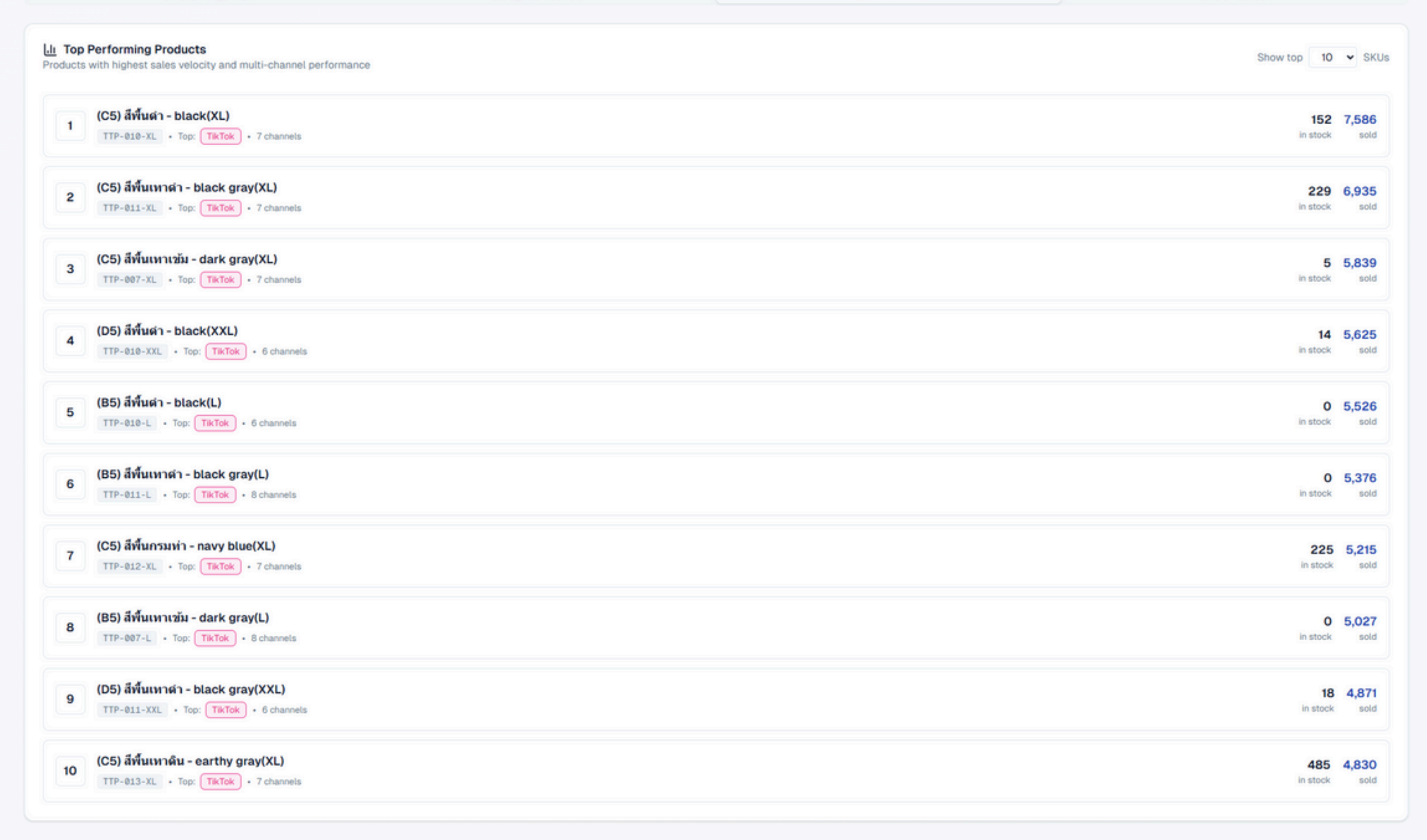




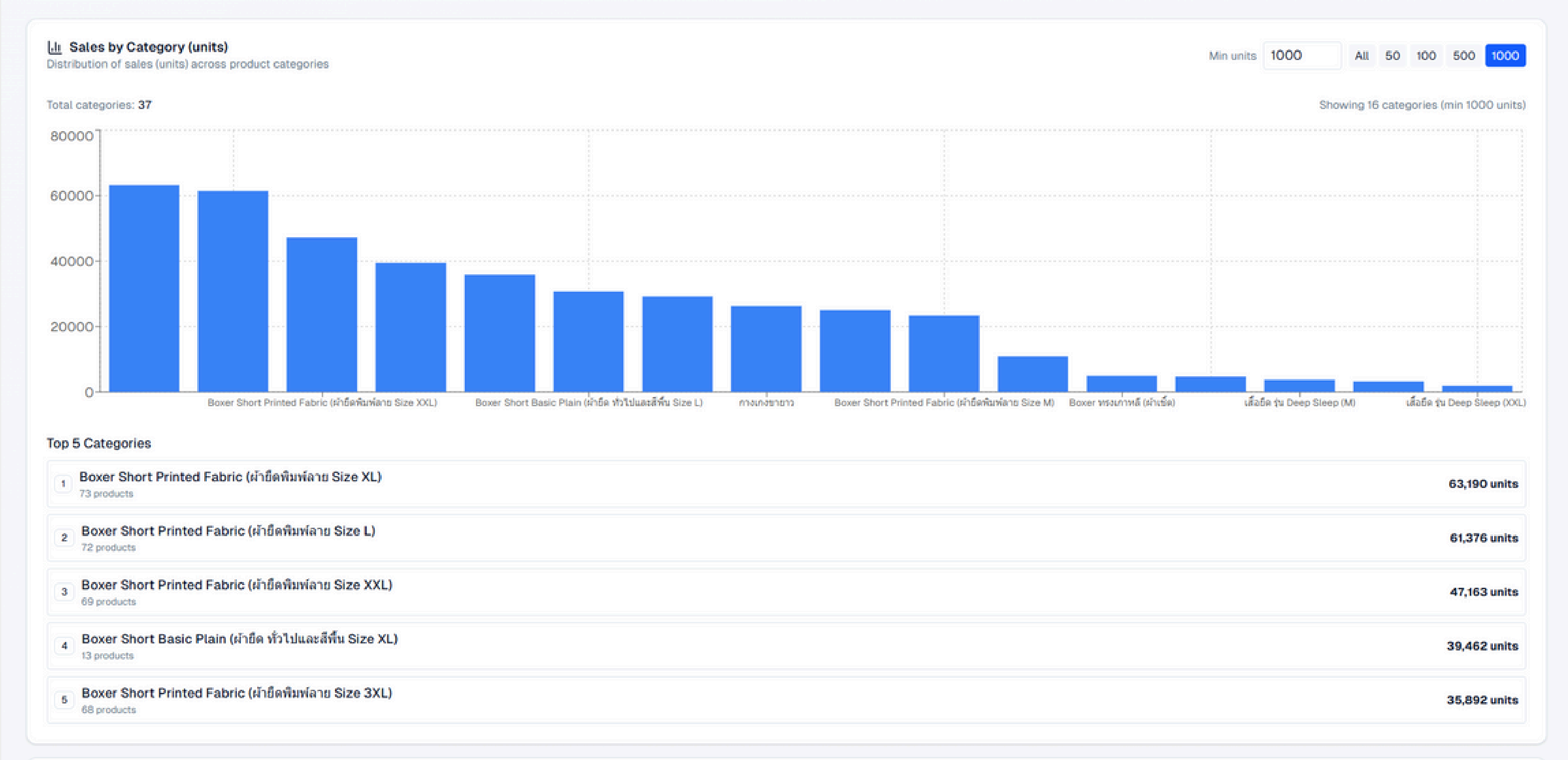
ANALYTICS



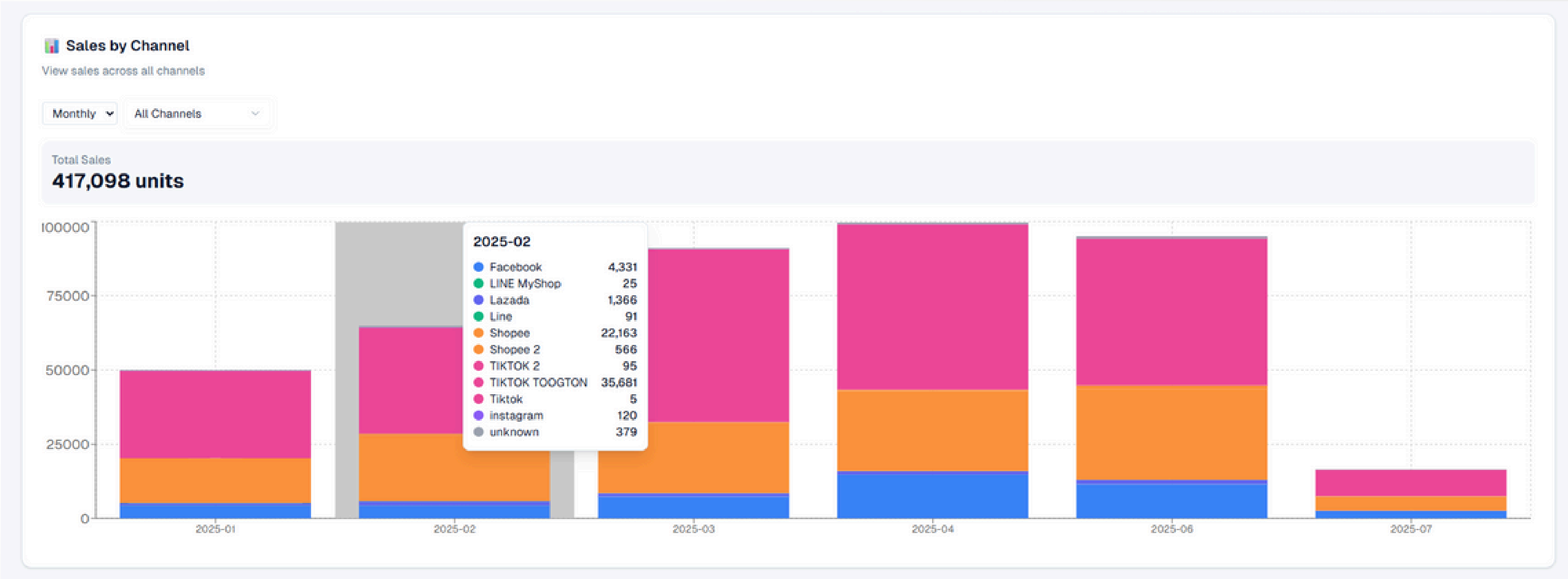
Inventory Summary
High-level overview of your inventory performance and health • Sales rate window: 180 days • 962 products with sales data
Stock Health Score
66.6/100
Multi-factor health assessment
Avg Days Until Stockout
135 days
Weighted by sales velocity
Total Sales
417,098 units
Total units sold: 417,098
Inventory Longevity
Category Breakdown
Top Performers
Overall Sales
Inventory Duration Distribution
How long current stock levels will last based on sales velocity
No sales 4446 SKUs (85.4%)
≤14 days 265 SKUs (5.1%)
15-30 days 43 SKUs (0.8%)
1-6 months 144 SKUs (2.8%)
6-12 months 54 SKUs (1.0%)
1+ years 257 SKUs (4.9%)



Top Performing Products
Products with highest sales velocity and multi-channel performance
Show top 10 SKUs
1 (C5) สีพื้นดำ - black(XL) TTP-010-XL • Top: TikTok • 7 channels 152 in stock 7,586 sold
2 (C5) สีพื้นเทาดำ - black gray(XL) TTP-011-XL • Top: TikTok • 7 channels 229 in stock 6,935 sold
3 (C5) สีพื้นเทาเข้ม - dark gray(XL) TTP-007-XL • Top: TikTok • 7 channels 5 in stock 5,839 sold
4 (D5) สีพื้นดำ - black(XXL) TTP-010-XXL • Top: TikTok • 6 channels 14 in stock 5,625 sold
5 (B5) สีพื้นดำ - black(L) TTP-010-L • Top: TikTok • 6 channels 0 in stock 5,526 sold
6 (B5) สีพื้นเทาดำ - black gray(L) TTP-011-L • Top: TikTok • 8 channels 0 in stock 5,376 sold
7 (C5) สีพื้นกรมท่า - navy blue(XL) TTP-012-XL • Top: TikTok • 7 channels 225 in stock 5,215 sold
8 (B5) สีพื้นเทาเข้ม - dark gray(L) TTP-007-L • Top: TikTok • 8 channels 0 in stock 5,027 sold
9 (D5) สีพื้นเทาดำ - black gray(XXL) TTP-011-XXL • Top: TikTok • 6 channels 18 in stock 4,871 sold
10 (C5) สีพื้นเทาดิน - earthy gray(XL) TTP-013-XL • Top: TikTok • 7 channels 485 in stock 4,830 sold

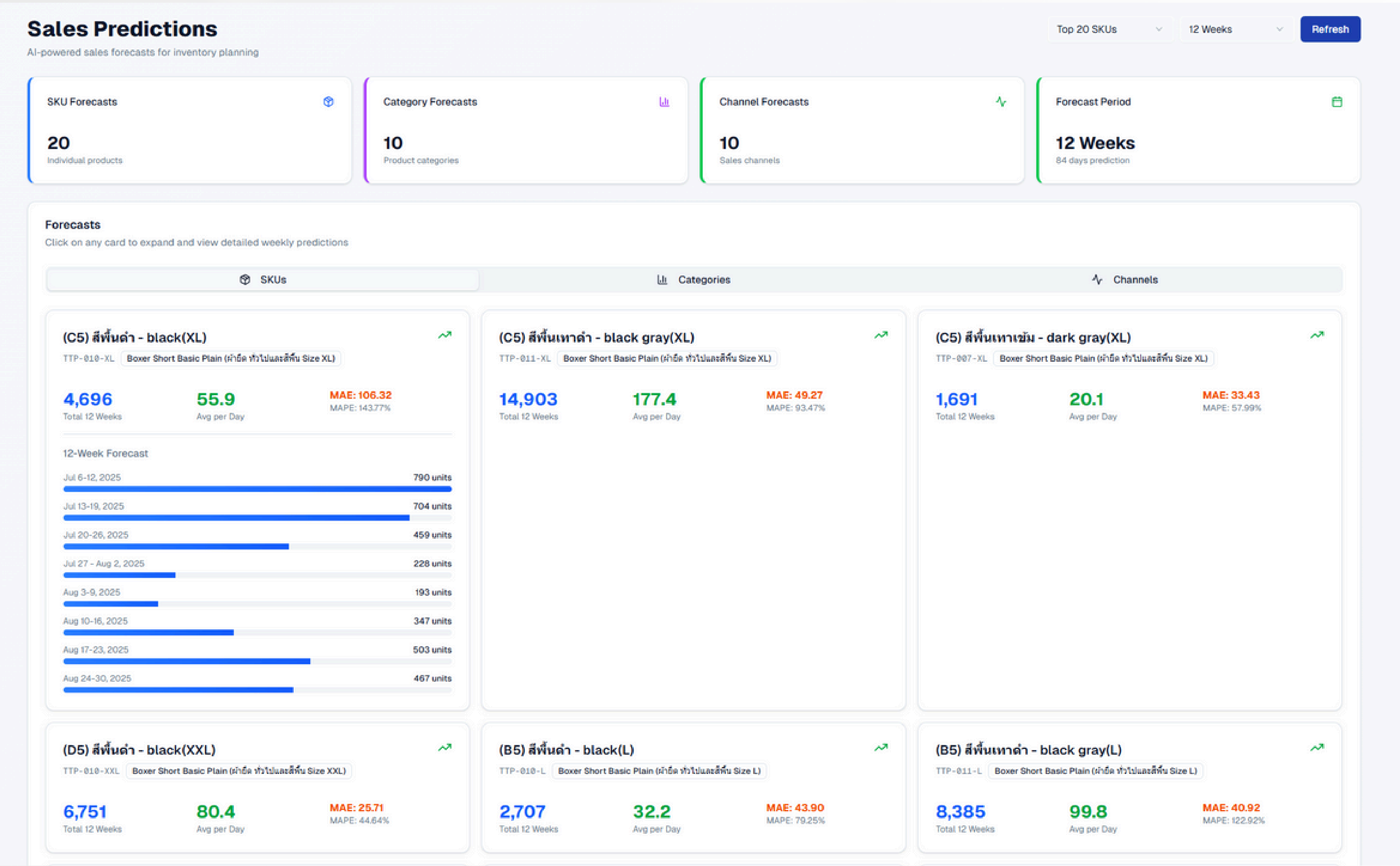


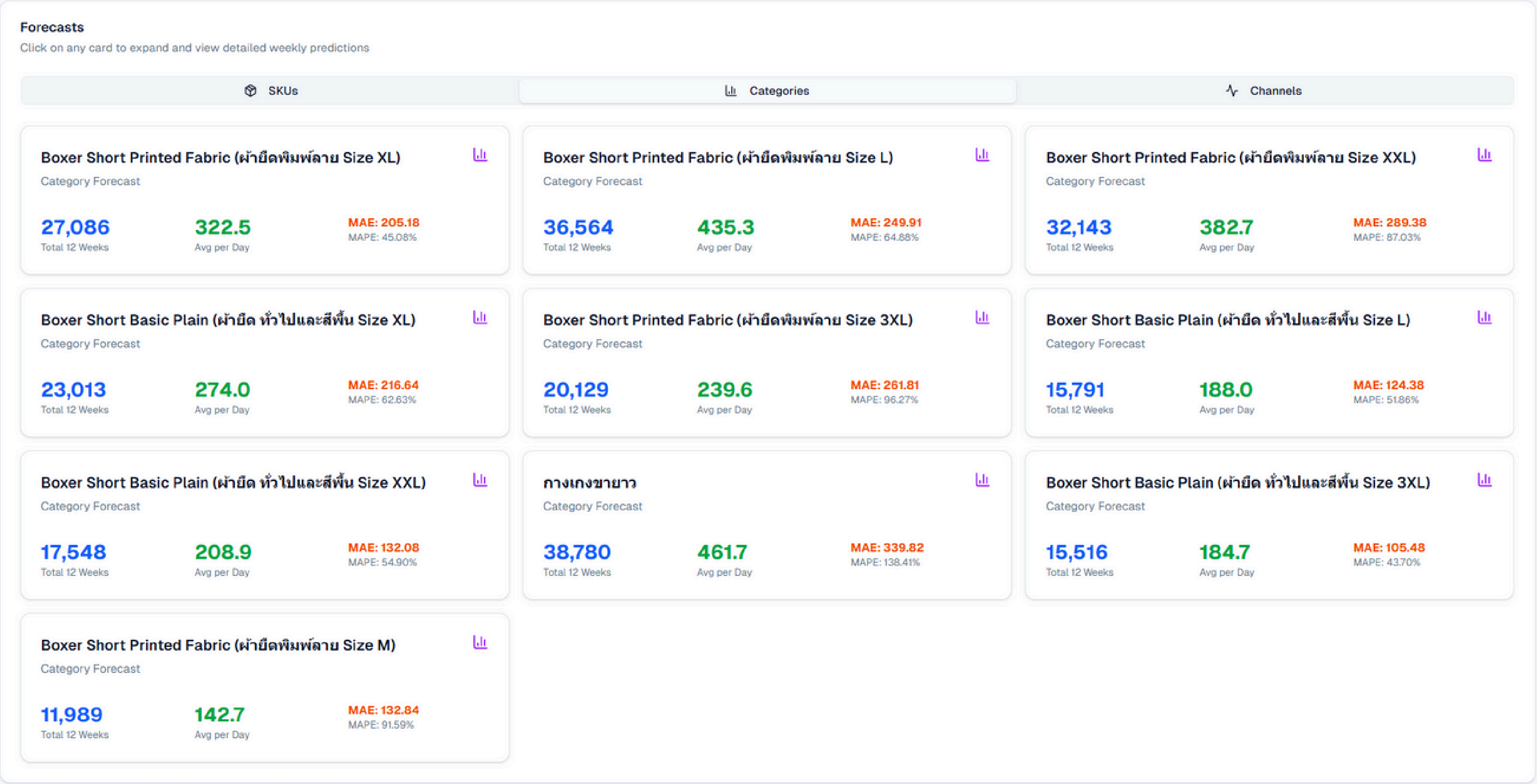
Sales by Category (units)
Distribution of sales (units) across product categories
Min units 1000 All 50 100 500 1000
Total categories: 37
Showing 16 categories (min 1000 units)
80000
60000
40000
20000
0
Boxer Short Printed Fabric (ผ้ายืดพิมพ์ลาย Size XXL)
Boxer Short Basic Plain (ผ้ายืด ทั่วไปและสีพื้น Size L)
Boxer Short Printed Fabric (ผ้ายืดพิมพ์ลาย Size M)
Top 5 Categories
1 Boxer Short Printed Fabric (ผ้ายืดพิมพ์ลาย Size XL) 73 products 63,190 units
2 Boxer Short Printed Fabric (ผ้ายืดพิมพ์ลาย Size L) 72 products 61,376 units
3 Boxer Short Printed Fabric (ผ้ายืดพิมพ์ลาย Size XXL) 69 products 47,163 units
4 Boxer Short Basic Plain (ผ้ายืด ทั่วไปและสีพื้น Size XL) 13 products 39,462 units
5 Boxer Short Printed Fabric (ผ้ายืดพิมพ์ลาย Size 3XL) 68 products 35,892 units

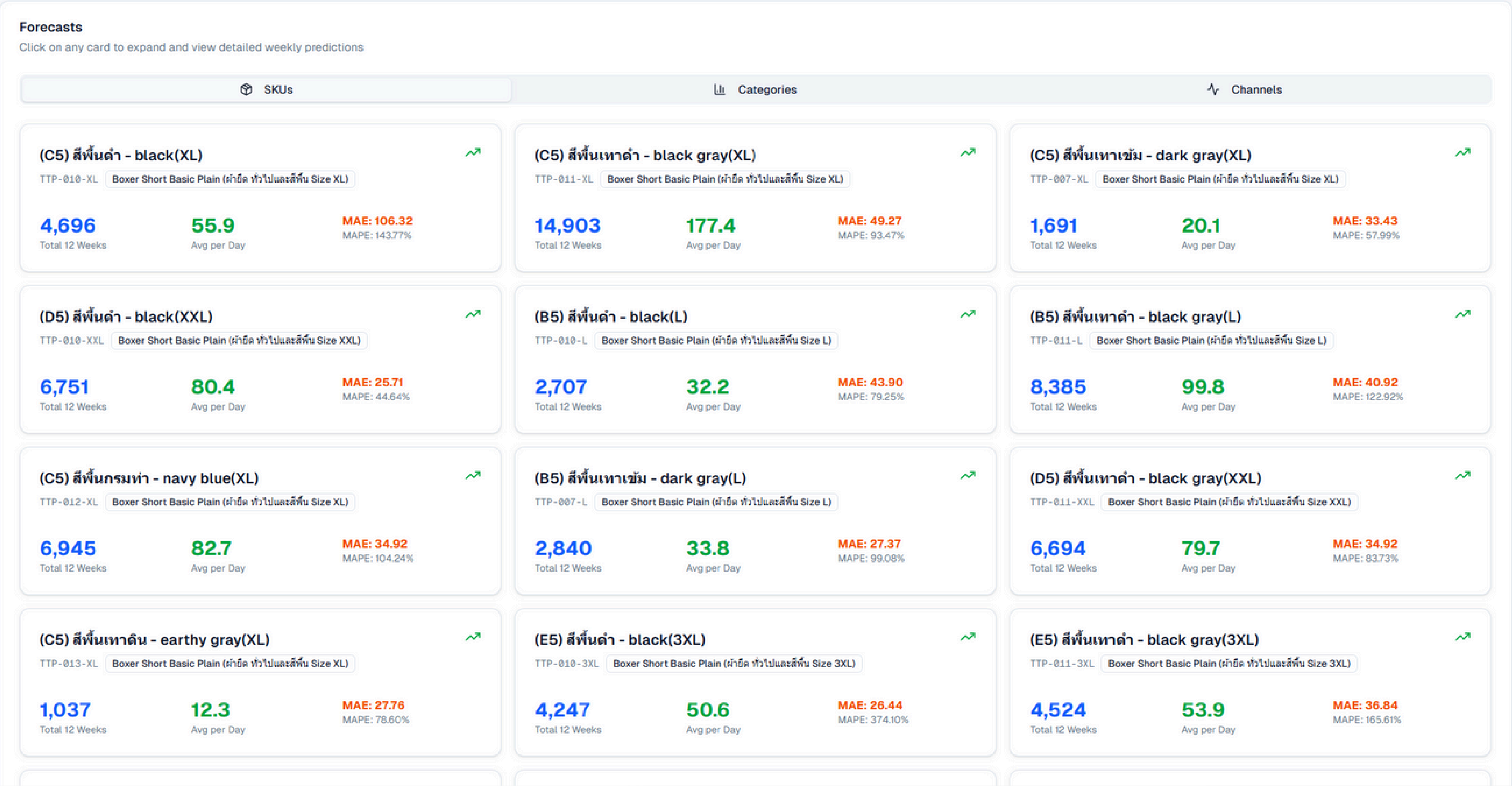


Sales by Channel
View sales across all channels
Monthly
All Channels
Total Sales
417,098 units
100000
75000
50000
25000
0
2025-02
Facebook 4,331
LINE MyShop 25
Lazada 1,366
Line 91
Shopee 22,163
Shopee 2 566
TIKTOK 2 95
TIKTOK TOOGTON 35,681
Tiktok 5
instagram 120
unknown 379
2025-01
2025-02
2025-03
2025-04
2025-06
2025-07

SALES PREDICTION

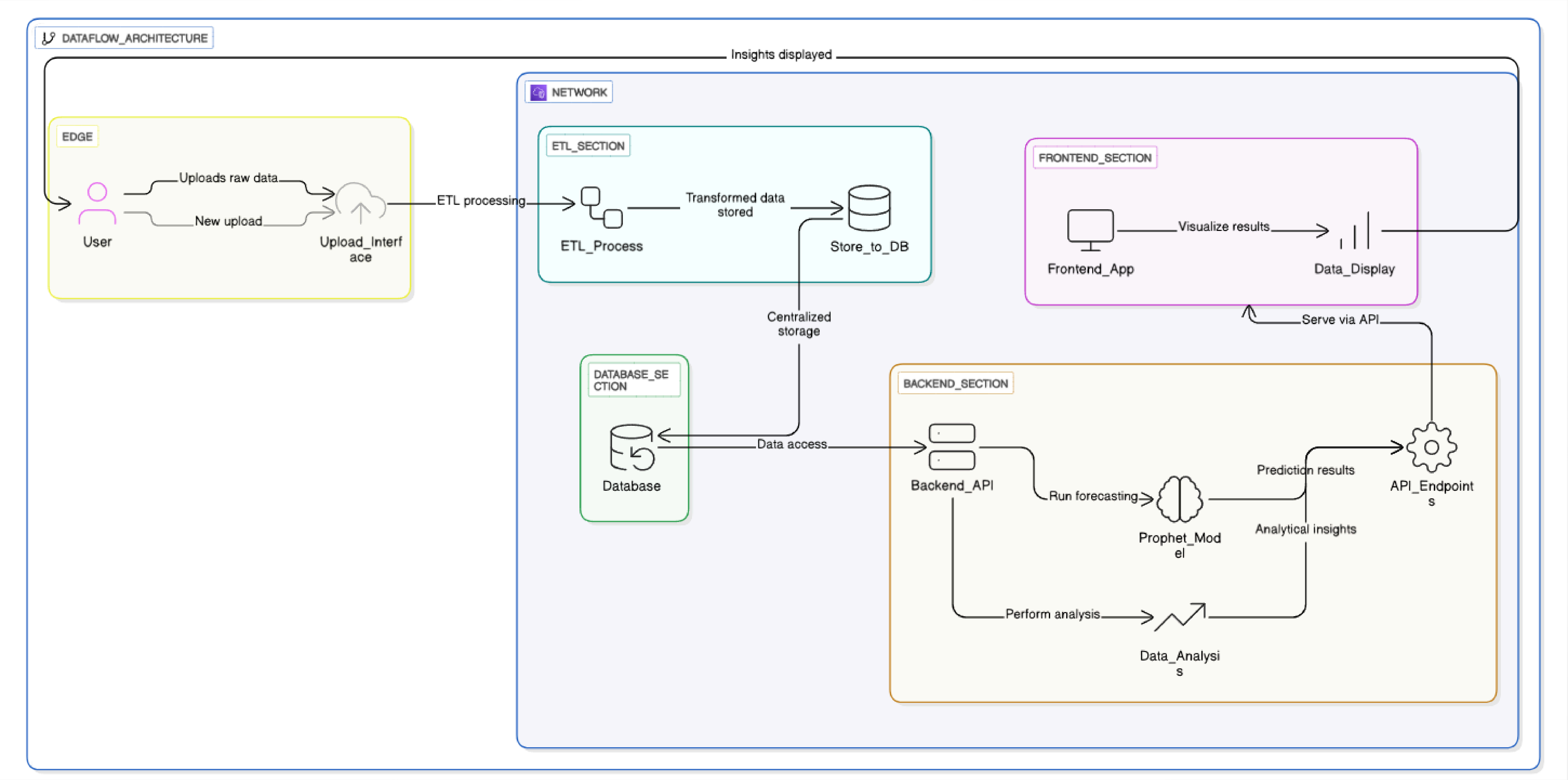






DESIGN METHOD
SYSTEM ARCHITECHTURE

- Raw data are uploaded in the form of CSV files that is cleaned during the ETL process
- The cleaned data is stored a database
- The backend retrieves the data from the database to preform sales predictions and analysis that will be displayed on the frontend



supabase

React JS

FastAPI

PROPHET

DESIGN METHOD
DEVELOPMENT STACK

Our development stack uses FastAPI, and supabase for the Backend, and React and Electron for the Frontend rendering of the desktop application. Alongside the Prophet model for sales prediction

DESIGN METHOD

DATABASE SCHEMA & BACKEND API ENDPOINTS

Inventory Prediction API 0.1.0 OAS 3.1

/openapi.json

default

GET	`/products`	Get Products
GET	`/products/facets`	Products Facets
GET	`/categories`	Categories
GET	`/sales`	Get Sales
GET	`/sales/top_skus`	Top Skus
GET	`/sales/top_categories`	Top Categories
GET	`/sales/{sku}`	Sales By Sku
GET	`/skus`	Get Skus
GET	`/stock`	Get Stock
GET	`/stock/out_of_stock`	Get Out Of Stock
GET	`/stock/low`	Get Low Stock
GET	`/stock/activity`	Get Stock Activity
GET	`/analytics/sales/timeseries`	Get Sales Timeseries
GET	`/analytics/sales/by-channel`	Get Sales By Channel
GET	`/analytics/sales/by-channel/sku`	Get Sales By Channel Summary For Sku
GET	`/analytics/sales/market-share`	Get Market Share For Sku
GET	`/analytics/sales/by-category`	Get Sales By Category

sales	
id	int4
transaction_date	timestamp
item_id	varchar
platform	varchar
quantity	int4

stock	
id	int4
raw_id	varchar
name	varchar
category	varchar
quantity	int4

skus	
id	int4
raw_id	varchar
name	varchar
category	varchar
subcategory	varchar
size	varchar
unit	varchar

METHODOLOGY - CONCEUPTUAL STAGE

PREDICTION MODEL

- Prophet is a machine-learning based tool for predictive analysis

- Prophet takes into consideration trend, seasonality and holidays

$$y(t) = g(t) + s(t) + h(t) + e(t)$$

- y(t) = Prediction
- g(t) = Trend
- s(t) = Seasonality
- h(t) = Holidays
- e(t) = Error

METHODOLOGY - CONCEUPTUAL STAGE

PREDICTION MODEL

Growth Function

- Prophet uses a Piece-Wise Linear Model to forecast the sales data where the intercept and slope will change at the changepoint
- Changepoints (c) are the points in which a trend shifts directions

$$y = \begin{cases} \beta 0+\beta 1x, & \text{if } x \leq c \\ \beta 0-\beta 2c+(\beta 1+\beta 2)x, & \text{if } x > c \end{cases}$$

METHODOLOGY - CONCEUPTUAL STAGE

PREDICTION MODEL

Seasonality Function

$$s(t) = \sum_{n=1}^{N} \left(a_n \cos\left(\frac{2\pi nt}{P}\right) + b_n \sin\left(\frac{2\pi nt}{P}\right)\right)$$

- A Fourier Series that is able to approximate the cyclical data of seasonality
- P = The time period (weekly seasonality = 7, yearly seasonality = 365.25)
- N = The total order. The lower order provides a smoother, simpler curve, a higher order creates a more complex and somewhat spiky curve

METHODOLOGY - CONCEUPTUAL STAGE

PREDICTION MODEL

Holiday Function

- A list of holidays are used and mapped onto the forecast depending on the country specified
- The model then adds or subtracts values from the forecast based on the historical data of said holidays

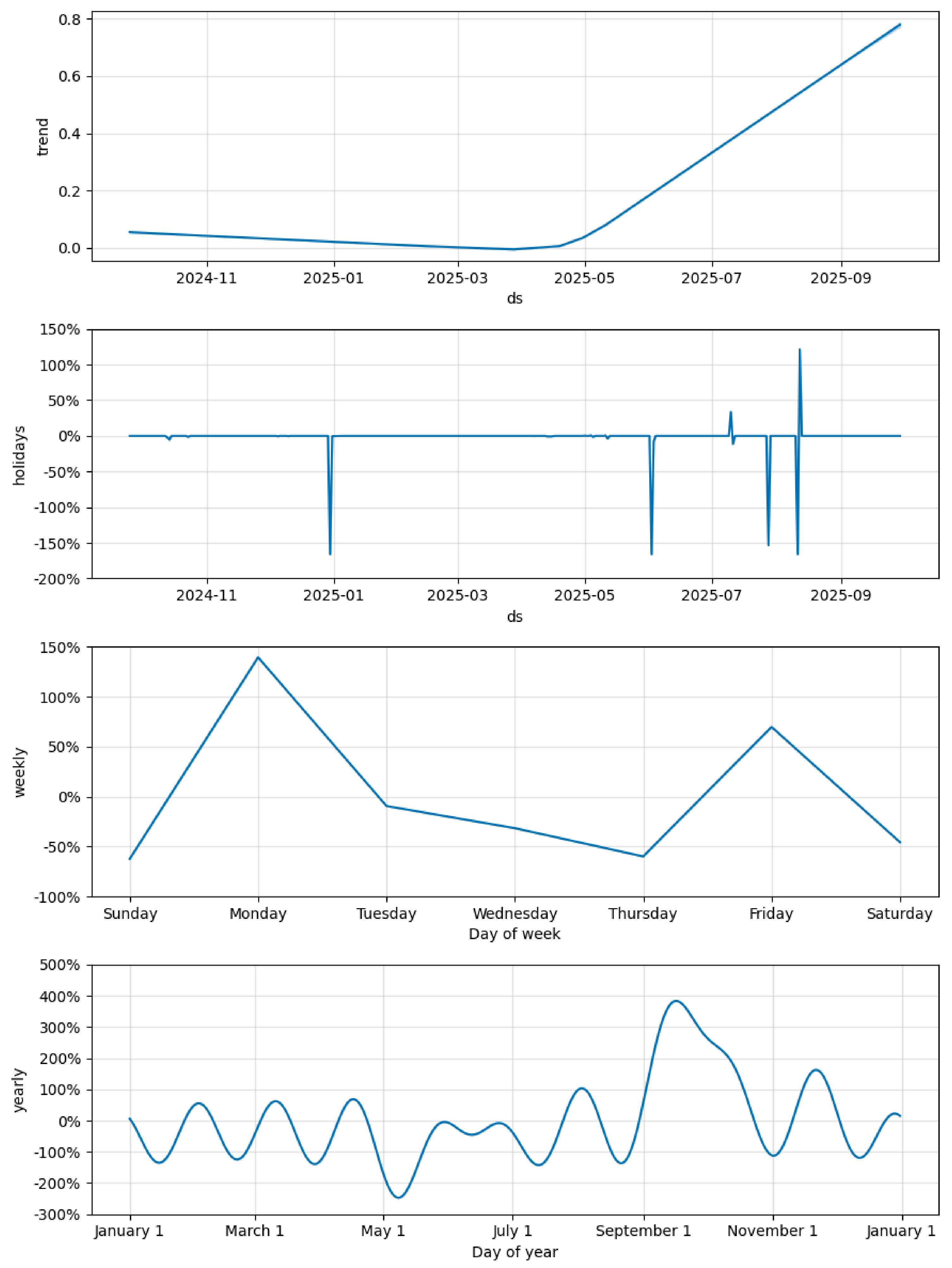
Error Function

- It is a statistical assumption about randomness or noise present in the data that cannot be explained

METHODOLOGY - CONCEUPTUAL STAGE

PREDICTION MODEL

- **Trend:** Shows how well the product is selling overall
- **Holidays:** Shows how different holidays affect sales rate
- **Weekly:** Shows the weekly trend of sales
- **Yearly:** Shows the yearly trend of sales

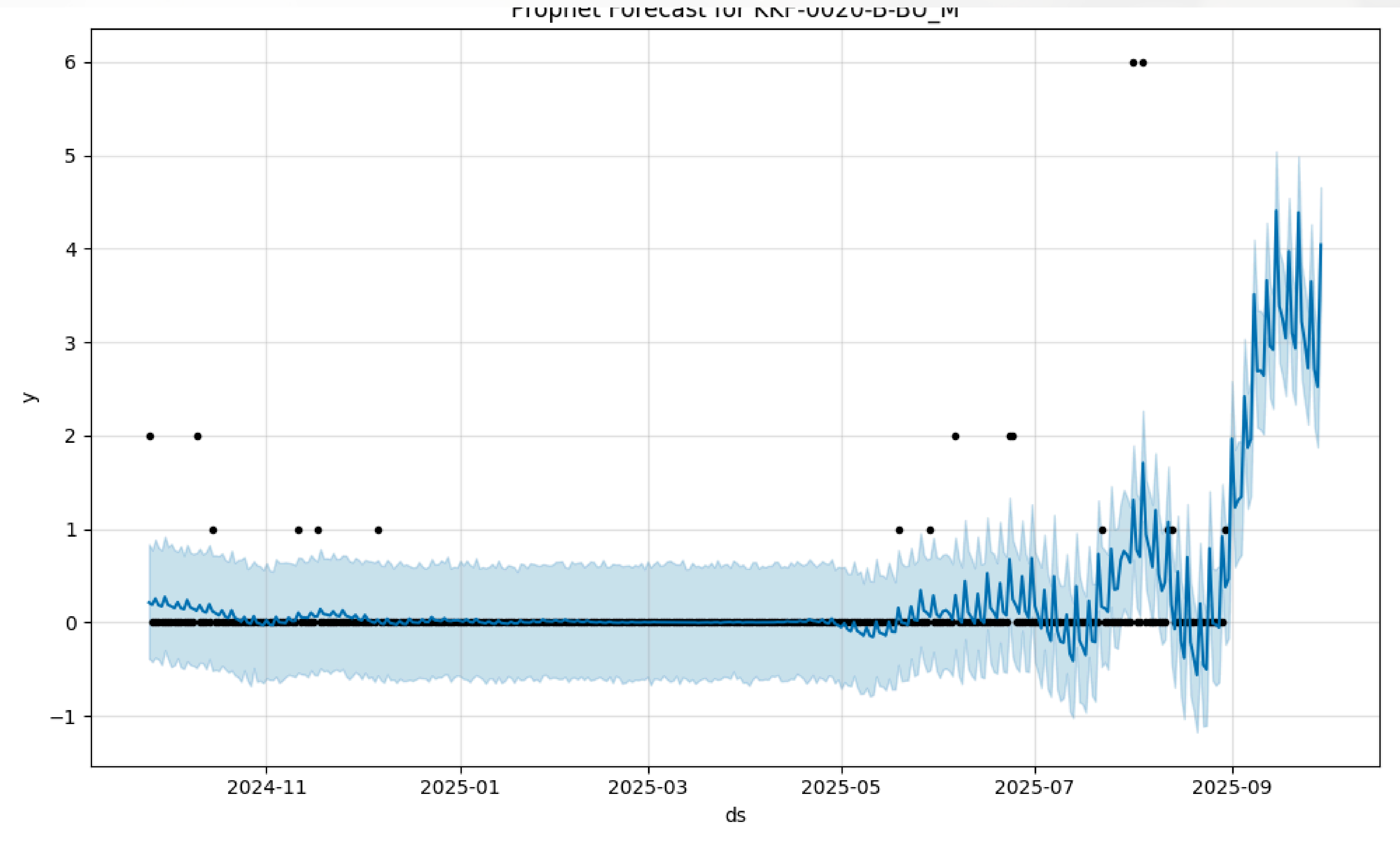


METHODOLOGY - CONCEUPTUAL STAGE

PREDICTION MODEL

Example Prediction

- Black dots represent historical sales
- Blue line represents the predicted sales
- Light blue area represents the certainty of the prediction



METHODOLOGY - CONCEUPTUAL STAGE

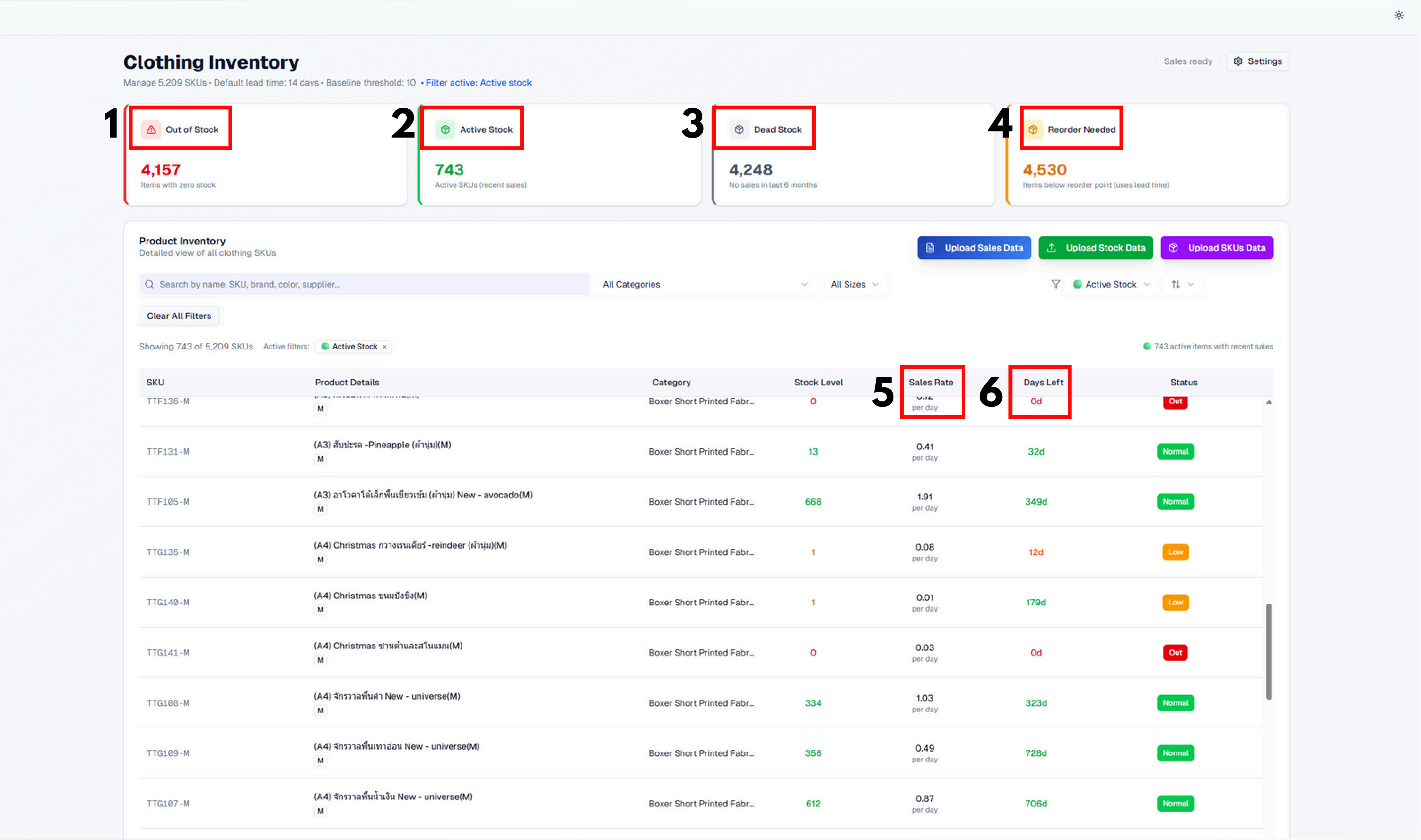
PREDICTION MODEL

Accuracy Check

- The model splits the data into a testing set and a training set
- The model then uses the data from the training set to make a forecast, comparing it with the testing set
- The difference between the two is the accuracy

METHODOLOGY - IMPLEMENTATION STAGE

CALCULATIONS



1. Out of Stock: Stock level = 0 from provided data

2. Active Stock: Is active if the last sales date is within the specified period (Configure in setting)

3. Dead Stock: Is inactive if the last sales date is outside of the specified period (Configure in setting)

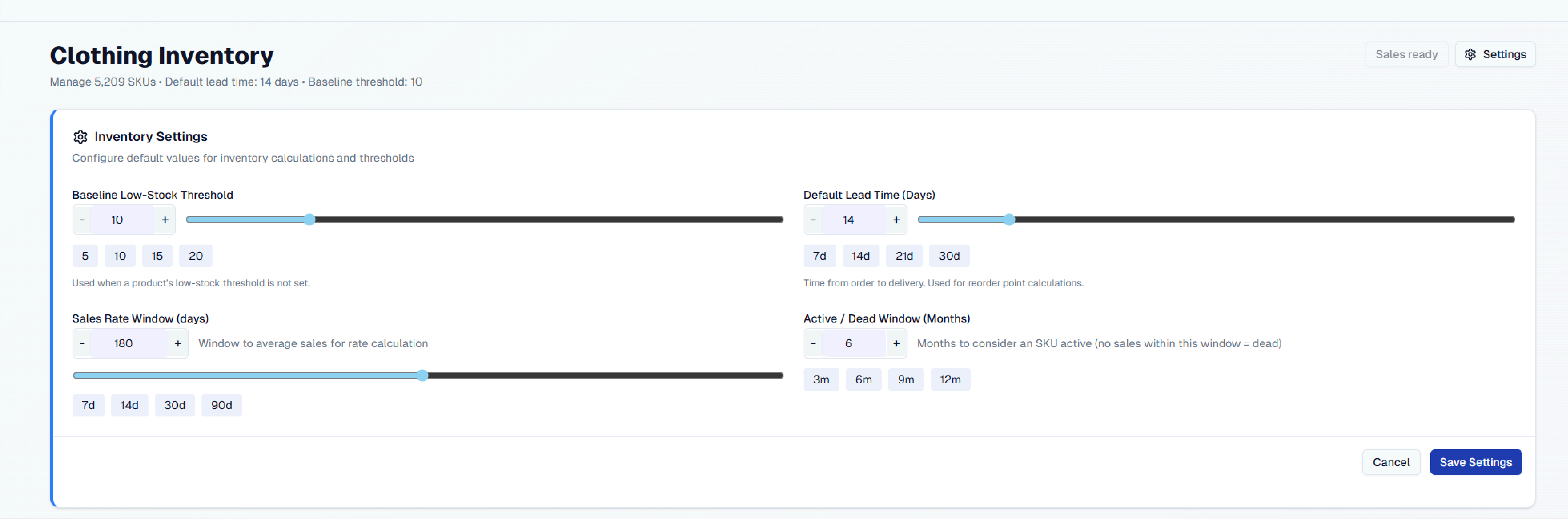
4. Reorder Needed: if stock level ≤ reorder_point. reorder_point = low stock threshold + (leadtime * daily salesrate)

5. Sales Rate: Total sales / period of sales (configurable in settings)

6. Days Left: Stock level / Daily sales rate

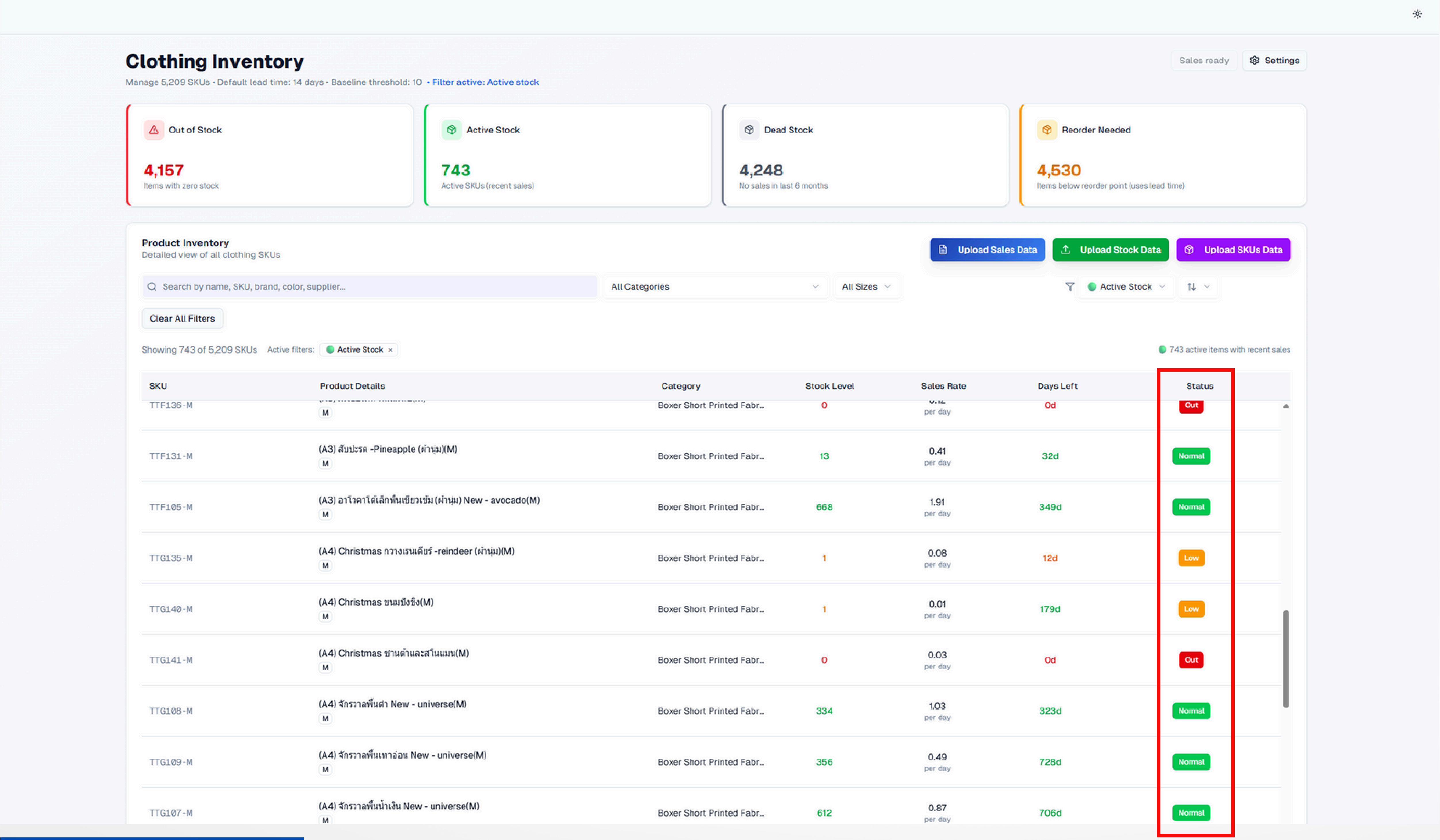
METHODOLOGY - IMPLEMENTATION STAGE

SETTINGS



METHODOLOGY - IMPLEMENTATION STAGE

CALCULATIONS

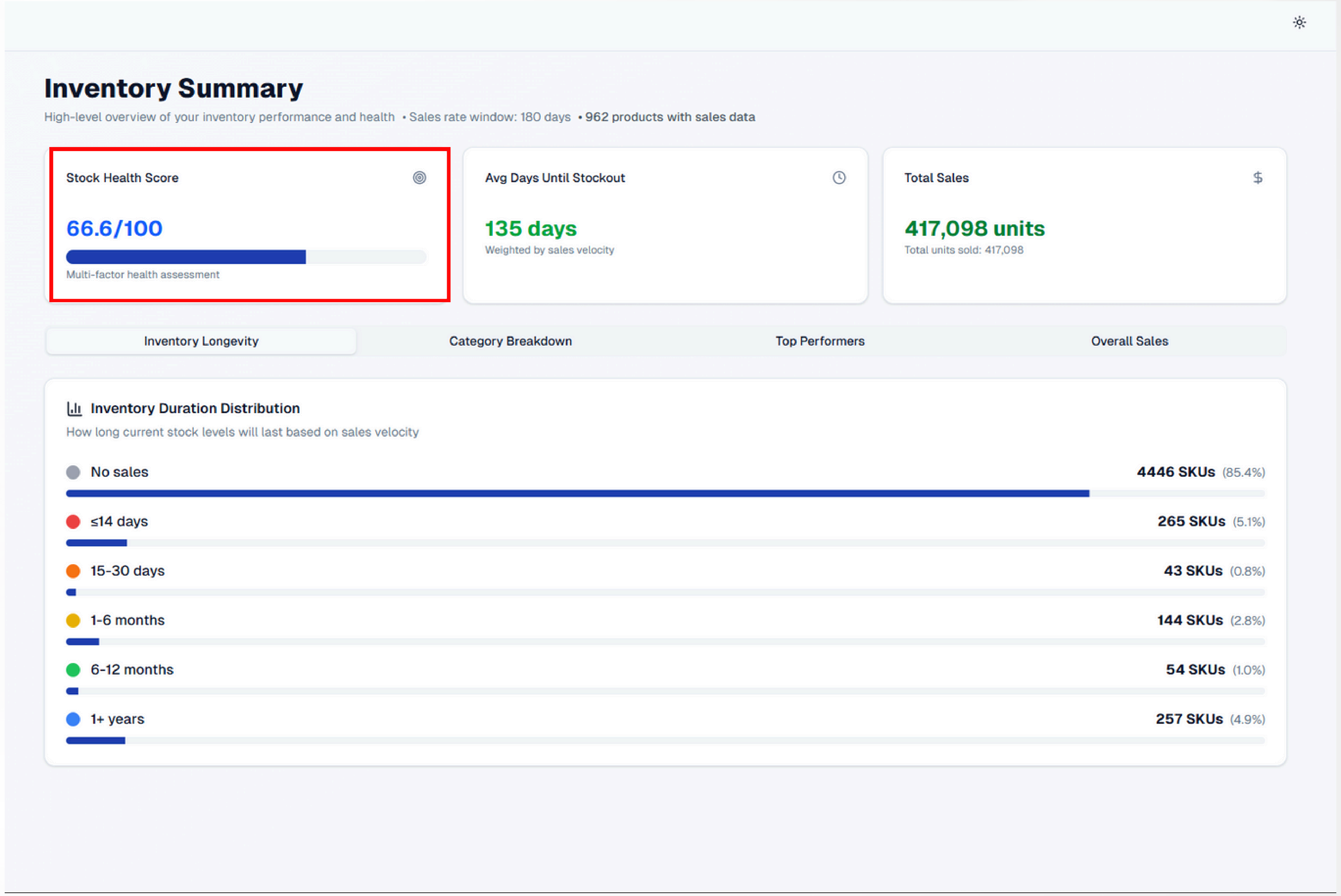


- Out - stock = 0
  - Red
- Urgent - days left < 7
  - Red
- Low - stock ≤ baseline threshold
  - Amber
- Watch - days left < 30
  - Yellow
- Normal - otherwise
  - Green

METHODOLOGY - IMPLEMENTATION STAGE

CALCULATIONS

Factor	Max Points	Criteria
Stock Coverage	40	Days until stockout: 90+ days = 40pts, 60-89 = 30pts, 30-59 = 20pts, 14-29 = 10pts, <14 = 0pts
Stock Vs Reorder Point	30	Stock ≥ 2× reorder = 30pts, ≥ 1.5× = 20pts, > 1× = 10pts, ≤ reorder = 0pts
Sales Activity	20	Last sale ≤7 days = 20pts, ≤30 = 15pts, ≤60 = 10pts, ≤90 = 5pts, >90 = 0pts
Not Overstocked	10	Days left ≤365 = 10pts, ≤500 = 5pts, >500 = 0pts
Total	100	Average across all products

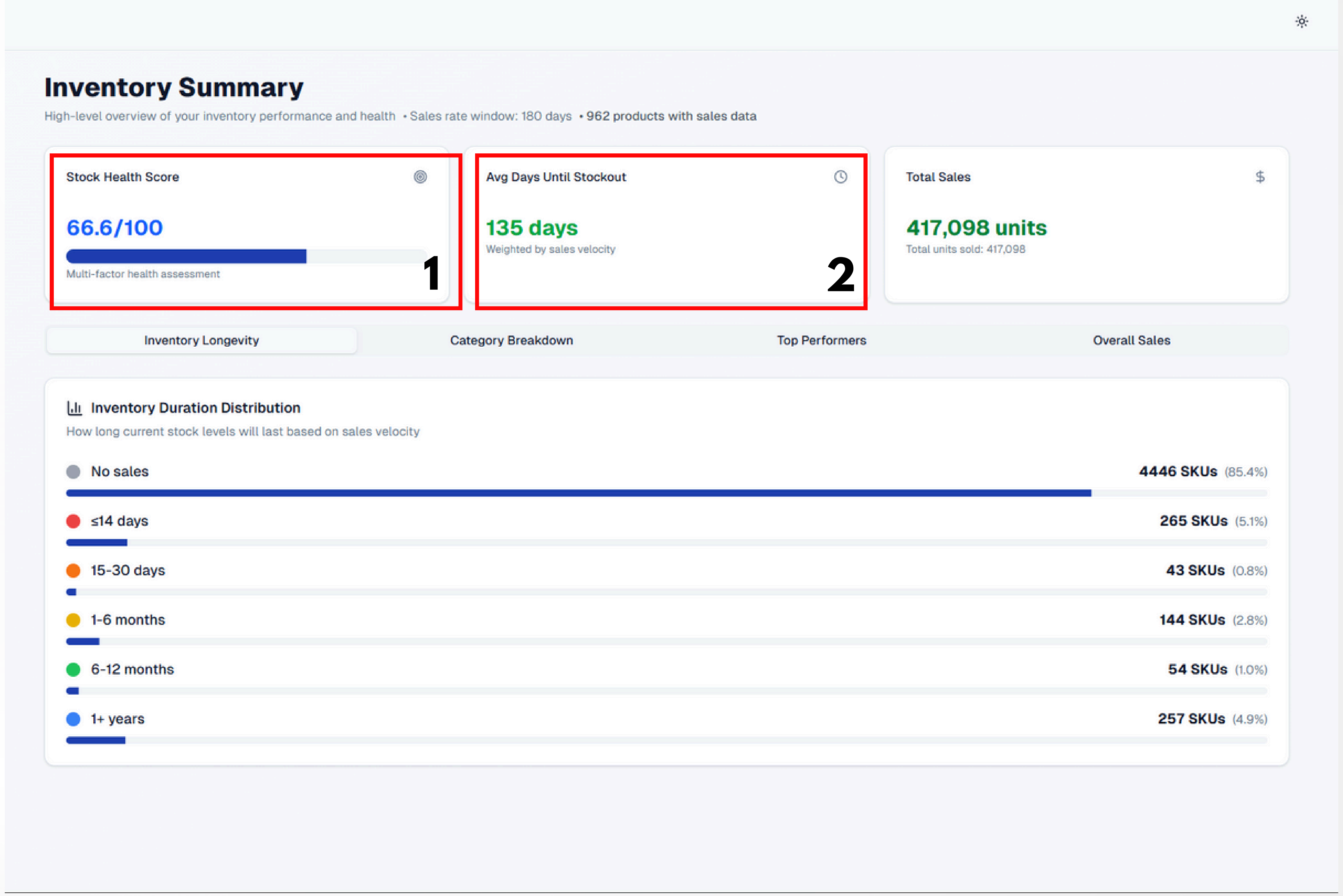


METHODOLOGY - IMPLEMENTATION STAGE
CALCULATIONS

1. Color Coding:
   - 80-100: 🟢 Green (Excellent health)
   - 60-79: 🔵 Blue (Good health)
   - 40-59: 🟠 Orange (Moderate health)
   - 0-39: 🔴 Red (Poor health)

2. Avg Days till Stockout: Weighted Avg = Σ(days_left × daily_rate) / Σ(daily_rate) (skus with higher sales rate have higher weight)

Color Coding:
- < 14 days: 🔴 Red (Critical)
- 14-29 days: 🟠 Orange (Warning)
- ≥ 30 days: 🟢 Green (Healthy)



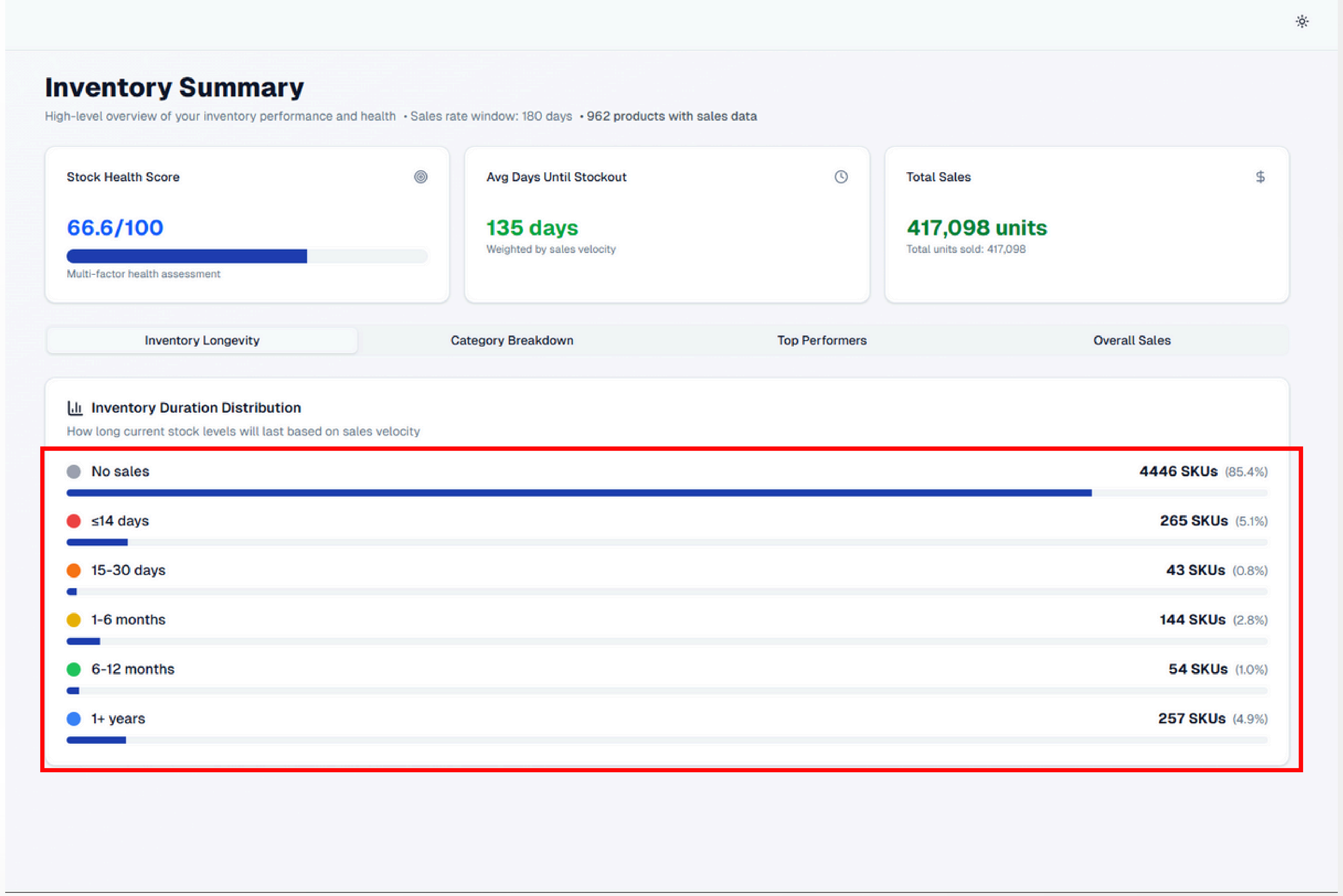
METHODOLOGY - IMPLEMENTATION STAGE

CALCULATIONS

Inventory Duration Distribution Calculations:

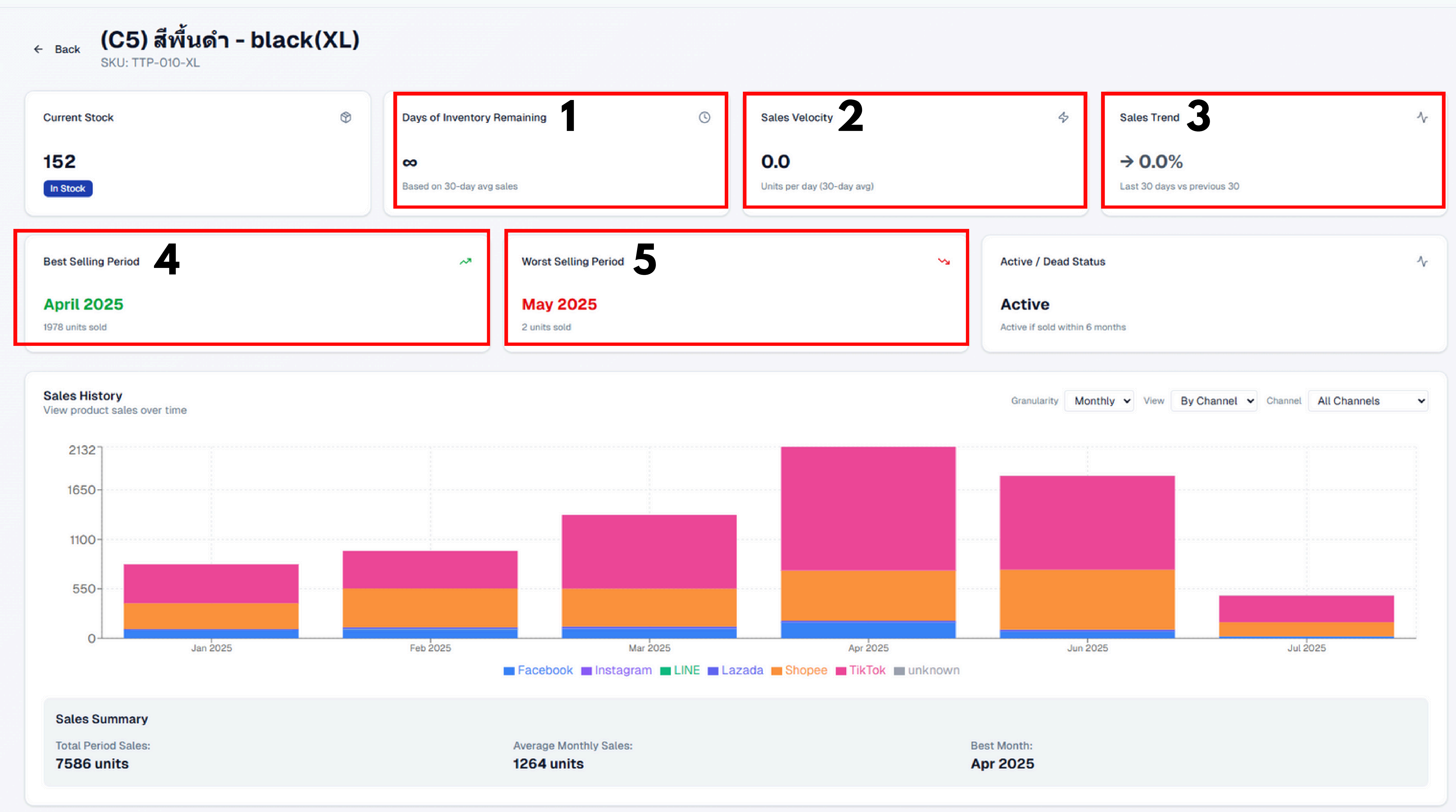
daysUntillStockout = stock / sales rate

Category	Condition	Color	Description
No sales	dailySalesRate <= 0 OR currentStock == 0	Gray	Products with no sales velocity
≤14 days	daysUntilStockout <= 14 OR	Red	Critical - stock will run out in 2 weeks or less
15-30 days	daysUntilStockout > 14 AND <= 30	Orange	Warning - stock will run out in 2-4 weeks
1-6 months	daysUntilStockout > 30 AND <= 180	Yellow	Moderate - stock will last 1-6 months
6-12 months	daysUntilStockout > 180 AND <= 365	Green	Healthy - stock will last 6-12 months
1+ years	daysUntilStockout > 365	Blue	Overstocked - stock will last over a year



METHODOLOGY - IMPLEMENTATION STAGE

CALCULATIONS



1. Days of inventory remaining: stock / sales rate of the past 30 days. 0 if stock is 0 and ∞ if no sales in the last 30 days

2. Sales Velocity: Avg sales rate for last 30 days

3. Sales Trend: (last30 - previous30) / previous30) × 100
Direction:
- 🟢 Up (↑): Trend > 5%
- 🔴 Down (↓): Trend < -5%
- ⚪ Stable (→): Between -5% and 5%

4. Best Selling Period: Month with most sales

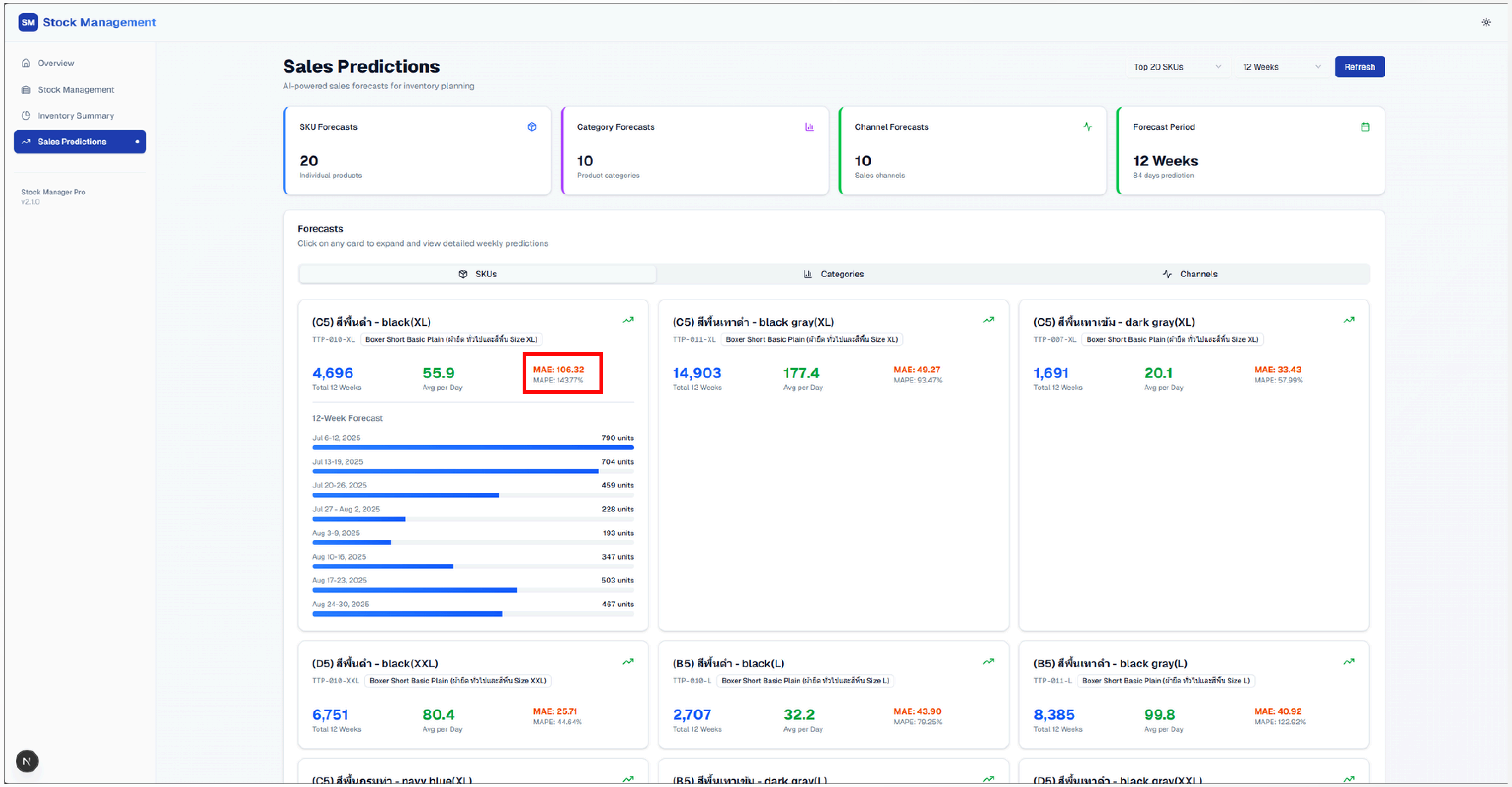
5. Worst Selling Period: Month with least sales

METHODOLOGY - IMPLEMENTATION STAGE

CALCULATIONS

$$\text{MAE} = \frac{1}{n}\sum_{i=1}^{n} \left| x_i - x \right|$$

Mean Absolute Error
Xi = Predicted Value
X = Actual Value
n = Number of data points



$$\text{MAPE} = \frac{\sum \frac{|A - F|}{A} \times 100}{N}$$

Mean Absolute Percentage Error
F = Predicted Value
A = Actual Value
N = Number of data points

RESULTS

1

Successfully launched a working application of the stock management website

2

Successfully implemented sales forecasting into the application

3

Successfully implement process to clean sales and stock data

DISCUSSION LIMITATIONS

- Experienced problems while packaging the application
- Prediction is not fully accurate and can be further fine-tuned
- Relies the user manually uploading data
- The ETL process is not 100% correct and can lead to some errors in the database

DISCUSSION FUTURE WORK

- Connecting the application directly with the company’s system
- Further fine tune the prediction model
- Develop a more robust ETL system
- Explore better ways to package the application

THANK YOU