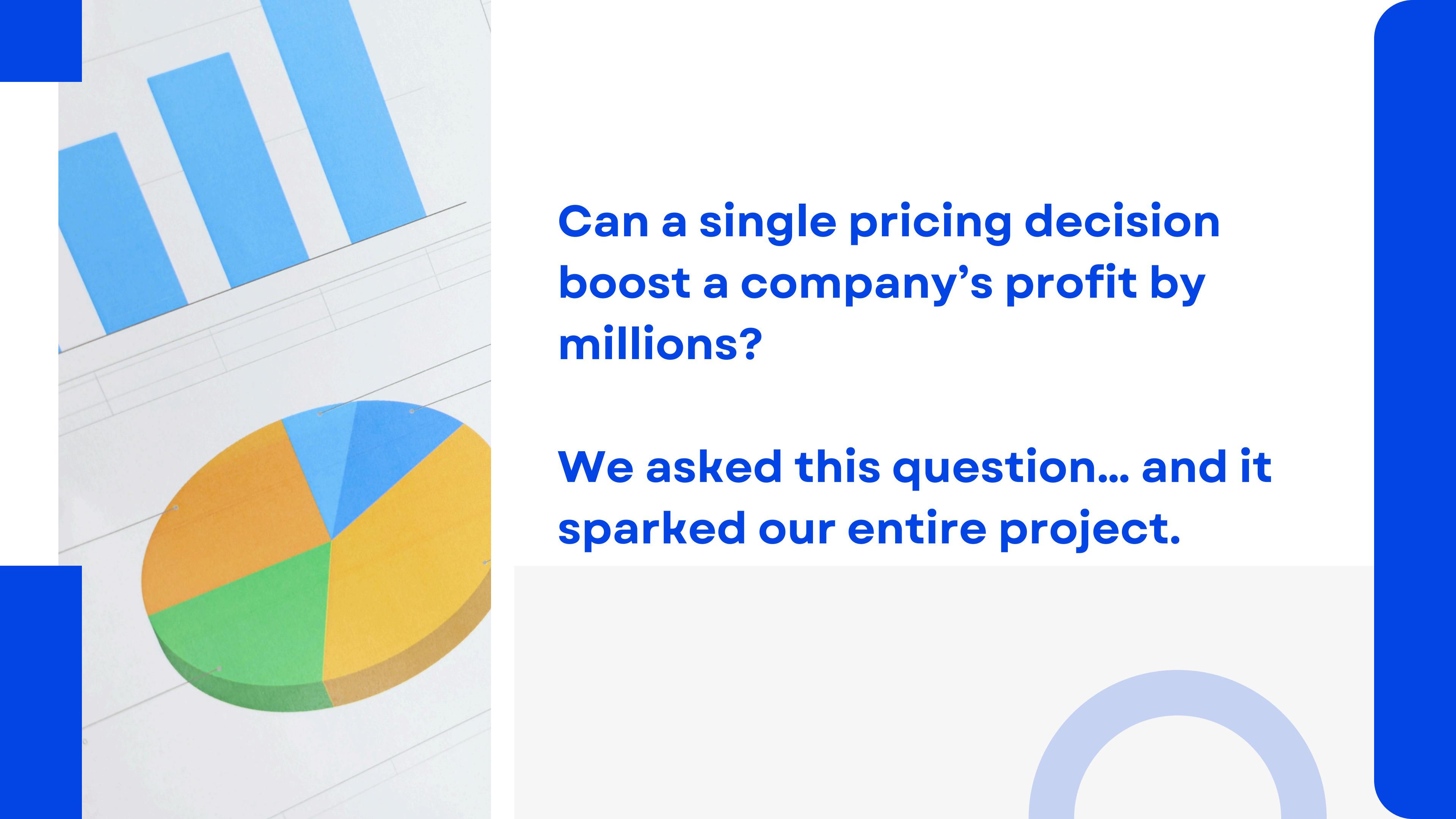


SALES FORECASTING AND OPTIMIZATION





**Can a single pricing decision
boost a company's profit by
millions?**

**We asked this question... and it
sparked our entire project.**

But before
diving in... let's
talk about the
real reason
we built this
project.



**Our goal is simple: use AI
and Machine Learning to
forecast future sales.**

**This helps companies make
smarter decisions in pricing,
inventory, and financial
planning.**

THE PROBLEM



Business Complexity

Companies like Walmart manage thousands of products across many stores.

Sales fluctuate every day due to seasons, pricing, promotions, and consumer behavior.



The Cost of Forecasting Errors

A small forecasting mistake can cost millions.

Overstock: More supply than demand → storage cost + value loss.

Shortage: Not enough supply → empty shelves + lost revenue.



Why It Matters

Sales forecasting isn't just data. It's the core engine behind supply chain, operations, and financial decisions.

When forecasting is wrong — everything downstream is affected.

WHAT WE DISCOVERED



Traditional Methods Fall Short

Most companies still rely on Moving Average or Linear Regression.

Useful... but they miss the real context behind the data.

Data Is Dynamic

Sales shift with seasons, promotions, competitors, and even the weather.

Static models can't capture this level of complexity.

Our Insight

So we asked: why not use Machine Learning and Deep Learning?

Models that actually learn patterns, adapt, and understand the market intelligently.

This became the first key to our journey.

WHAT DO WE NEED TO SOLVE THIS INTELLIGENTLY?

Three key goals:

Smart system → accurate sales forecasts

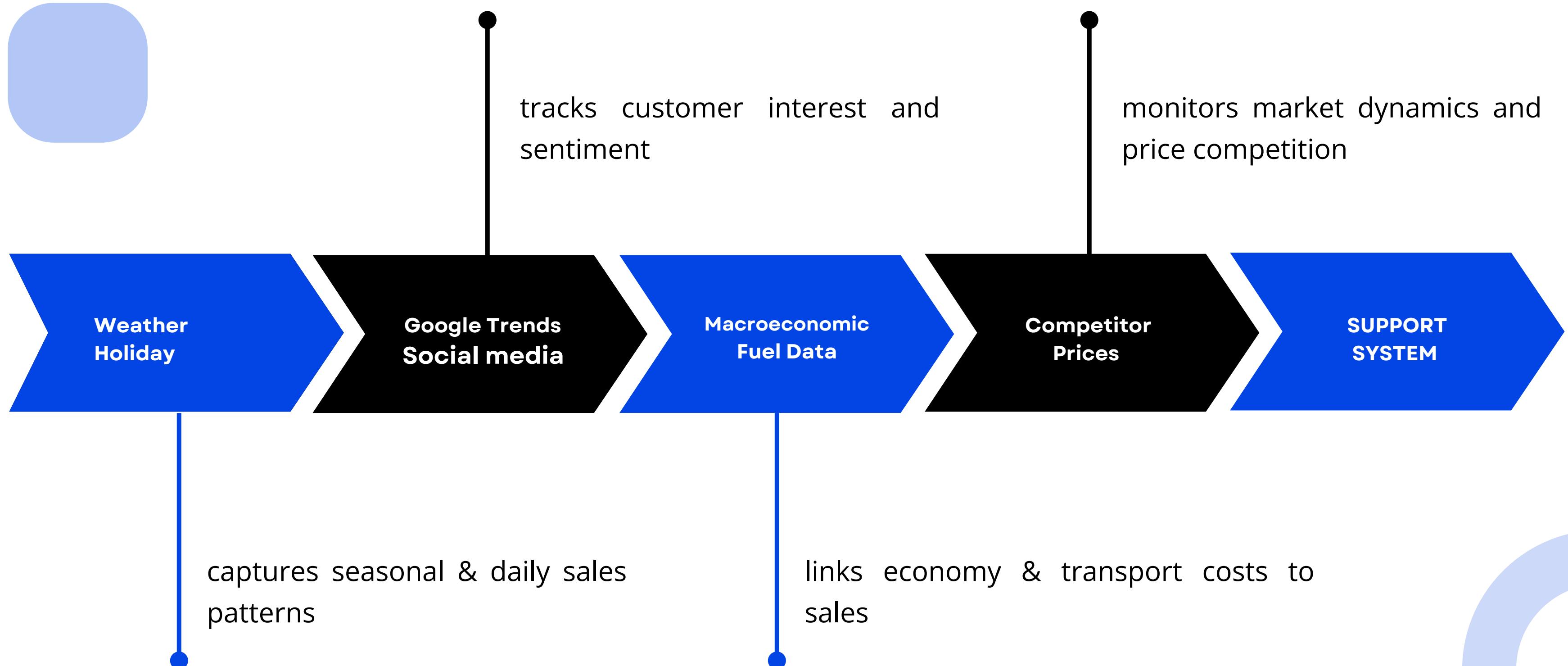
Optimization → reduce losses, boost profits

Business-friendly → easy to use without a

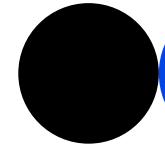
DATASET DATA ENGINEERING

We used the Walmart Sales Forecasting Dataset — rich, real-world data across stores and products.

To make our model smarter, we enhanced it with 4 key external sources:

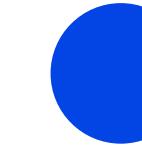


DATA CLEANING & FEATURE ENGINEERING



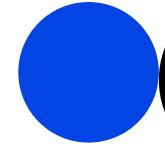
Data Cleaning

Using Pandas & NumPy, we applied interpolation for missing data and IQR for outliers to ensure clean, balanced data.



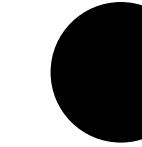
Feature Engineering

We didn't rely only on existing columns; we created new features to help the model understand sales behavior deeply.



Examples of Features

Moving Averages
Lag Features
Holiday Indicators
Sales Trends & Price Elasticity



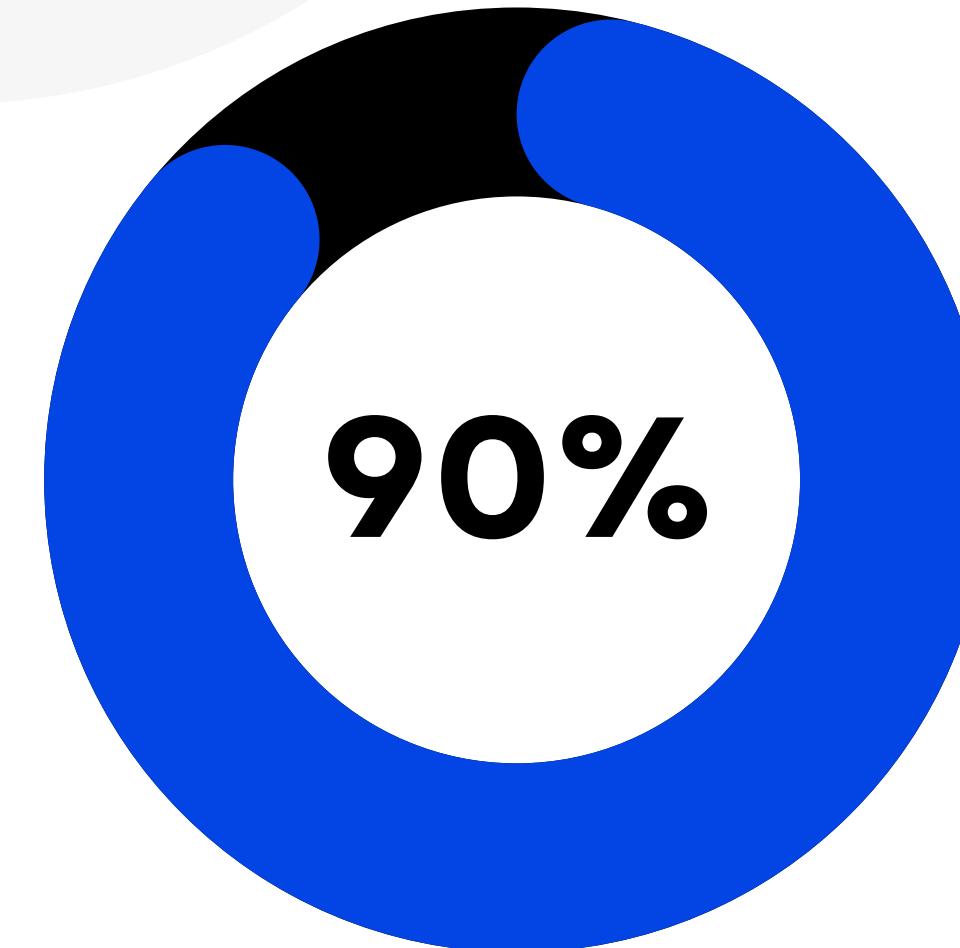
Outcome

This phase transformed the model from seeing just numbers to understanding a dynamic, real-world market

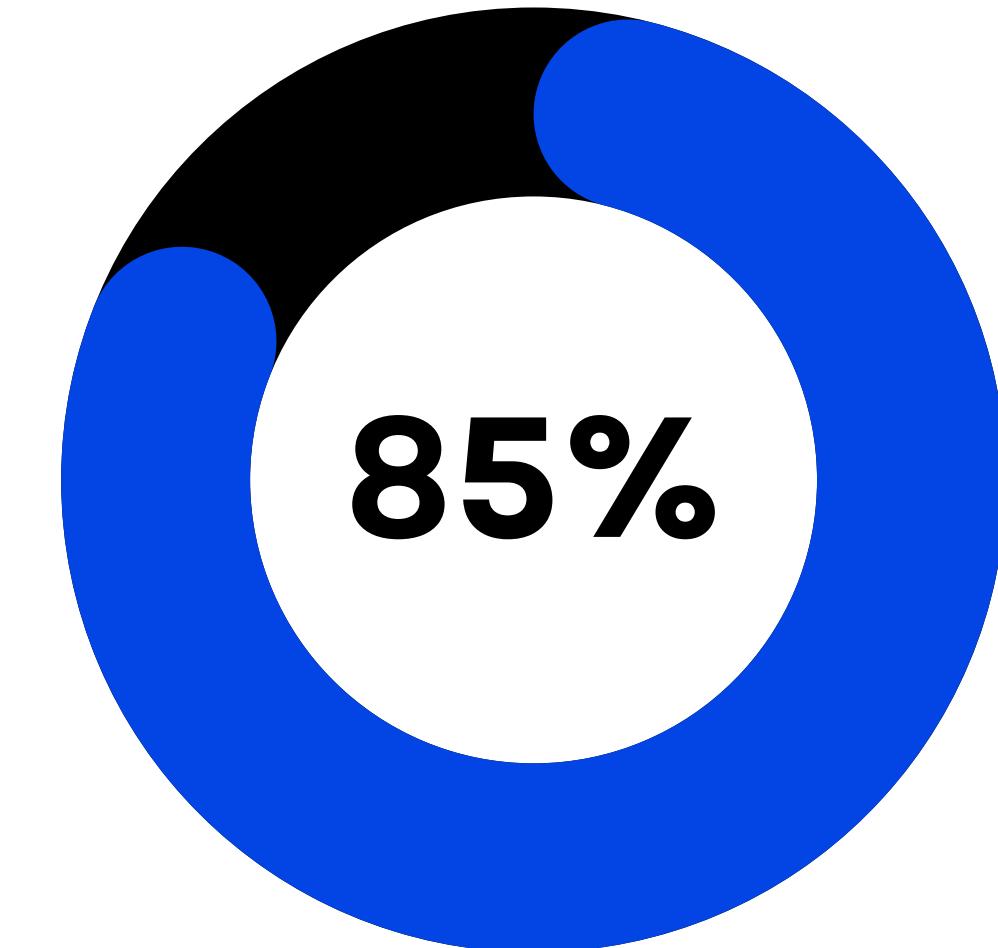
Feature Engineering was the key to higher accuracy.

We created new features beyond original columns to help the model understand sales behavior deeply.

Sales Trends Contributions



Impact of Price

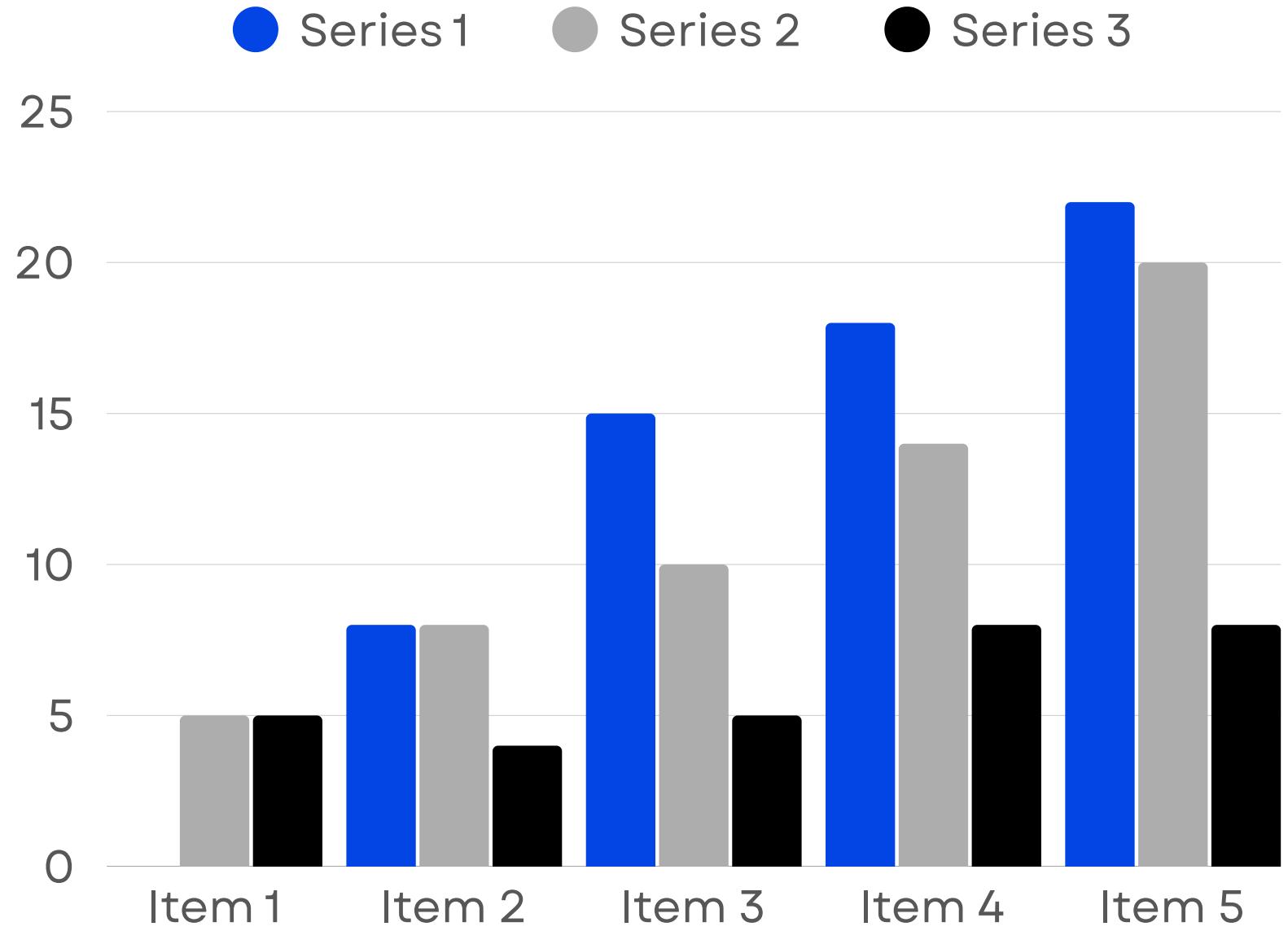


Moving Averages & Lag Features

Holiday Indicators & Price Elasticity

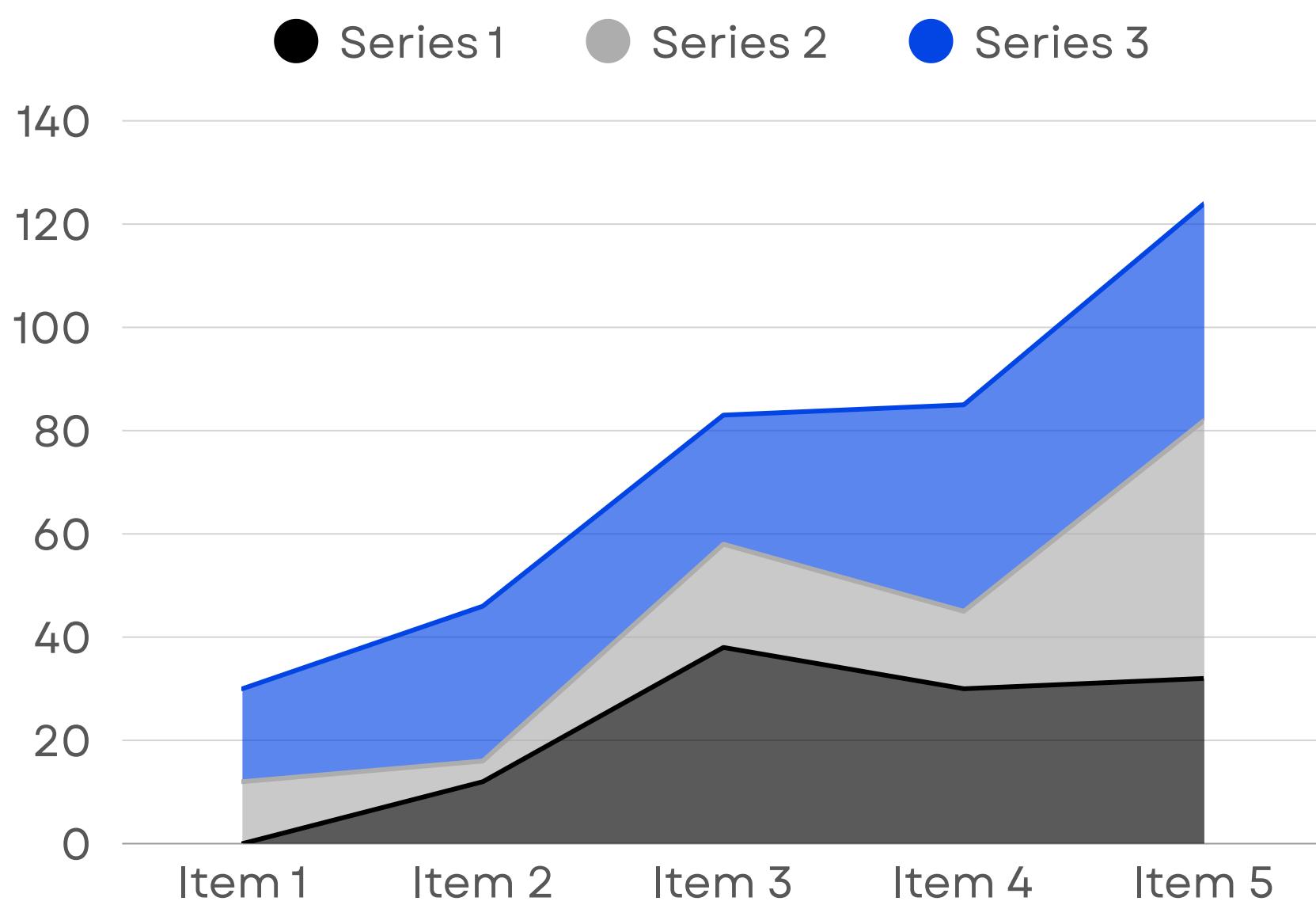
This helped the model see data not just as numbers, but as a dynamic market.

MODELING



Hybrid Modeling

we used a Hybrid Approach to leverage different strengths.
XGBoost & LightGBM handled tabular features and
captured non-linear relationships.



Time Series & Ensemble

We combined all models into an Ensemble Model to maximize accuracy.
This approach significantly improved prediction performance.

OPTIMIZATION

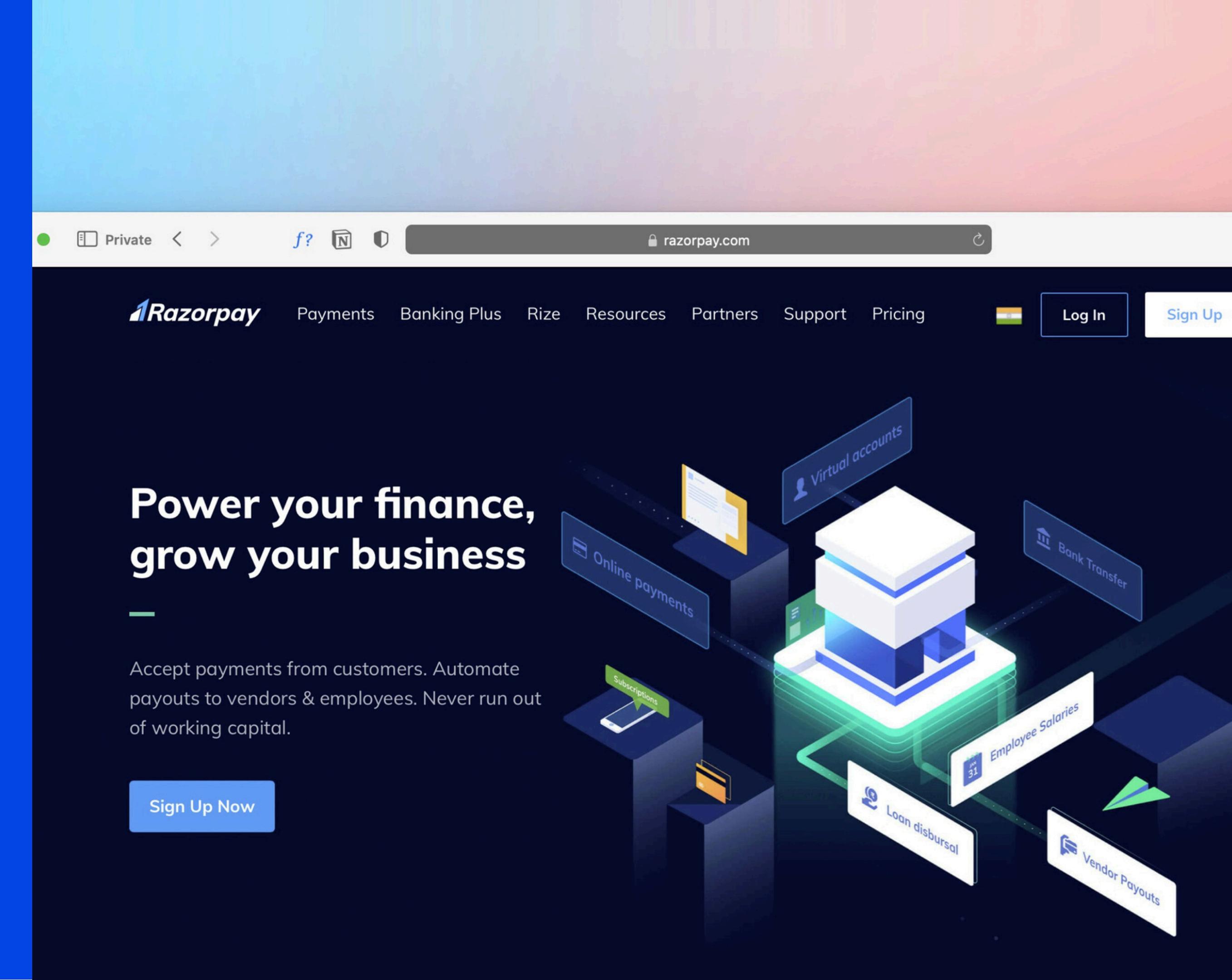
We boosted performance using Optuna for automatic hyperparameter tuning, improving the model significantly.
The final system delivers accurate weekly sales forecasts with interactive dashboards using Plotly & Matplotlib, enabling clear, data-driven decisions.



PRODUCTIZATION

T

We transformed the system into a SaaS-ready product with a full mobile app, real-time dashboards, smart notifications, and AI chatbot support. It includes auto-retraining, explainability dashboards, and seamless integration with ERP & Google Sheets for instant, data-driven actions.



ADVANCED FEATURES

T

The model includes Reinforcement Learning to adapt from user decisions, auto PDF reports with charts & KPIs, and daily updates from Google Trends & Weather APIs. It's designed for multi-country support, considering local holidays and trends for smarter, context-aware recommendations.



VISUAL EXPERIENCE



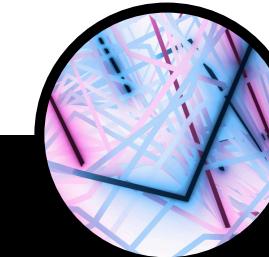
We'll create a sleek SaaS-style dashboard with animated KPIs, charts, and map visualizations by region.



Case Study on a virtual company 'ArabMart' shows 18% loss reduction and 15% profit increase.



ROI Simulation Dashboard calculates expected returns in real-time.



Strong system architecture with CI/CD, testing, MLflow monitoring, and Grafana dashboards.

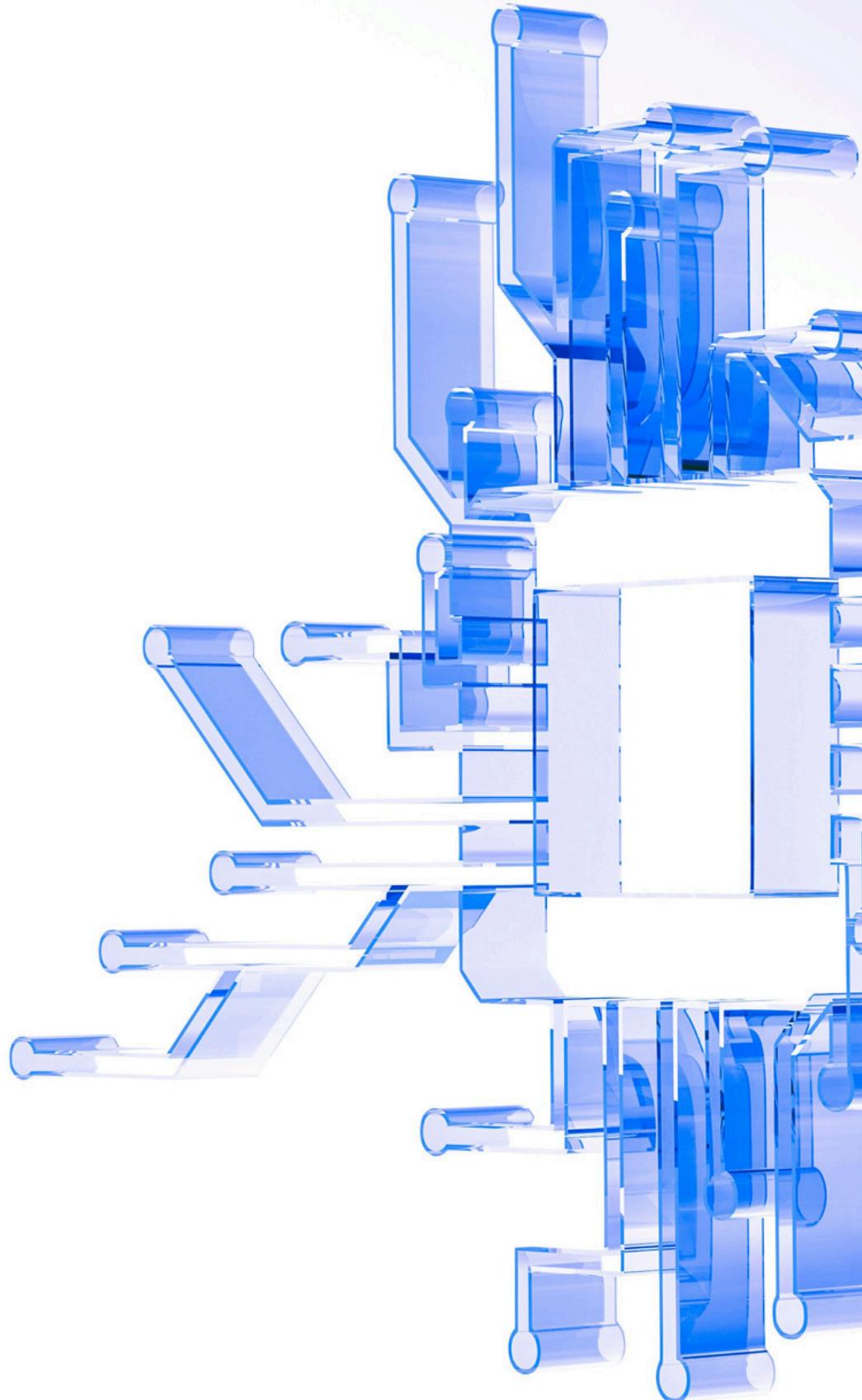
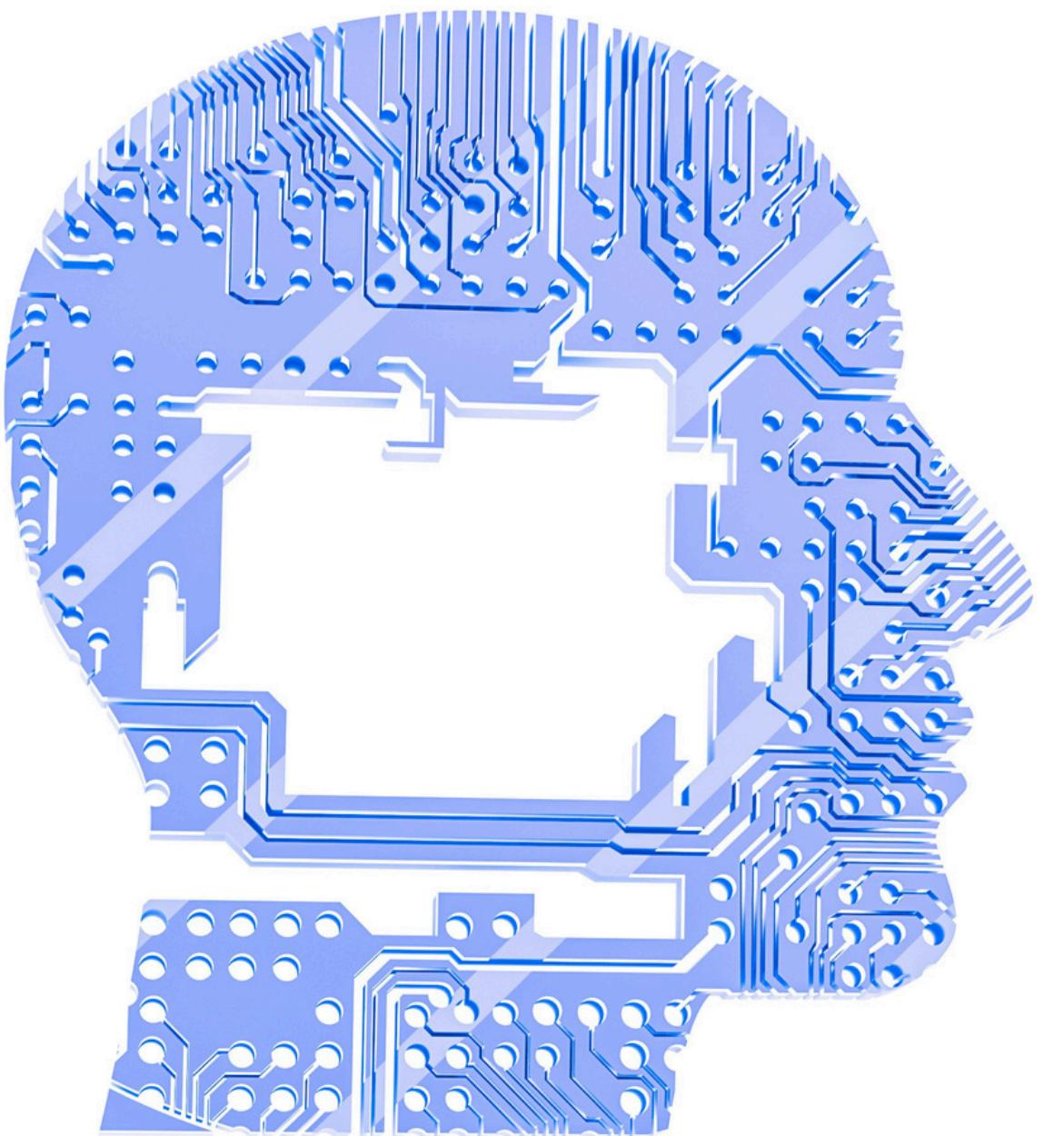
VISION & IMPACT

Our vision is to build a real AI Decision Support System that drives smart, data-backed business decisions in real-time. It empowers companies to automate pricing, optimize inventory, and learn from market behavior, making AI an essential tool, not a luxury.



OUR PROMISE

Our project changes how companies think — AI becomes a smart decision-maker, not just a number predictor.
Built by young Arab innovators, it understands the market and turns data into actionable, human-like decisions with AI precision



THANK YOU

FOR YOUR ATTENTION

November 2025

