3. Design Thinking Project Workbook

Team Name :

Team Members:

- 2420090065- P.Pranay Kumar
- 2420030262 - Nandini. J
- K Hemanth Sai - 2420030593

1. Problem/Opportunity Domain

Domain of Interest:

E-commerce forecasting, specifically optimized and accurate prediction of future product sales using artificial intelligence and machine learning techniques. The focus is on helping businesses manage inventory, pricing, and promotions effectively to maximize revenue and minimize losses due to overstocking or stockouts.

Description:

This project proposes a smart, AI-enabled forecasting system that uses ML models (like ARIMA, LSTM, and Random Forest Regressors) to analyze historical sales data, seasonal patterns, promotions, and customer behavior. The model generates short-term and medium-term sales forecasts for individual products. The outputs of this system assist businesses in effective inventory management, personalized marketing, and strategic decision-making.

Why Chosen:

E-commerce businesses rely heavily on accurate demand prediction. Errors in forecasting can result in significant revenue loss, wasted resources, poor customer satisfaction, and inefficient supply chain operations. By applying AI-driven forecasting, the project addresses real-world challenges faced by online retailers and supports growth in a competitive digital marketplace.

2. Problem/Opportunity Statement

Problem Statement:

Accurate and reliable sales forecasting in e-commerce is challenging due to volatile customer behavior, seasonal spikes, and promotional events. Inaccurate forecasts lead to overstocking, stockouts, and misaligned marketing strategies.

Problem Description:

Traditional forecasting methods depend on manual calculations, simple averages, or rule-based approaches. These fail to capture complex patterns such as holiday surges, product launches, and shifting consumer preferences. As a result, businesses struggle to align supply with demand, causing revenue leakage and poor customer experience.

Context:

E-commerce is growing rapidly, and data-driven forecasting is vital for maintaining competitive advantage. With thousands of SKUs and dynamic buying behavior, machine learning can transform sales forecasting into a more accurate, automated, and scalable process.

Alternatives:

- Manual predictions by managers.
- Simple moving averages or rule-based methods.
- Traditional statistical models like ARIMA without advanced feature engineering.
- Spreadsheet-based tracking without AI/ML.

Customers:

- E-commerce retailers and sellers.
- Warehouse managers and supply chain teams.

- Marketing managers and pricing strategists.
- Investors and financial planners.

Emotional Impact:

- Frustration for business owners facing frequent stockouts.
- Stress for supply chain teams due to last-minute restocking.
- Customer dissatisfaction due to delivery delays or product unavailability.

Quantifiable Impact:

- Accurate forecasts can reduce inventory costs by 15–25%.
- Increase sales revenue by preventing out-of-stock losses.
- Improve customer satisfaction scores and loyalty.

Alternative Shortcomings:

- Manual methods are slow and error-prone.
- Basic statistical models fail under rapidly changing trends.
- Traditional tools cannot scale to handle millions of SKUs.

3. Addressing SDGs

Relevant SDGs:

- SDG 8: Decent Work and Economic Growth
  Supports businesses in reducing operational inefficiencies and increasing profitability**.**

- SDG 9: Industry, Innovation, and Infrastructure
  Promotes innovation in business intelligence using AI-powered forecasting systems.

- SDG 12: Responsible Consumption and Production
  Ensures better resource utilization by reducing overproduction, waste, and unnecessary logistics costs.

How Addressed:
By leveraging machine learning for sales forecasting, the project enables businesses to optimize inventory, reduce waste, and improve customer satisfaction — all contributing to sustainable economic growth.

4. Stakeholders

- E-Commerce Retailers & Sellers → Depend on accurate forecasts to manage stock and pricing.

- Supply Chain & Warehouse Managers → Use forecasts to optimize logistics and reduce holding costs.

- Marketing Teams → Plan promotions, discounts, and campaigns based on demand predictions.

- Customers → Benefit from timely product availability and better service.

- Investors & Business Analysts → Rely on sales forecasts for financial planning and decision-making.

- Technology Teams → Implement and maintain forecasting models.

5. Power Interest Matrix of Stakeholders

High Interest, High Power:

- Retail Business Owners, Investors, Supply Chain Managers.

High Interest, Low Power:

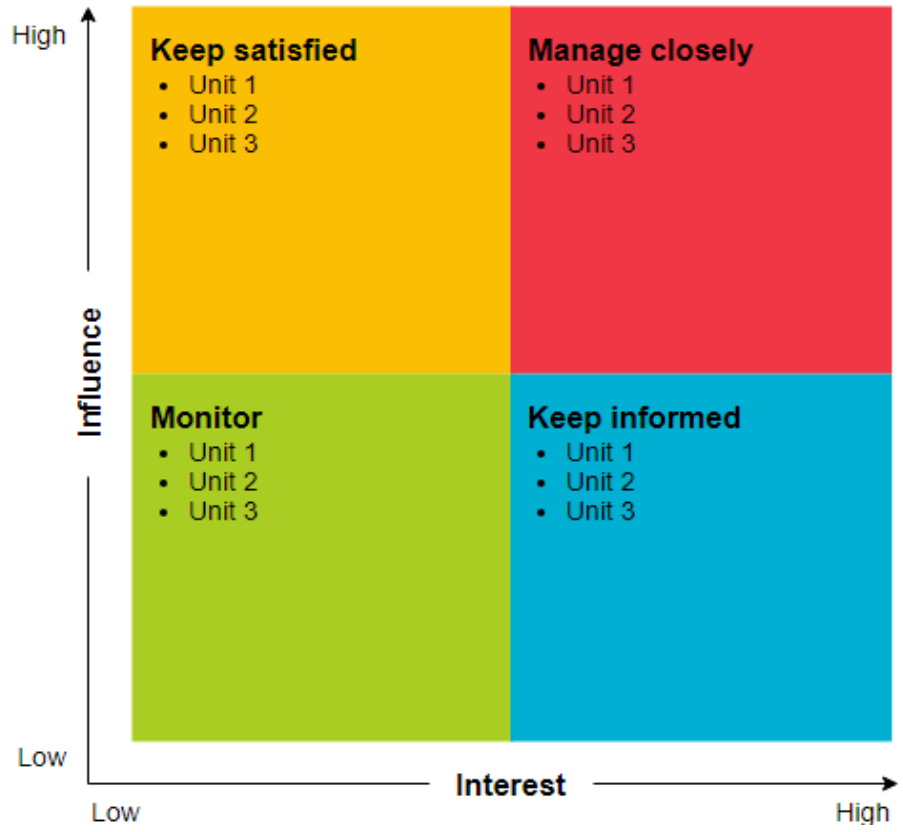
- Customers, Marketing Teams.

Low Interest, High Power:

- E-commerce Platforms (e.g., Amazon, Flipkart, Shopify).

Low Interest, Low Power:

- Third-party vendors with minor involvement.



6.Empathetic Interviews

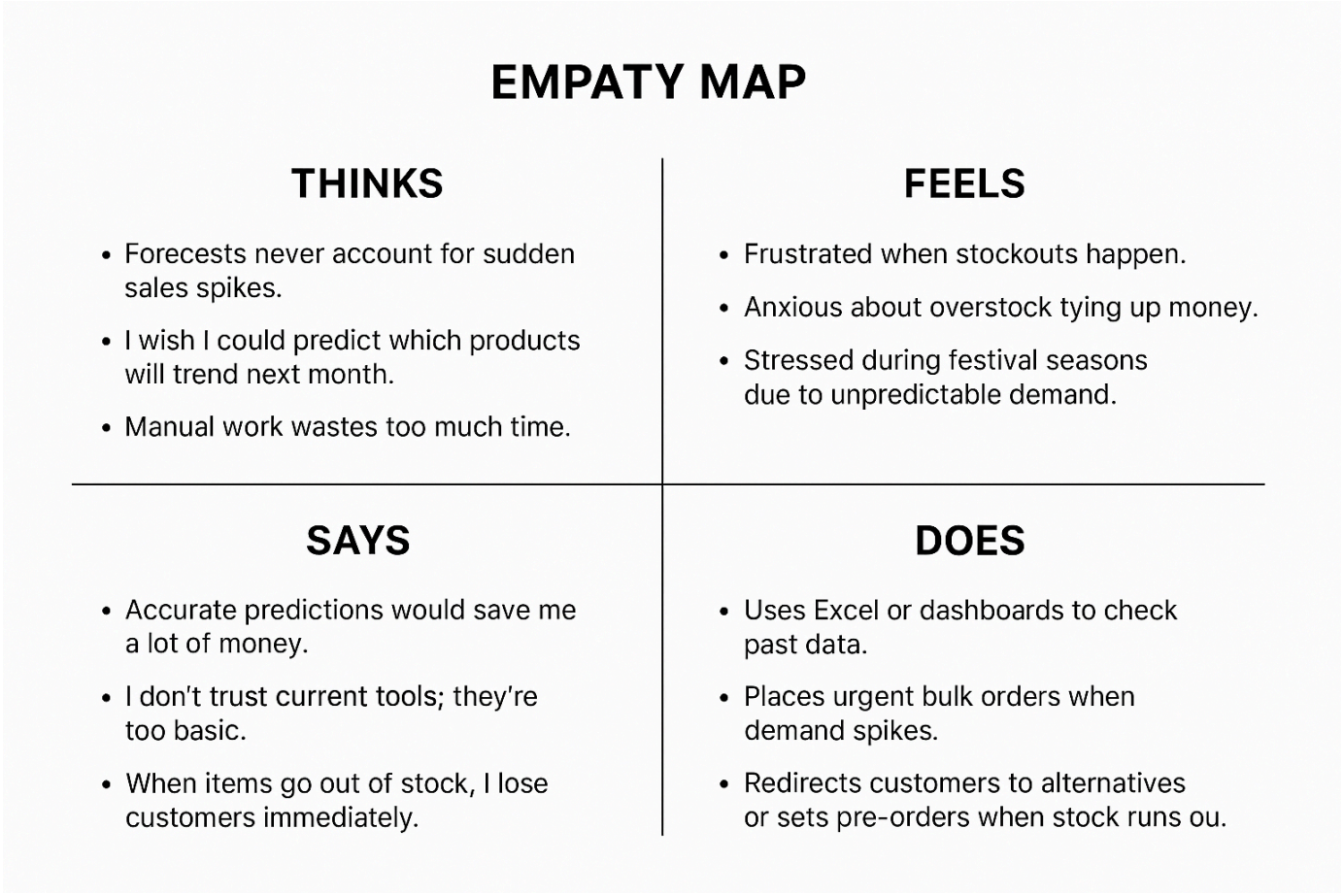
Category	Sample Question	Answer
Thoughts	**What sales forecasting tools do you currently use?**	**“Mostly Excel sheets and the Shopify dashboard. They don’t handle sudden spikes well.”**
Thoughts	**How do you decide stock for seasonal products?**	**“We check last year’s sales and add a buffer, but demand often surprises us.”**
Thoughts	**Which product categories are hardest to predict?**	**“Fashion items — trends change too fast. Electronics are easier to plan.”**
Feelings	**How do you feel when products go out of stock?**	**“It’s frustrating. Customers leave bad reviews and rarely return.”**

Feelings	**Do inaccurate forecasts affect your trust in tools?**	**“Yes, I trust my gut more than the software because predictions are generic.”**
Actions	**What do you do when stock runs out?**	**“We switch to pre-orders or suggest alternatives, but customers already lose trust.”**
Actions	**How often do you adjust plans due to wrong forecasts?**	**“Almost every month, especially after festivals or promotions.”**

SKILLED INTERVIEW REPORT

User / Interviewee	Questions Asked	Insights Gained
Rakesh, Small Seller	What forecasting tools do you use?	Existing tools are too simple → need smarter automation.
Divya, Warehouse Manager	How do you decide stock for festivals?	Seasonal surges (Diwali, Black Friday) must be captured in forecasts.
Amit, E-commerce Analyst	Which products are hardest to predict?	Fashion & trending items are unpredictable, unlike electronics.
Sneha, Customer	How do you feel when items are out of stock?	Stockouts damage loyalty; customers move to competitors.
Ravi, Marketing Manager	Do wrong forecasts affect campaigns?	Wrong demand estimates waste ad budgets and reduce ROI.

Empathy Map


EMPATY MAP
THINKS
• Forecests never account for sudden sales spikes.
• I wish I could predict which products will trend next month.
• Manual work wastes too much time.
FEELS
• Frustrated when stockouts happen.
• Anxious about overstock tying up money.
• Stressed during festival seasons due to unpredictable demand.
SAYS
• Accurate predictions would save me a lot of money.
• I don't trust current tools; they're too basic.
• When items go out of stock, I lose customers immediately.
DOES
• Uses Excel or dashboards to check past data.
• Places urgent bulk orders when demand spikes.
• Redirects customers to alternatives or sets pre-orders when stock runs ou.

Who is Your Customer?

- Example: Priya, 29, owns a small online fashion store.
- Struggles with stockouts during festive seasons and overstocking in off-seasons.
- Wants a tool to balance supply and demand easily.

Common Users:

- Small online sellers, large e-commerce companies, warehouse operators.

8. Persona of Stakeholders

Stakeholder Name: Priya

- **Demographics:** 29 years old, online fashion store owner.
- **Goals:** Improve sales, minimize losses, retain customers.
- **Challenges:** Can’t predict demand fluctuations accurately.

- **Aspirations:** Expand her business with data-driven planning.
- **Needs:** Affordable, easy-to-use forecasting tool.
- **Pain Points:** Overstocking, stockouts, wasted marketing spend.

9. Look for Common Themes, Behaviors, Needs, and Pain Points among the Users

Themes: Need for accurate, real-time sales forecasts.

Behaviors: Often rely on guesswork or outdated tools.

Needs: Automated, transparent, scalable solutions.

Pain Points: Stockouts, excess inventory, poor customer experience.

10. Define Needs and Insights of Your Users

User Needs:

- Real-time demand forecasting.
- High accuracy with seasonal and promotional adjustments.
- Easy integration with existing e-commerce platforms.
- Clear and interpretable insights.

User Insights:

- Users often react to sales trends instead of planning ahead.
- Current tools lack transparency and adaptability.
- Customers need trust in AI-driven solutions.

13. POV Statements

- Users need accurate demand predictions because poor forecasts cause stockouts and losses.
- Users need transparent and interpretable results because blind trust in AI is low.
- Users need real-time forecasting because customer behavior changes quickly.
- Users need integration with their platforms because switching tools is costly.

14. Develop POV/How Might We (HMW) Questions to Transform Insights/Needs into Opportunities for Design

- How might we design a forecasting system that adapts to seasonal changes and promotions?
- How might we make predictions transparent and explainable for non-technical users?

- How might we integrate forecasts seamlessly into existing e-commerce workflows?
- How might we make forecasting accessible for small sellers with limited budgets?

16. Crafting a Balanced and Actionable Design Challenge

Design Challenge Statement:

Design a fast, accurate, and user-friendly e-commerce sales forecasting system that predicts product demand across categories and time horizons, empowers businesses with real-time decision-making, explains forecasts clearly, and integrates seamlessly with existing platforms.

17. Validating the Problem Statement with Stakeholders for Alignment

Students / End Users: “Helps me learn how sales are predicted; needs easy interface.”

Retailers: “Useful for inventory management; add seasonal adjustment.”

Investors: “Accurate predictions reduce financial risks; need real-time dashboards.”

Tech Developers: “System architecture should support scalability and APIs.”

18. Ideation

Ideation Process:

Idea	Proposed Solution	Key Features/Benefits	Challenges
1	ML-Based Forecasting	Accurate predictions using LSTM & ARIMA	Data quality, seasonality

2	Real-Time Dashboard	Visual sales trends & predictions	UI complexity
3	Automated Alerts	Stockout/overstock warnings	Avoid false alarms
4	Platform Integration	Shopify, Amazon API integration	Compatibility
5	Explainable AI	Transparency in predictions	Balancing detail vs simplicity

Solution Concept Form

Solution Concept Form – E-Commerce Forecasting

1. Problem Statement:

Traditional forecasting methods in e-commerce are inaccurate and reactive, leading to overstocking, stockouts, and financial loss.

2. Target Audience:

E-commerce sellers, warehouse managers, marketing teams, investors.

3. Solution Overview:

An AI-powered forecasting system that predicts future sales quantities for products using historical sales data, promotions, and seasonal factors.

4. Key Features:

- Accurate sales predictions with ML algorithms.
- Real-time dashboard with visual trends.
- Automated alerts for inventory planning.
- API integration with e-commerce platforms.

5. Benefits:

- Reduces inventory costs.

- Increases revenue through better availability.
- Improves customer satisfaction.
- Saves time with automated predictions.

6. Unique Value Proposition:

Unlike traditional tools, our system provides real-time, AI-driven forecasts with explainability, transparency, and seamless integration.

7. Key Metrics:

Prediction accuracy, precision/recall, reduction in stockouts, customer satisfaction score, adoption rate.

8. Feasibility Assessment:

Feasible using existing ML frameworks, scalable with cloud infrastructure, adaptable to multiple product categories.

9. Next Steps:

- Collect and preprocess historical e-commerce sales data.
- Train models (ARIMA, LSTM, Random Forest).
- Build dashboard for visualization.

- Pilot test with small sellers.
- Scale and integrate with platforms.