# JUST-IN-TIME INVENTORY MODEL WITH ABC ANALYSIS FOR A MANUFACTURING UNIT

## 1. Background and Problem Statement:

A Tier 2 automotive parts manufacturer faced growing inefficiencies in managing raw material and component inventory. High-value parts were often overstocked, leading to capital lock-up, while essential consumables ran out frequently, halting production lines. The existing first-in-first-out approach failed to prioritize inventory based on value or usage frequency. The company sought a custom **JIT inventory model enhanced with ABC classification** to streamline procurement, minimize waste, and improve on-time production.

## 2. Objectives:

- To implement an ABC classification model for prioritizing inventory control based on consumption value
- To develop a Just-In-Time (JIT) replenishment framework for Class A and B parts
- To reduce holding costs and eliminate overstocking of non-critical Class C items
- To improve supplier coordination and lead-time compliance through predictive replenishment

## 3. Methodology:

**Data Sources:**

- Past 12 months of purchase and consumption data (volume and value)
- Lead time records per supplier
- Monthly production demand per part
- Warehouse capacity limits

**Modeling Approach:**

- **ABC Classification:**
    - A: Top 70% value – tight control, JIT replenishment
    - B: Next 20% – moderate control, buffer-based
    - C: Last 10% – bulk purchase, periodic review

- **JIT Implementation (Class A & B):**
    - Weekly delivery schedule based on BOM-linked production forecast
    - Minimum Order Quantity (MOQ) aligned to one production cycle
    - Lead time triggers linked to supplier performance score

**Tools Used:**

- Excel Dashboard for warehouse team
- SQL-connected tracking system for live consumption
- Python automation script for ABC classification updates and inventory alerts

# 4. Results:

- Class A inventory reduced by **28%** with no increase in stockouts
- 80% of Class B parts were successfully shifted to forecast-driven ordering
- Overstock of Class C items reduced by **35%**, freeing up 15% warehouse space
- Material availability for production improved from **86% to 97%**
- Improved supplier coordination reduced average lead time variance by **2.1 days**

# 5. Interpretation and Insights:

- ABC classification helped shift inventory attention to high-impact components
- JIT proved effective for Class A parts due to predictable usage and reliable vendors
- Class C items had high purchase frequency but negligible impact on production → bulk buying saved administrative effort
- Dashboards allowed real-time inventory tracking per part category, improving decision confidence

# 6. Recommendations:

- Conduct monthly ABC reviews to capture seasonality and production changes
- Expand vendor scorecard system to enforce JIT compliance via penalties or incentives
- Train procurement staff on using dashboards and reorder rules embedded in the model
- Integrate real-time alerts into the ERP system for proactive replenishment

## 7. Future Work:

- Introduce multi-echelon inventory optimization for regional warehouses
- Combine ABC-JIT model with safety stock buffers for demand uncertainty
- Apply machine learning clustering to refine ABC rules beyond value-based thresholds
- Add carbon footprint metrics to sourcing decisions as part of ESG initiatives

## 8. Stakeholder Relevance:

**Academic:**

- Illustrates the use of ABC and JIT models in real-world operations
- Applicable for coursework in supply chain, operations management, and manufacturing systems

**Corporate:**

- Offers a scalable model for manufacturing units seeking to reduce working capital and boost production efficiency
- Useful for procurement and warehouse teams working on lean inventory strategies