

# Supply Chain Management System for Perishable Goods Design Document

## Introduction

This document describes the database design for Supply Chain Management System for Perishable Goods, which aims to provide comprehensive data management solutions for enhancing shipment tracking and boosting inventory control. It will provide data on stock levels, monitor items throughout transit, monitor environmentally friendly regulations, and estimate the amount of waste that will be produced.

## Business Problems Addressed

### 1. Supplier

- **Key Design Decision:**
  - Every supplier is linked to the materials they provide, capturing the One-to-Many relationship between suppliers and materials. This allows tracking of where each material originates.
- **Business Problems Addressed:**
  - **Supplier Coordination:** Facilitates coordination with suppliers by tracking which materials are supplied by whom. This helps streamline the procurement process, reduce costs, and improve lead times.

### 2. Material

- **Key Design Decision:**
  - Materials are linked to both suppliers and manufacturers, capturing their role in the supply chain through Many-to-Many relationships. This allows the system to track which materials are used in which products and by which manufacturers.
- **Business Problems Addressed:**

- **Inventory Management:** Enables effective material tracking, supporting better stock level management and reducing the risk of material shortages or surpluses.
- **Operational Efficiency:** By identifying which materials are in demand, the company can optimize production schedules and reduce waste from excess materials.

### 3. Manufacturer

- **Key Design Decision:**
  - Manufacturers are linked to the products they produce and the distributors they supply. This One-to-Many relationship structure supports accurate tracking of manufacturing operations.
- **Business Problems Addressed:**
  - **Production Tracking:** Provides visibility into the products each manufacturer produces, aiding in efficient production scheduling and minimizing downtime.
  - **Supply Chain Coordination:** By linking manufacturers with distributors, the database helps facilitate smooth transitions from production to distribution.

### 4. Product

- **Key Design Decision:**
  - Products are linked to both warehouses and inventory records. This allows the company to track product quantities in specific locations, and supports efficient storage management.
- **Business Problems Addressed:**
  - **Inventory Optimization:** Helps track product storage across warehouses, reducing overstock and understock situations.
  - **Waste Reduction:** By monitoring perishable goods, the company can take timely actions to prevent spoilage, supporting sustainability goals.

### 5. Distributor

- **Key Design Decision:**
  - Distributors are linked to warehouses and retailers and also transporter, capturing their role in storing and distributing products to the market, through transporter
- **Business Problems Addressed:**
  - **Distribution Efficiency:** Facilitates better coordination with warehouses, enabling faster and more accurate distribution of products.

- **Supply Chain Transparency:** Supports efficient communication between the distributor, retailer, and warehouse, ensuring products are where they need to be and improving order fulfillment.

## 6. Warehouse

- **Key Design Decision:**
  - Warehouses are connected to distributors and products, enabling the company to track which warehouses are storing specific products.
- **Business Problems Addressed:**
  - **Inventory Management:** Helps manage product storage locations effectively, reducing storage costs and optimizing warehouse space.
  - **Operational Efficiency:** Supports faster and more accurate retrieval of products, improving order fulfillment and reducing delivery times.

## 7. Retailer

- **Key Design Decision:**
  - Retailers are linked to distributors and transporters, supporting efficient sourcing and delivery of products to customers.
- **Business Problems Addressed:**
  - **Coordination with Distributors:** Allows retailers to source products directly from distributors, reducing lead times and improving product availability.
  - **Enhanced Customer Service:** Ensures that retailers have the necessary products available, increasing customer satisfaction and sales efficiency.

## 8. Transporter

- **Key Design Decision:**
  - Transporters are linked to retailers and shipments, allowing for accurate tracking of product deliveries and coordination across the supply chain.
- **Business Problems Addressed:**
  - **Logistics Optimization:** Supports efficient scheduling of transporters for deliveries, minimizing delivery times and costs.
  - **Sustainability:** By optimizing delivery routes and loads, the company can reduce fuel consumption and emissions, supporting environmental goals.

## 9. Shipment

- **Key Design Decision:**
  - Each shipment is linked to a specific order, allowing precise tracking from order placement through to delivery.

- **Business Problems Addressed:**
  - **Order Fulfillment:** Facilitates accurate tracking of shipments, improving delivery accuracy and timeliness.
  - **Transparency:** Provides end-to-end visibility for orders, increasing customer trust and satisfaction.

## 10. Order

- **Key Design Decision:**
  - Orders are linked to users, tracking their purchases and connecting each order to a shipment. This supports comprehensive order management.
- **Business Problems Addressed:**
  - **Demand Forecasting:** Enables better demand analysis, helping to align inventory with customer needs.
  - **Enhanced Customer Experience:** Tracks order history, improving the ability to fulfill repeat orders and respond to customer needs efficiently.

## 11. Inventory

- **Key Design Decision:**
  - Inventory records quantities by product and warehouse location, ensuring up-to-date tracking of stock levels across all locations.
- **Business Problems Addressed:**
  - **Waste Reduction:** Helps monitor product levels and turnover, reducing the risk of spoilage for perishable items.
  - **Operational Efficiency:** Supports more accurate stock replenishment and reduces the risk of stockouts or overstocking.

# Entities and Attributes

## Supplier

- ID (PK)
- Name
- Phone number
- Address
- Email
- Material\_ID (FK)

## Manufacturer

- ID (PK)
- Name
- Phone number
- Address
- Email
- Material\_ID (FK)

## Distributor

- ID (PK)
- Name
- Phone number
- Address
- Availability (Boolean)
- Email
- Warehouse\_ID (FK)
- Transporter\_ID (FK)

## User

- User ID (PK)
- Name
- Phone number
- Address
- Email
- Order\_ID (FK) (*Linked to orders made by the user*)

## Retailer

- Retailer ID (PK)
- Name
- Phone number

- Address
- Type (e.g., Online/Physical Store)
- Email
- Transporter\_ID (FK) (*Retailers use transporters*)
- Distributor\_ID (FK) (*Retailers source products from distributors*)

## **Transporter**

- ID (PK)
- Name
- Phone number
- Address
- Mode of transport (e.g., Plane/Ship/Train/Truck)
- Distributor\_ID (FK)
- Shipment\_ID (FK)

## **Product**

- ID (PK)
- Name
- Manufacturer\_ID (FK) (*Products are made by manufacturers*)
- Price
- Type (e.g., Living products, Non-living products)
- Weight
- Size
- Expiry date
- Warehouse\_ID (FK) (*Products are stored in warehouses*)

## **Shipment**

- ID (PK)
- Estimated delivery time
- Destination
- Out-of-shipment time
- Status (e.g., In Transit/Delivered/Delayed)
- Date
- Maximum Capacity
- Transporter\_ID (FK)

## **Warehouse**

- ID (PK)
- Capacity
- Name
- Address
- Type (e.g., Living/Non-living products)

- Distributor\_ID (FK) (*Warehouses are managed by distributors*)
- Inventory\_ID (FK) (*Inventory is stored in warehouses*)

### **Inventory**

- ID (PK)
- Quantity of product
- Expiration date
- Product\_ID (FK)
- Warehouse\_ID (FK)

### **Material**

- ID (PK)
- Name
- Type (e.g., Ore, Oil, Agricultural items)
- Supplier\_ID (FK)
- Manufacturer\_ID (FK) (*Materials are supplied by suppliers and used by manufacturers*)

### **Order**

- ID (PK)
- Placing Date
- User\_ID (FK)
- Shipment\_ID (FK)

# Relationships

1. **Supplier-Material:** Many suppliers supply many materials.
  - Relationship: Many-to-Many (Many Supplier → many raw materials)
2. **Material-Manufacturer:** Different Manufacturer needs different Material
  - Relationship: Many-to-Many (Many material → many manufacturer )
3. **Manufacturer-Product:** A manufacturer produces many products.
  - Relationship: One-to-Many (One Manufacturer → Many Products)
4. **Manufacturer-Distributor:** A manufacturer produces many Distributors.
  - Relationship: One-to-Many (One Manufacturer → Many Distributor )
5. **Distributor-Warehouse**(Manufacturer to Distributor): A distributor may store products in many warehouses.
  - Relationship: One-to-Many (One Distributor → Many Warehouses)
6. **Retailer-Distributor:** A retailer sources products from a distributor.
  - Relationship: Many-to-One (Many Retailers → One Distributor)
7. **Retailer-Transporter:** A retailer may use a transporter to deliver products.
  - Relationship: Many-to-Many (Many Retailers → Many Transporters)
8. **Transporter-Shipment:** A transporter handles multiple shipments.
  - Relationship: One-to-Many (One Transporter → Many Shipments)
9. **Product-Warehouse:**(Distributor to Retailer) Products are stored in one or many warehouses.
  - Relationship: Many-to-Many (Many Products → Many Warehouses)
10. **Product-Inventory:** Each product has a specific quantity
  - Relationship: One-to-Many (One Product → Many Inventory Records)
11. **User-Order:** Users place orders for products, which could be modeled as a separate Order entity if needed.
  - Relationship: One-to-Many (One User → Many Orders)
12. **Order -Shipment :** Orders can have multiple shipments
  - Relationship: One-to-Many (One Order → Many Shipments )
13. **Distributor -Transporter:** One product distributor can have multiple transporters
  - Relationship: One-to-Many (One Distributor - Many Transporters)



# ERD



