Package Manufacturing Database System

Database Specification: Purpose, Business problems addressed, Business rules

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Database Purpose:
The packaging industry, despite being a part of the manufacturing process, is a service provider for clients. Consequently, every phase of the production process needs to be monitored in detail for quality control and improvement. Data such as inventory usage, production machine's schedule, and types of orders are detrimental for the company's performance. To achieve this, a complete and accurate database will ease the analysis that is required for the improvement and to gauge the manufacturing system's performance. The database will be mainly used by the management team, Production planner, and quality control team.

Business Problems addressed:
- Allow the staff of the manufacturing company to have report on orders placed by the customers
- Create a descriptive report on material usage to enable forecasting raw materials needed for future orders
- Create a descriptive report on possible sales opportunities for market analysis
- Provide information on product reviews for quality improvements
- Create a optimized schedule for each orders to fulfill deadlines

Business Rules:
- No partial refunds or reprocess, every orders that are being returned needs to be whole
- All raw materials orders placed to the vendors will be delivered whole (no partial delivery)
- Customers can only have 1 account and LoginID should be unique
- Subscription orders: when a subscription will be due, an order will be automatically placed and an orderID will be generated
- Customer can only pay for the whole orderID
- Customer can order one or more products

Design requirements:
1. Eliminate any multi-valued and/or composite attribute
2. Remove any repeating group
3. Avoid a many-to-many relationship
4. Pay attention to the multiplicity (cardinality and partition)
5. Make sure the type of a relationship is correct (Identifying vs Non-Identifying)
6. All entities must be connected
7. Avoid any unnecessary relationship
8. Make sure the ERD and design document match

Design Decisions:

Entity Name	Why Entity Included	How Entity is related to Other Entities
SalesOpportunities	One of the primary purposes of the database is to keep the record of the new customers, who might place a new order with new product specifications.	This entity is related to the 'Customer' entity through Many to One relationship, connected via CustomerID which is a FK in this entity. It keeps track of the number of sales opportunities brought in by the customer.
Customer	The database keeps a record of all the customers of the manufacturing company. It holds data like : Customer Name, address & contact details.	This entity is the parent entity for 'Orders', 'CustomerCredentials', 'Payment Details', 'Subscriptions' and 'SalesOpportunities'. It is related to 'Orders' so as to keep track of orders placed by the customer. It is related to the 'Orders' in a one to many relationship via the CustomerID which is a Foreign Key in 'Orders'. In a similar way, it is related to 'Subscriptions' as well. A customer can have multiple payment methods, hence it is related to the 'PaymentDetails' in a 1:n relationship.
CustomerCredentials	The database is a back-end for a web application, therefore, to log-in to the application, all customers need login credentials. It will hold the username and the password for the customers.	This entity is related to the Customer entity to store the customer's credential. Customers can only have one credential, and the LoginID should be unique since it's the primary key of this entity.
PaymentDetails	This entity holds the payment details of the customers, e.g the credit cards used to make payments in the application.	The 'PaymentDetails' entity is directly related to the Customer entity through 1:n relationship to keep the details of payment mode used by the customer. It is related to 'Customer' with the CustomerID which is the FK in the 'PaymentDetails'.
Subscriptions	Apart from holding 'Orders', the database also holds Subscription Orders. This keeps a record of the subscriptions made by the customers on specific products and after how long they want the subscription to be delivered. For scheduling, we use crontab to specify the	The Subscriptions entity has non-identifying one to many relationships between the Customer entity and Products Entity. One Customer can have multiple subscriptions and one product can have multiple subscriptions.

	next delivery date.	
Orders	Another key function of the database is to keep a record of the orders placed by the customers. It holds data such as contents of the order, date on which the order was placed, by which customer the order was placed and the status of the order (pending/processing/delivered)	The 'Orders' entity is related to the 'Products' entity through an associative entity 'OrderDetails' due to the many-to-many relationship. It is directly related to the customer table through a foreign key, so that we can have insights on the customer who placed a particular order.
OrderProducts	Since one order can have multiple products and one product can be present in multiple orders, we have a many to many relationship. To relate a product to a specific order, we have this associative entity.	This is an associative entity which identifies unique products which belong to a specific order. Every combination of OrderID & ProductID should be unique.
Products	This holds the details of the products in the manufacturing company, like name, price, specifications such as the dimensions of the product and its picture.	This entity is related to order products as the associative entity to prevent many to many relationships. This entity is also tied to reprocess, reviews, and returns to provide information about the reviews on the products, if the product is in reprocessing or being returned.
Process	This entity will keep track of each process of an order for ex. Printing, Lamination, Bag/Box making, Quality check. This will help to calculate the time to complete an order that is matching with estimated given time to the customer.	'Process' entity ties with 'Product' entity ,'ProcessType' entity as well as 'Orders' entity to keep track of each product from a particular order is in which process type of manufacturing process. On the other hand, to keep track of the quantity of materials used in each process this entity is connected to 'RawMaterials' entity.
ProcessType	This entity contains 4 manufacturing steps of a product: Printing, Lamination, Bag/Box making, Quality check. We can check the details of the process with this entity.	ProcessType entity is connected with 'Process' entity to keep track of the manufacturing step of a product.
RawMaterials	Each manufacturing process needs raw materials in order to create the products, this entity documents all types of materials that we have and maintains data of all quantities	This entity is related to Products, Process, RawMaterialPurchase, RawMaterialVendor. The quantity on hand will be tied to process (material usage) and RawMaterialPurchase (material delivery which adds the

	of the raw materials the plant has on hand for production purposes.	quantity on hand)
RawMaterialsVendors	This entity is to maintain the data of the vendors where the company will order the raw materials from. This tracks to prioritize which vendor to order from depending on the urgency of the raw materials.	This is tied to RawMaterials entity to provide information on what materials offered by the vendors and the orders made by the company to keep the vendor's information in the orders.
RawMaterialPurchase	Generally, raw materials orders for packaging manufacturing have long lead time. It is crucial for the plant to keep track of the orders made to the vendors to ensure timely delivery of the material with this entity.	This entity is related to 'RawMaterialVendors' to keep track of the order placed to the vendor and 'RawMaterials' for calculating the materials the plant has on hand.
Returns	Another important factor for the manufacturing company is to keep the track of the products which are returned by the customers with the reason for their return.	The Returns entity is related directly to the Customers entity through Many to One relationship as to keep track of the number of returns done by the customer. It is also linked to 'Orders' & 'Products' so that we know the product from which order is being returned. It is linked to the refunds in a 1:1 relationship, since a product can be returned only once. It keeps track of the status of the refund for a return.
Refunds	This entity will keep track of refunds to the customers who are not satisfied with the product. Refund process will start once the customer returns the product to the manufacturing plant.	The Refunds entity is related to the Returns entity to keep the refund details for the returns done by the customer through 1:1 relationship.
Reprocess	This entity maintains a product which fails to reach the customers expectations or fails in the quality check process and these products will again go for manufacturing.	This is related to the 'Orders' and 'Products' so that we can identify which product from which order is being reprocessed.
Reviews	The purpose of this entity is to get the reviews of products from customers once the order is completed.	The Reviews entity is related to the 'Orders' and 'Products' to keep track of the reviews for products by customers. OrderID ensures that it is a verified buy.

RawMaterial_Vendor Purchase	The purpose of this entity is to track the vendor of each material and to avoid many to many relation between RawMaterialPurchase and RawMaterialVendor	RawMaterial_VendorPurchase entity is related to RawMaterialPurchase and RawMaterialVendor to track material and their vendors of each purchase.
Vendors	This entity holds the Vendor information,like vendor's name and contact information.	Materials sold by the vendor are stored in a separate associative entity 'RawMaterialsVendors'. Vendors can be referenced using the VendorID.