***Business Case Analysis***

*WGU*

*Course Number: 605*

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**A: Business Need Identification**

GL Organics, a renowned company that produces organic and sustainable food products, is currently grappling with an inefficient inventory management system. The company frequently encounters overstocking and stockouts, resulting in a substantial waste of perishable goods and missed sales prospects. These challenges originate from an antiquated inventory system that lacks integration with sales or supply chain platforms. Consequently, businesses must implement a more efficient and responsive inventory management approach. Addressing this issue is paramount for enhancing operational efficiency, minimizing product spoilage, and ultimately elevating overall customer satisfaction.

**A1: Why Optimization Is Appropriate**

This business need can be effectively addressed through an optimization approach. It requires balancing multiple conflicting factors, such as limited warehouse space, variable supply timelines from over 100 small-scale farmers, and fluctuating customer demand. Optimization models are designed to handle such complex decision-making scenarios by identifying the most efficient outcomes based on defined objectives and constraints. In this case, an optimization model can be used to determine optimal inventory levels that minimize excess inventory and the risk of running out of stock. By leveraging optimization techniques, GL Organics can make data-driven decisions that reduce waste, lower costs, and sustainably improve product availability.

**A2: Linearity of the Optimization Problem**

The inventory management problem GL Organics faces can be classified as a linear optimization problem. The relationships between the key elements, such as order quantities, warehouse capacity, supply availability, and demand, can all be expressed using linear equations and inequalities. For instance, constraints like maximum storage space and supplier limits can be modeled linearly, and the objective function to minimize cost or waste is also linear. The simplicity and structure of a linear model make it an ideal choice for representing this business scenario.

**A3: Type of Optimization Problem**

The type of optimization problem identified is a Linear Programming problem. Linear programming is ideal for solving problems where the objective is to maximize or minimize a linear function subject to linear constraints. In GL Organics’ case, the objective could be to minimize the total cost associated with overstocking and stockouts while staying within the limits of warehouse space and supplier capabilities. LP models are particularly suitable for operational decisions like inventory control, where outcomes depend on numerous interrelated factors. This approach will provide a systematic and mathematically sound framework for improving inventory decisions and overall operational performance.

**B: Optimization Objective, Decision Variables, and Constraints**

The primary optimization objective in this scenario is to minimize the total cost associated with inventory mismanagement, specifically the costs of overstocking perishable goods and the opportunity costs of stockouts. This objective aligns with GL Organics’ goal of reducing waste and increasing customer satisfaction by ensuring consistent product availability. The decision variables in the model will include the quantity of each product to order or restock within a specific planning period. These variables will be adjusted to find each item's most cost-effective inventory levels based on projected demand and supply conditions.

Two major constraints will shape this optimization model. The first is warehouse capacity, which limits the total volume of inventory stored at any given time. This constraint ensures that the proposed inventory levels do not exceed the physical space available. The second constraint involves supply availability, as the company relies on over 100 small-scale farmers with varying delivery times and quantities. Additional constraints can include demand forecasts, the shelf life of perishable items, and minimum order requirements from suppliers.

**B1: Endpoint Considerations**

The endpoint considerations for this optimization approach include maintaining a balance between operational cost and customer satisfaction after each planning cycle. Since many of GL Organics’ products are perishable, any surplus inventory remaining at the end of the cycle may need to be discarded, resulting in additional waste and costs. Therefore, the optimization model must account for this by including inventory expiration thresholds and minimizing leftover stock beyond a product’s shelf life. Additionally, the model should ensure that stock levels do not drop below a minimum safety threshold, which helps prevent lost sales and ensures product availability. These endpoint constraints help guarantee that the optimization results are efficient at the start of the cycle and sustainable and effective throughout the entire operational period.

**C: Recommended Optimization Method**

Linear Programming is the most appropriate optimization method for the inventory management problem faced by GL Organics is Linear Programming. Linear programming is a well-established mathematical technique that finds the best possible outcome, such as minimizing cost or maximizing efficiency given a set of linear constraints and a linear objective function. In this scenario, LP is ideal because the objective is to minimize the total cost related to inventory issues, and the constraints, including warehouse capacity, supply limits, and forecasted demand, can all be accurately represented using linear equations. LP can handle multiple decision variables, such as order quantities for various products, and ensure that the solution respects all operational boundaries. Moreover, LP models are computationally efficient and can be easily implemented using widely available tools like Excel Solver, Python with PuLP, or commercial solvers such as Gurobi. By applying linear programming, GL Organics can make informed and optimal inventory decisions that align with its sustainability goals while enhancing operational performance.