

SUSTAINABLE VENDOR MANAGED INVENTORY MODEL WITH INTEGRATED ENVIRONMENTAL COST CONSIDERATION

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The Vendor Managed Inventory (VMI) is a crucial strategy in supply chain management, enabling suppliers to oversee inventory levels and streamline replenishment, thereby enhancing operational efficiency. With growing emphasis on environmental sustainability, this research extends the traditional VMI model by integrating environmental cost parameters alongside conventional costs such as holding, ordering, and transportation. The proposed model, formulated using differential equations, analyzes the trade-offs between cost minimization and environmental impact reduction, offering a comprehensive approach to inventory decision-making. Through sensitivity analysis, the model's performance is evaluated across various operational scenarios, revealing how factors like transportation frequency, order quantities, and environmental costs affect outcomes. The findings provide actionable insights into how organizations can achieve a balance between cost efficiency and environmental responsibility in inventory management. This integrated framework not only optimizes supply chain operations but also advances sustainability goals, making it a valuable tool for the future of sustainable supply chain management.

Keywords: *Vendor managed inventory, environmental costs, sustainability, Optimization.*