Optimal Inventory Allocation Policy with Product Substitution

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ABSTRACT

When customers purchase product, if the preferred product is out of stock, customers may choose another product or simply do not purchase anything and leave. In the past, enterprise managers tend to prepare more amount of hot sale products in an attempt to make more sales. Sometimes, too many units of hot sale products are allocated. As a result, stock-out of other products occurs and there are too many units of hot sale products in inventory. This research considers product substitution by calculating the probability values to find the optimal quantity of product allocation in order to reduce inventory and minimize lost-sales, and finally maximize the overall profit.

This study constructs a mathematical model and using the exhaustive search method to find the optimal quantity allocation of displayed products in a finite-capacity inventory system with product substitution. In addition, this research proposes an improved search method that can solve the problem with better efficiency. Comparison is made on the total expected profit under the optimal product allocations with and without consideration of product substitution. The result shows that the total profit is higher the effect of product substitution is taken into account. Sensitivity analysis is conducted on parameters including the probability of product substitution, the basic demand quantity and total capacity. This research demonstrates the parameters influence decision making and profits. The developed single-period model is further extended to the multi-period model, where a periodic replenishment strategy is implemented. The optimal replenishment period length that maximizes the total expected profit is discussed.

Keyword: Product substitution、Capacity constraint、Quantity allocation