A Decision Support Tool (DST) for Inventory Management

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ABSTRACT
Loss of customer goodwill is one of the greatest losses a business organization can incur. One reason for such a loss is stock outage. In an attempt to solve this problem, an overstock could result. Overstock comes with an increase in the holding and carrying cost. It is an attempt to solve these twin problems that an economic order quantity (EOQ) model was developed. Information on fifteen items comprised of 10 non-seasonal and 5 seasonal items was collected from a supermarket in Ikot Ekpene town, Nigeria. The information includes the quantity of daily sales, the unit price, the lead time and the number of times an item is ordered in a month. Based on this information, a simple moving average and y-trend method of forecasting were used to forecast the sales quantity for the following month for the non-seasonal and seasonal items. The forecast value was used to compute the EOQ for each of the items. Different scenarios were created to simulate the fuzzy logic EOQ after which the result of the conventional method, EOQ method, and fuzzy EOQ methods were obtained and compared. It was revealed that if the EOQ method is adopted, savings of 43% of holding and carrying cost would be made. From the scenarios of a fuzzy EOQ, a savings of 35.65% was recorded. It was however observed that in a real-life situation, the savings on a fuzzy EOQ is likely to be higher than that of an EOQ considering the incessant public power outages and the increase in transportation fares due to the high cost of fuel and the bad state of roads in Nigeria. To this end, a Decision Support Tool (DST) was developed to help the supermarket manage its inventory based on daily predictions. The DST incorporates a filter engine to take care of some emotional and cognitive incidences within the environment.

KEYWORDS
Database, Decision, EOQ, Filter Engine, Forecast, Fuzzy Logic, Holding Cost, Imprecision, Inventory, Knowledge Base, Lead Time, Management, Model, Ordering Cost, Re-Order Point, Uncertainty

1. INTRODUCTION
The business world is competitive, such that everyone is driving towards having an edge over another. Loss of customers’ goodwill is one index that could hamper the business environment and in effect, leads to a loss. One common way of losing a customer’s goodwill is to have a stock out when a customer needs an item. The customer simply gets out buying from another shop or gets a better service from another shop and may likely continue with the new-found service provider, thereby withdrawing his patronage from his erstwhile customer. The current practice of taking previous historical demands to calculate the average for the next forecasting period has caused a lot of setbacks leading to inaccurate

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forecasts. This in effect has caused stock out thereby leading to loss of customers’ goodwill and its attendant financial loss.

The Economic Order Quantity and Reorder Point (EOQ/ROP) models are long used models though many establishments have not really been using them. The EOQ model was first proposed in Harris (1913). The EOQ model has practical applications in illustrating the concept of cost tradeoffs as well as specific application in inventory (Roach, 2005). The following assumptions are made in using the EOQ model: (a) instantaneous delivery (b) batch ordering (c) deterministic demand (not applicable in real life) (d) replenishment is done when inventory is zero (does not happen in real life) (e) shortages are not allowed (f) all cost coefficients are known.

The relevant costs for the EOQ model are holding cost and ordering cost. The economic parameters for the model are as follows:

\[ C = \text{Ordering cost} \]
\[ T = \text{Holding cost} \]
\[ D = \text{Rate of demand} \]
\[ TM = \text{Total cost per unit time} \]
\[ D/Q = \text{Number of orders per month} \]

Total cost of ordering quantity (\( Q \)):

\[ TM(Q) = C \frac{D}{Q} + \frac{Q}{2} T \]  

\[ \therefore \frac{d}{dQ} TM(Q) = - \frac{CD}{Q^2} + \frac{T}{2} \]  

At the turning point:

\[ \frac{d}{dQ} TM(Q) = 0 \]

That is:

\[ \frac{T}{2} - \frac{CD}{Q^2} = 0 \]  

\[ \frac{CD}{Q^2} = \frac{T}{2} \]  

\[ \frac{Q^2}{1} = \frac{2CD}{T} \]
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