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A WEB APPLICATION FOR THE REORDER LEVEL AND REORDER QUANTITY

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Abstract: Connected supply chain is one of the technologies, which is focused on innovation for enhancing the experience of each stakeholder in the system. With the fast evolving nature of digital transformation and globalization , a connected end to end supply chain aims to provide comprehensive visibility and a shared view across the manufacturing enterprise , suppliers ,customers ,outsource partners and other trading partners .Ensuring integrated supply chain operations and management will enable manufactures to better anticipate and serve customer requirements and supply chain demand. In this paper, we develop functional aspects of a Web application that works as a *smart* inventory manager for *small scale retail* business. It assists to find the reorder point (or level) and reorder quantity for each item (fast moving consuming goods) every day. If the reorder level is more or equal to the closing stock value then the application alerts the quantity to be ordered.

Key Words: Connected supply chain, inventory cost, reorder level, reorder quantity.

1. Introduction

Supply chain management systems are effective in minimizing the inventory cost in the production cycle. A reorder level in a connected supply chain plays a significant role in identifying the purchase needs. In this paper, we study the following structure in the supply chain market.

1. **Primary- Company to Distributor Supply: This basically indicates the value / volume of the stocks that the distributor purchased from the Company directly.**
2. Secondary - Distributor to Retailer / Merchant Supply: The value / volume of the stocks that the retailer purchased from the distributor.
3. **Tertiary - The value / volume of the stocks that the retailer / merchant sold to the end user/customer.**

While the distributor does the primary, he knows the inventory management and knows the stock values as they maintain all purchases and sales in the system. But in the case of retailer, who do not maintain the sales and purchases in the system, it is very difficult to create the purchase order for the fast moving consumables he requires from the distributor. To meet such challenges, we discuss the methodology in generating the purchase order instantly and we propose the web application which is unique and efficient in identifying the purchase requirements and also in updating the reorder level and the reorder quantity for placing the new order such that the inventory cost is minimum. The proposed web application is highly useful for small scale retailers.

One of those technologies is connected supply chain, which focuses on innovation to improve the experience of each participant in the system. A linked end-to-end supply chain strives to provide full visibility and a common view across the manufacturing enterprise, suppliers, customers, outsourcing partners, and other trade partners, given the fast-evolving nature of digital transformation and globalization. Manufacturers will be able to better predict and service consumer demands and supply chain need by ensuring integrated supply chain operations and management [1,2,3,4,5,6,7].

2. Problem statement

TO FRAME AN OPTIMAL INVENTORY POLICY *FOR SMALL SCALE RETAIL BUSINESS*, FORMULATING THE TWO RULES:

- A rule indicating when to replenish.
- A rule indicating the amount to replenish.

3. Objective

To fix the following issues of a retailer:

- The distributor Sales person will check all the stock levels in the store manually to create a requirement list. While creating this requirement list, keeping his targets from distributor, distributor sales men may create the order for unwanted stocks also. This will be a burden to the Retailer/Merchant.
- Retailer himself needs to check all the stocks manually and need to generate the Purchase order for his requirements. In this case, rather than spending his valuable time on sales, retailer would be spending his valuable time on all stock levels manually.

4. Proposed Methodology

- Retailer/Merchant manually enter all the current stocks available in the store in the Application.
- Whenever the Merchant receives the (inward) stocks from the distributor, he will update the stocks in the application.
- At the end of each day, merchant updates the sales data in the portal.
- Based on the history of sales and purchases the proposed application automatically suggest the reorder level/quantity and places the order.

5. Parameters

- k: the unit set up cost.
- c: the unit purchase cost.
- h: unit holding cost per item.
- π: unit penalty cost per item.
- Q: demand variable (can be treated as sales data in the present procedure).
- q_L: demand variable during lead time
- M: the number of items demanded per unit time, which can be obtained from sales data from retailer.
- L: length of the interval between placing and receiving orders, lead time
- M_L: expected number of items demanded during an interval of L units of time.

The following tables/templates are used to update the data (purchase orders to be added/deleted/managed apart from sales per unit time) for the algorithm. They help us in computing the average demand per unit time, the average lead time, average demand during the average lead time, reorder point and reorder quantity,.

1. PARAMETERS

Table 1

PARAMETERS FOR THE ALGORITHM					
DATE	**ITEM NAME**	**AVERAGE ITEM COST, c**	**SETUP COST, $k = 10\%c$**	**UNIT HOLDING COST, $h = 10\%c$**	**UNIT PENALITY COST, $\pi = 5\%c$**

2. SALES

Table 2.1

MANAGE SALES TILL TODAY						
ITEM NAME	DATE	OPENING STOCK	CLOSING STOCK	SALES	SHORTAGE	**Alert for the Reorder Quantity from Algorithm**

Table 2.2

ADD SUPPLIERS/ITEMS (SHOWS ALL SUPPLIERS TILL TODAY)		
ITEM NAME	SUPPLIER NAME	ADD

Table 2.3

DELETE SUPPLIERS/ITEMS (SHOWS ALL SUPPLIERS TILL TODAY)		
ITEM NAME	SUPPLIER NAME	DELETE

3. ORDERS

Table 3.1

ADD ORDERS (SHOWS ALL ORDERS TILL TODAY)		
ITEM NAME	SUPPLIER NAME	ADD

Table 3.2

DELETE ORDERS (SHOWS ALL ORDERS YET TO BE DELIVERED TILL TODAY)		
ITEM	SUPPLIER	DELETE

Table 3.3

MANAGE ORDERS (SHOWS ALL SUPPLIES TILL TODAY)							
ITEM NAME	SUPPLIER NAME	ITEM COST,c	QUANTITY ORDERED	QUANTITY DELIVERED	ORDER DATE	DELIVERY DATE	LEAD TIME

4.Algorithm implementation

Table 4.1

Probability distribution of demand variable q (from sales data)				**Average Demand, M**
q				$M = \sum qp(q)$
p(q)				

Table 4.2

Computation of average lead time L (from ordered history)				**Average Lead time, L**
Quantity of the Order: q_o				$L = \frac{\sum q_O l_O}{\sum q_O}$
Frequency of order: f_o				
Average Lead Time: l_o				

Table 4.3

Demand distribution during lead time L				Average demand during lead time, M_L
Demand during the lead time: $q_L = L\frac{q_0}{l_0}$				$M_L = \sum q_L p_L(q_L)$; Cumulative distribution during leading time $P_L(y) = \sum_{q_L \le y} p_L(q_L)$
$p_L(q_L) = \frac{f_0}{\sum f_0}$				

Table 4.4

Alert for the Reorder Quantity from Algorithm				
DATE	ITEM NAME	ALERTED QUANTITY, q_a	ORDERED QUANTITY q_a	SUPPLIER

6. Algorithm

Step 1: set initial trial value for Q as $\sqrt{\frac{2KM}{h}}$

Step 2: compute R as $1 - \frac{hQ}{\frac{1}{2}hM_L + M\pi}$ using the current trial value for Q and find corresponding trial value for s as the smallest value of s such that $P_L(s) \geq R$(determination of reorder point)

Step3: stop if the new trial s is sufficiently close to the previous trial value. Otherwise calculate a new trial value of Q as

$\sqrt{\frac{2KM}{h} + (M_L + \frac{2M\pi}{h})(\sum_{ql>} (q_L - s)p_L(q_L))}$ (determination of order quantity) and return to step 2

Step4: current s and Q are the required values

7. Constraints

The factors (from retailers' standpoint) that limit the reorder quantity are:

- Setup or reorder cost (expense associated with processing and receiving the order).
- Inventory holding cost (capital invested on stock that might otherwise profitably

employed + expenses on storage/maintenance/insurance etc).

- Penalty cost or profit loss(expense on inventory if the out of stock cost is high, which comes from wholesalers' extra expense from keeping backlog records to fill the order in the later shipment).

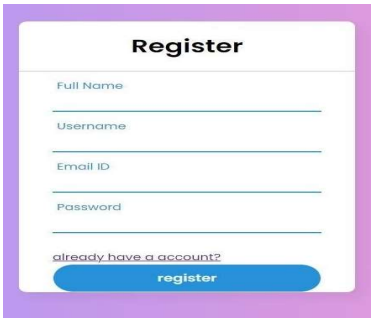
8. Assumptions

- The probability distribution of demand during a lead time pL(qL) does not depend on when the inventory reaches the reorder point, s
- The inventory level can be treated as a continuous variable
- After a replenishment order arrives, ra replenishment order arrives, there exists a future moment in time when inventory level is s, and a reorder action occurs as a consequence.
- In an optimal policy, the reorder points is greater than 0 and during any lead time, actual demand does not exceed the order quantity (qL ≤Q).

9. Implementation Screens

Screen 1

Screen 2



Screen 3: Register User: When a user tries to access the portal for the first time, he/she will

have to create an account by entering the required details.

Screen 4: Login: On creating an account, the user can login to the portal using valid credentials

11. Conclusions

In any business venture, inventories play a vital role. . Inventory constitutes major parts, approximately 40% to 80% of gross working capital depending upon the nature and size of the industrial unit. If the inventories are not controlled effectively it will create many problems in the industry. So there is a need for every company to control its inventory in all stages. The proposed methodology describes some functional aspects of the application which works as a *smart* inventory manager for *small scale retail* business and determines the reorder point along with reorder quantity of a fast moving item.

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