An Incentive Production Quantity Model for Pharmaceutical Products with Floor Space and Budget Constraints

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Abstract: Inventory is the critical strategy that requires cautious choice to turn into a creation. The choice turns out to be basic when the items are natural products, vegetables, pharmaceuticals, unstable fluids (crumbling items) and so forth., In this paper author explores manufacturer and buyer creation model for pharmaceuticals products with budget and floor space constraint. Lagrange's multiplier method is utilized to tackle this kind of issue. So as to diminish the total inventory cost, optimal order quantity and backorder levels are resolved and furthermore floor space and budget constraint should be fulfilled.

Keywords: Order quantity, Lagrange's multiplier technique, Floor space and Budget constraint.

1. INTRODUCTION

The pharmaceutical business can be described as a complex of methodology, assignments and affiliations connected with the disclosure, advancement and production of medications and drugs. Instructions to decide the optimal ordering policy for deteriorating items like pharmaceutical products has received a very little attention by the analysts. In this paper, we have built an incentive production model for the manufacturer and buyer to obtain optimal replenishment cycle time to satisfies the floor space and budget constraint.

Babu et al. [1] made incorporated production stock model for purchaser – seller with amount markdown for fixed life time items. Haj Meeral et al. [2] read an EPQ model for decaying items with spending requirements. Hemamalini et al. [3] created EOQ stock model for purchaser seller with screening, arranged expense and controllable lead time. Ravithammal et al. [4] investigated EOQ stock model utilizing mathematical technique with stock level imperative. Muniappan et al. [5] developed an incorporated financial request amount model including stock level and waret house limit imperative. Vediappan et al. [6] created incorporated coordination stock model for purchaser – seller utilizing Lagrange Multiplier Technique.

2. ASSUMPTIONS AND NOTATIONS

The model uses the following notations and assumptions. The notations are similar to those in Haj Meeral et al. [2].

Notations

D	Demand rate
P	Production rate
R_1, R_2	Buyer's and Manufacturer unit ordering cost
s	Buyer's shortage cost
p	Buyer's purchase cost
Q	Economic Order quantity
Q_1	Backorders level
H_b, H_v	Buyer's and Manufacturer unit holding cost
s_c	Manufacturer unit screening cost
n	Manufacturer order multiples
F	Space involved per item
X	Total accessible storage space
W	Maximum available inventory

Assumptions

(i) Demand is considered as a consistent.
(ii) Shortages are taken into account buyer and manufacturer screened the harm items.
(iii) System cost contains both buyer and manufacturer cost and furthermore fulfills the floor space and budget constraint. Mathematically, the constraint will be written as $FQ \leq X$ and $pQ \leq W$.

3. MODEL FORMULATION

Integrated system is combination of buyers cost and manufacturers cost and it will written as

$$TC_s = \frac{D}{Q}\left(R_1 + \frac{R_2}{n}\right) + \frac{H_b Q_1^2}{2Q} + \frac{s(Q - Q_1)^2}{2Q} + \frac{H_v nQ}{2}\left(1 - \frac{D}{P}\right) + \frac{s_c nQ}{2}$$

subject to the constraints

$$FQ \leq X.$$
$$pQ \leq W$$

The buyer cost contains, ordering cost $\frac{R_1 D}{Q}$, holding cost $\frac{H_b Q_1^2}{2Q}$ and shortage cost $\frac{s(Q-Q_1)^2}{2Q}$ and the manufacturer cost contains the setup cost $\frac{R_2 D}{nQ}$, the holding cost $\frac{H_v nQ}{2}\left(1 - \frac{D}{P}\right)$ and the screening cost $\frac{s_c nQ}{2}$.

Here, we consider the buyer's budget constraint and floor space constraint. Now, Lagrange multiplier functions $\alpha, 0 \leq \alpha \leq 1$ and $\mu, 0 \leq \mu \leq 1$ is added on integrated system cost and it can be written as follows:

$$TC_s = \frac{D}{Q}\left(R_1 + \frac{R_2}{n}\right) + \frac{H_b Q_1^2}{2Q} + \frac{s(Q - Q_1)^2}{2Q} + \frac{H_v nQ}{2}\left(1 - \frac{D}{P}\right) + \frac{s_c nQ}{2} + \alpha(FQ - X) + \mu(pQ - W)$$

The above equation will be written as

$$TC_s = \left(\frac{H_b + s}{2Q}\right) Q_1^2 - sQ_1 + \frac{D}{Q}\left(R_1 + \frac{R_2}{n}\right) + \frac{sQ}{2} + \frac{H_v nQ}{2}\left(1 - \frac{D}{P}\right) + \frac{s_c nQ}{2} + \alpha FQ + \mu pQ - \alpha X - \mu W$$

This is in the form of $c_1 Q_1^2 + c_2 Q_1 + c_3$.

Q_1 will be taken as, $Q_1 = \frac{-c_2}{2c_1}$

Now, $Q_1^* = \frac{sQ}{H_b + s}$

Again, the equation will be written as

$$TC_s = \left\{ \frac{sH_b + n\left[H_v\left(1 - \frac{D}{P}\right) + s_c\right](s + H_b) + 2(\mu p + \alpha F)(s + H_b)}{2(s + H_b)} \right\} Q + \left\{ R_1 D + \frac{R_2 D}{n} \right\} \frac{1}{Q} - \alpha X - \mu W$$

This is in the form of $c_1 Q + \frac{c_2}{Q} + c_3$.

Q will be taken as, $Q = \sqrt{\frac{c_2}{c_1}}$

Now, $Q^* = \sqrt{\frac{2D\left(R_1 + \frac{R_2}{n}\right)(s + H_b)}{sH_b + \left(nH_v\left(1 - \frac{D}{P}\right) + ns_c + 2(\mu p + \alpha F)\right)(s + H_b)}}$

Where $\alpha = \frac{2DF^2\left(R_1 + \frac{R_2}{n}\right)(s + H_b) - X\left\{sH_b + \left(nH_v\left(1 - \frac{D}{P}\right) + ns_c + 2\mu p\right)(s + H_b)\right\}}{2FX^2(s + H_b)}$

$$\mu = \frac{2Dp^2\left(R_1 + \frac{R_2}{n}\right)(s + H_b) - W\left\{sH_b + \left(nH_v\left(1 - \frac{D}{P}\right) + n\, s_c + 2\alpha F\right)(s + H_b)\right\}}{2W^2 p(s + H_b)}$$

4. CONCLUSION

This model is created for pharmaceutical products of buyer and manufacturer with shortage for buyer. Incorporated integrated system cost is produced for system enhancement. Likewise the model fulfils floor space and budget level constraint. This sort of issues is understood by utilizing Lagrange's multiplier Technique. Further the proposed model can be reached out to consider quantity rebate, stock level requirement, and so on.,

5. REFERENCES

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