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A Comparative Study of Small Scale Industries Involving with and Without Shortages

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Abstract: In this paper, we develop an economic order quantity inventory model for various items which will minimize the total inventory cost. The study took place at a small business scale of industries (Fitness Gym). This paper takes into consideration of two cases like shortage and no shortage. In both cases total annual inventory costs for various items are calculated. The results obtained for various items are summarized which shows that the optimum cost in both case.

Key words: Inventory · EOQ · Shortage · Small scale industries

INTRODUCTION

Inventory plays a vital role for running the activities of every organization. It helps to improve the production and distribution process both are linked by inventory. Current asserts and working capitals need the investment in inventories. It gives enhancement of the organization. Thus it is very important and to have proper control and management of inventories. Ordering in right quantities at right time is always a crucial issue in many small scale industries because demand is uncertain and difficult to forecast.

Aghezzaf *et al*. [1] developed distribution and inventory management in supply chains of high consumption products. Chien *et al*. [2] studied an integrated inventory allocation and vehicle routing problem. Padmanabhan and Whang [3] analyzed information distortion in a supply chain: the bullwhip effect. Muniappan *et al*. [4] developed a production inventory model for vendor–buyer coordination with quantity discount, backordering and rework for fixed life time products. Muniappan *et al*. [5] analyzed an EOQ model for deteriorating items with inflation and time value of money considering time-dependent deteriorating rate and delay payments. Parlar [6] developed probabilistic analysis of renewal cycles: An application to a non Markovian inventory problem with multiple objectives. Ravithammal *et al*. [7] studied an integrated production inventory system for perishable items with fixed and linear backorders. Ravithammal *et al*. [8] developed a deterministic production inventory model for buyer-manufacturer with quantity discount and completely backlogged shortages for fixed life time product.

The rest of the paper is organized as follows: In section 2, assumptions, notations and model formulation of with and without shortages are given. In section 3 conclusions are given. Finally summary are presented.

Model Formulation
Assumptions:

- Demand rate D is uniform and known.
- Lead time is zero.
- h, s denotes holding cost and shortage cost per order respectively.
- c_s denotes ordering cost per order.
- Q, Q_s denotes EOQ for without and with shortage respectively.
- TC, TC_s denotes total cost for without and with shortage respectively.

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Table 1: Summary of solution of without shortage

Items	Setup Cost	Demand	Holding Cost	Q	TC
Tread Mill	102000	20320	32000	359.9	1151733.02
Elliptical	86000	24150	1800	480.38	8646872.266
Spin Bike	48000	27980	8000	589.711	4717694.352
Upright Bike	42000	8625	7000	321.71	2251999.111
Recumbent Bike	46000	14490	8200	403.20	3306244.99
Rowing Machine	75000	14490	36000	425.5878	5107053.945
Functional Training	120000	14490	36000	310.805	11188944.592
Multi functional Bench	17000	20320	4000	415.595	1662383.830
Hype Extension	15000	9660	8200	187.993	1541544.679
Abdominal Bench	12000	24150	4000	380.657	1522629.30
Four Station	95000	24840	12000	627.136	7525636.185
Dumb bells	160	24840	4000	43981	175927.257
Aerobic Steps	4500	54150	300	269.165	807496.1300
Ankle Weight	650	20320	1500	132.7051	199057.780
Andicine Ball	1300	9660	1100	151.1050	166215.522
Gym Ball	1499	20320	1500	201.526	302289.6624
Resistance Tube	1500	20320	4000	123.450	493801.579
B Ball	7990	24150	1500	507.228	76838.6819
F Roller	3500	9660	1100	247.93	272730.6363

Table 2: Summary of solution of with shortage

Items	Setup Cost	Demand	Holding Cost	Shortage Cost	Q_S	Ts_s
Tread Mill	102000	20320	32000	200	14427.03	907, 693.008
Elliptical	86000	24150	1800	250	4104.37	1, 012, 039.849
Spin Bike	48000	27980	8000	350	2875.89	965, 874.243
Upright Bike	42000	8625	7000	300	1586.97	456, 527.99
Recumbent Bike	46000	14490	8200	300	2146.195	621, 135.27
Rowing Machine	75000	14490	36000	250	2979.06	729, 579.135
Functional Training	120000	14490	36000	200	4181.45	831, 671.418
Multi functional Bench	17000	20320	4000	100	2661.07	259, 620.732
Hype Extension	15000	9660	8200	250	1092.93	265, 153.745
Abdominal Bench	12000	24150	4000	100	2437.34	237, 794.7465
Four Station	95000	24840	12000	250	4344.925	1, 075, 090.883
Dumb bells	160	24840	4000	50	401.202	19, 812.45
Aerobic Steps	4500	24150	3000	40	2346.4	92, 626.158
Ankle Weight	650	20320	1500	50	738.870	35, 751.832
Andicine Ball	1300	9660	1100	40	806.67	31, 153, 0200
Gym Ball	1499	20320	1500	50	1122.04	54, 292.826
Resistance Tube	1500	20320	4000	50	1111.05	3491704.450
B Ball	7990	24150	1500	50	2846.79	135, 561.79402
F Roller	3500	9660	1100	50	492.867	56, 868.268

Case i EOQ Without Shortage: The ordering quantity which minimizes the balance of cost between the inventory holding cost and ordering cost is known as economic ordering quantity. Without shortage, order quantity and optimum total cost is given as follows: The order quantity is defined as $Q = \sqrt{\frac{2Dc_S}{h}}$ and the and optimum total cost is given as $TC = \sqrt{2Dhc_S}$.

Case ii EOQ with Shortage: In this case, the order quantity is defined as $Q_S = \sqrt{\frac{2Dc_S(h+s)}{hs}}$ and the optimum total cost is given as $TC_S = \sqrt{\frac{2Dhsc_S}{(h+s)}}$.

CONCLUSION

This paper focus on a comparative study of small scale industries involving with and without shortages. In both cases economic order quantity and optimal cost is developed. The goal of the model is to find the optimal EOQ which minimize the total inventory cost. In both cases the optimal results are summarized for various items which show the optimum annual total cost.

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