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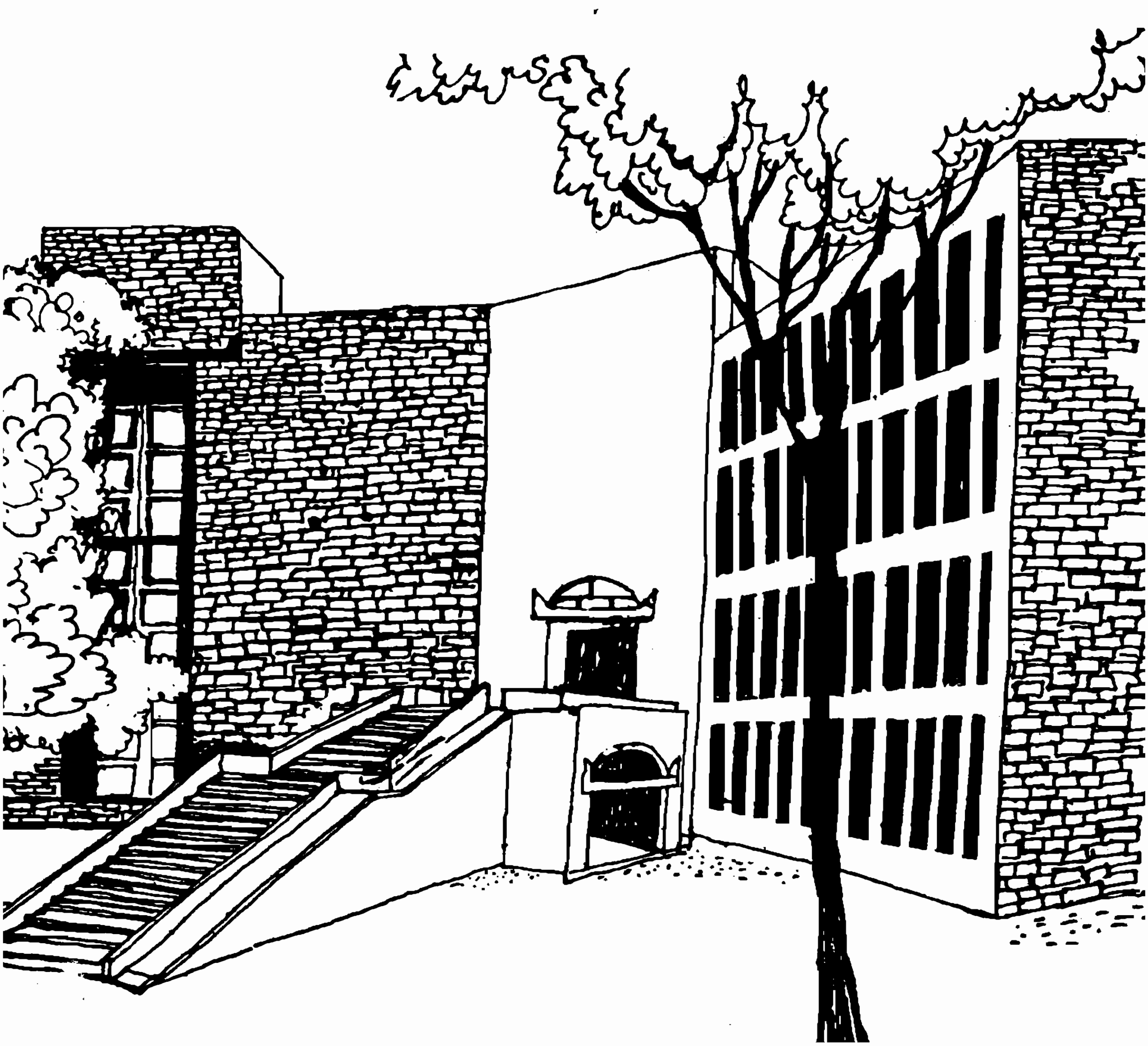

DETERMINISTIC LOT-SIZE INVENTORY MODEL WHEN DELAY IN PAYMENTS ARE PERMISSIBLE FOR A SYSTEM WITH TWO STORAGE FACILITIES

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Abstract

In this Paper a mathematical model of the economic order quantity with two storage facilities for single item has been considered under the conditions that when the fixed delay in payments are permissible by the supplier. In practice, however, supplier allows some fixed delay in settling the account after receiving goods, and no interest charges are payable on the out-standing as long as the account is settled within the specified delay period. The inventory system under consideration does not have sufficient space to accomodate the on-hand inventory. In such situation W units are stored at Own Warehouse (OW), and excess inventory is required to be kept in Rented Warehouse (RW). The holding costs at RW are higher as compared to OW. In this paper an attempt is made to analyse: a) when the system has both the warehouses facilities to accomodate the order quantity; b) when the OW has large capacity to store the on-hand inventory; c) when one does not wish to take RW services and stores maximum of OW capacity; and d) when simple EOQ model of single storage systems. The system suggest that when to hire RW services for more profitability among the given four alternatives. An expression for optimal order quantity is derived for all the above cases with an example to illustrate the methodology.

DETERMINISTIC LOT-SIZE INVENTORY MODEL WHEN DELAY IN PAYMENTS ARE PERMISSIBLE FOR A SYSTEM WITH TWO STORAGE FACILITIES

INTRODUCTION

In the classical EOQ models with or without shortages, it is implicitly assumed that the payment of an order is made as soon as the goods are received by the system. In practice, however, supplier allows some fixed delay in settling the accounts; and no interest charges are payable on the outstanding amount as long as the account is settled with- in the specified delay period. The supplier will obviously charge higher interest if the account is not settled by the end of the permissible delay period. This brings some economic advantages to buyer as he would try to earn some interest from the revenue received during the period of permissible delay. Goyal [2] has studied an EOQ model under this situation. Shah, Patel and Shah [11] have studied the same model by allowing shortages. Mandal and Phaujdar [4] studied the above mentioned authors model by including interest earned from the sales revenue on the stock remaining beyond the settlement period.

When the inventory system under consideration does not have sufficient storage capacity to accomodate the on-hand inventory in their Own Warehouse(OW), excess inventory is required to be kept in Rented Warehouse (RW). Such type of system has been studied by Hartley [3] Sarma [7,8,9], Murdeshwar and Sathe [5], Dave [1] , and Shah and Shah [10]. They all have considered deterministic models.

In this paper modifications of the above discussed models

[2,4,11] are considered, where the system is buying quantity Q = DT in bulk order, which is larger than the capacity W of OW. Consequently, W units are stored at OW and the excess (DT-W) units are stored at RW. The capacity of RW is assumed to be sufficiently large. Initially, demands are satisfied from RW in order to bring down the over all holding cost. The holding costs at RW are higher as compared to OW.

This paper also examine the effect of permissible delay in payment for a system with two storage facilities for single item and expression for optimal order quantity are obtained.

ASSUMPTIONS AND NOTATIONS

Following assumptions are made to develop the mathematical model:

i) The demand rate is deterministic.

ii) Shortages are not allowed. Lead time is zero.

iii) During the time period, when the account is not settled, generated sales revenue is deposited in an interest bearing account. At the end of this period the account is settled and interest charges are payable on the items in stock.

iv) The time horizon is infinite.

v) Storage capacity of OW is W, and that of RW is infinite. If the order quantity exceeds W, then excess units are kept in RW.

NOTATIONS

Following notations are used in the construction of mathematical model:

D = Demand rate per time unit.

F = Unit stock holding cost at RW excluding interest charges.

H = Unit stock holding cost at OW excluding interest charges.

I_c = Interest charges per rupee per year.

I_e = Interest that can be earned on the sales revenue of units sold during the permissible delay period ($I_e < I_c$).

A = Ordering cost per order

T^* = Permissible delay period in settling the accounts.

T = Cycle time.

W = Capacity to store number of units in own warehouse.

C = Purchase cost per unit.

CONSTRUCTION OF COST FUNCTION

The cost function is constructed by taking into account set up cost, holding cost and interest earned and paid. Two cases may arise here, viz. i) $T^* \leq T$ and ii) $T^* > T$.

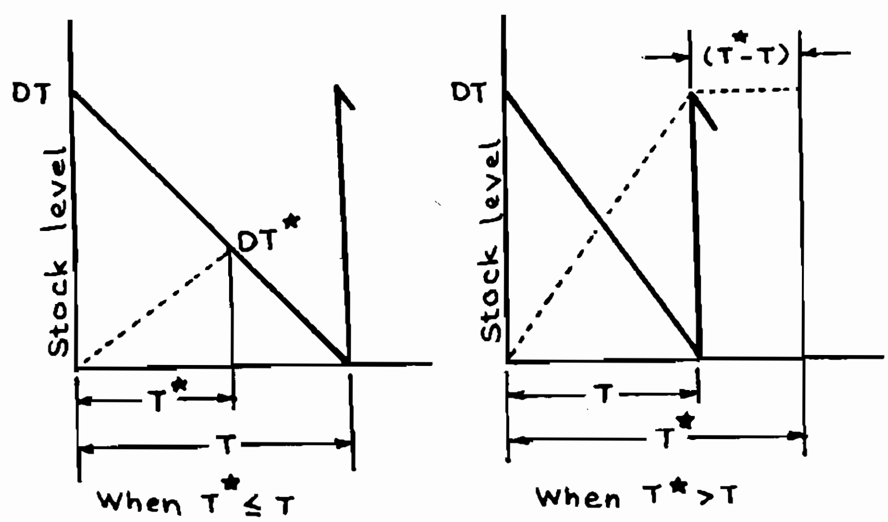

Figure 1 : Time weighted inventory level

It can easily be seen from figure 1 that per time unit cost consists of the following variable costs.

i) Cost of placing an order per time unit is A/T

ii) Total holding cost at RW per time unit is

$F(DT - W)^2/2DT$

iii) Total holding cost at OW per time unit is

$HW(1 - W/2DT)$

iv) Interest payable per time unit is

$DCI_c(T - T^*)^2/2T$, if $T^* \leq T$, and is zero if $T^* > T$.

v) Interest earned per time unit is

$DCI_e T^{*2}/2T$, if $T^* \leq T$.

and $DCI_e(T^* - T/2)$ if $T^* > T$.

Note that the interest earned should be subtracted from other variable costs in order to get the net total variable costs per time unit.

In order to obtain the total cost equation, both cases are discussed below:

CASE - I : DETERMINATION OF ORDER QUANTITY WHEN $T^* \leq T$

In this case the total variable cost per time unit is given by

$$Z_1(T) = A/T + F(DT - W)^2/2DT + HW - HW^2/2DT$$
$$+ DCI_c(T - T^*)^2/2T - DCI_e T^{*2}/2T$$
$$= (1/2DT)[2AD + (F - H)W^2 + D^2CT^{*2}(I_c - I_e)]$$
$$+ (DT/2)(F + CI_c) - [(F - H)W + DCI_c T^*] \qquad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

For minimum total cost per unit time, the optimum value of $T = T_{1o}$ will be solution of the $dZ(T)/dT = 0$, which gives

$$T_{10} = [\{2AD + (F - H)W^2 + D^2CT^{*2}(I_c - I_e)\}/(D^2(F + CI_c))]^{1/2} \qquad \ldots\ldots\ldots(2)$$

Then, the optimum order quantity is

$$Q_{1o}(T_{1o}) = DT_{1o}$$

$$= [\{2AD + (F - H)W^2 + D^2CT^{*2}(I_c - I_e)\}/(F + CI_c)]^{1/2} \quad \ldots\ldots\ldots(3)$$

and minimum total cost $Z_1(T_{1o})$ per time unit is

$$Z_1(T_{1o}) = [(F + CI_c)\{2AD + (F - H)W^2 + D^2CT^{*2}(I_c - I_e)\}]^{1/2} - [(F - H)W + DCI_cT^*] \quad \ldots\ldots(4)$$

As a result of permissible delay in settlement of replenishment account, the order quantity obtained (3) is generally higher than the order quantity of classic EOQ model. The extent of such a change in the order quantity depends entirely on the parameters of the problem situation.

When $F = H$, optimum value of T is

$$T_{1o} = [\{2AD + D^2CT^{*2}(I_c - I_e)\}/\{D^2(H + CI_c)\}]^{1/2} \quad \ldots\ldots\ldots\ldots\ldots(5)$$

$$Q_{1o}(T_{1o}) = [\{2AD + D^2CT^{*2}(I_c - I_e)\}/(H + CI_c)]^{1/2} \quad \ldots\ldots\ldots\ldots(6)$$

and

$$Z_1(T_{1o}) = [(H + CI_c)\{2AD + D^2CT^{*2}(I_c - I_e)\}]^{1/2} - DCI_cT^* \quad \ldots\ldots\ldots(7)$$

Equations obtained in (5), (6) and (7) are same as those given by Goyal [2].

Further, when $I_c = I_e = 0$, $F = H$ and $T^* = 0$, then

$$T_{2o} = [2A/DH]^{1/2} \quad \ldots\ldots\ldots\ldots\ldots(8)$$

$$Q_{1o}(T_{1o}) = DT_{1o} = [2AD/H]^{1/2} \quad \ldots\ldots\ldots(9)$$

and

$$Z_1(T_{1o}) = [2ADH]^{1/2} \quad \ldots\ldots\ldots\ldots(10)$$

Equation (8), (9) and (10) are same as those of classical EOQ model of Naddor [6].

Suppose that we do not wish to use RW at all, then we order W units per replenishment i.e. we take $DT'_1 = W$, where $T'_1 = W/D$ is cycle time. In this case the total cost per time unit due to OW is

$$Z(T'_1) = (1/2W)(2AD + D^2 CT^{*2}(I_c - I_e) + (W/2)(H + CI_c) - DCI_cT^* \qquad \text{...........(11)}$$

If the cost in (4) is less than (11), it is better to hire RW services.

CASE II: DETERMINATION OF ORDER QUANTITY WHEN $T^* > T$

In this case interest charges are not paid for the items kept in stock. The total cost per time unit is then given by

$$Z_2(T) = (1/2DT)[2AD + (F - H)W^2] + (DT/2)(F + CI_e) - [(F - H)W + DCI_eT^*] \qquad \text{...........(12)}$$

For optimum value of $T = T_{2o}$, $dZ(T)/dT = 0$, gives

$$T_{2o} = [\{2AD + (F - H)W^2\}/(D^2(F + CI_e))]^{1/2} \qquad \text{..........(13)}$$

then optimum order quantity

$$Q_{2o}(T_{2o}) = DT_{2o} = [(2AD + (F - H)W^2)/(F + CI_e)]^{1/2} \qquad \text{...........(14)}$$

and minimum cost $Z_{2o}(T_{2o})$ per unit is

$$Z_{2o}(T_{2o}) = [(F + CI_e)\{2AD + (F - H)W^2\}]^{1/2} - [(F - H)W + DCI_eT^*] \qquad \text{................(15)}$$

In equations (13), (14) and (15), if we take F = H, then

$T_{2o} = [2A/D(H + CI_e)]^{1/2}$ ....(16)

$Q_{2o}(T_{2o}) = [2AD/(H + CI_e)]^{1/2}$ ....(17)

and minimum cost

$Z_{2o}(T_{2o}) = [2AD(H + CI_e]^{1/2} - DCI_eT^*$ ....(18)

The results obtained in equation (16), (17) and (18) are similar to those obtained by Goyal [2], when $T^* > T$.

when $F = H$, $I_e = 0$ and $T^* = 0$, then results are similar to those of single storage EOQ model, obtained in (8), (9), and (10).

If we do not wish to use RW then taking $DT'_2 = W$, then the total cost from equation (12) is

$Z(T'_{2o}) = AD/W + (H + CI_e)W/2 - DCI_cT^*$ ......(19)

In case cost given by (19) is less than that of (15), then RW should not be hired.

Example 1 : Let us take an inventory system that has F = Rs. 2,
H = Rs.1, C = Rs.15, A = Rs.200(50)450, $I_c = 0.25$,
$I_e = 0.10$, W = 900 units and D = 10000 units per annum.

Table 1 shows values of T_{1o}, DT_{1o}, $Z(T_{1o})$ for two storage facilities, when F = H in case of single storage model, EOQ of single storage model and when inventory $DT_{1o} = W$, with increase in ordering cost. For a system with two storage facilities, we find that $Q_{1o} = DT_{1o}$ and $Z(T_{1o})$ increases as A increases. However, comparing with other systems it follows that total optimum cost for the system with two storage facilities is obviously high as compared to EOQ system with single storage facilities or as compared to the model developed by Goyal[3]. Moreover, it can be observed that the total optimum cost for the system with two storage facilities is less than that where RW is not used. This suggests that whenever necessary it is economical to hire RW.

Similar observations can also be made when $T^* > T$. But comparing the two cases we find that the total minimum cost when $T^* > T$ is very low as compared to the case when $T^* < T$.

When $T^* > T$ it is important to note that the total cost for the system with two storage facilities is smaller than that of EOQ with single storage model.

In Table 2 represents the impact of change in interest rate on time cycle length, ordering quantity and total minimum cost, while keeping all other parameter values unchanged. Reduction in interest charges (cost per annum), increases the time cycle length, order quantity with lower total minimum cost. Similarly, when $T^* > T$ with increase in earned interest rate value, the length of time cycle, ordering quantity, and ordering total minimum costs will decrease in comparision to Table 1, when $T^* > T$. But, overall hiring the services of RW is more economic when OW is having limited capacity.

Table 1: Simulated Values of Time Interval, Order Quantity and Total Minimum Cost with Prescribed Permissible Delay Period and Increasing Order Cost

	For two storage facilities			When F = H			EOQ of single storage			When DT_{1o} = W	
A	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	$Z_{1o}(T_{1o})$
When T^* = 0.0833 year < T											
200	0.1053	1052.74	2028.25	0.1082	1082.15	2015.22	0.2000	2000.00	2000.00	0.0900	2102.78
250	0.1132	1132.33	2485.90	0.1175	1175.41	2458.18	0.2236	2236.07	2236.07	0.0900	2658.33
300	0.1207	1206.68	2913.43	0.1262	1261.79	2868.49	0.2449	2449.49	2449.49	0.0900	3213.89
350	0.1277	1276.71	3316.11	0.1343	1342.62	3252.45	0.2646	2645.75	2645.75	0.0900	3769.44
400	0.1343	1343.10	3697.82	0.1419	1418.86	3614.58	0.2828	2828.43	2828.43	0.0900	4325.00
450	0.1406	1406.35	4061.52	0.1491	1491.20	3958.21	0.3000	3000.00	3000.00	0.0900	4880.56
When T^* = 0.1667 year > T											
200	0.1172	1172.30	703.05	0.1265	1264.91	662.28	0.2000	2000.00	2000.00	0.0900	847.22
250	0.1288	1288.41	1109.43	0.1414	1414.21	1035.53	0.2236	2236.07	2236.07	0.0900	1402.78
300	0.1395	1394.89	1482.11	0.1549	1549.19	1372.98	0.2449	2449.49	2449.49	0.0900	1958.33
350	0.1494	1493.80	1828.29	0.1673	1673.32	1683.30	0.2646	2645.75	2645.75	0.0900	2513.89
400	0.1587	1586.55	2152.93	0.1789	1788.85	1972.14	0.2828	2828.43	2828.43	0.0900	3069.44
450	0.1674	1674.17	2459.61	0.1792	1791.79	2243.42	0.3000	3000.00	3000.00	0.0900	3625.00

Where F = Rs.2, H = Rs.1, C = Rs.15, A = Rs.200(50)450, I_c = 0.25, I_e = 0.10, W = 900 units, D = 10,000 units

Table 2: Simulated values of time interval, order quantity and total minimum cost with prescribed permissible delay period, earned interest rate and chargeable interest rate and increasing ordering cost.

A	For two storage facilities			When F = H			EOQ of single storage			When $DT_{1o} = W$	
	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	$Z_{1o}(T_{1o})$
When $T^* = 0.0833 < T$, $I_c = 0.2$ and $I_e = 0.1$											
200	0.1082	1081.82	2009.10	0.1123	1122.68	1990.73	0.2000	2000.00	2000.00	0.0900	2100.93
250	0.1171	1170.61	2453.06	0.1229	1228.99	2415.96	0.2236	2236.07	2236.07	0.0900	2656.48
300	0.1253	1253.13	2865.65	0.1327	1326.81	2807.23	0.2449	2449.49	2449.49	0.0900	3212.04
350	0.1331	1330.54	3252.69	0.1418	1417.89	3171.57	0.2646	2645.75	2645.75	0.0900	3767.59
400	0.1404	1403.69	3618.43	0.1503	1503.47	3513.87	0.2828	2828.43	2828.43	0.0900	4323.15
450	0.1473	1473.21	3966.03	0.1584	1584.43	3837.72	0.3000	3000.00	3000.00	0.0900	4878.70
When $T^* = 0.1667$ year $> T$, $I_c = 0.2$ and $I_e = 0.16$											
250	0.1149	1149.11	156.09	0.1213	1212.68	123.11	0.2236	2236.07	2236.07	0.0900	503.70
300	0.1244	1244.08	573.94	0.1328	1328.42	516.64	0.2449	2449.49	2449.49	0.0900	1059.26
350	0.1332	1332.29	962.08	0.1435	1434.86	878.52	0.2646	2645.75	2645.75	0.0900	1614.81
400	0.1415	1415.02	1326.07	0.1534	1533.93	1215.36	0.2828	2828.43	2828.43	0.0900	2170.37
450	0.1493	1493.17	1669.93	0.1627	1626.98	1531.73	0.3000	3000.00	3000.00	0.0900	2725.93

Where F = Rs.2, H = Rs.1, C = Rs.15, A = Rs.200(50)450, W = 900 units and D = 10000 units.

Table 3: Simulated values of time interval, order quantity and total minimum cost with prescribed permissible delay period, and increasing demand.

	For two storage facilities			When F = H			EOQ of single storage			When $DT_{1o} = W$	
D	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	$Z_{1o}(T_{1o})$
When $T^* = 0.0833$ year $< T$											
10000	0.1053	1052.74	2028.25	0.1082	1082.15	2015.22	0.2000	2000.00	2000.00	0.0900	2102.78
11000	0.1010	1111.26	2052.23	0.1046	1150.80	2028.80	0.1907	2097.62	2097.62	0.0818	2194.79
12000	0.1055	1266.04	2031.14	0.1155	1385.64	1964.10	0.1826	2190.89	2190.89	0.0750	2304.17
13000	0.1008	1310.40	2061.39	0.1109	1442.22	1980.55	0.1754	2280.35	2280.35	0.0692	2430.90
14000	0.0967	1353.30	2086.56	0.1069	1496.66	1991.66	0.1690	2366.43	2366.43	0.0643	2575.00
15000	0.0930	1394.89	2107.11	0.1033	1549.19	1997.98	0.1633	2449.49	2449.49	0.0600	2736.46
When $T^* = 0.1667$ year $> T$,											
10000	0.1172	1172.30	703.05	0.1265	1264.91	662.28	0.2000	2000.00	2000.00	0.0900	1581.94
11000	0.1109	1220.07	620.25	0.1206	1326.65	566.62	0.1907	2097.62	2097.62	0.0818	1908.33
12000	0.1055	1266.04	531.14	0.1155	1385.64	464.10	0.1826	2190.89	2190.89	0.0750	2304.17
13000	0.1008	1310.40	436.39	0.1109	1442.22	355.55	0.1754	2280.35	2280.35	0.0692	2769.44
14000	0.0967	1353.30	336.56	0.1069	1496.66	241.66	0.1690	2366.43	2366.43	0.0643	3304.17
15000	0.0930	1394.89	232.11	0.1033	1549.19	122.98	0.1633	2449.49	2449.49	0.0600	3908.33

Where F = Rs.2, H = Rs.1, C = Rs.15, A = Rs.200, $I_c = 0.25$, $I_e = 0.10$, W = 900 units, and D = 10000(1000)15000 units.

Table 4: Simulated values of time interval, order quantity and total minimum cost with prescribed permissible delay period , and increasing ordering cost and demand

		For two storage facilities			When F = H			EOQ of single storage			When DT_{1o} = W	
A	D	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	$Z_{1o}(T_{1o})$
When T^{*} = 0.0833 < T												
200	10000	0.1053	1052.74	2028.25	0.1082	1082.15	2015.22	0.2000	2000.00	2000.00	0.0900	2102.78
250	11000	0.1086	1194.23	2529.35	0.1134	1247.37	2487.49	0.2132	2345.21	2345.21	0.0818	2805.90
300	12000	0.1261	1512.80	2894.81	0.1414	1697.06	2742.64	0.2236	2683.28	2683.28	0.0750	3637.50
350	13000	0.1294	1682.68	3364.40	0.1468	1907.88	3144.70	0.2320	3016.62	3016.62	0.0692	4597.57
400	14000	0.1323	1852.41	3833.44	0.1512	2116.60	3541.50	0.2390	3346.64	3346.64	0.0643	5686.11
450	15000	0.1348	2022.02	4302.08	0.1549	2323.79	3934.48	0.2449	3674.23	3674.23	0.0600	6903.13
When T^{*} = 0.1667 > T												
200	10000	0.1172	1172.30	703.05	0.1265	1264.91	662.28	0.2000	2000.00	2000.00	0.0900	1581.94
250	11000	0.1221	1342.71	1049.47	0.1348	1483.24	958.10	0.2132	2345.21	2345.21	0.0818	2519.44
300	12000	0.1261	1512.80	1394.81	0.1414	1697.06	1242.64	0.2236	2683.28	2683.28	0.0750	3637.50
350	13000	0.1294	1682.68	1739.40	0.1468	1907.88	1519.70	0.2320	3016.62	3016.62	0.0692	4936.11
400	14000	0.1323	1852.41	2083.44	0.1512	2116.60	1791.50	0.2390	3346.64	3346.64	0.0643	6415.28
450	15000	0.1348	2022.02	2427.08	0.1549	2323.79	2059.48	0.2449	3674.23	3674.23	0.0600	8075.00

Where F = Rs.2, H = Rs.1, C = Rs.15, A = Rs.200(50)450, I_c = 0.25, I_e = 0.10, W = 900 units, and D = 10000(1000)15000 units.

Table 5: Simulated values of time interval, order quantity and total minimum cost with prescribed permissible delay period , and increasing holding cost of RW & OW.

		For two storage facilities			When F = H			EOQ of single storage			When DT_{1o} = W	
F	H	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	DT_{1o}	$Z_{1o}(T_{1o})$	T_{1o}	$Z_{1o}(T_{1o})$
When $T^* = 0.0833 < T$												
2	1	0.1053	1052.74	2028.25	0.1082	1082.15	2015.22	0.2000	2000.00	2000.00	0.0900	2102.78
3	1	0.1032	1031.54	2037.89	0.1082	1082.15	2015.22	0.2000	2000.00	2000.00	0.0900	2102.78
4	1	0.1016	1015.52	2045.32	0.1082	1082.15	2015.22	0.2000	2000.00	2000.00	0.0900	2102.78
5	1	0.1003	1003.00	2051.21	0.1082	1082.15	2015.22	0.2000	2000.00	2000.00	0.0900	2102.78
3	2	0.0972	971.63	2533.53	0.0984	983.56	2530.47	0.1414	1414.21	2828.43	0.0900	2552.78
4	2	0.0963	962.69	2535.86	0.0984	983.56	2530.47	0.1414	1414.21	2828.43	0.0900	2552.78
5	2	0.0956	955.73	2537.68	0.0984	983.56	2530.47	0.1414	1414.21	2828.43	0.0900	2552.78
When $T^* = 0.1667 > T$												
2	1	0.1172	1172.30	703.05	0.1265	1264.91	662.28	0.2000	2000.00	2000.00	0.0900	847.22
3	1	0.1118	1117.54	728.92	0.1265	1264.91	662.28	0.2000	2000.00	2000.00	0.0900	847.22
4	1	0.1081	1081.25	746.85	0.1265	1264.91	662.28	0.2000	2000.00	2000.00	0.0900	847.22
5	1	0.1055	1055.39	760.03	0.1265	1264.91	662.28	0.2000	2000.00	2000.00	0.0900	847.22
3	2	0.1034	1033.87	1252.42	0.1069	1069.04	1241.66	0.1414	1414.21	2828.43	0.0900	1297.22
4	2	0.1011	1010.85	1259.68	0.1335	1335.14	1241.66	0.1414	1414.21	2828.43	0.0900	1297.22
5	2	0.0995	994.60	1264.91	0.1335	1335.14	1241.66	0.1414	1414.21	2828.43	0.0900	1297.22

Where F = Rs.2(1)5, H = Rs.1,2, C = Rs.15, A = Rs.200, I_c = 0.25, I_e = 0.10, W = 900 units, and D = 10000 units.

Table 3 represents the impact of increase in demand on time, ordering quantity and total minimum cost, by keeping values of other parameter unchanged. It is indicated that as demand increases, the length of time cycle reduces and order quantity increases with increase in total minimum cost values. Similar observations are made when $T^* = 0.1667$ year > T.

Results of Table 4 are similar to those of Table 3, except change in parameter of ordering cost, which increases the length of time cycle as well as ordering quantity andtotal minimum cost values.

A perusal of Table 5 suggests that when holding cost of RW and OW increases with unchanged other parameter values. If holding cost of RW increases and OW remains unchanged, then the length of time cycle, order quantity and total minimum costs remain constant in all the systems. While increasing in holding cost of RW and OW, also further decreases time cycle length and ordering quantity with again incurring more total minimum cost.

CONCLUSION

The objective of this paper was to examine the conditions under which the delay in payments are permissible, and its effects on optimal lot-sizing of two storage facilities models for realistic inventory system. However, the numerical example results shows that there is a considerable change in EOQ with permissible delay period and two storage facilities.

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