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INVENTORY PLANNING OF CHANGING PRODUCTIONMODEL FOR VARIABLE DETERIORATION ITEMS WITH DEMANDIN LINEAR EQUATION WITHOUT CONSTANT TERM

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Abstract:

In the manufacturing sector, the expectation of production and demand is the challenging one.To manage the above, it is necessary to concentrate the efficiency of the worker and replacement policy of the machines, the logistics and it supplies of the raw materials. Here to develop a model of inventory *planning of varying production for changing deterioration items with linear demand, the keeping of the stock in a place is considered as fixed, the rate of deterioration is changing with time,using thesesupposition to develop mathematical formationprovides the solution in numerical and its parameter changing shown using computation table and represent using graphs. At last to check the time should be optimal, more quantity and very least overall average cost.*

Key Words: Inventory planning, Deterioration, Linear demand, Variable Production rate.

1. Introduction

In the production department of any concern faces many challenges. Therefore the output of the any manufacturing firms depending on the following issues (i) manpower(ii) efficiency of the worker (ii) quality of the machines (iv) supply and logistics of the raw materialduring the installation of any machine clearly written when that particular machine is replaced. The replacement policy should be followed properly.The Manufacturing or business activity is very crucial to take care of an honest inventory for thesmooth and efficient functioning of the system. If the firm doesn't have the desired quantity of things available when the customer arrives, they need to may look elsewhere to fulfil his requirement, which araises lost sales and loss of goodwill.

Anindita Mukherjeeand et al have introduced a work of an Integrated Imperfect Production–Inventory Model with Optimal Vendor Investment and Backorder Price Discount [1].Hsu, J.T and et al havesuggested some amount of production was not in good condition, it is not observed by the inspection team after reach to the salesman return to the manufacturer [2].Hui-Ming and et al have set up an Economic creation part size for weakening things assessing the time estimation of cash [3].Kai Zhu1 and et al broke down hilter kilter information around a three-echelon gracefully chain issue, where buyback arrangement, credit cost, altruism punishment cost, speculation cost and flawed parts were thought of. So as to handle obscure components, vulnerability hypothesis was actualized into the flexibly chain issue

[4].Kartik Patra and et al have planned a creation stock model made with a non-constant creation rate which reduce a little bit at a time concerning. Here cost of selling considered depending upon the creation time and solicitation is considered as a non-constant with darken enlistment regards. Along these lines the most extraordinary hard and fast advantage gets fluffy with darken enlistment regards. Thusly, the issue has two dimensional figurines.[5].M. Palanivel and et al have built up the monetary creation package size model for choosing the perfect creation length and the perfect solicitation sum for brief things is made. Holding cost is imparted as straightly extending components of time in this model. This model is uncommonly helpful for the endeavors in which the holding cost is depending on the time. In the present situation, Inflation and time estimation of money are furthermore major variables. With respect to this reality, these components are participated in the present model [6].Patel Raman and Shital Patel have defined a model of Production stock model for weibull breaking down Items with cost and amount subordinate interest with time differing holding cost [7].Patel. S has recommended an article Production stock model for falling apart things with various disintegration rates under stock and value subordinate interest and deficiencies under swelling and passable deferral in installments [8].Shital S. Patel has examined of EPQ model with insecure debilitating rate is assessed. The model really taken as solicitation as exponential limit of time. In light of some circumstance during creation process, the pace of creation is less up to certain time, anyway after some time the creation rate increase with time. As a result of this clarification the model consider variable creation rate. Numerical part exhibits the pertinence of the decide model and parametric examination shows the effect in some parameter. The decided model can develop for things having different sorts of intrigue and rot [9].Singh C and et al have recommended an article of an EPQ model with power structure stock ward request under inflationary condition utilizing hereditary calculation [10].Singh Sand et al have talked about of Production model with selling value subordinate interest and halfway multiplying under expansion [11].Sujata Saha and Tripti Chakrabarti have built up a paper in which presents a summed up EPQ model for deterioration things. We have considered variable creation rate which diminishes slowly regarding time and this supposition makes our examination near reality as pretty much every assembling firms face such circumstance because of different causes like apparatus deficiency, torpidity of the laborers, delay in flexibly of crude materials and so forth [12].Tsao, Y. C. have built up a paper of "A Piecewise Nonlinear Model for a Production System Under Maintenance, Trade Credit and Limited Warehouse Space [13].Van Kampen T.J and et al have built up a paper of Safety stock or wellbeing lead time adapting to inconsistency sought after and flexibly [14].

To have built up an evaluating model for deteriorating things with variable production rate. The production rate is steady toward the start of the production procedure, however after some time the pace of production diminishes because of different issues related with the production system. We have considered improvement cost to lessen the breaks in the production procedure. Additionally, it is expected that the demand rate follows linear time linked function. At long last, we have look at the overall average cost of the suggested model. To assess the total expense and total production time a numerical model has been delineated. The remainder of this paper is sorted out as follows. In Sect 2, the Symbols and Suppositionare given. In sect 3, we have built up the numerical(mathematical) model. In Sec 4, we have given numerical guides to delineate the outcomes. What's more, the affectability investigation of the ideal arrangement as for parameters of the system is completed in Sect 5. At last, we reach the determinations and future research in Sect 6.

2. Symbols and Supposition

2.1. Symbols

S_v	*Setup cost per order*
α_v	*development* cos*t* / unit / unit time

D_v	*customers demand rate, which is random in nature,*
l_v	*production rate / unit time*
c_v	*prodution cost / unit time*
h_v	*holding cost / unit time*
d_v	*Deterioration cost / unit time*
θ_v	*Deterioration,* $0 < \theta_v < 1$
T_v	*The cycle length.*
t_{v_1}	*Begining of the shortage time.*
$I_{v_1}(t)$	*Inventory level at* $0 \le t \le t_{v_1}$
$I_{v_2}(t)$	*Inventory level at* $t_{v_1} \le t \le t_{v_2}$
$I_{v_3}(t)$	*Inventory level at* $t_{v_2} \le t \le T_v$
Q_{v_1}	*Order quantity at time* t_{v_1}
Q_{v_2}	*Order quantity at time* t_{v_2}
$ATC(t_v, T_v)$	*Over all average expences of the cost/unit time*

2.2 . Supposition

TheSupposition of thesuggested production inventory model are as follows:
(i) The demand of this production is $D_v = b_v t$

(ii)The trading period T_V is constant.

(iii) A single item is produced by the production system.
(iv) In the inventory Shortages are not allowed.
(v)A decimal constant θ_v , $0 < \theta_v < 1$ for the inventory deteriorates per unit time.
(vi)The variable production rate l is taken as

$$l = \begin{cases} l_V & \text{for } 0 \le t \le t_{V_1} \\ l_V\, e^{-m_v\left(t - t_{v_1}\right)} & \text{for } t_{V_1} \le t \le t_{V_2}, \left(0 < m_V < 1\right) \end{cases}$$

where m_v is a constant $0 < m_v < 1$ (vii)In all actuality we see that, when creation goes on inside the industrial facility at that point at first up to certain timeframe the get together procedure delivers the items at a proceeding with rate however after your time the gathering rate diminishes as a result of some intrinsic issues identified with the get together framework like apparatus flaw, incompetent labourer, crude materials arrived at late to the organization and so on. To keep away from such unforeseen circumstances, it's savvy for them to embrace an upkeep methodology and to attempt thusly the maker pay an extra cost, called improvement cost all together that it's conceivable to downsize the breaks underway. Here we've considered the occasion cost as a component of introductory creation rate, i.e., $d_v = \alpha_v l_v$, where α is a constant.

3. Mathematical Model

The behaviour of the inventory model at time 0 to T_v as shown in the Fig:1

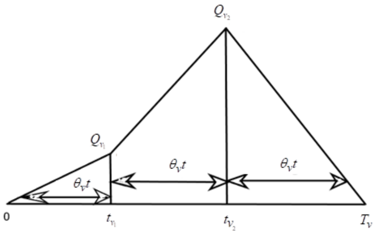

Fig:1

Using the fixed production rate l_v in the period $0 \le t \le t_{v_1}$ then the rate of production begins to decline with time and continues up to time t_{v_2}. The production is idle in the time period $t_{v_2} \le t \le T_v$ and the inventory level tends to zero at $t = T_v$ in the joint operation of deterioration and demand. The diff eqns. forming the stage of $I_v(t)$ in the interval $0 \le t \le T_v$ are,

$$\frac{dI_{v_1}(t)}{dt} + \theta_v t\, I_{v_1}(t) = l_v - D_v \quad when\; 0 \le t \le t_{v_1} \quad (1)$$

$$\frac{dI_{v_2}(t)}{dt} + \theta_v t\, I_{v_2}(t) = l_v e^{-m_v(t - t_{v_1})} - D_v \quad when\; t_{v_1} \le t \le t_{v_2} \quad (2)$$

$$\frac{dI_{v_3}(t)}{dt} + \theta_v t\, I_{v_3}(t) = -D_v \quad when\; t_{v_2} \le t \le T_v \quad (3)$$

with the conditions on the boundary are $I_{v_1}(0) = 0$, $I_{v_1}(t_{v_1}) = Q_{v_1} = I_{v_2}(t_{v_1})$, $I_{v_2}(t_{v_2}) = Q_{v_2} = I_{v_3}(t_{v_2})$,
$I_{v_3}(T_v) = 0$

The solution of equation (1) with the boundary condition $I_{v_1}(0) = 0$, we get

$$I_{v_1}(t) = \left(l_v t - \frac{b_v}{2} t^2 + \frac{l_v \theta_v t^3}{6} - \frac{b_v \theta_v t^4}{8} \right) e^{-\frac{\theta_v t^2}{2}}$$

$$(or) \quad (4)$$

$$I_{v_1}(t) = \left(l_v t - \frac{b_v}{2} t^2 - \frac{l_v \theta_v t^3}{3} + \frac{b_v \theta_v t^4}{8} \right) \text{neglating higher powers of } \theta_v.$$

$$Q_{v_1} = I_{v_1}(t_{v_1}) \Rightarrow Q_{v_1} = \left(l_v t_{v_1} - \frac{b_v}{2} t_{v_1}^{\;2} + \frac{l_v \theta_v t_{v_1}^{\;3}}{6} - \frac{b_v \theta_v t_{v_1}^{\;4}}{8} \right) e^{-\frac{\theta_v t_{v_1}^{\;2}}{2}} \quad (5)$$

The solution of equation (2) with the boundary condition $I_{v_2}\left(t_{v_1}\right)=Q_{v_1}$ we get

$$I_{v_2}(t)=\left[l_v t-\left(\frac{m_v l_v+b_v}{2}\right)t^2+\frac{\theta_v l_v}{6}t^3-\left(\frac{m_v l_v\theta_v+b_v\theta_v}{8}\right)t^4-\frac{m_v l_v}{2}\left(t_{v_1}\right)^2-\frac{m_v l_v\theta_v}{24}\left(t_{v_1}\right)^4+m_v l_v t_{v_1}t+\frac{m_v l_v\theta_v}{6}t_{v_1}t^3\right]e^{-\theta_v\frac{t^2}{2}}$$

(or) (6)

$$I_{v_2}(t)=\left[l_v t-\left(\frac{m_v l_v+b_v}{2}\right)t^2-\frac{\theta_v l_v}{3}t^3+\left(\frac{m_v l_v\theta_v+b_v\theta_v}{8}\right)t^4-\frac{m_v l_v}{2}\left(t_{v_1}\right)^2-\frac{m_v l_v\theta_v}{24}\left(t_{v_1}\right)^4+m_v l_v t_{v_1}t+\frac{m_v l_v\theta_v}{4}\left(t_{v_1}\right)^2t^2-\frac{m_v l_v\theta_v}{3}t_{v_1}t^3\right]$$

$$Q_{v_2}=\left[l_v t_{v_2}-\left(\frac{m_v l_v+b_v}{2}\right)\left(t_{v_2}\right)^2+\frac{\theta_v l_v}{6}\left(t_{v_2}\right)^3-\left(\frac{m_v l_v\theta_v+b_v\theta_v}{8}\right)\left(t_{v_2}\right)^4-\frac{m_v l_v}{2}\left(t_{v_1}\right)^2-\frac{m_v l_v\theta_v}{24}\left(t_{v_1}\right)^4+m_v l_v t_{v_1}t_{v_2}+\frac{m_v l_v\theta_v}{6}t_{v_1}\left(t_{v_2}\right)^3\right]e^{-\theta_v\frac{\left(t_{v_2}\right)^2}{2}} \quad (7)$$

The solution of equation (3) with the boundary condition $I_{v_3}\left(T_v\right)=0$, we get

$$I_{v_3}(t)=\left(-\frac{b_v}{2}t^2+\frac{b_v\theta_v}{8}t^4+\frac{b_v}{2}T^2+\frac{b_v\theta_v}{8}T^4\right)e^{-\theta_v\frac{t^2}{2}}$$

(or) (8)

$$I_{v_3}(t)=-\frac{b_v}{2}t^2+\frac{b_v\theta_v}{8}t^4+\frac{b_v}{2}T^2+\frac{b_v\theta_v}{8}T^4-\frac{b_v\theta_v}{4}T^2t^2 \quad \text{(neglating higher powers of } \theta_v) \quad (9)$$

At this moment, the manufacturer set up cost $= S_v$

The manufacturer production cost $= c_v\int_0^{T_v} D_v dt=\frac{c_v b_v}{2}T_v^2$ (10)

The manufacturer holding cost (H_vC)= $h_v\int_0^{T_v} I_v(t)\,dt$

(ie.,) Holding cost (H_vC)= $h_v\left[\int_0^{t_{v_1}} I_{v_1}(t)dt+\int_{t_{v_1}}^{t_{v_2}} I_{v_2}(t)dt+\int_{t_{v_2}}^{T_v} I_{v_3}(t)dt\right]$

$$H_vC=h_c\left\{\begin{aligned}&\frac{m_v l_v\theta_v}{60}\left(t_{v_1}\right)^5+\left(\frac{m_v l_v}{6}\right)\left(t_{v_1}\right)^3+\frac{m_v\theta_v l_v}{40}\left(t_{v_2}\right)^5-\left(\frac{l_v\theta_v}{12}\right)\left(t_{v_2}\right)^4-\frac{m_v l_v}{6}\left(t_{v_2}\right)^3+\frac{l_v}{2}\left(t_{v_2}\right)^3\\&+\frac{b_v l_v}{15}T_v^5+\frac{b_v}{3}T_v^3-\left(\frac{m_v l_v}{2}\right)\left(t_{v_1}\right)^2t_{v_2}-\frac{m_v\theta_v l_v}{24}\left(t_{v_1}\right)^4t_{v_2}+\left(\frac{m_v l_v}{2}\right)t_{v_1}\left(t_{v_2}\right)^2\\&-\frac{m_v\theta_v l_v}{12}t_{v_1}\left(t_{v_2}\right)^4+\frac{m_v\theta_v l_v}{12}\left(t_{v_1}\right)^2\left(t_{v_2}\right)^3-\frac{b_v}{2}T_v^2t_{v_2}-\frac{b_v\theta_v}{8}T_v^4t_{v_2}+\frac{b_v\theta_v}{12}T_v^2\left(t_{v_2}\right)^3\end{aligned}\right\} \quad (11)$$

The manufacturer deterioration cost(D_vC) $= d_v\int_0^{T_v}\theta_v t\, I_v(t)\,dt$

$$(i.e)\quad Deterioration\cos t(D_vC) = \theta_v d_v\left[\int_0^{t_{v_1}} t\,I_{v_1}(t)\,dt + \int_{t_{v_1}}^{t_{v_2}} t\,I_{v_2}(t)\,dt + \int_{t_{v_2}}^{T_v} t\,I_{v_3}(t)\,dt\right]$$

$$D_vC = \theta_v d_v\left[\frac{m_v l_v}{24}(t_{v_1})^4 - \frac{m_v l_v}{8}(t_{v_2})^4 + \frac{l_v}{3}(t_{v_2})^3 + \frac{b_v}{8}T_v^{\,4} - \frac{m_v l_v}{4}(t_{v_1})^2(t_{v_2})^2 + \frac{m_v l_v}{8}t_{v_1}(t_{v_2})^3 - \frac{b_v}{4}T_v^{\,2}(t_{v_2})^2\right] \quad (12)$$

Let $t_{v_1} = \eta_v\, t_{v_2}$

Therefore, the manufacture average total cost,

$$\text{Average total cost} = \frac{1}{T_v}\left[\text{Setup cost} + \text{Production cost} + \text{Progress cost} + \text{Holding cost} + \text{Deterioration cost}\right]$$

$$ATC(t_{v_2},T_v) = \frac{1}{T_v}\left\{\begin{aligned} &S_v + \alpha_v l_v + \frac{h_v l_v}{2}(t_{v_2})^2 + \left[\frac{h_v m_v l_v}{6}\left(\eta_v^{\,3} - 3\eta_v^{\,2} + 3\eta_v - 1\right) + \frac{d_v l_v \theta_v}{3}\right](t_{v_2})^3 \\ &+\left[-\frac{h_v\theta_v l_v}{12} + \frac{d_v\theta_v l_v m_v}{24}\left(\eta_v^{\,4} - 6\eta_v^{\,2} + 3\eta_v - 3\right)\right](t_{v_2})^4 \\ &+\frac{d_v\theta_v h_v m_v}{120}\left(2\eta_v^{\,5} - 5\eta_v^{\,4} + 10\eta_v^{\,2} - 10\eta_v + 3\right)(t_{v_2})^5 \\ &+\frac{h_v\theta_v b_v}{15}T_v^{\,5} + \frac{d_v\theta_v b_v}{8}T_v^{\,4} + \frac{h_v b_v}{3}T_v^{\,3} + \frac{c_v b_v}{2}T_v^{\,2} \\ &-\left[\frac{h_v b_v}{8}\left(4T_v^{\,2} + \theta_v T^4\right)\right]t_{v_2} - \frac{d_v\theta_v b_v}{4}T_v^{\,2}(t_{v_2})^2 + \frac{h_v\theta_v b_v}{12}T_v^{\,2}(t_{v_2})^3 \end{aligned}\right\} \quad (13)$$

The necessary condition for least value of $ATC(t_{v_2},T_v)$ are $\dfrac{\partial(ATC(t_{v_2},T_v))}{\partial t_{v_2}} = 0$ & $\dfrac{\partial(ATC(t_{v_2},T_v))}{\partial T_v} = 0$ and the sufficient condition for least of $ATC(t_{v_2},T_v)$ are $t_{v_2} > 0,\ T_v > 0.$

$$\text{and}\quad \begin{vmatrix} \dfrac{\partial^2(ATC)}{\partial t_{v_2}^2} & \dfrac{\partial^2(ATC)}{\partial t_{v_2}T_v} \\ \dfrac{\partial^2(ATC)}{\partial T_v t_{v_2}} & \dfrac{\partial^2(ATC)}{\partial T_v^{\,2}} \end{vmatrix} > 0$$

4. Simple Numerical Examples

***Example 1*:**Let us take the feed in values: $b_v = 60\,units, l_v = 140\,units, \alpha_v = 14.4\,units,.$
$m_v = 0.05,\ \theta_v = 0.06,\ S_v = Rs.500,\ c_v = Rs.15,\ d_v = 5, h_v = 3,\ \eta_v = 0.625$ We have the optimum solution as $t^*_{v2} = 0.6273, T_v^* = 1.6792, ATC = 2389.1519$ and quantity $Q_{v_1} = 50.1202\ Q_{v_2} = 75.2053.$

***Example 2*:**Let us take the feed in values: $b_v = 150\,units, l_v = 250\,units, \alpha_v = 16\,units,.$
$m_v = 0.05,\ \theta_v = 0.01,\ S_v = Rs.750,\ c_v = Rs.20,\ d_v = 10, h_v = 5,\ \eta_v = 0.6$ We have the optimum solution as $t^*_{v2} = 0.5632, T_v^* = 1.3666, ATC = 5853.6436$ and quantity $Q_{v_1} = 75.8822\ Q_{v_2} = 116.5581.$

5. Sensitivity analysis and representations using graphs

5.1. To demonstrate the modifications in the parameters are shown in Table.

Parameter	Variation	t_{v_2}	T_v	Q_{v_1}	Q_{v_2}	ATC
b_v	50	0.5997	1.7934	48.8223	74.2374	2210.2025
	55	0.6137	1.7325	49.5073	74.7936	2301.9237
	60	0.6273	1.6792	50.1202	75.2053	2389.1519
	65	0.6405	1.632	50.6682	75.4838	2472.4472
	70	0.6534	1.5899	51.157	75.6374	2552.2642
l_v	120	0.6701	1.6096	44.8324	66.1221	2226.6895
	130	0.6471	1.6448	47.5094	70.7458	2309.0146
	140	0.6273	1.6792	50.1202	75.2053	2389.1519
	150	0.6101	1.7126	52.677	79.5338	2467.304
	160	0.5949	1.7452	55.1888	83.7553	2543.6428
α_v	14.2	0.6219	1.6721	49.7268	74.6649	2374.5861
	14.3	0.6246	1.6756	49.9236	74.9353	2381.8786
	14.4	0.6273	1.6792	50.1202	75.2053	2389.1519
	14.5	0.63	1.6827	50.3166	75.4748	2396.4062
	14.6	0.6328	1.6862	50.5129	75.7438	2403.6417
θ_v	0.04	0.6241	1.6845	49.9384	75.0873	2383.6503
	0.05	0.6257	1.6818	50.0324	75.1511	2386.4132
	0.06	0.6273	1.6792	50.1202	75.2053	2389.1519
	0.07	0.6288	1.6766	50.202	75.2503	2391.8672
	0.08	0.6302	1.674	50.2779	75.2866	2394.5598
S_v	400	0.6078	1.6537	48.7123	73.2665	2336.774
	450	0.6176	1.6665	49.4173	74.2389	2363.0874
	500	0.6273	1.6792	50.1202	75.2053	2389.1519
	550	0.6371	1.6917	50.821	76.1655	2414.9739
	600	0.6468	1.7042	51.5197	77.1197	2440.5599
c_v	13	0.6878	1.7556	54.4301	81.0583	2263.6727
	14	0.6559	1.7158	52.1696	78.0041	2327.2806
	15	0.6273	1.6792	50.1202	75.2053	2389.1519
	16	0.6015	1.6454	48.2539	72.6324	2449.4186
	17	0.5782	1.6141	46.5473	70.2604	2508.1965
h_v	1	0.6825	1.7511	54.0575	80.5573	2280.5006
	2	0.6532	1.7129	51.9804	77.7469	2336.3169
	3	0.6273	1.6792	50.1202	75.2053	2389.1519
	4	0.6045	1.6491	48.4705	72.9322	2439.3859
	5	0.5844	1.6221	47.0026	70.8951	2487.3364
d_v	3	0.6316	1.6843	50.4294	75.6293	2383.6797
	4	0.6294	1.6817	50.2736	75.4158	2386.4254
	5	0.6273	1.6792	50.1202	75.2053	2389.1519
	6	0.6252	1.6766	49.969	74.9977	2391.8596

5.2 Graph of parameters with average total cost

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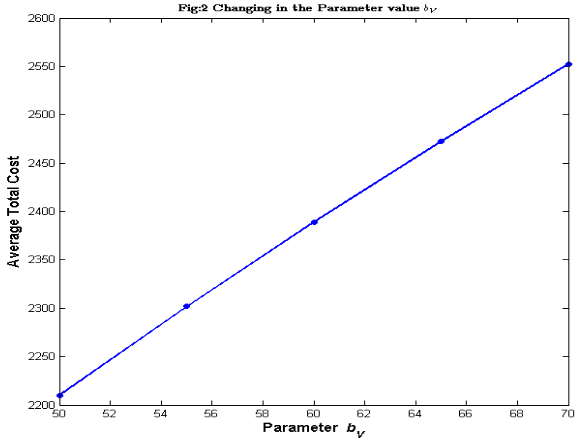
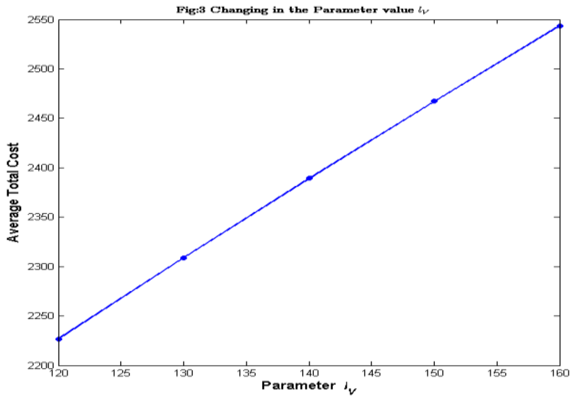
Here we investigated the impact of all parameters with time and order quantity with average overall cost and we observe the following progress.

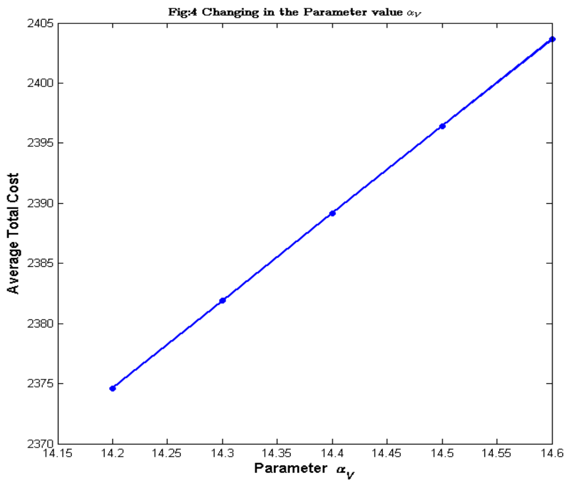
1) When you raise up the values of the parameter b_v,the values of the cycle time T_V go down but the values of production run time t_{V_2} , the quantity Q_{v_1}, Q_{v_2} and total cost of the system are raising up.



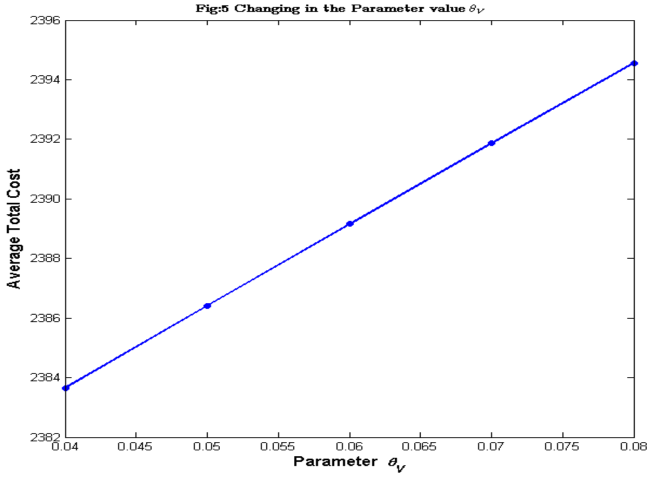
2) When you raise up the values of the parameter l_v, the values of the production run time t_{V_2} go down but the values of cycle time T_V, the quantity Q_{v_1}, Q_{v_2} and total cost of the system are raising up.



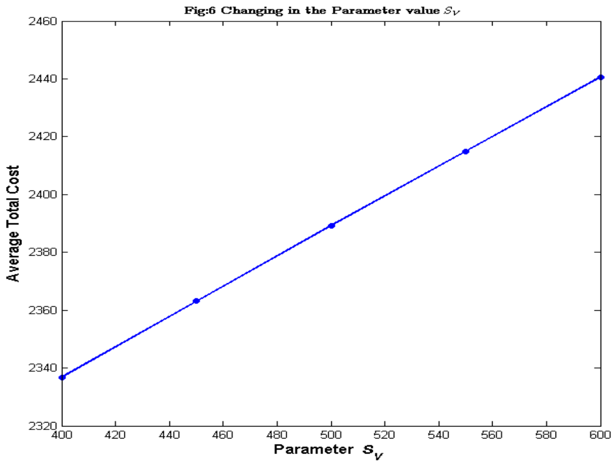
3) When you raise up the values of the parameter α_v, the values of the cycle time T_V, the values of production run time t_{V_2} ,the quantity Q_{v_1}, Q_{v_2} and total cost of the system are raising up.



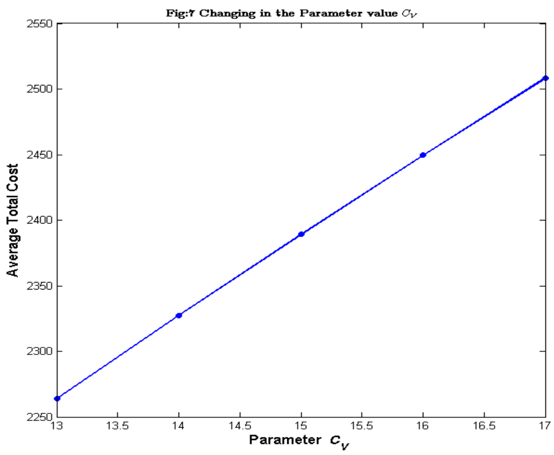
4) When you raise up the values of the parameter θ_v , the values of the cycle time T_V go down but the values of production run time t_{V_2} ,the quantity Q_{v_1} , Q_{v_2} and total cost of the system are raising up.



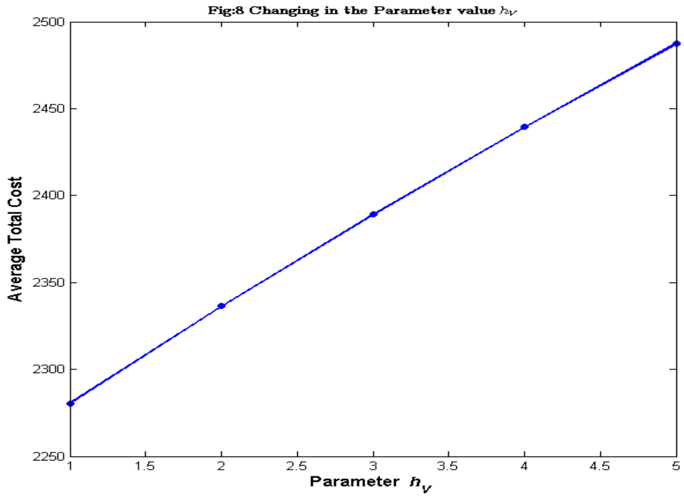
5) When you raise up the values of the parameter S_v , the values of the cycle time T_V ,the values of production run time t_{V_2} ,the quantity Q_{v_1} , Q_{v_2} and total cost of the system are raising up.



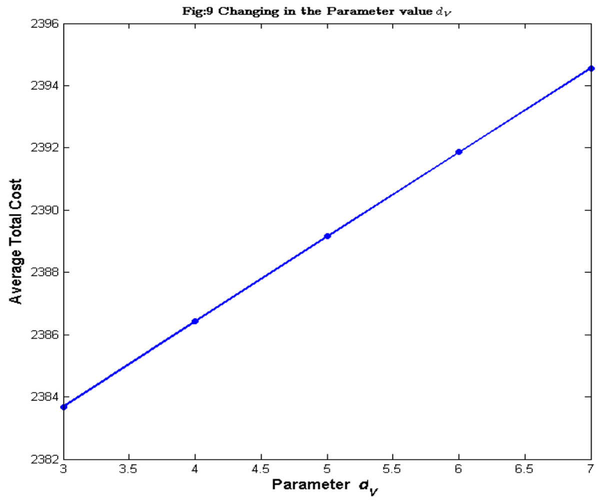
6) When you raise up the values of the parameter c_v , the values of the cycle time T_V, the quantity Q_{v_1} , Q_{v_2} and the values of production run time t_{V_2} goes down and total cost of the system are raising up



7) When you raise up the values of the parameter h_v, the values of the cycle time T_V, the quantity Q_{v_1}, Q_{v_2} and the values of production run time t_{V_2} goes down and total cost of the system are raising up



8) When you raise up the values of the parameter d_v, the values of the cycle time T_V, the quantity Q_{v_1}, Q_{v_2} and the values of production run time t_{V_2} goes down and total cost of the system are raising up



7.Conclusion

Here this paper developed acomputation model in inventory planning of varying production for changing deterioration items with linear demand. The keeping of the stock in a place is considered as no changing with time period and the rate of deterioration is changing with time. Using this suppositionto developthe mathematical formation and thenumerical solution is found, its parameter changing is also shown using computation table and graphical changes is also made using tabular values. At last to checked the time should be optimal, quantity of theitem ismore and very least Totalaverage cost. The development of this paper to considerrandomness in demand, linear equation of deterioration and coordination between supplier of raw material and manufacturer.

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