An Inventory Model for Constant Deteriorating Items Carry forward with Price, Reserve and Lifetime Demand, and Constant Holding cost

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Abstract:

The aim of the recent work is to reinforce the essential motivation of business enterprises for efficient inventory supervision and faster rate of utilizating the inventory objects and also highlights to provide good quality of service to the customers. In this work is computed using edge computing technique. The prime goal of edge computing (EC) technic is minimize the required time to communicate huge quantities of data related to the model. In this method we receive very quick feedbacks which are very impontent for decision-making process. This model shows the prime approach of an inventory structure for deteriorating goods. This paper designs an inventory model for constantly deteriorating items with price, stock, and lifetime demand rate while keeping the holding cost constant. This prototype is Mathematically formulating differential equations and finding the root of these equations. The very purpose of this prototype is to optimize the total inventory value exclusive of allowing shortages. The very model ultimately has been illustrated through a numerical example and computing using Mathematica 12.0 and analysing the data by edge computing (EC) method. Formerly, Gnu software uses these data values to plot the graphs. The functionality of the model as well as a sensitivity analysis to discern the best solution concerning assorted framework.

Keywords: Edge computing; Rate of Deterioration; Constant Stock price; Inventory; Stock dependent Lifetime rate of Demand.

1.Introduction:

Inventory is the essence for any commercial governments i.e., it is the main strength and every so often inadequately accomplished. In commercial association, inventory managing is the foremost essential proficiencies to contest in the international marketplace. The utmost significant determination assisted by the provisions is to afford the continual facility to the industrial dissections. Inventories signify a considerable serving of over-all resources of a business and substantial determination is essential to rheostat the accounts. Objective of the recent work is to make stronger the principal aggression of commercial firm for efficient inventory supervision and also for better use of inventory objects.(i) Foremost, performance of inventory analysis bases on inter relationship between supply and actual demand of that products within supply chain atmosphere. As the inventory supervised efficiently that resuts decreasing inventory cost of the items and also improving the service level of inventory system. Several techniques are proposed on different data and demand functions. In this work Edge computing method is used for optimizing the model. The inventory system is designed on cloud-edge joint computing process. The Edge Computing (EC) method is a highly dispersed context uses last few years and also receves better profits with less affort in real-time situation. It is also used to perform:

managing the inventory,

(ii) Real-time decision-making capacity.
(iii) Improving the sustainability of the products.
(iv) optimizing the cost factors of the products.
(v) Compliance with Data Sovereignty Regulations.
(vi) Enabling Innovative Applications.
(vii) Empowering Remote Locations.
(viii) Streamlining Updates and In-Life Change Requests.
(ix) managing Manufacturing jobs.
(x) managing Retail services.
(xi) managing Transportation and Logistics works.
(xii) Improving the Experience for Customers and Retailers.
(xiii) Bringing Retail Improvements to Life.

Furthermore, the edge computing method consumes less computation time, more productivity, well steadiness, and improved inclusive presentation compared to other computing methods like genetic algorithms. The Output of research affords locus and designs appeal for edge computing in inventory systems, that have certain comments on the importance and implementation cost. Under cost-effective computation, edge computing (EC) carries real-time assets and observes the process, better the quality of supervision, analyzes the data, and controls the inventory system. In the recent industrial revolution, the edge computing (EC) method plays an important role in analysis and control as compared then other technological applications and it's also applied in several manufacturing domains. EC also performing in full work that is assemble based on planning, Intellect platforms, Edge object, and Prospective implementations. Generally, physical matters that are tranesect in our daily are deteriorating of their characture. Some special types of healthcare items like Vaccines (BCG, Hep-B*, OPV, series of Rota vaccine, Penta vaccines Booster of Diphtheria,Tetanus and pertussis(DPT) series, Intravenous Pyelogram injections, Covid vaccines for Adults etc.), edible oils, and vegetables are deteriorating nature over time but have lifetime demand. Therefore, declining matters is a usual process in stock, thus record reviewers achieve know-how of the certainty of this aspect. The novel product comes to the market then its claim goes at a swift pace. Of late, it is acknowledged that consumers are becoming more cautious and mindful about their well-being as their livelihood standard gets enhanced than earlier occasions, so the requirement for goods with an extensive existence phase has extremely augmented in recent days. Aliyu I., and Sani B. [1] have studied a stock model for declining objects with an indiscriminate exponential diminishing claim with varying investment cost rates. Aliyu I., and Sani B. [2] improve the idea of a stock model on behalf of diminishing objects considering universal exponential declining order, steady asset cost, and time-changing decline rate. Dash B. P, Singh. T., and Pattanayak H. [5] meticulously showcased, a stock model for fading objects with exponential declining order and time-changing asset costs. As per the observation registered by Kumar et al.[8], designed a model in which demand for declining objects using a quadratic order rate and inconsistent investment cost. Mishra et al.[9] have verified a manipulated advance towards the EOQ model exclusive of power-form accumulation-reliant order along with cubic decline. Singh et al. [11] monitoring a model against a declining article having instant dependent relative to Quadratic Order and inconsistent worsening vies acceptable hold-up in payment. The authors namely Bhunia et al. [4] noticed, an EOQ model of perishiable goods based on lot size reliant upon refilling price, and demand as a linear order. Jalan et al. [7] fabricated Bhunia et al. [4] model considering the demand as an exponentially decreasing order of time. Sahoo et al. [15] have also emphasized, that an EOQ accounts for decreasing substances with cubic order, unpredictable degradation, and discriminatory Inventory. The authors Sahoo C.K., and Paul K.C. [16] have also predicted a inventory model having products for cubic deterioration rate with demand as Weibull function of time and shortages are not allowed. The researchers, Sahoo C.K., Paul K.C., and Kumar S. [17] have also put forward, two Warehouses EOQ inventory models regarding the degrading matters considering exponential decreasing demand, confined deferment in cost counting recover the price. Paul et al. [18] developed a model having Parabolic Demand with deterioration rate as Three parameter-Weibull function of time, Shortage is measured as backlogged and calculated Salvage Value. Tripathi et al. [19] published an EOQ model based on stock-dependent demand rate and taking as Variable holding price. Tripathi R.P. [20] enhanced an inventory model for decline products having demand rate as non-decreasing order with shortages at the time of inflection and time-discounting. Wee. [13] published an article for decline items that become rotten, putried, decayed, disintegrated, disordered,losing their suitability or missing their secondary status, become profuse over time. This work is designed with increasing the stock along with a increase in size of self-reliance with time dependent, and a diminishing pace associated with steady catch costs. Due to the increasing order, quality of the products will be decline because fresh products are arrived that are quite efficient, cost-effective, or might be more aesthetic than the grown-up complement. Passess over time order of the fresh product inceases as compared to the old products. Generally, it includes products related to the food items, organic products, electronic goods are comes in this categories. It’s been very significant to experience a good figure of researchers engaged in enlarging stock prototypes for diminishing objects over points in time. Out of those within [14], it has been standardized the matter decline of the aforementioned units on accomplished to their required time. Afterward, Ghare et al.[6] developed an optimal policy for degrading objects are storaged in the warehouse. The duo excitedly coordinated the classical warehouse structure by passing scarcity with affixing the deterioration step. The investigators namely Shah, and Jaiswal. [10] along with Aggarwal. [3] have developed an acceptable order anxiety warehouse structure that proceeds into account the unchanging decline rate. Teng et. al. [12] demonstrated an EOQ model on behalf of diminishing objects having power commencing inventory-reliant orders for that the researchers extended their EOQ model to pass through not only against the declining goods but also non-zero finish stock. Mishra, and Singh. [9] expressed an associated work where it fabricated a stock model against the diminishing goods considering a steady recovery pace holding power from orders added with no scarcity. The researchers observed the pace of decline as a cubic polynomial event of point in time. The full-value utility was developed along with a computer algorithm to find an improved model solution. Other recent developments associated with Kumar, and Saini. [8], brings out a bi-house design prototype added to a previous demand component and a breakdown in Weibull distribution. The researchers consider the rise and use rebated inflows to analyze problems. The researcher Alfares H.K. [26] has also designed a model with stock dependent demand and with different storage costs. Next, the researchers Lee Y.P., and Dye C.Y. [27] improved a model with a stock-dependent demand rate and the deterioration rate is controllable. As per the observation of Chang et al.[28] presented Optimal policies for non-instantaneous degrading products in which rate of demand dependents on stock amount. Soni H., and Shah N.H. [29] have also emphasized an Optimal ordering policyin which rate of demand dependents on stock level of the objects with a pre-payment plan. As per the observation registered by Sonawane S.S., and Kulkarni P. [21], using a graph model verified Concept-based document similarity. The researchers namely Hsu et al.[22] studied a model related to service oriented business for the CAE software industry in Greater China: a case study. Alafif et al. [23] have also discussed a study on COVID-19 infection from recovered patients: a case study in Saudi Arabia. The authors, Siddique et al.[24] studied the building of a reverse dictionary with specific application to the COVID-19 pandemic. Deepakraj D., and Raja K. [25] have also designed an efficient routing wireless sensor network based on the Markov-chain concept.

In the proposed paper, degradation of goods has been indicating the rate of demand aligning price, stock, and lifetime and deterioration rate constantly along with fetch appraisal slightly stored, scarcities are eliminated.

Comparative Table:

Researchers	Deterioration Rate	Demand	Shortages	Permissible Delay in Payments
Jaggi & Verma	N.	SPD.	CB.	Y.
Jaggi et al.	Y.	SPD.	P.	N.
Bhunia and Shaikh	Y.	PTDD.	P.	N.
Bhunia et al.	Y.	ILDD.	P.	N.
Jaggi et al.	Y.	LFT	P.	N.
Yang.	Y.	CON.	P.	N.
Bhunia et al.	Y.	LFT	P.	N.
Bhunia et al.	Y.	LFT	P.	S.
Chung, and Huang.	Y.	CON.	N.	S.
Liang, and Zhou.	Y.	CON.	N.	N.
Bhunia et al.	Y.	CON.	P.	S.
Shaikh et al.	Y.	SPD.	P.	AP.
Khan et al.	Y.	SPD.	P.	AP.
Khan et al.	Y.	SPD.	P.	N.
Khan et al.	Non-instantaneous.	SPD.	P.	AP.
Khan et al.	Y.	SASD.	P.	AP.
Khan et al.	Y.	SAAD.	P.	AP.
Weiss (1982)	Y.	SDR.	SNA.	N.
Z.P. Balkhi et al. (2004)	Y.	TDD	SNA.	N.
L. Moon et al. (2005)	Y.	TDD	SA	N.
Goh. (1994)	Y.	ILDD.	N.	N.
H.K. Alfares. (2007)	Y.	SD.	SNA.	N.
Muhlemann, and Valris. (1980)	Y.	SD.	SNA.	N.
C.T. Chang et al. (2010)	Y.	SD.	P.	N.
Y.P. Lee et al. (2012)	Y.	SD.	SAPB.	N.
Singh, Tripathi, and Mishra. (2015)	Y.	SD.	N.	N.

Tripathi, and Singh. (2015)	Y.	NDDR.	N.	N.
Pando et al. (2013)	Y.	SD.	N.	N.
Tripathi et al. (2013)	Y.	CON.	SNA.	N.
Roy	Y.	PDD.	SNA.	N.
Soni, and Shah,	Y.	SD.	SNA.	AP.
T. Arinadav et al. (2013)	Y.	TDD	Without Backlogging.	N.
Gupta, and Virat. (1986)	Y.	SD.	SNA.	N.
Sahoo, Paul, and Kumar. (2020)	Y.	DEDO	SNA.	N.
Sahoo, Paul, and Kalam. (2020)	Y.	CD.	Inequitable backlogging.	N.
Sahoo, and Paul. (2021)	Y.	TFWD	SNA.	N.
Sahoo, and Paul. (2021)	Y.	TWD	SNA.	N.
Sahoo, Paul, and Sahoo. (2021)	Y.	CD.	SSV	N.
Paul, Sahoo, and Sarangi. (2022)	TWD	Parabolic Demand.	SSV	N.
Present Paper	CON.	Price, stock, and lifetime Demand.	SNA.	N.

SPD.=Selling price dependent, P.=partial backlogging, CON.=constant, SA = With shortages, SNA. =Without shorages, SSV =With scarcity and salvage value, SD.= demand depends on stock, TWD=three factors weibull function, TFWD=two factors weibull function, AP. = pre-payment, TDD = Demand pattern depends on time variation, LFT = Demand is a Linear function of time, SASD. =Demand depends on selling price and stock, SAAD =Demand depends on selling price and advertisement, DEDO = Demand is exponentially decreasing order, PDD. = Demand depends on price, SDR=Demand depends on Stochastic function of time, PTDD. =Demand depends on price and time, ILDD =Demand depends on inventory level, S. = At a time, CB=complete backorder, CD. = Demand is a cubic function of time, NDDR=Demand is the non-decreasing pattern, SAPB= allowing shortages and partially, Y. = positive respond, N. = Negative respond.

Meaning of Edge Computing:

Computing of edge permits position of equipments farther the cloud, provides facilities-based service, and analyzes a important data from several sources of inventory system. It includes making choices about information sources making edge ecosystems separate data from data centers.

Method of adopting edge in several commercial organizations:

Organization like Hospiality, Marketing, Transportation, healthcare etc.are obtained benefitsby using cloud edge computing technique. Practical illustration is flipkart organization designed cogenial in the fifth generation(5G) environment. It also provide field sales representatives service in offline mode. In the case of health , Backpack EC is assigning obtain the healthcare service in remote area where the internet service is not avalible and also shares the data of different patient from their own equipments with the help of edge computing. Several private firms and industry works with Google and Microsoft. Various supply chain environment are also used edge computing approach like scarcity of Labor, increasing the labor costs, and aftereffects of COVID-19 are much more necessary for businesses in particularly inventory system and intralogistics.

Supervision of Inventory control system bases on cloud-edge relationship:

Principal keenness is critical to huge kit producers. Due to the effective managing of additional fragments, then the inventory can successfully minimizes the prices and also the level of the service is improved. The manufacturing apparatus are usually in multifaceted assembly and several machineries and spare portions. Still, the prevailing additional fragments, supervision of the inventory is unwieldly and random that controls inventory as per the individual involvement and also strategies demands as per the inventory part. carrying pressure to the manufacture sector and also in other interelated sectors. The result obtained by conventional cloud computation manner is to transfer data from several sources by using sensor networks, and analysis the data from big data by using data analysis technic. For the meantime, the downloaded data transfer to the cloud server through the data accession module for upgrade the efficiency of work and aggression. The cloud-edge method is a computional cooperative method in business IoT to resolve the quick reply delinquent of actual control and processes extensive business data in faster manner.

Additionally, to increase the effectiveness of inventory supervision by expecting the request of manufacturing susceptible portions. There are three important demand models for susceptible parts. (i) intervallic model,(ii) Immobilzed model, (iii) movement model. To expect the additional fragments with stable demand function we can be use exponential smoothing method, whereas to predict the additional fragments with linear pattern, we used quadritric exponential smoothing method. Lastly, we proposed an inventory system based on cloud edge computing method assigned inventory resources properly and also improving the use of inventory related resources. Creating and optimizing the system of inventory by using cloud-edge computing method redueces processing time and also increases productivity rather than use of GAs. To stabilized the research aspects EC method is much more beneficial then GAs method. We can not find a finite decisions of this work because some restrictions are to study it and also some intention are still insufficiencies.

Assumptions:

- The stock level designes for perishable products.
- Deterministic order pace is consider.
- Price, stock and lifetime demand rate is consider.
- Rate of deterioration is taken as constant.
- Holding cost is taken as constant.
- Assuming lead time is zero.
- Shortages are not allowed.

Notations:

- A_0: per order demand value.
- I(t): The inventory at arbitrary time t, $0 \leq t \leq T$
- D (t): Price, reserve and Lifetime demand rate, where D (t) = $(\alpha + \beta I(t))p^{-\eta}(\frac{m-t}{m})$, with $\eta > 0$, $m \neq 0$, and all are constants.
- α : The scale parameter,where $\alpha > 0$.
- β: The mark-up price, where $\beta > 0$.
- η: Price Elasticity, where $\eta > 0$.
- p: Price of sells the per unit item.

- m: Extreme life period. (Represented in some months.)
- t: Instantinous time of inventory.
- θ: The constant deterioration rates.
- iC: Holding cost remains constant, where C is per unit cost of item and ‘ I ‘ units put in the stock.
- A_c: Per unit deterioration value.
- T: The Cycle length.
- I_o: Starting (Initial) stock.
- TC:Total inventory cost obtained per unit time.
- T^*: Length of the optimal cycle period.
- I_o^*: Amount of Initial inventory.
- TC^*: Minimal (Optimal) value per unit time.

2. Mathematical Formulation:

We observe the level of stock since the same linear declines begin at the starting stage on behalf of both order and diminishing standards. Assuming the range of inventory within the cycle period (0.T) is represented by the differential equation with 't' is the time of the inventory level:

$$\frac{dI(t)}{dt} + \theta I(t) = -D(t) \quad (1)$$

Where $D(t) = \big(\alpha + \beta I(t)\big)p^{-\eta}(\frac{m-t}{m})$

$$\Rightarrow \frac{d(t)}{dt} + \theta I(t) = -\big(\alpha + \beta I(t)\big)p^{-\eta}(\frac{m-t}{m})$$

$$\Rightarrow I(t) = \frac{\frac{-\alpha P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)+Ae^{-\theta t}}{1+\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)} \quad (2)$$

Initial condition I (t) =0, when T = t is

$$I(t) = 0 = \frac{\frac{-\alpha P^{-\eta}}{\theta}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)+Ae^{-\theta T}}{1+\frac{\beta P^{-\eta}}{\theta}(1-\frac{T}{m}+\frac{1}{m\theta})}$$

$$\Rightarrow I(t) = \frac{\frac{\alpha P^{-\eta}}{\theta}\left\{\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)e^{\theta(T-t)}+\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)\right\}}{1+\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)} \quad (3)$$

Here it can be determined the starting demand amount considering boundary condition I (0) = I_0 , then the equation (3) reduces to the following :

$$I(0) = I_0 = \frac{\frac{\alpha P^{-\eta}}{\theta}\left\{\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)e^{\theta T}-1-\frac{1}{m\theta}\right\}}{1+\frac{\beta P^{-\eta}}{\theta}\left(1+\frac{1}{m\theta}\right)} \quad (4)$$

Net demand in the interval [0, T] is

$$\int_0^T D(t)dt = \int_0^T \big(\alpha + \beta I(t)\big)p^{-\eta}(\frac{m-t}{m})dt$$

$$= \int_0^T \alpha p^{-\eta}\left(\frac{m-t}{m}\right)dt + \int_0^T \beta\frac{\frac{\alpha p^{-2\eta}}{\theta}\left(\frac{m-t}{m}\right)\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)e^{\theta(T-t)}}{1+\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)}dt - \int_0^T \beta\frac{\frac{\alpha p^{-2\eta}}{\theta}\left(\frac{m-t}{m}\right)\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)}{1+\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)}dt$$

$$= B_1 + B_2 + B_3 \quad (5)$$

$$B_1 = \int_0^T \alpha p^{-\eta}\left(\frac{m-t}{m}\right)dt$$

$$\Rightarrow B_1 = \frac{\alpha p^{-\eta}}{m}\left[mT - \frac{T^2}{2}\right]$$

(5(a))

$$B_2 = \int_0^T \frac{\beta \frac{\alpha p^{-2\eta}}{\theta}\left(\frac{m-t}{m}\right)\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)e^{\theta(T-t)}}{1+\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)}dt$$

$$= \frac{\alpha\beta p^{-2\eta}}{\theta}e^{\theta T}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)\left[\int_0^T \begin{matrix}\left[1-\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)\right]e^{-\theta t}dt \\ -\int_0^T \frac{t}{m}e^{-\theta t}dt + \frac{\beta P^{-\eta}}{\theta}\int_0^T\left(t-\frac{t^2}{m}+\frac{t}{m\theta}\right)e^{-\theta t}dt\end{matrix}\right]$$

$$\Rightarrow B_2 = \frac{\alpha\beta p^{-2\eta}}{\theta}e^{\theta T}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)[B^1-B^2-B^3] \qquad (5(b))$$

$$B^1 = \int_0^T \left\{1-\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)\right\}e^{-\theta t}dt$$

$$\Rightarrow B^1 = \left(\frac{\beta P^{-\eta}-\theta}{\theta^2}\right)\left(e^{-\theta T}-1\right)-\left(\frac{\beta P^{-\eta}Te^{-\theta T}}{m\theta^2}\right)$$
(5b(1))

$$B^2 = \int_0^T \frac{t}{m}e^{-\theta T}dt = \frac{1}{m\theta}\left[\frac{1}{\theta}\left(e^{-\theta t}-1\right)-Te^{-\theta t}\right]$$
(5b(2))

$$B^3 = \frac{\beta P^{-\eta}}{m\theta}\int_0^T\left(t-\frac{t^2}{m}+\frac{t}{m\theta}\right)e^{-\theta t}dt$$

$$\Rightarrow B^3 = \frac{\beta P^{-\eta}}{m\theta}\left[\frac{e^{-\theta T}}{\theta}\left\{-\frac{1}{\theta}+\frac{T}{m\theta}-T+\frac{1}{m\theta^2}+\frac{T^2}{m}\right\}+\frac{1}{\theta^2}-\frac{1}{m\theta^3}\right]$$

(5b(3))

Putting the value of B^1, B^2andB^3in equation 5(b) we get ,

$$B_2 = \frac{\alpha\beta p^{-2\eta}}{\theta}e^{\theta T}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)[B^1-B^2-B^3]$$

$$\Longrightarrow B_2 = \frac{\alpha\beta p^{-2\eta}}{\theta}e^{\theta T}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)\left[\begin{matrix}\frac{\beta P^{-\eta}-\theta}{\theta^2}\left(e^{-\theta T}-1\right)-\frac{\beta p^{-\eta}Te^{-\theta T}}{m\theta^2} \\ -\frac{1}{m\theta}\left\{\frac{1}{\theta}\left(e^{-\theta T}-1\right)-Te^{-\theta T}\right\} \\ -\frac{\beta P^{-\eta}}{m\theta}\left[\frac{e^{-\theta T}}{\theta}\left\{-\frac{1}{\theta}+\frac{T}{m\theta}-T+\frac{1}{m\theta^2}+\frac{T^2}{m}\right\}+\frac{1}{\theta^2}-\frac{1}{m\theta^3}\right]\end{matrix}\right]$$

$$\Rightarrow B_2 = \frac{\alpha\beta p^{-2\eta}}{\theta}e^{\theta T}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)\left[\begin{matrix}\frac{\left(e^{-\theta T}-1\right)}{m\theta^2}\left\{\frac{\beta p^{-\eta}}{m\theta^2}\left(m^2\theta^2+m\theta-1\right)-\frac{1}{\theta}(m\theta-1)\right\} \\ -\frac{Te^{-\theta T}}{m\theta}\left[\frac{\beta p^{-\eta}}{m\theta}\left(\frac{1}{\theta}+T\right)-1\right]\end{matrix}\right]$$
(5(c))

$$B_3 = \int_0^T \frac{\beta \frac{\alpha p^{-2\eta}}{\theta}\left(\frac{m-t}{m}\right)\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)}{1+\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)}dt$$

$$= \frac{\alpha\beta p^{-2\eta}}{\theta}\left[\int_0^T\left\{\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)-\frac{1}{m}\left(t-\frac{t^2}{m}+\frac{t}{m\theta}\right)\right\}dt-\frac{\beta P^{-\eta}}{\theta}\int_0^T\left(1-\frac{t}{m}\right)\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)^2dt\right]$$

$$\Longrightarrow B_3 = \frac{\alpha\beta p^{-2\eta}}{\theta}[B_4-B_5]$$
(5(d))

$B_4 = \int_0^T \left\{\left(1 - \frac{t}{m} + \frac{1}{m\theta}\right) - \frac{1}{m}\left(t - \frac{t^2}{m} + \frac{t}{m\theta}\right)\right\} dt = T\left(\frac{m\theta+1}{m\theta}\right) - \frac{T^2}{2m^2}\left(\frac{2m\theta+1}{\theta}\right) + \frac{T^3}{3m^2}$
(5(e))

$B_5 = \frac{\beta P^{-\eta}}{\theta}\int_0^T \left(1 - \frac{t}{m}\right)\left(1 - \frac{t}{m} + \frac{1}{m\theta}\right)^2 dt = \frac{\beta P^{-\eta}}{\theta}\begin{bmatrix} T\left(\frac{m\theta+1}{m\theta}\right)^2 - T^2\left(\frac{3m\theta^2+4m\theta+1}{2m^3\theta^2}\right) \\ +T^3\left(\frac{m^2\theta+2m\theta+2}{3m^3\theta}\right) - \frac{T^4}{4m^3} \end{bmatrix}$

(5(f))

Putting the value of$B_4 and B_5$ in $B_3 of eqn\ 5(d)$, we get

$$B_3 = \frac{\alpha\beta p^{-2\eta}}{\theta}\left\{\begin{matrix} \left[T\left(\frac{m\theta+1}{m\theta}\right) - \frac{T^2}{2m^2}\left(\frac{2m\theta+1}{\theta}\right) + \frac{T^3}{3m^2}\right] \\ -\left[\frac{\beta P^{-\eta}}{\theta}\begin{bmatrix} T\left(\frac{m\theta+1}{m\theta}\right)^2 - T^2\left(\frac{3m\theta^2+4m\theta+1}{2m^3\theta^2}\right) \\ +T^3\left(\frac{m^2\theta+2m\theta+2}{3m^3\theta}\right) - \frac{T^4}{4m^3} \end{bmatrix}\right] \end{matrix}\right\}$$

Putting the value ofB_1, B_2 andB_3 in eqn (5), then we get

$$\int_0^T D(t)dt = \frac{\alpha p^{-\eta}}{m}\left[mT - \frac{T^2}{2}\right] + \frac{\alpha\beta p^{-2\eta}}{\theta}e^{\theta T}\left(1 - \frac{T}{m} + \frac{1}{m\theta}\right)\begin{bmatrix} \frac{(e^{-\theta T}-1)}{m\theta^2} \\ \left\{\frac{\beta p^{-\eta}}{\theta^2}\left(1 + \frac{1}{m\theta} - \frac{1}{m^2\theta^2}\right) - \frac{1}{\theta}(m\theta - 1)\right\} \\ -\frac{Te^{-\theta T}}{m\theta}\left[\frac{\beta p^{-\eta}}{m\theta}\left(\frac{1}{\theta} + T\right) - 1\right] \end{bmatrix} -$$
$$\frac{\alpha\beta p^{-2\eta}}{\theta}\left\{\begin{matrix} \left[T\left(\frac{m\theta+1}{m\theta}\right) - \frac{T^2}{2m^2}\left(\frac{2m\theta+1}{\theta}\right) + \frac{T^3}{3m^2}\right] \\ -\left[\frac{\beta P^{-\eta}}{\theta}\begin{bmatrix} T\left(\frac{m\theta+1}{m\theta}\right)^2 - T^2\left(\frac{3m\theta^2+4m\theta+1}{2m^3\theta^2}\right) \\ +T^3\left(\frac{m^2\theta+2m\theta+2}{3m^3\theta}\right) - \frac{T^4}{4m^3} \end{bmatrix}\right] \end{matrix}\right\} \quad (6)$$

The number of deteriorated units is $I_0 - \int_0^T D(t)dt$

$$= \left\{\frac{\alpha P^{-\eta}}{\theta}\left[\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)e^{\theta T}-1-\frac{1}{m\theta}\right]\left[1-\frac{\beta P^{-\eta}}{\theta}\left(1+\frac{1}{m\theta}\right)\right]\right\} - \left\{\begin{array}{c}\frac{\alpha p^{-\eta}}{m}\left[mT-\frac{T^2}{2}\right] \\ +\frac{\alpha\beta p^{-2\eta}}{\theta}\left\{\begin{array}{c} e^{\theta T}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)\left[\begin{array}{c}\frac{(e^{-\theta T}-1)}{m\theta^2}\left\{\frac{\beta p^{-\eta}}{\theta^2}\left(1+\frac{1}{m\theta}-\frac{1}{m^2\theta^2}\right)-\frac{1}{\theta}(m\theta-1)\right\} \\ -\frac{Te^{-\theta T}}{m\theta}\left[\frac{\beta p^{-\eta}}{m\theta}\left(\frac{1}{\theta}+T\right)-1\right]\end{array}\right] \\ -\left\{\begin{array}{c}\left[T\left(\frac{m\theta+1}{m\theta}\right)-\frac{T^2}{2m^2}\left(\frac{2m\theta+1}{\theta}\right)+\frac{T^3}{3m^2}\right] \\ -\left[\frac{\beta P^{-\eta}}{\theta}\left[\begin{array}{c}T\left(\frac{m\theta+1}{m\theta}\right)^2-T^2\left(\frac{3m\theta^2+4m\theta+1}{2m^3\theta^2}\right) \\ +T^3\left(\frac{m^2\theta+2m\theta+2}{3m^3\theta}\right)-\frac{T^4}{4m^3}\end{array}\right]\right]\end{array}\right\}\end{array}\right\}\end{array}\right\} \tag{7}$$

The cost of deterioration (DC) in the period [0, T] = A_c.Number of deteriorated units' i.e.

$$DC = A_c\left[\begin{array}{c}\left\{\frac{\alpha P^{-\eta}}{\theta}\left[\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)e^{\theta T}-1-\frac{1}{m\theta}\right]\left[1-\frac{\beta P^{-\eta}}{\theta}\left(1+\frac{1}{m\theta}\right)\right]\right\} \\ -\left\{\begin{array}{c}\frac{\alpha p^{-\eta}}{m}\left[mT-\frac{T^2}{2}\right] \\ +\frac{\alpha\beta p^{-2\eta}}{\theta}\left\{\begin{array}{c} e^{\theta T}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)\left[\begin{array}{c}\frac{(e^{-\theta T}-1)}{m\theta^2}\left\{\frac{\beta p^{-\eta}}{\theta^2}\left(1+\frac{1}{m\theta}-\frac{1}{m^2\theta^2}\right)-\frac{1}{\theta}(m\theta-1)\right\} \\ -\frac{Te^{-\theta T}}{m\theta}\left[\frac{\beta p^{-\eta}}{m\theta}\left(\frac{1}{\theta}+T\right)-1\right]\end{array}\right] \\ -\left\{\begin{array}{c}\left[T\left(\frac{m\theta+1}{m\theta}\right)-\frac{T^2}{2m^2}\left(\frac{2m\theta+1}{\theta}\right)+\frac{T^3}{3m^2}\right] \\ -\left[\frac{\beta P^{-\eta}}{\theta}\left[\begin{array}{c}T\left(\frac{m\theta+1}{m\theta}\right)^2-T^2\left(\frac{3m\theta^2+4m\theta+1}{2m^3\theta^2}\right) \\ +T^3\left(\frac{m^2\theta+2m\theta+2}{3m^3\theta}\right)-\frac{T^4}{4m^3}\end{array}\right]\right]\end{array}\right\}\end{array}\right\}\end{array}\right\}\end{array}\right] \tag{8}$$

The Net Inventory Holding Cost (IHC) within the interval [0, T] is $\mathrm{IHC} = \int_0^T iC.I(t)dt = iC\int_0^T I(t)dt$

$$= iC\int_0^t \frac{\frac{\alpha P^{-\eta}}{\theta}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)e^{\theta(T-t)}}{1+\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)} + \int_0^T \frac{\frac{\alpha P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)}{1+\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)}$$

$$= iC[C_1 + C_2] \tag{9}$$

$$C_1 = \int_0^t \frac{\frac{\alpha P^{-\eta}}{\theta}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)e^{\theta(T-t)}}{1+\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)}dt = \frac{\alpha P^{-\eta}}{\theta^2}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)\left\{\left(e^{\theta T}-1\right)+\frac{\beta P^{-\eta}}{\theta}\left(1+\frac{T}{m}-e^{\theta T}\right)\right\} \tag{9(a)}$$

$$C_2 = \int_0^T \frac{\frac{\alpha P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)}{1+\frac{\beta P^{-\eta}}{\theta}\left(1-\frac{t}{m}+\frac{1}{m\theta}\right)}dt$$

$$-\frac{\beta P^{-\eta}}{\theta}\frac{T^3}{3m^2}\Big\} \tag{9(b)}$$

Substituting the data of C_1 and C_2 in equation (9) we get,

$$-e^{\theta T}\Big)\Big\}$$

$$\Big) - \frac{1}{2m}\Big] - \frac{\beta P^{-\eta}}{\theta}\frac{T^3}{3m^2}\Big\}\Big\}\Big] \tag{10}$$

Net variable inventory Cost = Ordering cost (OC) + Deterioration cot (DC) + Holding cost of Inventory (IHC)

The Total Inventory Cost per Unit Time is $\mathrm{TC(T)} = \frac{\text{Net variable inventory Cost}}{\mathrm{T}} =$

$$\frac{A_0}{T}+\frac{A_c}{T}\left[\begin{array}{c}\left\{\begin{array}{c}\frac{\alpha P^{-\eta}}{\theta}\left[\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)e^{\theta T}-1-\frac{1}{m\theta}\right]\\ \left[1-\frac{\beta P^{-\eta}}{\theta}\left(1+\frac{1}{m\theta}\right)\right]\end{array}\right\}\\ -\left\{\begin{array}{c}\frac{\alpha p^{-\eta}}{m}\left[mT-\frac{T^2}{2}\right]\\ +\frac{\alpha\beta p^{-2\eta}}{\theta}\left\{\begin{array}{c}e^{\theta T}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)\left[\begin{array}{c}\frac{\left(e^{-\theta T}-1\right)}{m\theta^2}\\ \left\{\frac{\beta p^{-\eta}}{\theta^2}\left(1+\frac{1}{m\theta}-\frac{1}{m^2\theta^2}\right)-\frac{1}{\theta}(m\theta-1)\right\}\\ -\frac{Te^{-\theta T}}{m\theta}\left[\frac{\beta p^{-\eta}}{m\theta}\left(\frac{1}{\theta}+T\right)-1\right]\end{array}\right]\\ -\left\{\begin{array}{c}\left[T\left(\frac{m\theta+1}{m\theta}\right)-\frac{T^2}{2m^2}\left(\frac{2m\theta+1}{\theta}\right)+\frac{T^3}{3m^2}\right]\\ -\left[\frac{\beta P^{-\eta}}{\theta}\left[\begin{array}{c}T\left(\frac{m\theta+1}{m\theta}\right)^2-T^2\left(\frac{3m\theta^2+4m\theta+1}{2m^3\theta^2}\right)\\ +T^3\left(\frac{m^2\theta+2m\theta+2}{3m^3\theta}\right)-\frac{T^4}{4m^3}\end{array}\right]\right]\end{array}\right\}\end{array}\right\}\end{array}\right\}\end{array}\right]$$

$$+\frac{ic\alpha P^{-\eta}}{T^5\theta}\left[\begin{array}{c}\left(1-\frac{T}{m}+\frac{1}{m\theta}\right)\\ \left\{\left(e^{\theta T}-1\right)+\frac{\beta P^{-\eta}}{\theta}\left(1+\frac{T}{m}-e^{\theta T}\right)\right\}\\ +\left\{\frac{\alpha P^{-\eta}}{\theta}\left\{\begin{array}{c}T\left[1+\frac{1}{m\theta}-\frac{\beta P^{-\eta}}{\theta}\left(\frac{m^2\theta-2m\theta-1}{m^2\theta}\right)\right]\\ +T^2\left[\frac{\beta P^{-\eta}}{m\theta}\left(\frac{m\theta+1}{m\theta}\right)-\frac{1}{2m}\right]\\ -\frac{\beta P^{-\eta}}{\theta}\frac{T^3}{3m^2}\end{array}\right\}\right\}\end{array}\right] \quad (11)$$

Now, we minimize the absolute inventory variable cost and the value of T obtained after conforming the following provision.

$$\frac{dTC(T)}{dT}=0 \quad \text{and} \quad \frac{d^2(TC)}{dT^2}>0$$

$$\frac{dTC(T)}{dT}=-\frac{A_o}{T^2}+A_c\left\{\begin{array}{c}\left\{\frac{\propto P^{-\eta}e^{\theta T}}{\theta}\left[-\frac{1}{T^2}+\frac{\theta}{T}-\frac{\theta}{m}+\frac{1}{mT}-\frac{1}{m\theta T^2}+\frac{1}{T^2}+\frac{1}{T^2m\theta}\right]\left[-\frac{1}{T^2}+\frac{\beta P^{-\eta}}{\theta T^2}\left(1+\frac{1}{m\theta}\right)\right]\right\}\\ -\frac{\alpha\beta P^{-2\eta}e^{\theta T}}{\theta}\left\{\left(\frac{\theta}{T}-\frac{1}{T^2}+\frac{\theta}{m}+\frac{1}{mT}-\frac{1}{m\theta T^2}\right)\left\{\begin{array}{c}\left(\frac{e^{\theta T}}{Tm\theta}-\frac{e^{\theta T}}{T^2m\theta^2}+\frac{1}{T^2m\theta^2}\right)\left[-\frac{\beta P^{-\eta}}{\theta^2T^2}\left(1+\frac{1}{m\theta}+\frac{1}{m^2\theta^2}\right)+\frac{1}{\theta T^2}(m\theta-1)\right]\\ +\frac{e^{\theta T}}{m}\left[\frac{\beta P^{-\eta}}{m\theta}\left(-\frac{1}{\theta T^2}\right)+\frac{1}{T^2}\right]\end{array}\right\}\right\}\\ -\left\{\left[\frac{2m\theta+1}{2m^2\theta}+\frac{2T}{3m^2}\right]-\left[\frac{\beta P^{-\eta}}{\theta}\left[-2T\left(\frac{3m\theta^2+4m\theta+1}{2m^3\theta^2}\right)+3T^2\frac{m^2\theta+2m\theta+2}{3m^3\theta}-\frac{3T^2}{4m^3}\right]\right]\right\}\end{array}\right\}$$

$$+\frac{ic\alpha P^{-\eta}}{\theta}\left\{\begin{array}{c}\left(-\frac{1}{T^2}-\frac{1}{m\theta T^2}\right)\left\{\frac{\theta e^{\theta T}}{T}-\frac{e^{\theta T}}{T^2}+\frac{1}{T^2}+\frac{\beta P^{-\eta}}{\theta}\left(-\frac{1}{T^2}-\frac{\theta e^{\theta T}}{T}+\frac{e^{\theta T}}{T^2}\right)\right\}\\ +\frac{\alpha P^{-\eta}}{\theta}\left[\frac{(m\theta+1)\beta P^{-\eta}}{m^2\theta^2}-\frac{1}{2m}-\frac{2T\beta P^{-\eta}}{3m^2\theta}\right]\end{array}\right\}$$

(12)

Thus, the sufficient condition is

$$\frac{d^2(TC)}{dT^2} = \frac{2A_o}{T^3} + A_c\left\{\begin{array}{c}\left\{\frac{\alpha P^{-\eta}}{\theta} - \left[\begin{array}{c}\frac{2e^{\theta T}}{T^3} - \frac{\theta e^{\theta T}}{T^2} - \frac{\theta e^{\theta T}}{T^2} + \frac{\theta^2 e^{\theta T}}{T} \\ -\frac{\theta^2 e^{\theta T}}{m} - \frac{e^{\theta T}}{T^2 m} + \frac{\theta e^{\theta T}}{mT} - \frac{2}{T^3} - \frac{2}{T^3 m\theta}\end{array}\right]\left[\frac{2}{T^3} - \frac{2\beta P^{-\eta}}{\theta T^3}\left(1 + \frac{1}{m\theta}\right)\right]\right\} \\ -\frac{\alpha\beta P^{-\eta}}{\theta}\left\{\begin{array}{c}\left(\begin{array}{c}\frac{\theta^2 e^{\theta T}}{T} - \frac{\theta e^{\theta T}}{T^2} + \frac{2e^{\theta T}}{T^3} - \frac{\theta^2 e^{\theta T}}{T^2} - \frac{\theta^2 e^{\theta T}}{m} \\ + \frac{\theta e^{\theta T}}{mT} - \frac{e^{\theta T}}{mT^2} + \frac{2e^{\theta T}}{m\theta T^3} - \frac{\theta e^{2T}}{m\theta T^2}\end{array}\right) \\ \left\{\left(\begin{array}{c}\frac{e^{\theta T}}{Tm} - \frac{e^{\theta T}}{T^2 m\theta} - \frac{e^{\theta T}}{T^2 m\theta} \\ + \frac{2e^{\theta T}}{T^3 m\theta^2} - \frac{2}{T^3 m\theta^2}\end{array}\right)\left[\begin{array}{c}\frac{2\beta P^{-\eta}}{\theta^2 T^3}\left(1 + \frac{1}{m\theta} + \frac{1}{m^2\theta^2}\right) \\ -\frac{2}{\theta T^3}(m\theta - 1)\end{array}\right]\right\} \\ + \frac{\theta e^{\theta T}}{m}\left(\frac{2\beta P^{-\eta}}{m^2\theta^2 T^3} - \frac{2}{T^3}\right)\end{array}\right\} \\ -\frac{2}{3m^3} + \frac{2\beta P^{-\eta}}{\theta}\left(\frac{3m\theta^2 + 4m\theta + 1}{2m^3\theta^2}\right) \\ -\frac{6T\beta P^{-\eta}}{\theta}\left(\frac{m^2\theta + 2m\theta + 2}{3m^3\theta}\right) + \frac{6T\beta P^{-\eta}}{4\theta m^3}\end{array}\right\}$$

$$+\frac{ic\alpha P^{-n}}{\theta}\left\{\left(\frac{2}{T^3} + \frac{2}{m\theta T^3}\right)\left[\begin{array}{c}\frac{\theta^2 e^{\theta T}}{T} - \frac{e^{\theta T}}{T^2} + \frac{2e^{\theta T}}{T^3} - \frac{\theta e^{\theta T}}{T^2} - \frac{2}{T^3} + \frac{\beta P^{-n}}{\theta}\frac{2}{T^3} \\ + \frac{\theta e^{\theta T}}{T^2} - \frac{\theta^2 e^{\theta T}}{T} + \frac{\theta e^{\theta T}}{T^2} - \frac{2e^{\theta T}}{T^3} - \frac{2\alpha\beta P^{-2n}}{3m^2\theta^2}\end{array}\right]\right\}$$

(13)

Substituting the value of all the parameters into equation (11), it draws the significance of T that supplies the optimum lower cost. The numerical example mentioned below confirms the provision and consequently draws upon the lower value.

Algorithm:

Step1: Input the values of $\alpha, \beta, \theta, p, \eta, m, iC, and\ A_c$ in eqn. (12), then we obtained length of cycle T.

Again, Changing Parameter values of $, \beta, \theta, p, \eta, m, iC, and\ A_c$, then we obtained the updated values

of Cycle time T*.

Step2: Input the values of $\alpha, \beta, \theta, p, \eta, m, T, A, and\ t$ in eqn. (3), then we obtained the value of I.

Again, by changing the value of the Parameters $\alpha, \beta, \theta, p, \eta, m, T, A, and\ t$, then we obtained the updated

I* value.

Step3: Input the values of $\alpha, \beta, \theta, p, \eta, m, and\ T$ in eqn. (4), then we obtained value of I_0. Again, by changing the

value of Parameters $\alpha, \beta, \theta, p, \eta, m, and\ T$, then we obtained the updated values of I_0*.

Step4: Input the values of $\alpha, \beta, \theta, p, \eta\ and\ m,$ in eqn. (6), then we obtained value of D(t.) Again, by changing value

of Parameters $\alpha, \beta, \theta, p, \eta\ and\ m,$ then we obtained the updated values of D(t)*.

Step5: Input the values of $\alpha, \beta, \theta, p, \eta\ , m, T\ and\ A_c$ in eqn. (8), then we obtained DC value. Again, varing the value

of Parameters $\alpha, \beta, \theta, p, \eta\ , m, T\ and\ A_c$, then we obtained the updated values of DC*.

Step6: Input the values of $\alpha, \beta, \theta, p, \eta\ , m, T\ and\ iC$ in eqn. (10), then we obtained the value of IHC. Again, by

changing value of Parameters $\alpha, \beta, \theta, p, \eta\ , m, T\ and\ iC$, then we obtained the updated values of IHC*.

Step 7: Inputting the corresponding parameters value of step 1 and corresponding cycle time value T value in eqn.

(11), then we obtained TC value. Again, varying the parameter values and corresponding T values, then we

Obtained updated values of TC*.

3. Numerical Example:

Convey this verying inventory model, counterfeit an illustration which is sworn assuming the beneath parameters. Suppose A_0=700, $\alpha = 600, \beta = 2.8, \eta = 1.004, \theta = 1.5, T = 2\ months, m = 6\ months, P = 550, A_c = 650, i = 0.30, C = 500$ relevant unit. By employing the procedure to calculate the solution using Mathematica 12.0. Acquire the required result for I_0^*, *T** and TC* from equations (3), (12) and (11) respectively. The results are $\mathrm{I_0}^* = 0.935819, \mathrm{T}^* = 275.7205$ and $\mathrm{TC}^* = 19.7407$.

Table 1: (Variation of I, T & TC)

Notations	values	I*	T*	TC*
α	600	0.935819	275.7205	19.7407
	550	0.857834	283.1501	22.8551
	500	0.779849	290.3541	22.4526
	450	0.701864	297.3333	18.5332
	400	0.623879	304.0869	11.0969
β	2.8	0.935819	275.7205	19.7407
	3.2	0.935488	275.8311	136.361
	3.6	0.935157	275.9391	252.9849
	4.0	0.934827	276.0443	369.6133
	4.4	0.934497	276.1468	486.2444
η	1.004	0.935819	275.7205	19.7407
	1.006	0.924112	277.7908	32.8177
	1.008	0.912551	279.8116	45.6594
	1.010	0.901134	281.7845	58.2713
	1.012	0.889860	283.7109	70.6588
θ	1.5	0.935819	275.7205	19.7407
	2.5	1.13699	31742.3725	539.7352
	3.5	1.70377	104600.5485	1539.2788
	4.5	2.51056	232816.4763	3356.1341
	5.5	3.523095	430341.3653	6276.1534
m (in months)	6	0.935819	275.7205	19.7407
	8	0.989037	−7160.25	3516.72

	10	1.02096	−28766.32	10758.19
	12	1.04223	−75015.96	22953.55
	14	1.05743	−159179.74	41317.03
P	550	0.935819	275.7205	19.7407
	530	0.971185	272.2435	48.9573
	510	1.00932	268.3359	82.1533
	490	1.05057	263.9111	120.0185
	470	1.09533	258.8592	163.3934

Table 2: (Variation of T & TC)

Notations	values	T*	TC*
A_0	700	275.7205	19.7407
	600	225.7205	44.7407
	500	175.7205	69.7407
	400	125.7205	94.7407
	300	75.7205	119.7407
A_c	650	275.7205	19.7405
	670	276.1470	42.6988
	690	276.5735	65.6568
	710	277.0001	88.6148
	730	277.4266	111.5728
I	0.30	275.7205	19.7405
	0.25	290.4107	111.6399
	0.20	305.1009	203.5391
	0.15	319.7912	295.4383
	0.10	334.4814	387.3375
C	500	275.7205	19.7405
	450	284.5346	74.8802
	400	293.3487	130.0197
	350	302.1629	185.1592
	300	310.9771	240.2988

Result of the Graphs:

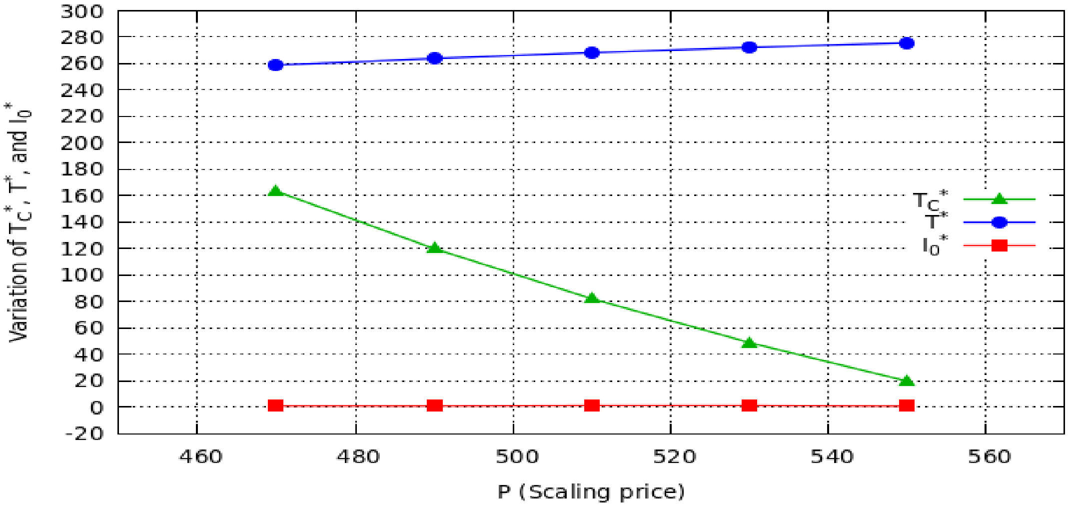

Figure-1

shows that change of inventory time TC*, T* and $I_0{}^*$ versus Selling price(p). Caused by pandemic situation, Scarcity of supply and high demand of those goods as a result increasing the Selling price of the goods. Since the initial stock of the goods remains constant it is not affected by growing the selling price of the goods. But TC value declines gradually because as the cost factor of the goods, it is not able to purchase it as a result the value of the T increases.

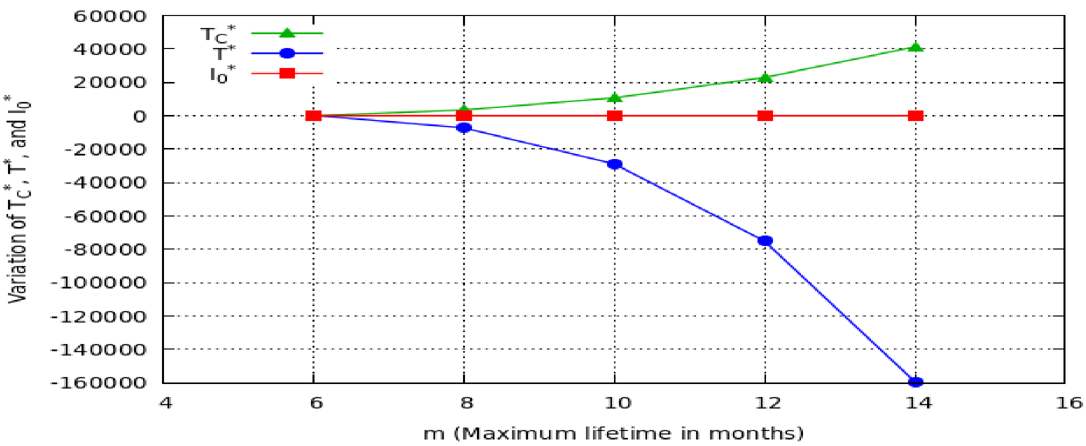

Figure-2

Figure 2 shows that change of inventory time TC*, T* and $I_0{}^*$ versus Maximum lifetime in months(m). Due to the COVID-19 pandemic situation, Scarcity of supply and high demand of those goods as a result increasing the Maximum lifetime in months(m) of the goods. Since the Maximum lifetime in months(m) of the goods increases which is not affect the initial stock (I_0) of the goods. However due to increases in the value of the Maximum lifetime in months(m) of the goods, then T value reduceses gently whereas TC rise gradually because demand and selling price of the goods increases.

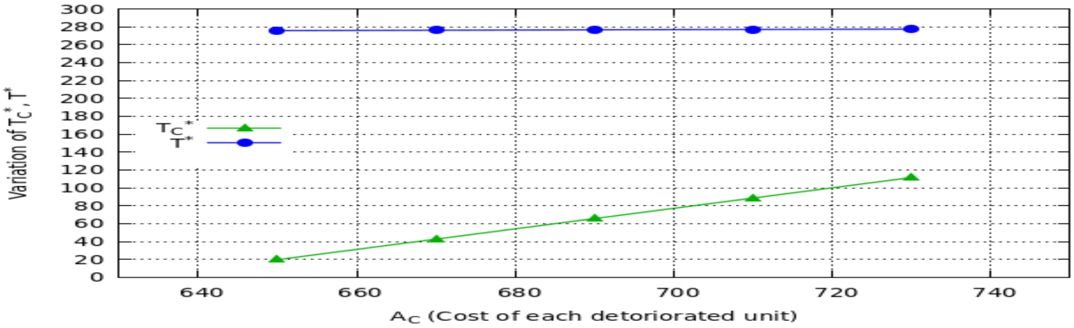

Figure-3

Figure 3 shows that change of inventory time TC* and T* versus every deteriorated unit cost (A_c). Due to COVID-19 pandamic situation, every deteriorated unit cost of goods rise, then it does not influence ohe value of T*. But by increasing the every deteriorated unit cost of the items rise, then TC value increases gradually because the demand and selling price of the goods increase.

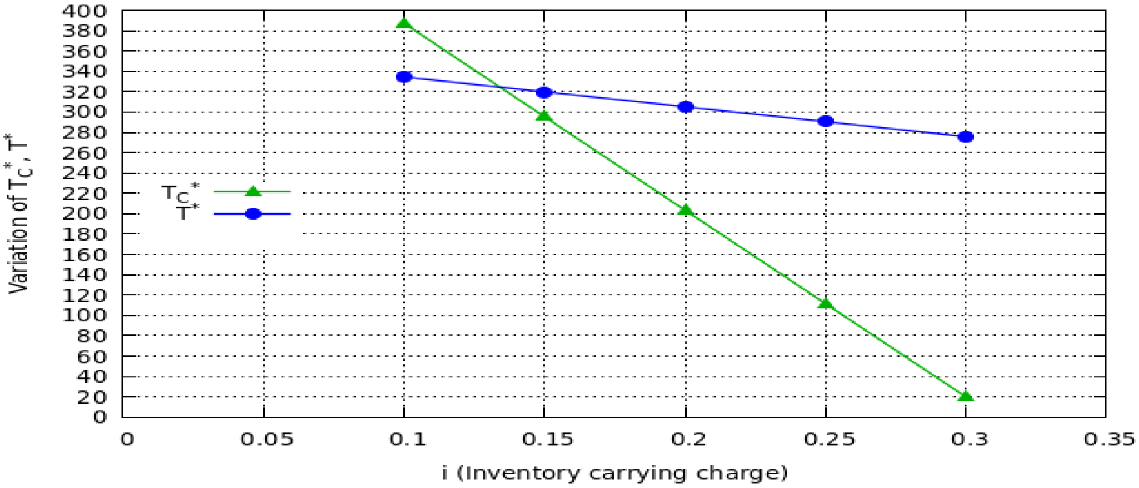

Figure-Figure-4

Figure 4 shows the variation of TC* and T* versus Inventory carrying Charge (I*). Due to the COVID-19 pandemic situation, increasing the Cost of Inventory carrying Charge (I*) of the goods, then T* value slowly moves downward, thereby rising the cost of carrying inventory charges (I*) of the goods, then TC* value reduces swiftly because due to increase in selling price increases, the customer is not affordable to purchase these goods for their economic condition.

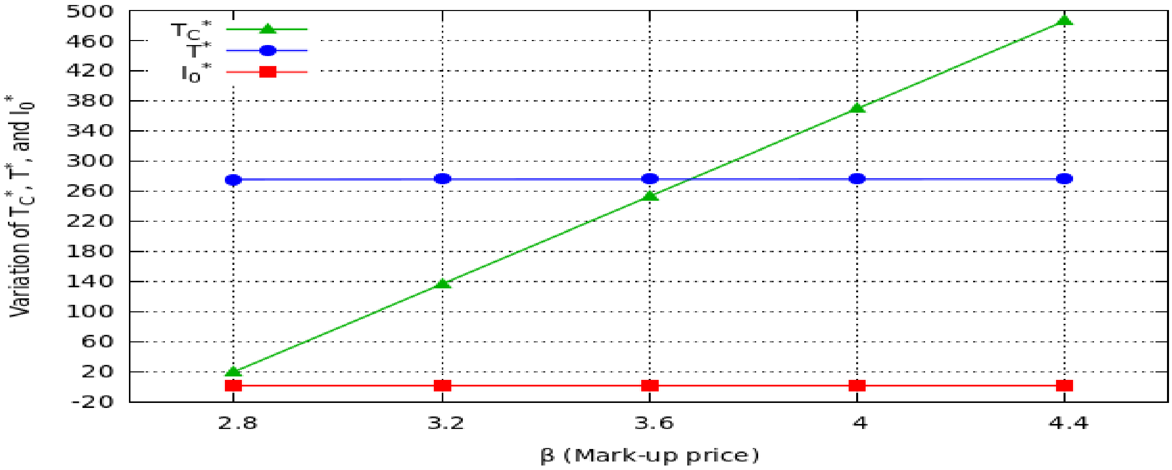

Figure-5

Figure 5 shows that change of inventory time TC*, T* and I_0^* versus Mark-up price (β). Due to the COVID-19 pandemic situation, Scarcity of supply of toods and high demand. By increasing the Mark-up price (β) of the goods, then T* and I* values are not affected. But by increasing the Mark-up price (β) of the goods, then TC* value rises quickly because due to high demand, and the selling price of the goods increases.

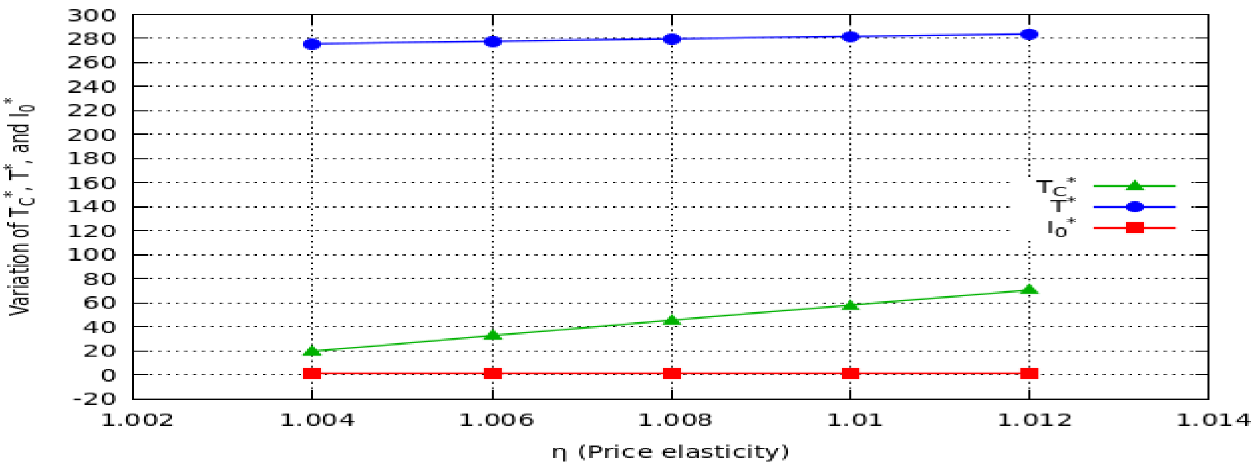

Figure-6

Figure-6 shows that change of TC*, T* and I_0^* versus price elasticity (η). Due to the COVID-19 pandemic situation, the Economic condition of the customers is not well. So, the Vendor allows price elasticity (η) policy. Otherwise, due to the deterioration of goods, the Market value of the goods degrades. When price elasticity (η) value increases, then it does not influence on initial stock (I_0^*). But T* value slightly increases and TC* value rises cautiously.

4. Sensitivity Analysis:

Discussion of sensitivity Analysis versus the inventory system parameters: $A_0, \theta, \beta, \alpha, \eta, m, p$, A_c, *iC,* for the most satisfactory entire cost. The changing value of each parameter have inspected by taking parameter Analysis. By changing a single parameter at that time other parameters are unaltered.

A. *Discussion of Results:*

The statements generally depend on design of mathematical model followed by its results display in the plotted Graph revealed above.

Table-1

1. With the decrease in the amount of parameter $'\alpha'$, amount of T^* and TC^* values increase whereas the value of *I**

decrease.

2. When the parameter ‘β' $increases$, then the value of *I** decreases. In this case, we study that when

$'\beta'$ $value$ increase, then the value of T^* and TC^* $are\ also$ increases.

3. Correspond to the rise of the factor η, , the value of *I** diminishes. In this case, we analyzed that when the

Parameter value $'\eta'$ increase, then the value of T^* and TC^* $are\ also$ increases.

4. When the parameter $'\theta'$ increases, then the value of T^* , TC^*, and *I** also increases. In this case, when

the parameter value θ’is increases, the total minimum cost also increases.

5. When the parameter of $'m'$ increases, then the value of TC^*, and I* increases whereas the value of

T^*decrease. In this case, when the value of $'m'$ it increases, then the total minimum cost also increases.

6. When the parameter $'p'$ decreases, then the value of TC^* and *I** increases whereas T^* $value$ decrease.

Table-2

1. With the decrease in the amount of the factor ‘A_0’, the amount of TC^* increases whileT^*decrease, here, when ‘A_0

decreases, then the total minimal cost of the inventory system increases.

2. When $'A_c'$ value rises, then TC^* and T* values are also rises.

3. With decrease in the amount of parameter$s$ $'I'$ and ‘*C*, the amount of T^* and TC^* increases.

Conclusion.

Economic order Quantities models are useful for edge computing supervesion because it can help us to clarify the performance of cloud-edge objects and forecast the influence of the model in the recent situation. So, it is very significant to comprehend the constraints that defines in this model. The conclusions in this work make a substantial involvement to the study of the computational based budget, by encroach on commercial plans intended by market-based planning. Prominently, this effort assistances understand the possible of fiscal-grounded source managing in creating universal computer-generated era. This approach permitted us to have improved considerate of the presentation of this model for an inclusive of supply the items and demand of the products. The expected research work has been intended for an EOQ model that determines the deterioration rate is constant and not permitting shortages. Rate of demand is taken as a function of price, stock, and lifetime. This kind of presumption is reasonable with small-scale wholesalers those resell short-lived products like green vegetables, different brands of breads, cell phones, high-tech electronic goods, different brands oil, insulin, organic honey, Some healthcare products like a variety of Vaccines like bacille Calmette-Guerin (BCG) for tuberculosis (TB), Hep-B*, Oral polio vaccine (OPV), Rotavirus vaccines, Penta virus vaccine, DPT vaccine, Inactvated polio vaccine (IPV), and Covid vaccine, etc.), variety of seasonal fruits and dairy products (milk,Cream,Butter,Cheese,Custard etc), are reduces its quality by passing over time. Because of the COVID-19 epidemic, things that were physically decaying or directly spoiling caused sales to drop, although holding times for the products increased. A realistic element is introduced in the form of the time-dependent holding cost. Large-scale items are preserved by the implementation of preservation storage facilities due to the variable holding cost to stop the deterioration of in-stock goods. In instantaneous retailling of goods, it is frequently seen its desire for some well-known product names or some stylish products, such as shoes, garments (clothing), etc., results in back ordering during times of shortage in these products availability. For data analysis, we utilized Edge computing (EC) technique, and to make the graphics, we used Gnu Plot. In this analysis, the rate of demand is expressed in terms of price, reserve, lifetime cost, and constant holding cost. The prime outcomes of this work is to significantly reduces the overall ideal inventory cost when permitting the shortages. Generally speaking, demand for the majority of products fell during the COVID-19 epidemic. Wholesalers use preservation technology to prioritize the preservation of the goods to reduce deterioration. If feasible, decision-makers should construct a better innovative preservation capability within the constraints of their budget. Our aim is to use innovative preservation technology for reducing the deterioration rate and raises the demand of the items by using the methods like advertisements through mass/electronic/print media and arranging awareness programs etc. By introducing fuzzy logic or interval settings as well, this study activity may be expanded to additional researchable fields, and it can subsequently be determined using Genetic Algorithm (GAs) technique or Grid computing approach.

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