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Reliable Supply Chain To Deliver Inventory To Consumers With Exponential Demand With The Effect Of Inflation On The Model Over Time

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Abstract: The present paper acknowledges the impact of inflation over time and the significant challenge of managing a reliable supply chain on increasing consumer demands. In today's fast-paced business scenario, maintaining uninterrupted a flow of inventory is a crucial challenge, which is paramount to maintaining customer satisfaction. Consumer' demand has increased exponentially across various industries due to various factors such as e-commerce growth, changing consumer preferences and emerging markets. Along with this, production costs, transportation costs and overall supply chain operating costs cannot remain unaffected by the cascading effects of inflation. With the help of this paper, an attempt has been made to develop a reliable supply chain management model which helps to form integrate demand sensing technologies and inflation-adjusted strategies to ensure an uninterrupted supply of inventory to consumers with exponentially increasing demand. The proposed model has been tested using real-world data, with the help of which an attempt has been made to create a reliable supply chain reflecting the impact of exponential demand and inflationary pressure. Through which, the market can remain agile and responsive even in the changing scenario, which also ensures customer satisfaction and sustainable growth.

Keywords: supply chain • exponential demand • inflation • deterioration.

1. Introduction: In today's dynamic and interconnected business environment, meeting the exponentially increasing demands of consumers is a significant challenge, for which maintaining an efficient and reliable supply chain is paramount. There are many challenges involved in this work, one of the most significant challenges that has the potential to impact even the most efficient supply chain models is inflation. As the global economy grows, the inflation factor reduces the purchasing power of currencies, which increases costs in the supply chain. This paper attempts to maintain a reliable supply chain with the persistent effects of inflation. Complexity of supply chains involved in various global industries is a common phenomenon, as they operate under a variety of challenges, including natural disasters, economic fluctuations, geopolitical issues and technology-related challenges. As a result, various businesses often invest in supply chain optimization, risk management, and resiliency strategies to adapt to the circumstances and ensure uninterrupted delivery of goods or services to customers.

In the era of industrial development where technologies have become so advanced, businesses must not only meet the growing expectations of consumers but also protect their operations from the economic complications arising from the effects of inflation. With the help of a successful strategic approach, supply chain management must balance the imperative to promptly deliver inventory to consumers with mitigating the consequences of inflation. The present paper develops an inventory model to meet the challenge of inflation with exponential demands in a reliable supply chain. With the help of this paper an effort has been made to deal with the challenges of growth in consumers demand and inflation while maintaining the reliability of the supply chain. Furthermore, efforts have been made to formulate efficient strategies by taking real-world examples and incorporating innovative strategies and best practices from industries. With the help of which the organization can optimize its supply chain model to meet the demands of a dynamic and ever-growing market under the effect of inflation.

1.2 Contribution of study: The paper titled "Reliable supply chain to deliver inventory to consumers with exponential demand with the effect of inflation on the model over time" will provide significant additions to the field of supply chain management. With the help of this paper, an attempt has been made to find the solution for a business who wish to navigate the complex scenario of exponential demand growth along with the impact of inflation on their supply chains. Here, some potential contributions are discussed point by point.

Reliability Analysis: The proposed paper will contribute to the analysis of various aspects to maintain supply chain reliability. A reliable supply chain should be free from disruptions, to achieve which this paper can propose various strategies.

Demand Forecasting: Facing exponential demand is a significant challenge when developing inventory models. Therefore, this paper can make a meaningful contribution to a successful inventory management model by proposing advanced methods for such demands.

Impact of Inflation: It is essential to consider the impact of inflation on supply chain models. Inflation impacts various aspects such as pricing, cost structure and inventory valuation. Therefore, with the help of this paper, an effort has been made to analyse these impacts and develop strategies for this.

Long-term planning: The effects of inflation considered in this paper can contribute to long-term supply chain planning. Which along with bringing stability in the changing economic environment with time, also ensures efforts to bring the businesses to a profitable position.

In the field of academic advancement: The proposed paper attempts to address the complex and relevant problem of supply chain management, which will contribute to the academic literature in the field of supply chain management, operations research, and inventory management.

In short, this paper provides important strategies to researchers, practitioners, and industries by investigating and addressing the impact of exponentially increasing demand and inflation on reliable supply chain models.

2. Literature review:

2.1. Inventory management under supply chain: Inventory management is a vital component in any supply chain management, whose major function is to efficiently control and monitor the flow of goods and services within the organization. With its help it is ensured that the right product is available at the right time and in the right quantity. Besides, holding costs can also be reduced and situations of stockout or overstock can also be avoided. Ensuring efficient inventory management can have a significant impact on any company's profitability and customer satisfaction.Supply chain management is the network concerned with the production, maintenance, and efficient delivery of goods and services to their consumers. The stages of an efficient supply chain management include all the steps required to bring a product from its initial state to the final consumer. Supply chains have become a fundamental part of the success of any business, which ensures that products and services flow efficiently and effectively to the market, so that there is uninterrupted supply of goods to the customers connected with those services. It also helps in reducing costs, improving product quality, reducing lead times, and increasing customer satisfaction. Avinadav et.al (2019) studied the effect of information superiority on two echelon supply chain model, where the demand of the item is dependent upon selling price. Guchhait, and Sarkar (2021) presented a unreliable supply chain model with the collaboration of vendor , manufacturer and retailers ,where the policies managed by vendor ,is used by single manufacturer and with its help he deals with multiple unreliable retailers. Manupati et al.(2019) discussed a sustainable supply chain inventory model with carbon emissions policies under lead time consideration. Sarkar and Guchhait (2023) developed the inventory model based on green supply chain management, incorporating cap-trade, service and vendor-managed inventory strategies. Wang et al. (2022) develops supply chain coordination model based on bilateral asymmetric information and commitment-penalty contracts. With the help of this paper, they demonstrated how VMI supply chain coordination can be achieved in asymmetric information environments. With the development of efficient supply chain business, bargaining is increasing nowadays, to which practitioners and academics have drawn their attention. To know the effect of bargaining on retail sales, Davoudi et al. (2023) developed a two -echelon green supply chain model. And it was found that the use of bargaining can increase the greenness level of products and overall profits.

2.2. Effect of inflation on inventory over the time: Inflation has a cascading effect on inventory over time. It generally refers to rising prices of raw materials, labor, and other production costs. Because the increase in these prices has a direct impact on the prices of goods sold, which can lead to a decrease in profitability. Inflation also affects inventory turnover. With increased prices it may take longer for a company to sell its inventory to the market. As a result, holding costs may also increase and turnover rates will decrease, which can have a direct impact on the cash flow as well as the efficiency of the company's operations. Inflation also has a wide-ranging impact on supply chains, this can cause delays in the inventory reaching its destination, which can also increase transportation costs. To mitigate risks from inflation, businesses may need to hold more safety stock, which could lead to tying up additional capital. Therefore, inflation can have a wide-ranging impact on inventory management and a company's financial performance. Businesses should ensure that they carefully monitor their inventory levels, pricing strategies and financial statements by making appropriate strategies to mitigate the adverse effects of inflation. Also, during the time of inflation, advice from financial experts and accountants can help reduce the complexities of inventory management. Inflation has a wide-ranging impact on the economy. To understand the impact of inflation, many researchers have developed several inventory models that take inflation into account. Jaggi et.al.(2006) presented a DCF approach for deteriorating items under inflationary conditions,where the demand for the item is assumed to be function of inflation with completely backlogged shortages. Yang et al. (2010) carried out with an inventory model for deteriorating items having demand of items depends upon the level of stock under the inflation. Their model allows time varying replenishment cycle and time varying time varying shortage intervals Uthayakumar and Palanivel (2014) proposed an inventory model with finite replenishment policy under progressive payment scheme within the cycle time. The demand is taken as deterministic function of selling price and the supplier offers trade credit to the retailer,this whole model is studied under inflationary environment. Agarwal et al. (2018) presented a two- warehouse inventory model for non-instantaneous deteriorating items with exponential demand

and inflation. Singh et al (2018) presented a two-warehouse inventory model for deteriorating items where the demand of the items dependent upon the time with partially backlogged shortages under the effect of inflation. Singh et al. (2020) discussed an inventory model for the items having demands is taken as function of expiration date. They allows partially backlogging shortages and effect of inflation in their model. With the help of this paper they tried to find the optimal order quantity which helps to minimised the total associated cost.

2.3. About The exponential demand: When the demand for a product or service increases at an accelerated rate over time it is referred to as exponential demand. The following can contribute to exponential demand:

2.3. Technological progress: The main reason for the rapid increase in demand for products and services is progress in the field of technology. For example, the digital revolution in smartphones and the Internet has led to a rapid increase in demand for mobile apps, online services and digital content.

2.4. Disruption in supply chain: Disruptions in the supply chain due to various reasons can lead to shortages of many critical components or resources, creating a sudden and exponential demand for alternative products.

2.5. Epidemics and crises: Some extraordinary events such as epidemics or natural disasters can cause a sharp increase in demands for certain products and services. For example, during the Corona pandemic, we saw how the demands for personal protective equipment (PPE) or telemedicine services increased exponentially.

There are both positive and negative sides to exponential demand for any business. The positive side emphasizes that it can help in rapid revenue growth. Its negative side says that, if a company is not able to meet the demand growth, then it may put pressure on resources, which may cause disruption in supply chains, as a result, operational challenges may arise.

In today's dynamic market the demand of most of the items are not constant. The demand for the items increases or decreases rapidly. Keeping this exponential demand in mind, various inventory models have been developed by many researchers in recent years. Tayal et al. (2015) presented a supply chain inventory model for deteriorating items with the collaboration of vendor an buyer .The demand rate for this model is taken as exponential while the production rate is a function of demand rate . Tripathi et al. (2017) proposed an inventory model having exponential time dependent demand and deterioration with shortages. They also assume that demand rate and unit production cost are proportional to each other. Sekar and Uthayakumar (2018) introduced a production inventory model for deteriorating items with preservation facilities and shortages. The demand is taken as exponentially increasing and the production is demand dependent. Kumar et al. (2018) presented an inventory model under the hypothesis of two different production rates and exponential demand rates where the rate of deterioration rate is linear function time having no shortages of items. Kumar (2021) presented a fuzzy production inventory model for deteriorating items with Time Dependent Exponential Demand Rate under partially backlogging shortages of items. Malumfashi et al.(2022) proposed an EPQ model considering two phase production period with exponential demand rate to solve the problem arising during the covid -19. Yadav et al. (2023) presented a smart production-inventory model for deteriorating items under an imperfect process with a constant rate of deterioration with the effect of inflation.

3. Research gap Table

Authors	**Model type**	**Deterioration**	**Demand**	**Inflation**
Alamri et al.(2022)	Inventory	Considered	Multi variable	Considered
Sarkar et al.(2022)	SCM	NC	service level	NC
Padiyar et al.(2022)	SCM	Considered	Constant	Considered
Mahapatra et al.(2022)	Inventory	Considered	imprecise	NC
Sundararajan et al.(2022)	Inventory	Considered	selling price	Considered
Khan et al.(2022)	Inventory	Considered	stock dependent	NC
Dey et al.(2022)	SCM	NC	selling price	NC
Chakraborty et al.(2020)	Inventory	Considered	stock dependent	NC
Khan et al. (2022)	Inventoy	Considered	selling price	NC
Duary et al.(2022)	Inventory	Considered	Time dependent	NC
Shah and Naik(2020)	Inventory	Considered	time-price dependent	NC
Padiyar et al.(2023)	SCM	Considered	Constant	considered
This study	SCM	Considered	Exponential	Considered

NC : Not considered for this study

4. **Problem definition, Notation, and Assumptions:**

4.1. Problem definition: The main objective of this paper is to develop an inventory model that can address the challenges posed by the impact of inflation on a reliable supply chain system in the presence of exponential demand patterns. Several major problems arise while preparing this paper, which are as follows: Whenever the demand for a product or service increases exponentially, the primary problem that arises is inventory management and distribution. Rapidly increasing demand can put unnecessary strain on traditional supply chain systems, due to which the supply chain is not working properly and problems like stockouts, overstocking and customer dissatisfaction may be faced.

Inflation has a very strong impact on the supply chain, inflation can also affect supply chain costs over time. Rising costs of raw materials, transportation, labor, and other factors influence pricing strategies. Due to which the profit margin is affected, as a result the stability of the supply chain is also affected.

The model should be designed in such a way that, it can present appropriate decision-making strategies to deal with unexpected events such as supply chain disruptions, natural disasters, or economic recession.

4.2. Notations.

$I_s(t)$	inventory level of supplier at time *t*	A_p	set up cost per production run
$I_P(t)$	inventory level of producer at time *t*	θ_1	deterioration rate for producer
$I_r(t)$	inventory level of retailer at time *t*	θ_2	deterioration rate for supplier
Q_S	maximum inventory of raw material for supplier	θ_3	deterioration rate for retailer
Q_P	maximum inventory for production quantity per production run	A_r	ordering cost per order for retailer
Q_R	retailer's maximum inventory level	d_r	deterioration cost for retailer
h_s	Supplier's holding cost	λ	percentage of the defective items
d_s	Supplier's deterioration cost	T_i	inventory cycle time for different situation specified in model formulation
A_s	Supplier's ordering	d_i	Rework cost
r	Inflation Rate	l	number of deliveries from supplier to retailer
h_p	holding cost per unit for producer	n	number of deliveries from producer to supplier
d_p	deterioration cost per unit for producer		
c_p	production cost per unit		

h_r Retailer's holding cost	

3.3 **Assumptions**

(1) The system consists of three-echelon supply chain, i.e., producer, supplier and retailer.
(2) Demand rate for producers and suppliers is exponentially depending on time, i.e., D(t)=a e^{bt},where a and b >0, while demand rate for retailers is dependent on stock level.
(3) Production rate is totally demand dependent, i.e., P(t)=kD(t) where k >1
(4) Shortage is not allowed at any stage.
(5) Multiple deliveries per order are considered.

5. Mathematical modelling

5.1. Model development for producer: Inventory model for producer's depicted by figure (1) (Ref., Singh et al. (2015)), the planning horizon T is divided into two parts where T_1 is production period and after that no production takes place, during the time T_1 the inventory level decreases due to demand and deterioration while increases due to production. The inventory level decreases in the time interval $[T_1, T]$ due to the demand of the commodity as well as the deterioration of the commodity.

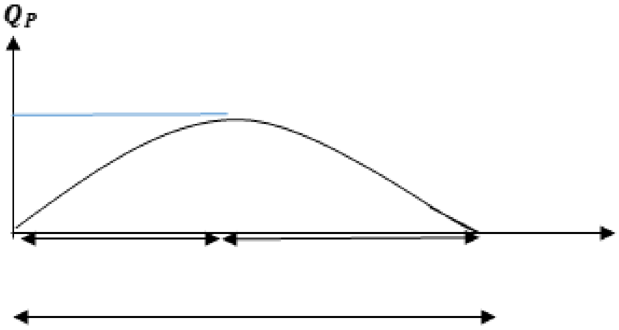

Figure 1: Inventory system of producer

The nature of producer's inventory can be clearly understood from the following mathematical equations

$$\frac{dI_{P_1}(t)}{dt} = P(t) - D(t) - \theta_1 I_{P_1}(t), \quad 0 \le t \le T_1 \qquad (1)$$

$$\frac{dI_{P_2}(t)}{dt} = -D(t) - \theta_1 I_{P_2}(t), \quad T_1 \le t \le T \qquad (2)$$

with $I_{P_1}(0) = 0$ and $I_{P_2}(T) = 0$

Solution of the equations (1) and (2) are follows

$$I_{P_1}(t) = \frac{a(k-1)}{b+\theta_1}\left[e^{bt} - e^{-\theta_1 t}\right] \quad 0 \le t \le T_1 \qquad (3)$$

$$I_{P_2}(t) = \frac{a}{b+\theta_1} e^{-\theta_1 t}\left[e^{(b+\theta_1)T} - e^{(b+\theta_1)t}\right], \quad T_1 \le t \le T \qquad (4)$$

Producer's total cost consists of the following sub costs:

(a) Set up cost: Setup costs include expenses incurred while transferring a production process or operation from one state to another. Along with this, it also includes the cost of labor and resources spent in preparing the equipment and systems for the successful operation of a new task or business.

$$SC_P = A_p \qquad (5)$$

(b) Holding cost: Holding costs are the costs associated with storing and maintaining a product or service over a period of time. This cost includes the expenses associated with handling of inventory as well as the financial implications. Holding cost is an essential factor for efficient inventory management and supply chain optimization.

$$HC_P = h_p\left[\int_0^{T_1} I_{P_1}(t)e^{-rt}dt + \int_{T_1}^{T} I_{P_2}(t)e^{-rt}dt\right]$$

$$HC_P = h_p\left[\begin{array}{l}\frac{(k-1)a}{b+\theta_1}\left[\left(\frac{e^{(b-r)T_1}-1}{b-r}\right)+\left(\frac{e^{-(\theta_1+r)T_1}-1}{\theta_1+r}\right)\right] \\ +\frac{a}{(b-(-\theta_1))}\left[\begin{array}{l}\left(\frac{e^{-(-b+r)T_1}-e^{(b-r)T}}{b-r}\right) \\ +e^{(b-(-\theta_1))T}\left(\frac{e^{-(\theta_1+r)T_1}-e^{-(\theta_1+r)T}}{r+\theta_1}\right)\end{array}\right]\end{array}\right] \quad (6)$$

(c) Deteriorating cost: Deterioration costs refer to the decline in the quality or performance of a product, service or asset over time. In manufacturing system production of defective or low-quality products increases the cost of deterioration which can lead to rework, scrap or customer complaints.

$$DC_P = d_p\theta_1\left[\int_0^{T_1} I_{P_1}(t)e^{-rt}dt + \int_{T_1}^{T} I_{P_2}(t)e^{-rt}dt\right]$$

$$DC_P = d_p\theta_1\left[\begin{array}{l}\frac{(k-1)a}{b+\theta_1}\left[\left(\frac{e^{(b-r)T_1}-1}{b-r}\right)+\left(\frac{e^{-(\theta_1+r)T_1}-1}{\theta_1+r}\right)\right] \\ -\frac{a}{(-b-\theta_1)}\left[\begin{array}{l}\left(\frac{e^{(b-r)T_1}-e^{(b-r)T}}{b-r}\right) \\ +e^{(b+\theta_1)T}\left(\frac{e^{-(\theta_1+r)T_1}-e^{-(\theta_1+r)T}}{r+\theta_1}\right)\end{array}\right]\end{array}\right] \quad (7)$$

(d) Production cost: Production cost, also called cost of goods manufactured, is the total expense incurred by a business in the process of manufacturing or producing inventory items over a period of time.

$$PC_P = c_p\left[\int_0^{T_1} P(t)e^{-rt}dt\right]$$

$$= c_p\frac{ka}{b-r}\left[e^{(b-r)T_1}-1\right] \quad (8)$$

Total cost for producer is:

$$\Pi_P = \frac{1}{T}\left[SC_P + DC_P + HC_P + PC_P\right] \quad (9)$$

5.2. Model development for supplier: In the time interval $[0, T_2]$, the level of inventory decreases due to deterioration and demand, shown in figure 2 (Ref., Singh et al. (2015)). The supplier's inventory system can be represented by the linear differential equation

$Q_s(t)$

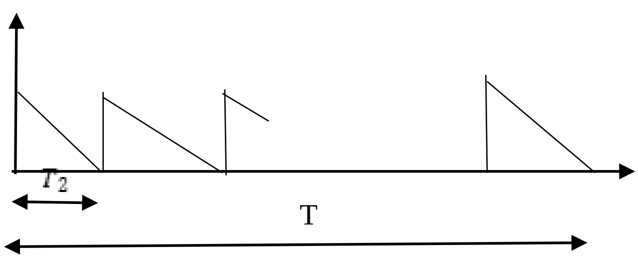

Figure 2: Inventory system of supplier

The nature of supplier's inventory can be clearly understood from the following mathematical equations

$$\frac{dI_s(t)}{dt} = -D(t) - \theta_2 I_s(t) \qquad 0 \le t \le T_2 \quad (10)$$

Using the boundary condition $I_s(T_2) = 0$

The solution of equation (13) is

$I_s(t) = \frac{a}{(\theta_2+b)} e^{-\theta_2 t} [e^{(b+\theta_2)T_2} - e^{(b+\theta_2)t}$ (11)

The maximum inventory level of raw material

$Q_S = I_s(0) = = \frac{a}{(\theta_2+b)}[e^{(b+\theta_2)T_2} - 1]$

Supplier's total cost depends on following factors:

(a) Holding cost:

$HC_S = h_s \left[\int_0^{T_2} I_s(t) e^{-rt} dt\right]$

$HC_S = h_s \frac{a}{b+\theta_2}\left[\left(\frac{1-e^{(b-r)T_2}}{b-r}\right) e^{(b+\theta_2)T_2} \left(\frac{1-e^{-(r+\theta_2)T_2}}{r+\theta_2}\right)\right]$ (12)

(b) Deterioration cost:

$DC_S = \theta_2 d_s \left[\int_0^{T_2} I_s(t) e^{-rt} dt\right]$

$DC_S = \theta_2 d_s \frac{a}{b+\theta_2}\left[\left(\frac{1-e^{(b-r)T_2}}{b-r}\right) e^{(b+\theta_2)T_2} \left(\frac{1-e^{-(r+\theta_2)T_2}}{r+\theta_2}\right)\right]$ (13)

(c) Ordering cost:

$OC_S = A_S$ (14)

Total cost for supplier is the sum of ordering cost, holding cost and deteriorating cost for n shipments

$\Pi_S = \frac{n}{T}[\, OC_s + HC_s + DC_s \,]$ (15)

5.3. Model development for Retailer:

The inventory model system for retailer's given in figure 3, retailer purchases a fixed quantity of finished goods item from the supplier at time t=0, The nature of retailer's inventory can be clearly understood from the following mathematical equations

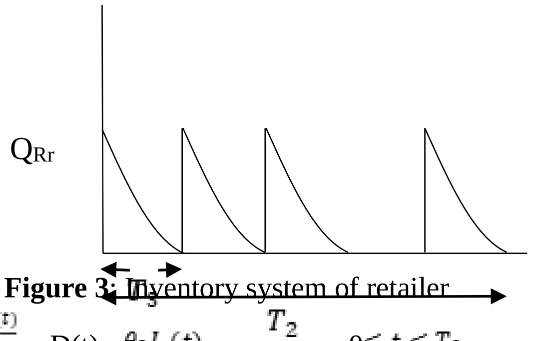

Figure 3: Inventory system of retailer

$\frac{dI_r(t)}{dt} = -D(t) - \theta_3 I_r(t) \qquad 0 \le t \le T_3$ (16)

Where $D(t) = \alpha + \beta I_r(t)$ With $I_r(T_3) = 0$

Solution of equation (19) is

$I_r(t) = \frac{-\alpha}{\theta_3+\beta} + \frac{\alpha}{\theta_3+\beta} e^{(\theta_3+\beta)(T_3-t)}$ (17)

The retailer's maximum inventory level is

$Q_R = \frac{-\alpha}{\theta_3+\beta} + \frac{\alpha}{\theta_3+\beta} e^{(\theta_3+\beta)T_3}$ (18)

(a) Ordering cost:

$OC_R = A_R$ (19)

(b) Holding cost:

$HC_R = h_r \left[\int_0^{T_3} I_r(t) e^{-rt}\, dt\right]$

$HC_R = h_r \left[\frac{\alpha(e^{-rT_3}-1)}{\theta_3+\beta} + \left(\frac{\alpha}{\theta_3+\beta}\right) e^{(\beta+\theta_3)T_3} \left(\frac{1-e^{-(\theta_3+\beta+r)T_3}}{\theta_3+\beta+r}\right)\right]$ (20)

(c) Deterioration cost:

$$DC_R = d_r\theta_3\left[\int_0^{T_3} I_r(t)e^{-rt}\,dt\right]$$

$$= d_r\theta_3\left[\frac{\alpha(e^{-rT_3}-1)}{\theta_3+\beta} + \left(\frac{\alpha}{\theta_3+\beta}\right)e^{(\beta+\theta_3)T_3}\left(\frac{1-e^{-(\theta_3+\beta+r)T_3}}{\theta_3+\beta+r}\right)\right] \quad (21)$$

Total cost of retailer is

$$\Pi_R=\frac{nl}{T}\left[OC_R + HC_R + DC_R\right] \quad (22)$$

The study develops an integrated three echelon supply for different rate of deterioration; the present worth total cost per unit time of supplier, producer and the retailer are the sum of Π_S, Π_P and Π_R

The optimization problem can be stated as

Minimize TC(T_1)=$\Pi_S + \Pi_P + \Pi_R$

Subject to $0 \le T_1 \le T$ (23)

6. Solution methodology:

Differentiate both sides of equation (23) with respect to T_1, and the necessary condition to obtain the optimal value is

$$\frac{dTC(T_1)}{dT_1} = 0$$

Again, the second derivative of equation (23) with respect to variable T_1 and if

$$\frac{d^2TC(T_1)}{dT_1{}^2} > 0,$$

Then the total cost of this integrated model mínimum at t= T_1

7. Numerical Example with Sensitivity Analysis and Observations:

7.1. Numerical example: To explain the above proposed model, which is prepared considering inflation and conditionally permissible delay with reverse logistic concept and also explained using the below parameters in appropriate units to understand the model in real life.

a=40, b=0.2, k=1.5, A_p=10 \$/unit, h_p=0.3 \$/unit, d_p =0.2 \$/unit, A_s=11 \$/unit, h_s=0.5 \$/unit, d_s=0.3 \$/unit, A_r= 15\$/unit, h_r=0.7 \$/unit, d_r= 0.4 \$/unit, r=0.03, θ_1=0.01, θ_2=0.11, θ_3=0.2, α=50 units, β=0.02, μ=0.1, λ=0.003, d_i=6 \$/unit, C_p=5 \$, n=2, l=2,

Optimal solution –

For T=30, T_3=15 & T_2=18

Crisp: TC=11937.8 at T_1 = 9.31

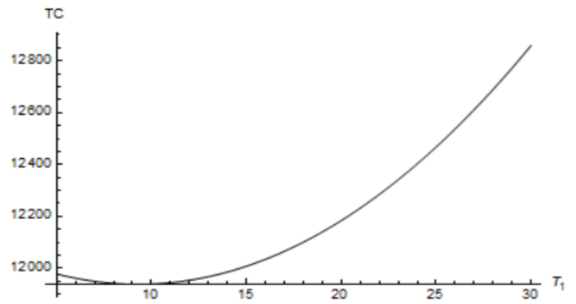

Fig 4:

8. Managerial Insights: With the help of this paper, we explore the interrelationship between inflation and exponentially increasing demand on inventory control processes in an efficient supply chain management. Here some important managerial information related to the paper:

7.2. Senstivity Analysis:

Parameter	Change in Parameter	Change in Total Cost
h_p	0.225	11921.2
	0.15	11904.7
	0.075	11888.1
A_p	7.5	11937.7
	5	11937.6
	2.5	11937.5
c_p	3.75	11896.1
	2.5	11854.4
	1.25	11812.6
d_p	0.15	11937.7
	0.1	11937.6
	0.05	
h_s	0.375	6862.1
	0.25	1786.42
	0.125	Not Feasible solution
A_s	8.25	11937.6
	5.5	11937.4
	2.75	11937.2
d_s	0.225	11602.8
	0.15	11267.8
	0.075	10932.8
A_R	11.25	11937.3
	7.5	11936.8
	3.75	11936.3
h_R	0.525	14168.2
	0.35	16398.7
	0.175	18629.2
d_R	0.3	12192.7
	0.2	12447.6
	0.1	12702.5

Inflation impact: The impact of inflation on the supply chain increases over time. Managers should invest in long-term plans that consider the cumulative impact of inflation and have the ability to make appropriate decisions to deal with it. Which are necessary for pricing, sourcing strategies and adjustments.

Demand forecasting: It is important to consider the exponential demand pattern as well as the importance of accurate demand forecasting. Therefore, to anticipate future demand, managers should encourage investment in the development of advanced technologies.

Investment in Technology: This is the era of technology. Therefore, managers should take advantage of technology by making appropriate investments in advanced technologies such as AI and IoT. Efforts should be made to find appropriate solutions to the related problems. With the help of technology, accurate information about the performance of the supply chain and the impact of inflation on it as well as the demand pattern can be obtained. Therefore, investing in technology can help managers operate the supply chain efficiently.

9. Conclusion, Limitation and scope for future research

9.1. Conclusion: In this paper, we proposed a reliable supply chain model to meet consumer demands under an inflationary environment by delivering inventories to consumers facing exponential demands. Also, dynamic factors of inflation and their impact on supply chain models over time have been studied. Our analysis shows that as an economic force, effect of inflation always creates complexity. Therefore, the effect of inflation cannot be ignored while building the inventory model. Some important conclusions make from our study are as follows:

Flexibility of supply chain: To deal with the rapidly increasing demand, a reliable supply chain model has been adopted by us. Our model postulates that by optimizing inventory management, production and distribution strategies, supply chains can remain reliable even with increasing demands.

Impact of Inflation: This study shows that inflation affects supply chain costs and business profits over time. Therefore, inclusion of inflation in this model helps industries or organizations to consider inflation in their operations and pricing strategies.

Sensitivity Analysis: To know the impact of different parameters and assumptions on the model, sensitivity analysis has been conducted by us. With the help of which the factors that most significantly affect the performance of the supply chain are revealed, which can help organizations to take the right decisions.

Finally, to build a reliable supply chain under the influence of inflation with exponentially increasing demand, is an important aspect of modern business. With the help of the results generated from this paper, industries or organizations may be able to formulate appropriate strategies to meet the exponentially increasing demands of consumers as well as face the challenges arising from the impact of inflation. So that they can achieve long-term stability and success even when faced with an unstable economic scenario.

9.2. Limitations: However, our study provides valuable insights for an reliable supply chain management model by balancing exponential increasing demand and inflation. Nevertheless, it has some limitations which need to be acknowledged:

1. In our model, assumptions like constant rate of inflation and deterioration along with increasing demand have been taken, but real-world environments may also involve more complex concepts, whose precise identity is difficult to ascertain.
2. The accuracy of this model can be affected by the variability and uncertainty of the data sources, as the accuracy of this model completely depends on the quality of the data used for parameter estimation.
3. The applicability of this model may vary to different industries and supply chain managements. Therefore, before implementing this model, organizations should examine the specific characteristics of this model and their supply chain models.

9.3. Scope for future research: In the future, this research could be expanded to focus on several areas:

1. The model can be extended by incorporating sustainability factors into the supply chain model, including inflation in a fuzzy environment along with the environmental impact of production and distribution decisions.
2. This model can also be further extended by using machine learning to improve decision making and incorporating advanced analytics techniques such as artificial intelligence for inventory optimization.

Finally, in conclusion it can be said that with the help of this paper an attempt has been made to find solutions to the challenges of managing a reliable supply chain incorporating exponential demand growth and inflation, which is an important achievement of this research work.

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