International Research Journal of Mathematics, Engineering and IT
ISSN: (2349-0322)
Association of Academic Researchers and Faculties (AARF)
Impact Factor- 7.132 Volume 11, Issue 06, June 2024
Website- www.aarf.asia, Email : editoraarf@gmail.com

Comparative Study of Inventory Models to Lower Overall Inventory Cost

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Abstract: In the majority of industrial settings, demand is erratic and difficult to predict. Numerous demand histories exhibit random walk characteristics, changing often in both direction and rate of rise or drop over time.Demand is erratic and testing to forecast in the majority of industrial environments. Others call for History behaves like a random walk that varies its orientation and development or fall rate frequently throughout time. This work takes a number of models into consideration, including lot-by-lot obtaining, purchasing through economic order quantities, purchasing byepisodic order quantities, purchasing through the least unit costs, the least total costs, the least epoch costs, purchasing using Wagner-Whitin algorithms, etc.The results of using each model aimed at different lengths of time are shown. From the results, it is clear that the periodical order quantity technique is stable over a long period of time.

Keyword: Probabilistic Inventory Models, Economic Order Quantity,Least total cost

1. INTRODUCTION:

Inventory modelling is centred on determining the minimum quantity of a good that must be maintained in order to maintain operations. Based on a formula that weighs the fine costs of an inventory deficiency against the capital costs of holding excessive amounts of goods, a decision is made. The batch size and backordering quantity were improved by Kumar et al.

(2020) in order to lower the total cost of inventory. Numerical examples are used to improve the lot size and backorder quantity. In contrast to the findings that were presented by Donohue and Croson (ibid), the research that was presented by "Steckel et al. (2004) suggests that the increase in Supply Chain efficiency brought about by Shared Point of Sale Information is dependent on the pattern of the demand function". This is in contrast to the findings that were presented by Donohue and Croson (ibid). Sternman's (1989) step function may be tremendously disruptive, and sharing knowledge about POS systems may genuinely lead to significant improvements in the efficiency of operational processes. This study develops a fuzzy EOQ model in the context of single sampling plans with inspection errors, as described by Thomas and Kumar (2022). The model assumes that there will occasionally be misclassifications. We suggest an inventory system that separates defective items from the supply, removes backorders, and subjects orders to acceptability sampling. According to Shafali et al. (2021), the study's main goals are to categorise the various wastes produced and offer recommendations for actions that may be taken to cut trash production and protect the environment. According to De and Mahata (2019), cloud models are significantly more profitable than deterministic models when combined with their innovative methods.Kumar et al. (2020) studied on the Inventory Control Policy aimed at Imperfect Manufacture Procedure on Numerous Demand. Poswal et al. (2022) the goal of the effort is to identify upcoming research recommendations and acquire an on-going, thorough assessment of the body of literature. Shafali et al. (2021) his paper explores a combined inventory model (IM) when the collapse rate shadows histrionic movement under conversation acclaim. Chaudhary et al. (2023) determine the model's robustness; sensitivity analysis has also been done on the effective parameters. Through the process of literature review, researchers participate in the investigation of studies that are theoretical, topical, methodological, practical, and procedural in nature. These studies are concerned with the guiding framework of the case study as well as its limitations (Ross & Mash, 2014). The professional contribution that academics make to publications such as journals, reports, legislative papers, and books is one factor that contributes to the justification of research, as stated by Carolan, Forbat, and Smith (2015). This is one of the factors that contribute to the justification of research. It is essential for a researcher to evaluate the existing literature in order to organise and sharpen the focus of an investigation in order to generate a research topic and offer a conclusion that is supported by existing theory. The following table shows how the demand for a certain component has changed over the last three years. The variation coefficient, standard deviation, and mean in Figures 1, 2, and 3 are also estimated. In order to create an inventory model where the demand for the month is unpredictable and variable, the aforementioned needs are compared to the average deviation and variation coefficient.The measurement of variation V can be applied by the subsequent guidelines to ascertain the type of demand:

1) You could say that the demand is consistent and predictable if the normal monthly demand is about the same for completely months and V is a respectably small amount (30%).
2) You could say that the demand is both fixed and variable if the average monthly need changes a lot from month to month but V is still a small percentage (30%).
3) The probabilistic non-stationary demand, which happens when the resources and measurements of variation vary considerably across period, is the lone surviving case.

Table 1: Demand during three consecutive years:

COV %	Mean	StdDev	2019	**2020**	**2021**	Year
41.25	21	9.24	21	31	11	Apr
86.90	26.4	22.45	57	9	13	May
15.40	18.4	1.51	19	15	21	Jun
16.87	30.4	17.57	39	7	45	Jul
57.34	20.4	11.89	35	9	17	Aug
62.08	49	30.9	25	91	31	Sep
57.91	37	21.85	15	65	31	Oct
5.14	37.6	2.79	39	39	35	Nov
13.5	33	6.32	39	29	31	Dec
18	37.6	7.5	39	45	29	Jan
47.74	29	14.47	25	15	47	Feb
4.4	57.8	3.59	57	61	55	Mar

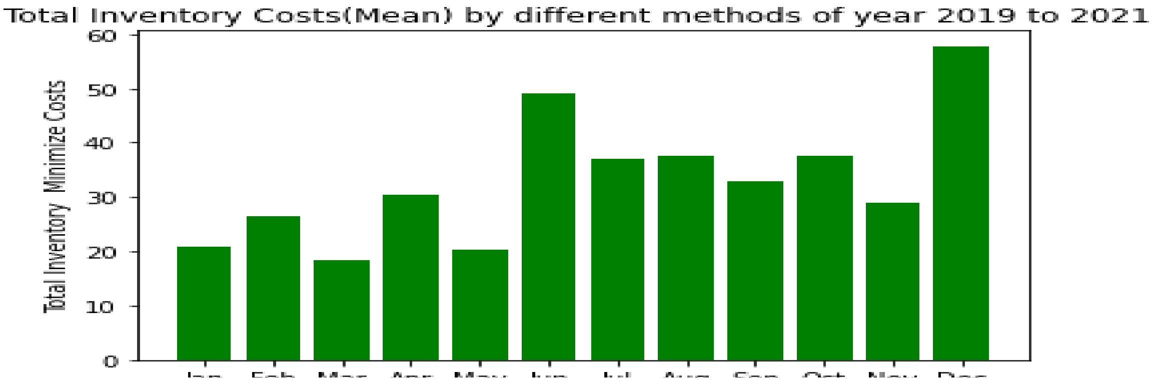

Figure 1: Total cost of inventory as determined by Mean

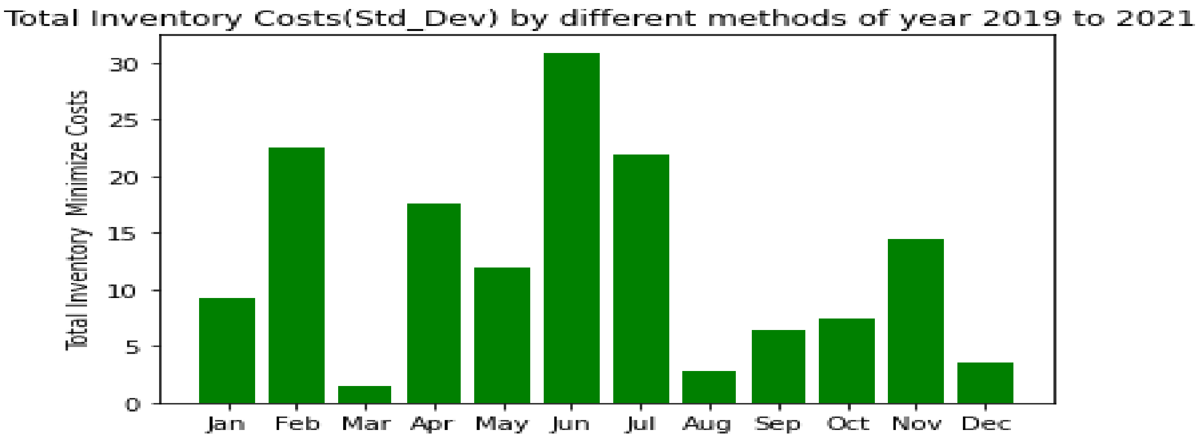

Figure 2: Total inventory costs through Std. Dev.

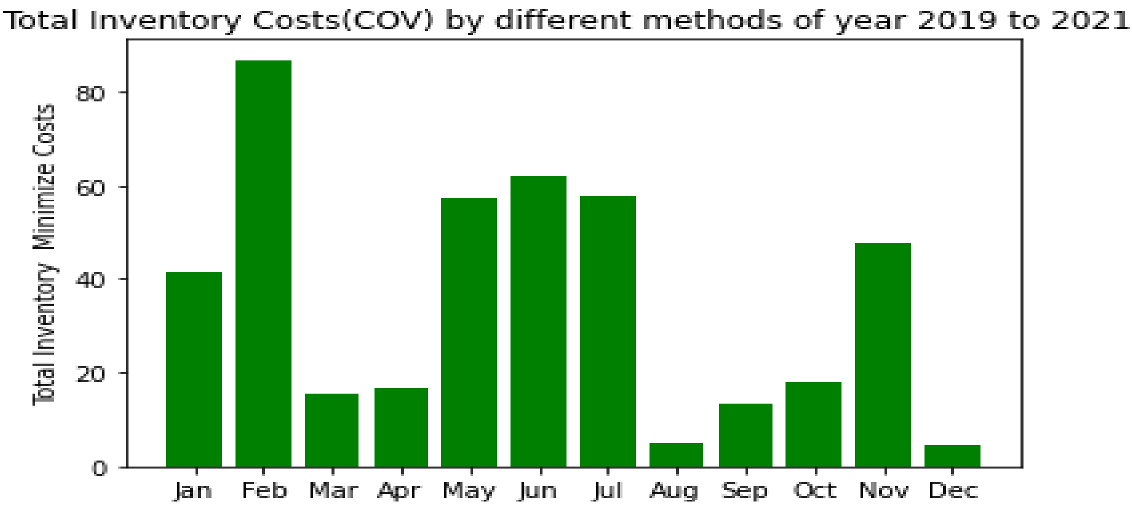

Figure 3: Total inventory costs through COV

2. METHODOLOGY:

There, a variety of inventory models were taken into account in an effort to reduce the overall cost of inventory.

Economic Order Quantity (E.O.Q): The time frame is typically one year. The cost of purchasing, ordering, and storing inventory is added together[21-30]. TC is the total cost and is calculated as follows: TC = PC + OC + HC, (1)

Production order quantity (POQ): For products with independent needs, the economic production order quantity (POQ) stands a freeware model aimed at calculating the best manufacturing capacity for every production line. According to the stock dependent concept, a product is integrated within one or more additional products, and its demand is contingent on the availability of other items.

Production order quantity (POQ= $\frac{\text{E.O.Q}}{Average\ \ weekly\ \ Usage}$ (2)

Least Unit Cost (LUC): When deciding on an order size, the demand for the next "n" periods is taken into account, where "n" is chosen to minimize the typical cost apiece unit.

Least total cost (LTC): The least total cost attitude is a dynamic lot extenttechnique that determines the order quantity thru comparing the resonant cost and the inventory cost aimed atdiverse lot sizes and selecting the lot in which thesestand most similarly spread. The quantity of components that must be acquired is determined by this model, with almost equal transportation and ordering costs.

Least period cost(LPC): We determine the order size that determinationconcealment the following "n" periods whenever the total requirements are positive, where "n" is chosen to reduce the average price per unit of time.

Wagner-Whitin Algorithm (W-W): It is an accurate method aimed atdefining the best packet size aimed at a product and obtaining meaningful results during a single program without taking into account power constraints. The W-W method identifies potential options in a forward calculation and then chooses the best course of action in a backward calculation, similar to how the traditional lot size formula undertakes an unlimited rate of construction and uniform feasting across the retro.

Model 1: Lot for Lot: Every period, obtain only what is needed. Items are bought here in precisely the amounts needed for every timeframe. Therefore, this strategy works well when holding costs are high and order costs are low.

Model 2: Economic order Quantity: The order quantity that reduces overall inventory property costs and organization expenses is referred to as the "economic order quantity." Regardless of the amount bought, there is a flat cost for every order.

Model 3: Period order quantity: In terms of periods, this is the EOQ. POQ is equal to EOQ separated by the typical demand per era.

Model 4: Least unit cost: We determine the order quantity that willsconcealment the following "n" epochs when the net requirements are good, where "n" is chosen to reduce average unit cost.

Model 5: Least total cost: In cases where the overall requirement is high, we determine the order quantity that resolve cover the subsequent "n" period, where "n" is the epoch during which the holding costs and inventory costs are contiguous to one another. This model determines how many parts need to be purchased with roughly equal carrying and ordering costs.

Model 6: Least period cost: We determine the inventory levels that resolve cover the following "n" periods when the net requirements are favorable, where "n" is chosen to reduce the cost per unit of period.

Model 7: Wagner-Whitin Algorithm: Those models are used with the consumption data for a specific product over the last three years, taking into account varied times, to determine the best models in the present situation.The three years are divided in various ways when calculating the average cost.

Method 1:

1) Divide every year into 12 halves, each lasting one month.
2) Repetition of the process each year.
3) To calculate the yearly inventory cost, determine the average of these three numbers.

Method 2:

1) Split the three-year timeframe into 36 intervals of one month respectively.
2) Calculate the entire cost of the inventory for every time period.
3) To calculate the annual inventory expenses, divide this figure by three.

Method 3:

1) Split the three-year period into three equal intervals of one year each.
2) Determine the annual cost of all inventories.
3) For each of these approaches, the data from the last three years are used individually.

Method 1: There are twelve equal months in a year. The total of the monthly expenses for ordering, purchasing, and overhead is the total inventory cost for the entire year. The above table 3 illustrations that the lot for lot approach was used to determine the lowest total inventory cost.Table 2 below lists the holding costs for each model that has been selected to employ this method:

Table 2: Average Annual Cost

2019	2020	2021	Model
602041	527978	602741	LotforLot
603166	618277	604054	E.O.Q.
593890	602650	593890	P.O.Q.
593890	601050	593890	LUC
593590	601290	593590	LTC
592390	601050	592390	LPC
593890	601450	593890	W-W

Table 3: Annual Inventory Cost on Average

Annual Cost on Average in Rs.	Model
553760	LotforLot
596733	E.O.Q.
575397	P.O.Q.
574897	LUC
575047	LTC
573997	LPC
575297	W-W

Method 2: This approach divides the entire three-year period into 36 segments, each lasting one month. The total inventory cost for three years is determined by totaling up the

purchasing expenses, inventory cost, and order costs for every period. This table 4 shows that even though the lowest unit price model has the lowest cost, the average total cost of inventory stays the same when this strategy is used. The following values are presented:

Table 4: Shows the 36-month total cost of inventory

ATC on average in Rs.	36-Month Price	Model
575397	1783260	LotforLot
579964	1816962	E.O.Q.
575397	1783260	P.O.Q.
574347	1792120	LUC
575047	1793120	LTC
573747	1798310	LPC
575297	1793750	W-W

Method 3: This table 5 demonstrates that despite the lowest unit price model's lowest cost, the average total cost of inventory generally stays constant when this strategy.

Table 5 shows the three-year total cost of inventory.

ATC on average in Rs.	36-Month Price	Model
565133	1762470	LotforLot
578917	1803822	E.O.Q.
571750	1782320	P.O.Q.
571780	1782470	LUC
571780	1782470	LTC
571780	1782470	LPC
571780	1782470	W-W

3. CONCLUSION:

The explanation that was provided above makes it rather evident that the three approaches were used to seven different inventory models. One-month increments are used to compute the annual inventory levels in the first technique. The average of the data gathered over the preceding three years is then used to determine the total annual inventory levels. The second method looks at the whole three-year span at one-month intervals. The average of the inventory values over the preceding 36 months is used to determine the total inventory cost for the year. The third method adds the monthly requests to get information about the annual wants. The inventory values are then averaged throughout the course of each year to estimate the total annual inventory cost. As a result, a new model emerges as the optimal model, changing the phase at which averages are computed. For longer runs, then, the little to nonexistent change periodic quantity model makes sense.

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