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Average Monthly Appraisal of Inventory Management Policy Using The Probabilistic Model

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Abstract – The development of inventory policy for an organization appears to be a tedious process for most organizations. The lack of an effective inventory management culture can propagate material wastage while simultaneously lowering cost effectiveness. In this study, an average monthly appraisal of the inventory management policy of Technodrill is examined. This study was carried out employing the probabilistic model. The optimum inventory level on one hand, as well as the ordering and reordering of the packets of electrodes utilized for welding oil and gas pipelines, were both ascertained for the months of January to December for the period from 2002 to 2012. The monthly buffer stock was obtained. It is inferred that these inventory variables were employed to develop a policy which was recommended to direct the firm studied. A step by step methodology is shown in the body of the work.

Keywords – Appraisal, Inventory, Management policy, Probabilistic, Model.

I. Introduction And Literature Review

The Management of Inventory is a concept that has assisted organizations or entrepreneurs to optimize material procurement, handling, and distribution, in such a way that minimize materials wastage. The concept if not properly managed would make the cost of operation to be high and as a result the resultant finished product selling price would be high. The higher the selling price, the fewer the number of people or customers that would purchase the product. For less complex products the management of the inflow and outflow of raw materials, considering the large number of customers require the formulation of strategic policies. These strategic policies monitor the inflow of raw materials and feedback from the customers and the outflow of finished products meeting the customers demands.

The formulation of inventory management policies minimize materials stock out and control buffer stock, this process eventually optimize materials and financial resource allocations.

Banjoko [1994] described an inventory as a stock of items used in the operation of the business. They include items used within the production system such as basic raw materials, supplies of components or spare parts, work in progress, and finished goods. The author wrote that to keep an optimal level of inventory, an effective balance between the various inventory costs must be obtained. These costs must be managed optimally when policies are formulated and exercised as well.

Other investigators who have investigated policies guiding inventory control management, are Russell and Taylor III [2] who wrote that the objective of inventory management has been to keep enough inventory to meet customer demand and also be cost-effective. The authors said that inventory is a stock of items kept by an organization to meet internal and external customer demand, therefore virtually every type of organization maintains some form of inventory. An inventory system formulates a policy that directs the level of inventory by establishing how much to be ordered and when to order. Walley (1986) explained the inventory

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control practiced in different organizations and the management strategies that informed the policies applied. Durben et al. (1987) were of the opinion that inventories represent a reasonable percentage of the total assets of a company, and considerable efforts is required to control the inventories. Once inventory is physically present, it is essentialthat it be handled and stored at minimum cost while at the same time allowing production schedules to be met.

This study, several factors that affect inventory control are determined on a monthly basis in order to formulate inventory management policies that would guide the organization in keeping an optimum inventory level and adequate buffer stock. This would eventually minimize materials wastages, meet customers demand at appropriate times and help the organization to generate more revenue.

II. METHODOLOGY

2.1 Design Instrument

The research was carried out utilizing the secondary design instrument where data are collected by obtaining recorded data of the company's daily operation

2.2: Sampling

The sample size is seen as a true representation of the population. The sample size of 11 years ranging from 2002 to 2012.

2.3 Fieldwork

The fieldwork was done by researchers who were trained on how to obtain relevant information from organizations and they were involved individuals in this study.

2.4 Research Design Technique

$$Mean, \overline{X} = \frac{\sum x_i}{N} = \frac{1}{N}\sum_{i=1}^{n} x_i \quad \text{…….. (1)}$$

$$\text{Standard deviation, } \sigma = \sqrt{\frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{N-1}} = \sqrt{\left[\left(\frac{1}{\text{N-1}}\right)\left[\sum_{i=1}^{n} x_i - \frac{1}{N}\left(\sum_{i=1}^{n} x_i\right)^2\right]\right]} \quad \text{…….. (2)}$$

$$\text{Coefficient of variation, } CV = \frac{\text{Standard deviation}}{Mean} x100\% \quad \text{……. (3)}$$

CLASSIFICATION CRITERIA

According to Taha (2007)

1. If the mean monthly demand is approximately constant for all months and CV is moderately small (< 20%), then the demand may be considered deterministic and constant, with its value equal to the average of all monthly demands.

2. If the mean monthly demand changes significantly among the different months but CV remains

reasonably small, then the demand is considered deterministic but variable.

3. If, in case 1, CV is high (_ 20%) but relatively constant, then the demand is said to be probabilistic and stationary,

4. The only remaining case is the probabilistic non stationary demand which happens when the averages and coefficients of variation change significantly overtime.

Ordering cycle length (time units), $t_o = \frac{Y}{D}$ = time unit …… (4)

Where, y = order quantity (number of units)

D = Demand rate (units per unit time)

Average inventory level = $\frac{Y}{2}$ …… (5)

Total cost per unit time (TCU), y = setup cost per unit time + Holding cost per unit time

TCU(y) = $\frac{\text{Setup cost + Holding cost per cycle, to}}{t_o}$ …….. (6)

$\underline{TCU(y) = k + h\,(y/2)\,t_o}$ ……... (7)

t_o

Daily inventory cost associated with the proposed inventory policy =

TCU(y) = $\frac{k}{(y/d)}$ + h (y/2) …… (8)

Where k is setup cost associated with the placement of an order

h is the holding cost (Naira per inventory unit per unit time).

The optimum value of the order quantity, y is determined by minimizing TCU (y) with respect to y. Assuming y is continuous, a necessary condition for finding the optimal value of y as follows

Differentiate $\frac{d\,TCU\,(y)}{dy} = \frac{KD}{y^2} + \frac{h}{2} = 0$ …… (9)

The condition is also sufficient because TCU (y) is convex.

The solution of the equation yields the EOQ, y^* as

$$y^* = \frac{\sqrt{2KD}}{h} \quad \text{…….. (10)}$$

Thus , the optimum inventory policy for the proposed model is

$y^* = \frac{\sqrt{2KD}}{h}$ units every $t^*_o = \frac{y^*}{D}$ time unit.

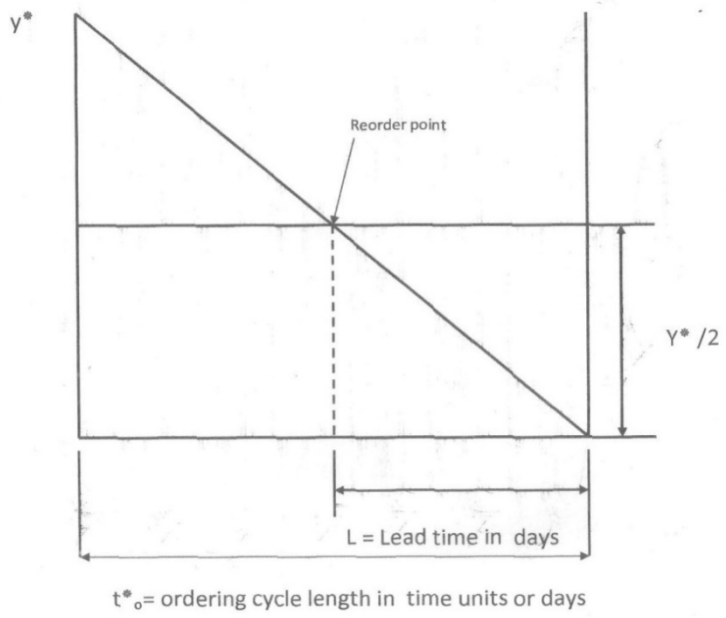
Lead time may happen between the placement and the receipt of an order.

Reorder point occurs when the inventory level drops to LD units.

Effective lead time, $L_e = L - nt^*_o$ ..... (11)

Where n is the largest integer not exceeding $\frac{L.}{t^*o}$ Thus the

reorder point occurs at L_eD units and the inventory policy can be stated as order the quantity, y^* whenever the inventory level drops to L_eD units.



The average demand during lead time, $\mu_L = DL$ …… ….. (12)

Where D = mean demand and L = lead time between placing and receiving an order.

Standard deviation of demand during lead time, $\sigma_L=\sqrt{(\sigma 2L)}$ ……. (13)

where σ is the standard deviation

Buffer size must satisfy, B

$B \geq \sigma_L k_\alpha$ ..... (14)

Where α is the maximum allowable probability of running out of stock during lead time

$K_{\alpha=0.05}$ is determined from the standard usual table,

2.6 Interpretation

Optimal inventory policy with buffer, B calls for reordering y* units whenever the inventory level drops to $(B + \mu_L)$ units.

III. Presentation And Discussion Of Results

3.1 Presentation of results

Table 1: Company's Data and some calculated parameters

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	700	1240	960	1001	684	820	1600	980	520	910	1020	820
2003	1045	862	745	1010	974	1120	320	730	967	1000	450	1200
2004	944	1014	950	280	560	1004	880	610	836	913	1030	900
2005	635	430	848	1040	1125	436	545	1000	1020	732	905	748
2006	1040	990	1001	980	970	995	1015	550	1000	1000	720	620

2007	342	820	1020	562	1040	784	938	1044	743	430	1010	1010
2008	940	734	382	720	840	920	670	410	950	510	621	810
2009	1042	520	820	780	1000	830	990	620	815	625	820	1002
2010	520	1020	1000	500	740	1000	850	910	420	1010	710	210
2011	1020	980	460	1002	1020	510	1020	1000	990	420	450	420
2012	804	320	1000	940	440	715	910	1020	1020	780	1001	900
Total	9032	8930	9186	8815	9392	9134	9738	8874	9281	8330	8737	8640
Mean	821.091	811.818	835.091	801.364	853.818	830.364	885.273	806.727	843.727	757.273	794.273	785.455
Standard deviation	241.958	284.44	223.475	256.657	220.102	212.527	322.972	228.022	207.322	230.203	220.999	281.19
Coeff of var.	29.50%	35%	27%	32%	26%	26%	37%	28%	25%	30%	28%	36%
k	550,000	82,000	500,000	480,000	800,000	600,500	50,000	750,000	820,000	640,000	740,000	550,000
h	1700	1800	2000	1700	1620	1200	1950	1600	1500	1600	1650	1100
Y*	729	860	646	673	918	912	768	870	960	778	844	886
t^*	0.89	1.06	0.77	0.84	1.08	1.1	0.87	1.08	1.14	1.03	1.06	1.13

3.2 Discussion of results

A monthly appraisal of inventory control management in Technodrill company is investigated. Technodrill is a company that has a section that is dedicated to the welding and fabrication of pipes used in the downstream of the oil and gas industry. Table 1 shows the monthly supply of packets mild steel electrodes consumed by Technodrill company for the periods of 2002 to 2012. Each packet contains about 100 mild steel electrodes.

From the values obtained, from the individual coefficient of variation (CV), it is found that the coefficient of variance from January to December are above 20% and according to the classification criteria explained by Taha (2007) that if the mean monthly demand changes significantly among the different months but CV is high, that is , above 20% than the demand may be said to be probabilistic non-stationary demand which happens when the means and coefficient of variation vary significantly overtime. This Taha (2007) explains that, this case occurs in real life situation.

IV. Conclusion

In this research work, the average monthly appraisal of the inventory management policies of technodrill company has been generated. From the secondary data obtained as shown in table 1, it was discovered that probabilistic non stationary demand has occurred as the average and coefficient of variation of the monthly data vary appreciably overtime. This shows that the study is a practical example of what occurs in a real life situation.

The monthly optimum packets of welding electrodes expected to be orded has been determined. Both the ordering and the re-order periods of time when particular packets of welding electrodesare leftas buffer stock were also determined in this study. These calculated inventory control variables have been able to generate a monthly appraisal policy trend for the year of 2002 to 2012 studied.

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