

Unconstrained EOQ Analysis of a Furniture Mall - A Case Study of Bellwether Furniture

Manminder Singh Saluja

International Institute of Professional Studies, DAVV, INDIA

gursikh11@rediffmail.com

Available online at www.isroset.org

Received: 22 Aug 2014

Revised: 04 Sep 2014

Accepted: 26 Sep 2014

Published: 31 Oct 2014

Abstract- Indian economy had been growing fast over last 25 years leading to sharp rise in household incomes. The reality boom in the country had resulted in high demand for stylish furniture. Bellwether Furniture, a leading furniture mall of India has been actively fulfilling this demand. This had created a tough challenge of managing fast inventory flow. The paper had tried to find out the best inventory level for the mall for their product - TV units. The primary data on inventory of TV units was collected from the firm for financial year 2013-14. This was analyzed using unconstrained EOQ model for cost minimization. It was found that in unconstrained conditions Bellwether will need to invest total of Rs. 49, 08, 869.77 on its TV units with maximum investment of Rs. 6,65,195.98 for maintaining 89 units of model no 43XXX for minimizing its total cost on this product line of TV units.

Keywords - *EOQ, Inventory Management, Bellwether Furniture, Cost Minimization*

I. INTRODUCTION

Bellwether Furniture had seen a rapid growth from its inception way back in the year 1990. From a small scale manufacturing unit of furniture, it has become a leading brand in India. It is also now a leading importer of furniture from countries like Malaysia, Indonesia, Thailand, China, Italy and Brazil. Bellwether specializes in all the segments of furniture, be it Bed room sets, Living/Drawing room furniture, Dining sets, Coffee Tables, outdoor furniture or office furniture. It has variety for every segment and also customizes to suit the requirements of the customers.

The company in these many years, with great efforts of its efficient workers, professional designers and high-class managers, built up an effective sales chain that brings the customer the best quality products. Customer satisfaction has been their motto and they have imbibed it to the grass root level. They are a professionally managed company following the TQM (Total Quality Management) philosophy. The Bellwether Furniture' has a showroom in New Delhi, Hyderabad & in Indore, the commercial capital of M.P. They have recently started the state of the art, furniture Mall in Indore. The furniture at its mall in

Indore is displayed in more than 50,000 Square Feet area, along with other segment of Life Style products, which surely provide complete solution to the Interior spaces of home as well as office. The product range shall include, Picture frames, Paintings, Flower pots, Designer pots, Throw cushions, Bed spreads, Candle stands, Candles, Clocks, Artificial flowers, Artificial Plants, Figurines and many more.

Today Bellwether is amongst the leading brands of India having its presence in more than 300 cities with a wide network of over 500 dealers. Bellwether has been able to achieve the rapid growth due to its commitment to quality and service. Devoted to continual development of new products and technologies, they are creating innovative designs and are continuously enriching their product line. The product line broadly comprises of Home and Office furniture. The category subsets follows as Home furniture includes - Bedroom furniture, Living room furniture, Dining room furniture, Kids room furniture, Study room furniture etc. Office furniture mainly comprises of desk and chairs. Thus it will not be wrong to say that the big and diversified product line makes Bellwether a one stop destination for designer furniture.

II. LITERATURE REVIEW

In accordance with the complexity of inventory management in recent times, huge literature is available on inventory control techniques especially Economic Order Quantity (EOQ). Most development of the EOQ model treat constant order size as an essential requirement of inventory system; Brimberg and Harley [1]. They derived the general cost function for n consecutive inventory cycles and showed a unique optimal solution for a constant lot size. Earlier in 1995 Bill and Chaouch [2], presented a EOQ model that incorporated variations in the demand rate at random time points into inventory planning decisions. They used system point level crossing theory to derive expressions for the distribution and expected value of on hand inventory, ordering rate and the expected total cost rate for a given ordering policy. In the classical EOQ model, it is assumed that retailer must pay for the received order immediately. But in practice it is observed that supplier not only allows retailer to settle their accounts after a certain time period but also offers a cash discount for early payment of his purchase. However it is also common in many inventory systems to hold excess stocks in rented warehouses, when storage capacity of owned warehouses is limited. Ouyang *et. al.*[3] developed an EOQ model with limited storage capacity, in which supplier provides cash discounts and permissible delay in payments for retailers.

Customers for retail merchandise can often be satisfied with one of several items. Accounting for demand substitution in defining customer service influences the choice of items to stock and the optimal inventory level for each item stocked. Further, when certain items are not stocked, the resulting substitutions increase the demand for other items, which also affects the optimal stock levels. Smith and Agrawal [4] developed a probabilistic demand model for items in an assortment that captures the effects of substitution and a methodology for selecting item inventory levels so as to maximize total expected profit, subject to given resource constraints. Liberatore [5] presented a EOQ model under stochastic lead time while Alinovi *et.al.* [6] formulated a stochastic EOQ based inventory control model for a mixed manufacturing system. The present study also takes a lead from these models and tries to create a application of EOQ model of inventory control in

unconstrained situation for a retail mall having fast demand for its products.

III. OBJECTIVES

- To Study about the Inventory Stock of TV Units of Bellwether Furniture
- To estimate the output that minimizes their inventory cost.

IV. METHODOLOGY AND DATA

Bellwether Furniture is a furniture mall that trades in a variety of items. The study deals with the problem of inventory cost minimization for its Mall in Indore for a particular product. The product thus taken for research was the TV units. In all total 16 most selling varieties of the units were taken. The limitation of taking one product was due to the constraint of availability of information from the concerned firm. The firm faces the complex problem of handling Multi-Item Inventory with certain practical business limitations. When the inventories consist of several items under some limitations, then it is not possible to consider each item separately, since there exists a relation among the items. After constructing the cost equation in such models we use Lagrange's multiplier technique to minimize the cost in simple cases. The study tries to solve this problem by ignoring the limitations. Therefore the study attempts to find the minimum inventory cost for Bellwether Furniture by formulating given model.

Let us suppose

n = number of items with instantaneous production and no lead time

D_i = the demand rate which is known and is uniform for the i^{th} item

($i=1, 2, 3, \dots, n$)

C_{i1} = the holding (or carrying) cost per unit of the quantity of i^{th} item

C_{Si} = the set up cost per production run for the i^{th} term

Q_i = quantity of the i^{th} item in inventory at the beginning of the period

The total cost per unit of time is given by

$$C = \sum_{i=1}^n \left\{ \frac{1}{2} C_{ii} Q_i + C_{si} \frac{D_i}{Q_i} \right\} \dots\dots\dots \text{eq.(1)}$$

To determine the optimum values for Q_i , $i = 1, 2, 3, \dots, n$ so as to minimize the total cost C , we have

the necessary condition $\frac{\partial C}{\partial Q_i} = 0$ & $\frac{\partial^2 C}{\partial Q_i^2} > 0$ for all Q_i .

$$\frac{\partial C}{\partial Q_i} = \frac{1}{2} C_{ii} - \frac{C_{si} D_i}{Q_i^2} \quad (\text{From eq. 1})$$

$$\frac{\partial C}{\partial Q_i} = 0 \Rightarrow Q_i = \sqrt{\frac{2C_{si} D_i}{C_{ii}}}$$

$$\frac{\partial^2 C}{\partial Q_i^2} = \frac{2C_{si} D_i}{Q_i^3} > 0$$

Hence the optimum Q_i^0 of Q_i is given by

$$Q_i^0 = \sqrt{\frac{2C_{si} D_i}{C_{ii}}}, (i = 1, 2, 3, \dots, n) \dots\dots\dots \text{eq. (2)}$$

The above given model was analyzed using the primary data collected from Millennium Pvt. Ltd. (Bellwether Furniture) for the financial year 2013-14. The company only provided the monthly data on inward and outward inventory; their procurement and selling prices, which was used to calculate the data on various components required to estimate the optimal inventory with minimal cost. It took five months for the company to provide the data and the information required for the study.

V. RESULTS AND DISCUSSION

Inventory Holding At Bellwether Furniture

The aim of this paper is to analyze the inventory position of Bellwether Furniture and to estimate the Economic Order Quantity (EOQ) for the firm in order to minimize their inventory cost. The analysis represented the inventory stock position of the firm for the financial year 2013-14. It was found that on 1st of April 2013, the firm is having a opening stock of 18, 19, 11, 38, 8, 16, 6, 1, 24, and 12 units of TV units with the model no:- 1120AG, 1005AF, 1131AF, 43XXX, Lh001, 1001, 2007, 21010, 3010 and 3270 respectively. The monthly figures shows the inward and outwards of all the above models along with other models like 148, 162, 180, 129, 811 and 170. The addition to the stock and the outflows are varying in different months based on their demand. The year end stock figures nil for the units with model no: - 1120AG, 162, 170, 2007 and 3270, while other models are having a closing inventory stock. The highest inventory being of model no:- 43XXX with 10 units. It is interesting to note that this unit also saw a highest inward and outward.

EOQ Analysis of Inventory At Bellwether Furniture

It has been observed above that Bellwether is having a varying demand for different items and accordingly is holding varying inventory for those different items. The holding of such inventories incur any firm a substantial amount of cost. The amount of holding of these inventories, further determine the reorder point leading to set up cost. Overall, all these components of inventory cost desires a need for optimizing the level of output that minimizes these cost. The study therefore tries to estimate the optimum inventory level by finding out the Economic Order Quantity i.e. that level of output which minimizes the inventory cost. The EOQ was estimated by applying the Minima method via differentiation. The minimum level of cost derived is shown in equation 2. Table no 1 estimates that Economic Order Quantity as is derived in equation no. 2.

Table- 1 : Unconstrained EOQ Model With Capital Investment

S No.	Particulars Model No.	Unconstrained EOQ	Unconstrained Total Capital Investment (in Rupees)
1	1120AG	48 Nos	362534.07
2	148	52 Nos	301276.67
3	162	32 Nos	207733.81
4	180	58 Nos	385093.85
5	129	34 Nos	179952.12
6	811	31 Nos	170934.51
7	1005AF	45 Nos	471465.87
8	1131AF	18 Nos	185248.27
9	43XXX	89 Nos	665195.98
10	Lh001	35 Nos	226928.99
11	1001	41 Nos	142637.55
12	170	19 Nos	313918.39
13	2007	16 Nos	321935.02
14	21010	16 Nos	430529.17
15	3010	55 Nos	322274.22
16	3270	32 Nos	221211.27
Total of Capital Investment =			4,908,869.77

It can be seen from the table that Bellwether Furniture will be able to minimize its inventory expenses if it sale 48, 52, 32, 58, 34, 31, 45, 18, 89, 35, 41, 19, 16, 16, 55 and 32 units of the models:- 1120AG, 148, 162, 180, 129, 811, 1005AF, 1131AF, 43XXX, Lh001, 1001, 170, 2007, 21010, 3010 and 3270 respectively. It should also be noted from the respective table that these levels of output though are minimizing the inventory cost, but is exceeding the desired level of capital investment that is being allocated for these units as stated by Bellwether. The total capital investment required for ordering the EOQ level is Rs. 49,08,869.77, which far exceeds the limit. This opens a further scope for research on inventory management of Bellwether under constraint situations.

VI. CONCLUSION

The study was set up for a leading furniture mall of the country i.e. Bellwether Furniture. Bellwether Furniture is indulged in selling a variety of products in the various categories of furniture. The prime one being the home

furniture, under which TV units of large varieties are the regular seller. The study had therefore taken a tough task of analyzing the inventory management of the firm. The research was done to estimate the Economic Order Quantity, i.e. that quantity of output which minimizes the inventory cost of the firm. The estimation was done by minimizing the cost using differentiation method. The cost minimization will occur by managing the total inventory of Rs. 49,08,869 for the 16 types of TV units, the highest quantity of 89 being for model no. 43XXX to lowest of 16 units for model no. 2007 & 21010.

REFERENCES

- [1]. Brimberg, Jack and Hurley, W.J. (2006), "A Note on The Assumption of Constant Order Size in The Basic EOQ Model", Production and Operations Management, Vol. 15, No. 1, Spring, pp. 171-172
- [2]. Bill, Percy H. and Chaouch, Ben A. (1995), "An EOQ Model With Random Variations in Demand", Management Science, Vol. 41, No. 5, May, pp. 927-936

- [3]. Ouyang, Liyang -Yuh; Wu, Kun-Shan; Yang, Chih-Te; (2007), "An EOQ Model With Limited Storage Capacity Under Trade Credits", Asia-Pacific Journal of Operation Research, Vol. 24, No.4, 575-592
- [4]. Smith Stephen A. and Agrawal, Narendra (2000), "Management of Multi-Item Retail Inventory Systems With Demand Substitution", Operations Research, Vol. 48, No. 1, January - February, 050-064
- [5]. Liberatore, Mathew J. (1979), "The EOQ Model Under Stochastic Lead Time", Operations Research, Vol. 27, No. 2, March - April, 391-396
- [6]. Alinovi, A., Bottani, E., Montanari R., (2012), "Reverse Logistics: A Stochastic EOQ- Based Inventory Control Model For Mixed Manufacturing/ Remanufacturing Systems With Return Policies", International Journal of Production Research, Vol. 50, No. 5, March, 1243-1264.

AUTHOR(S) PROFILE

Dr. Manminder Singh Saluja, is a University Assistant Professor (Senior Scale) at International Institute of Professional Studies, Devi Ahilya University. He conducts empirical research in the field of Macro Economics, International Economics, Applied Econometrics and Financial Economics. His papers had been published in various International and National Journals, Conferences and Edited Books.