Determining the Economic Order Quantity for Patient Files with Continuous Cost Reduction Programme

Nethradhama Super Speciality Eye Hospital, Bangalore

Key words: Economic Order Quantity, ABC Analysis, Classical Wilson Model, Ordering Cost, Carrying Cost, Annual Demand

ABSTRACT

Estimated share of material costs in hospitals varies from 30% to 40% of total costs. Containment of materials costs therefore has a tremendous potential in making the hospital costs bearable to patients. For keeping inventory cost low, it is necessary to determine Economic Order Quantity (EOQ) and thereby the frequency of Ordering.

In this study patient files were selected in the project to determine EOQ.

As per ABC Analysis for the years 2010-11 and 2011-12, it was found that Patient Files have come under “A” Category and was observed that items with high annual value were clinical items, but Patient Files was the only non clinical item that involved high total annual expenses and this anomaly was cause of concern. Patient Files had been under B category in year 2009–2010.

The challenge was to determine EOQ for files without compromising the quality and strive to bring patient files from A to B category. This project also emphasizes the importance of ABC analysis.

EOQ was calculated for patient files by applying the Classical Wilson Model resulting in huge savings for the organization as unit cost of file reduced drastically.

Introduction

Nethradhama Super Speciality Eye Hospital is the first eye hospital in India to be accredited by National Accreditation Board for Hospitals and Healthcare provider (NABH), a constituent board of Quality Council of India in 2008, which focuses on “Patient safety and Quality of care”. We are also the first eye hospital in India to be certified for the ISO 9001:2008 standards in 2009.

We are actively participating in Continuous Quality Improvement (CQI) programme. Along with CQI programmes we are also undertaking Continuous Cost Reduction Programme where we believe in the saying “A penny saved is a penny earned.” This EOQ project was initiated as a part of continuous cost reduction programme. This project gives insight into the importance of controlling expenses apart from revenue generation for business excellence. Materials are said to be a major cost factor in any enterprise and in hospitals about 35-40 per cent of the budgetary allocation is for procurement and management of materials. The key to cost saving begins with the use of the Pareto principle – 20 per cent of the items lead to 80 per cent of the costs.

Problem Definition

Under continuous cost reduction programme, yearly exercise of ABC analysis was introduced as a tool to monitor and scientifically control the inventory in 2008.

- A Category : 85% Total Inventory Cost, 5% of Inventory
- B Category: 10% total Inventory Cost, 10 % of Inventory
- C Category : 5% Total Inventory Cost, 85% of inventory
ABC Analysis for the FY 2009-10, 2010-11 & 2011-12 was the project data source.

ABC Analysis for the years 2010-11 and 2011-12 revealed that patient files had come under A category, the only non-clinical item to do so. This was a major cause of concern for the management as A category (High Annual Value items) includes clinical items such as Intraocular Lenses (IOLs) and other ophthalmic implants.

**ABC Analysis (2009-10)**
ABC Analysis (2010-11)

Problem Diagnosis

ABC Analysis for the years 2010–11 and 2011–12 revealed that Patient Files have come under “A” Category. A low cost non-clinical item had gained huge monetary significance because of high annual demand.

Patient files was the only non-clinical Item that involved high total annual expenses and this anomaly was the cause of concern for the hospital management, although patient files were under B category as per ABC Analysis 2009-2010.

Management analyzed and identified the problem and decided to control the expenses on patients files. On comparing the data for consumption and expenses for year 2009-10, 2010-11 & 2011–12 we found that consumption in 2009-10 was 26,000 & annual expenses was Rs. 540800, annual consumption in 2010-11 was 30,464 & expenses was Rs. 607756 and consumption in 2011–12 was 33235 and annual expenses was Rs. 642764. It was observed that frequency of ordering was 5 to 7 times in a year for quantity 5,000 nos.

Management expectations were procurement with economical prices without compromising the quality and patient satisfaction.

This project is a structured approach to problem solving involving the following five steps;

- Defining the Problem – Define Phase
- Measuring the Problem – Measure Phase
- Analyzing the Root Causes – Analyze Phase
- Implementing the Improvements – Improve Phase
- Sustaining the Gains – Control Phase
- Monitoring the Performance – Continuous Improvement Phase
### Comparison of Consumption & Expenses for Patient Files

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption</th>
<th>Expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-10</td>
<td>26000</td>
<td>540800</td>
</tr>
<tr>
<td>2010-11</td>
<td>30464</td>
<td>607756</td>
</tr>
<tr>
<td>2011-12</td>
<td>33235</td>
<td>642764</td>
</tr>
</tbody>
</table>

Design of Old File (outside)
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Design of Old File (inside)

Problem Analysis

Management analyzed the problem and realized that quantity of files is to be ordered in the most Economic way, with continuous cost reduction programme. Need for EOQ was identified and it was realised that negotiation for best price should be done by inviting quotations from multiple vendors. Standardization of the design of files to be done, to eliminate variables and to reduce Internal Lead Time. Frequency of Ordering should be decided based on EOQ.

Problem Remedy/Methodology

Economic Order Quantity (EOQ)

EOQ is the quantity where Sum of Ordering cost and Carrying cost is minimal. To derive this quantity we calculated ordering cost, carrying cost and annual demand.

Deployment of Quality Tools & Management

Tool Adopted for Calculation of EOQ (Q)

Classical Wilson Model

\[
Q = \sqrt{\frac{2DK}{h}}
\]

D = Annual Demand (Consumption) of item

K = Ordering Cost Per Order

h = Carrying (or Holding) Cost Per Item

EOQ MODEL = Annual Ordering Cost + Annual Inventory Holding Cost → minimal
Annual Demand (D)
Annual Demand (D) of patient files for the year 2011-2012 is 33,235 nos.

Ordering Cost (K)
Cost of procurement and inbound logistics costs form a part of Ordering Cost. These include cost of placing a purchase order, costs of inspection of received material, documentation costs, etc.

(It includes Purchase Officer salary, stores staff salary, stationery, phone expenses)

In P.O. (Purchase Order) generation process salary of two purchase staff = Approx Rs. 40,000/month.

Average number of P.O. generated per month = 100

Per Order P.O. process cost = Rs. 400 (40,000/100)

Calculation of Ordering Cost
- Material Receipt (MR) process
- Salary of stores staff Approx. Rs. 20,000/month
  Average total no. of MR handled/month = 200 nos.
  hence per receipt MR process contributed Rs. 100 = (Rs. 20,000/200)
- Miscellaneous expenses like stationery, fax, mail, telephone etc. assumed as Rs. 100 per Order
- \( K = Rs. 400 + Rs. 100 + Rs. 100 \)
  Ordering Cost = Rs. 600 Per Order

Carrying Cost
The price of holding, or “carrying,” inventory is called Carrying Cost. Carrying costs include storage costs, maintenance (particularly in regard to perishable items), insurance etc.

Calculation of Carrying Cost
Carrying Cost is considered according to the industry standards 2% of \( P \), i.e. the unit cost of the item.

For patient files, \( P = Rs. 19.34 \) per file.

Hence \( h \) (Carrying Cost) = 0.02 * 19.34 = Rs. 0.39 per file.

Final Calculation of EOQ

\[
Q = \sqrt{\frac{2DK}{h}} = \sqrt{2*33235*600/.39}
\]

Hence \( Q = 10,112 \) Pieces

Approximately 10,000 pieces (rounded off) per order is the Economic Order Quantity for patient files
**EOQ Calculation by Charting the Ordering Cost, Carrying Cost and Total Cost versus the Order Quantity**

![Graph showing EOQ calculation](image)

**Design of New File**

Inner part of file is blank

**Implementation of EOQ and its results**

Implementing EOQ quantity as 10,000 nos. per order with best negotiation of price the unit cost of files reduced from Rs. 19.34 to approximately Rs. 10.00 and frequency of ordering reduced from 7 times to 3 times per year. Centralized purchasing is encouraged in Nethradhama Eye Hospital with decentralized distribution to its various branches.
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Direct/Tangible Benefits
- There is financial gain for organization by adopting scientific way of inventory control and cost reduction.
- Accommodates quantity discounts either incremental or all units.
- Ordering Quantity is fixed now i.e. 10,000 per order increased to 14,000 per order for the financial Year 2015-16

Indirect/Intangible Benefits
- Frequency of ordering is reduced from 7 times to 3 times per year. So ordering cost has been controlled.
- Motivation for workforce to closely monitor requirement, consumption, pilferages/wastage of material under continuous cost reduction programme.
- Duplication of work is minimized and manpower involved in receiving material utilized optimally.

Socio-Economic Benefits
As cost of files are very economical it would help in decreasing the burden transferred on end consumer i.e. patients which would have been costlier for them.

Sustainability
- No drift in performance post closure of the project by yearly monitoring & control.
- Annual Demand is recorded & ABC Analysis is done. EOQ is calculated whenever there is an increase in price or huge difference in Annual Demand.
- Frequency of Ordering is fixed now i.e. 3 times per year for 10,000 nos.
- The EOQ analysis would be also extended to other high value materials in a phased manner.
- Good Vendor Management : On time payment encourages vendor to deliver the material on time in single supply.

Significance of Problem and Solution
In hospital scenario it has been seen that generally people do not pay attention or ignore controlling inventories scientifically and because of this reason the hospital has to bear a huge burden on inventories. If inventories are controlled scientifically by adopting ABC analysis, FSN analysis, VED analysis, EOQ hospitals can make huge savings.

Lesson Learned
- The Classical Wilson Model was reincarnated and its importance and application can be seen not only in manufacturing industries but in healthcare industries also.
- Usefulness of EOQ was identified.
- ABC Analysis is an important tool as it categorizes the inventory based on the value.
- High value items need to be monitored.
- Annual demand should be monitored irrespective of low unit cost of item.
Carrying Cost & EOQ to be calculated whenever there is change in price or annual demand.

This project promotes competitive pricing among vendors by inviting multiple quotations.

**Cloning of the Project**

Under Continuous Cost Reduction Programme EOQ project was deployed for other vital and B category items such as a surgical consumable visco elastic - Viscomet PF in order to reduce the cost. EOQ was calculated as 2100 per order which reduced frequency of ordering from 12 times to 8 times saving approximately Rs. 15000 per year. EOQ determination may be applied for other consumables eg Disposable Surgical Gloves, Syringes, needles, IV drip sets, Face Masks, Caps, IV cannulas etc.

**EOQ Calculation by Charting the Ordering Cost, Carrying Cost and Total Cost versus the Order Quantity (2014-15)**

Conclusion

This project has helped the organization to save more than 50% on expenses of patient files and is a good example to minimize the expenses by using scientific tools and can be implemented for other items which are purchased in bulk.

**Acknowledgement**

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