Research Article

An ABC Analysis of Multiple Component of Compressor unit- Inventory Management Case Study

Shishir Kumar[†] and Shailendra Kumar Singh^{‡*}

[†]Department of Toolroom, Central Institute of Plastics Engineering & Technology (CIPET) – Bhopal, india [‡]Dept. of Chemicals & Petrochemicals, (Govt. of India), India

Accepted 28 Aug 2016, Available online 29 Aug 2016, Vol.6, No.4 (Aug 2016)

Abstract

Inventory constitutes the most common part of current assets of larger majority of leading manufacturing industries. The main intention of this study is to conclude whether or not multiple-products in the Manufacturing Company can be evaluated and understood using inventory management techniques. The study is considered as qualitative single-case study. The study method employed includes ABC analysis. Data collection is mainly through the interviews with the officers and Technical staff involved in inventory control operations. Secondary data is collected from the online information system to provide the annual reports, sales report, SRR Report.

Keywords: ABC Analysis, Inventory, MRP, Multi-Component, demand, Stock Level.

Introduction

Inventory management is the activity involved in developing and managing the inventory levels of raw materials, semi-finished materials (working- process) and finished goods so that adequate supplies are available and the costs of over or under

Stocks are low. In a manufacturing system, even for a very complicate and flexible process of different products, the physical arrangement and capabilities of machines usually determines how production control should operate. The machines are not specified only for one task and the different tools need to be set up every time when the work changes. According to some research (Arnold, et al. 2008), they mentioned about the four main manufacturing strategies that were using in manufacturing such as: make-to-stock , deliver-from stock, make-to-order, and assemble-to-order. All the strategies are supposed to optimize the total production cost of inventory control system. The studied Company, Godrej Compressor manufacturing plant, Mohali is a public sector company. Sometime, the company does not produce the products on time. It also makes more parts damage and reduced company's revenue. It was observed that company does not always adopt Inventory optimization model to evaluate their inventory using raw materials and finished products as a parameter for measurement. Godrej net loss (before tax) stood at about Rs 2 cr during the year 2012-13 fiscal. This paper intends to discuss the production control technique for а small manufacturing company by using the ABC analysis to promote a better material management policy that would affect the company's profit.

Following are the objectives of this research

a) To describe the inventory management procedures currently used in Godrej Compressor manufacturing plant, Mohali-Punjab.

b) To determine whether or not inventory management in Compressor manufacturing plant, can be evaluated and understood using ABC- analysis in inventory management.

c) To determine the optimality in the company

Inventory policies. The research is quiet significant in following areas:-

a) It will be vital to the management of Compressor manufacturing unit to improve the quality of inventory management system effectively.

b) It will benefit the management of Compressor manufacturing plant to employ efficient/competent personnel in proper inventory management. The ideal inventory level is a material's Economic Order Quantity (EOQ). This is the amount ordered when an order is placed. Next you need to determine yours Safety Stock (SS). This is the amount that you should have remaining when the EOQ arrives.

Basically, Safety stock is the average bare minimum you will have at any given time, and EOQ+SS is the average maximum amount you will have at any given point in time. This should be intuitive because safety is what you have when your shipment arrives and when the order arrives (EOQ) it gets added to then safety stock.

*Corresponding author: Shailendra Kumar Singh

There can be average minimum and maximum because you might not receive the EOQ exactly when you planned to and therefore may have more or less. On average you should have the SS amount when you receive shipments. Between these two average minimum and maximum values lies your long-term average inventory.

The ABC analysis is a business term used to define an inventory categorization technique often used in material management. It is also known as Selective Inventory Control. Policies based on ABC analysis:

- A ITEMS: very tight control and accurate records
- B ITEMS: less tightly controlled and good records
- C ITEMS: simplest controls possible and minimal records.

A Class items		B Class items			C Class items		
1. 2. 3. 4.	Very strict control Maximum follow up Rigorous value analysis Handled by senior officers	1. 2. 3. 4.	Moderate control Periodic follow up Moderate value analysis Handled by middle management	1. 2. 3. 4.	Loose control Follow up in exceptional cases Minimum value analysis Can be delegated		

The ABC analysis provides a mechanism for identifying items that will have a significant impact on overall inventory cost, while also providing a mechanism for identifying different categories of stock that will require different management and controls.

The ABC analysis suggests that inventories of an organization are not of equal value. Thus, the inventory is grouped into three categories (A, B, and C) in order of their estimated importance.

A items are very important for an organization. Because of the high value of these A items, frequent value analysis is required. In addition to that, an organization needs to choose an appropriate order pattern (e.g., Just- in- time) to avoid excess capacity.

B items are important, but of course less important, than A items and more important than C items. Therefore, B items are intergroup items.

C items are marginally important.

Inventory Control Application: The ABC classification system is to grouping items according to annual issue value, (in terms of money), in an attempt to identify the small number of items that will account for most of the issue value and that are the most important ones to control for effective inventory management. The emphasis is on putting effort where it will have the most effect.

All the items of inventories are put in three categories, as below:

A Items: These Items are seen to be of high Rupee consumption volume. A items usually include 10-20% of all inventory items, and account for 50-60% of the total Rupee consumption volume.

B Items: B items are those that are 30-40% of all inventory items, and account for 30-40% of the total

Rupee consumption volume of the inventory. These are important, but not critical, and don't pose sourcing difficulties.

C Items: C items account for 40-50% of all inventory items, but only 5-10% of the total Rupee consumption volume. Characteristically, these are standard, low-cost and readily available items. ABC classifications allow the inventory manager to assign priorities for inventory control. Strict control needs to be kept on A and B items, with preferably low safety stock level. Taking a lenient view, the C class items can be maintained with looser control and with high safety stock level. The ABC concept puts emphasis on the fact that every item of inventory is critical and has the potential of affecting ,adversely, production, or sales to a customer or operations. The categorization helps in better control on A and B items.



Figure 1- ABC representation graph

In addition to other management procedures, ABC classifications can be used to design cycle counting schemes. For example, A items may be counted 3 times per year, B items 1 to 2 times, and C items only once, or not at all.

Types of Inventory Control

- 1. ABC analysis
- 2. VED analysis
- 3. XYZ Analysis
- 4. FSN Analysis
- 5. SDE Analysis

Techniques of Inventory Control Inventory Control

Some of the major techniques of inventory control are as follows:

- 1. Economic Order Quantity
- 2. Inventory Models
- 3. ABC Analysis
- 4. Material Requirements Planning
- 5. VED Analysis.

1. Economic Order Quantity: A problem which always remains in that how much material may be ordered at a time. An industry making bolts will definitely would

like to know the length of steel bars to be purchased at any one time. This length is called economic order quantity and an economic order quantity is one which permits lowest cost per unit and is most advantages.

2. Inventory Models

Concept

Inventory models determine when and how inventory to carry.

i. Inventory models handle chiefly two decisions:

(a) How much to order at one time.

(b) When to order this quantity to minimize total costs. ii. Lowest-cost decision rules for inventory management pertain to either buying products from outside or producing then within the company.

iii. Single inventory models assume no delivery delay and that demand is known.

iv. Probabilistic models handle situations of risks and uncertainty.

3. ABC Analysis: ABC Analysis is the basis for material management processes and helps define how stock is managed. It can form the basis of various activity including leading plans on alternative stocking arrangements (consignment stock), reorder calculations and can help determine at what intervals inventory checks are carried out (for example A class items may be required to be checked more frequently than c class stores

4. Material Requirements Planning: MRP is a computational technique that converts the master schedule for end products into a detailed schedule for raw material and components used in the end products. The detailed schedule identifies the quantities of each raw material and component items. It also tells when each item must be ordered and delivered so as to meet the master schedule for the final products.

5. VED Analysis: Vital essential and desirable analysis is used primarily for the control of spare parts. The spare parts can be divided into three categories:

(i) Vital (ii) Essential (iii) Desirable

(i) Vital: The spares the stock out of which even for a short time will stop production for quite some time and future the cost of stock out is very high are known as vital spares.

(ii) Essential: The spare stock out of which even for a few hours of days and cost of lost production is high is called essential.

(iii) Desirable: Spares are those which are needed but their absence for even a week or so will not lead to stoppage of production.

Literature Review

Effective inventory management is essential in the operation of any business (Bassin, 1990). Hakansson and Persson (2004) identifies three different trends in the development of logistics solutions within industry, one trend is concerned with the increased integration of logistics activities beyond organization boundaries with an aim to reduce cost items such as capital costs for inventory and handling costs of flows.

Inventory as an asset on the balance sheet of companies has taken on increased importance because many companies are applying the strategy of reducing their investment in fixed assets, like plants, warehouses, equipment and machinery, and so on, which even highlights the significance of reducing inventory (Coyle *et al.*, 2003).

Changes in inventory levels affect return on assets (ROA), which is an important financial Parameter from an internal and external perspective. Reducing inventory usually improves ROA, and vice versa if inventory goes up without offsetting increases in revenue (Coyle *et al.*, 2003).

According to Bloomberg *et al.* (2002), inventory classification systems help allocate time and money in inventory management and allow firms to deal with multiple product lines and multitude of stock-keeping units (SKU). The most widely used classification model is

ABC analysis is an inventory classification technique in which the items in inventory are classified according to the dollar volume (value) generated in annual sales (Fuerst, 1981).

According to Onwubolu and Dube (2006), when ABC analysis is applied to an inventory Situation, it determines the importance of items and the level of control placed on the items. The result of importance ranking is determined by two factors, the usage rate for an item and its unit value. These two factors can be multiplied to give the annual usage value

(AUV), which is the total value of the annual usage. The bigger each factor, the more top ranking is the item. Therefore, close control is more important for fast moving items with a high unit value. To the contrary, for slow moving, low unit value items the cost of the stock control system may exceed the benefits to be gained and simple methods of control should be substituted.

By dividing a company's inventory into different classifications-A, B, or C, Onwubolu *et al.* (2006) indicates that managers can focus on the items that account for the majority of the inventory. Fuerst.et.al (1981) describes, generally, the A items include approximately 10 percent of the items in inventory, while accounting for roughly 50 percent of the dollar volume generated. The next classification, B items, includes roughly 40 percent of the items with 40 percent of the dollar volume. The remaining items, the C items, account for only 10 percent of the dollar volume, yet include approximately 50 percent of the items.

Methodology

Research methodology represents the strategies Involved in collecting and analyzing data. This section attempts to give a direction and manner for research work. This includes the mode of data collection, analysis and the research design.

Case Study Strategy

Robson (2002) defines case study as 'a strategy for doing research which involves empirical an particular investigation of a contemporary phenomenon within its real life context using multiple sources of evidence' .The researcher must be alert to the need for multiple sources of evidence. 'All evidence is of some use to the case study researcher: nothing is turned away.' But this does not mean that it should talk to a lot of different people, but it needs to look for kinds of evidence: what people say, what they are doing, what they are making or producing, what documents and records show.

For research project, current situation of inventory management in Compressor manufacturing unit, Mohali was investigated by using multiple sources of evidence, for instance, the interviews with the manager and other related staff at Godrej Compressor manufacturing Plant, Mohali Direct observation on warehousing operation was also conducted. There are two major types of case study, single-case study and multiple-case study. According to Yin (2003), 'Singlecase study is similar to a single experiment, and many of such conditions that justify a single experiment also justify a single-case study.' Compared with single-case study, multiple cases' evidence is often considered more compelling and the overall study is regarded as being more robust. Single-case study approach was used to conduct the research project at Compressor manufacturing Plant, Mohali. Single-case study strategy helped to understand the research context and acquire deep understanding about specific management issues.

Methods of Data collection

Primary and secondary sources provided essential information for this research work. These sources include

a) Interview with some key personnel in the stores, purchasing, production and inventory departments of the company.

b) Observation of the production process was done to see the flow of goods in the conversion process. Materials handling and storage were also observed and so was the inspection procedures.

c) Record analysis of relevant data was obtained from the annual reports, product catalogue, sales reports, purchasing reports of the company and the related journals.

d) Theoretical background information was gathered through review of related literature on ABC-model.

e) E-mails were also used to send out questions and get responses.

Data Presentation, Analysis and Findings

Inventory sales and management of Compressor manufacturing Plant, Mohali

A case study Compressor manufacturing Plant, Mohali is a small manufacturer in Mohali. The company is an ISO 9001:2000 and ISO: 14001 Company. The company is principally engaged in the business of manufacturing and sale of refrigerator and compressor. It designs, develops, manufactures and market a range of reciprocating compressor. It has own marketing network of Regional Sales offices to fulfill customer's requirements in the areas of sales and services.

These products are designed for local transportation.

b) Sparesc) Lubricants, Refrigerants

Policies & Objectives

Policies

a) To improve the performance of the company so as to be competitive and profitable through constantly. Improving existing products, adding new products and expanding customer base.

b) To fulfill customers' needs for economic and safe mode of road transport and quality engineering products through contemporary technologies.

Objectives

- a) To achieve 10% increase in production.
- b) Rationalization of Manpower.
- c) To achieve 5% decrease in cost.
- d) To reduce energy input.

Analysis

Itom		Annual De	emand	Unit Cost	Annual Cost	Total Annual Cost (Rupees in Million)
No.	Component List	Region	No sold	(Rupees)	(Rupees in Million)	
	Body 1-10R-005-152	CR	8962	16872	151.20	201.45
		NR	2423	15732	38.11	
1		ER	343	18693	6.41	
		WR	291	14736	4.28	
		SR	98	14893	31.88	
	Con rod 2-13-UJC-N60	CR	3985	8000	21.14	
		NR	2678	7896	7.20	
2		ER	987	7298	2.27	63.67
		WR	278	8783	1.18	
		SR	167	7091	5.80	
	Vlv Plt 215 CHS	CR	1937	3003	3.60	11.66
		NR	872	4136	1.71	
3		ER	538	3189	0.24	
		WR	62	3891	0.31	
		SR	148	2096	1.40	
4	Dist 2.075 126 K4	CR	348	4036	1.52	2.02
4	PISt 2-075-136-K4	NR	494	3094	1.93	2.92
	Gudg Pin 2-11P-501#7	NR	500	3869	1.93	2.72
5		WR	218	3654	0.79	
NO	Product list	Annual demand (No.)	Demand	Unit cost (Rupees)	Annual Cost (Rupees in Million)	Total Anuual cost (Rupees in Mion
6	Spare Parts	-	-		38.62	38.62
7	Lubricants	-	-		168.22	168.22

Table 1 ABC- classification of Multiple-Products in Company Compressor unit

Table 2 Cumulative Percentage of Total Usage of Compressor component

Item No	Component List	Annual Demand	Cumulative % of Items	Annual Cost (Million Rupees)	Percentage in total usage (%)	Cumulative % of Total Usage
1	Body 1-10R-005-152	12117	14 %	201.45	41.17 %	41.17
2	Con rod 2-13-UJC-N60	8095	29 %	63.67	13.01 %	54.18
3	Vlv Plt 215 CHS	3557	42 %	11.66	2.38 %	56.56
4	Pist 2-075-136-K4	842	56 %	2.92	0.59 %	57.15
5	Gudg Pin 2-11P-501#7	718	70 %	2.72	0.57 %	57.72
6	Spare Parts	-	84 %	38.62	7.89 %	65.61
7	Lubricants	-	100 %	168.22	34.39 %	100
	Total amount	Cost	489.26			

Table 3 ABC Classification

Category	Items No Product List P		Percentage Usage (%)	Action
А	1, 2	-Body 1-10R-005-152	-Body 1-10R-005-152 54.18 %	
		-Con rod 2-13-UJC-N60		
В	7	-Lubricants	34.37%	Regular Review
		-Vlv Plt 215 CHS		Infrequent Review
С	3, 4, 5, 6	-Pist 2-075-136-K4	11.45%	
		-Gudg Pin 2-11P-501#7		
		-Spare Parts		

In continuation with the real situation of the sampled seven components of compressor Unit, 30-30-40 classification was established as percentage of the products as shown in Table 3.

Our analysis shows that company follows the ABC analysis for multiple- products. It was observed that there is no relation between annual demand and total costs of the products. An inventory model based on projected sales, lead times and stock holding costs has not been established.

Findings

Conclusions

Company has problems in procurement and handling of raw materials not for finished components. Our study makes a contribution to the management of inventory in the unit .It also develops an approach if adopted by company, would result in more efficient utilization of financial resources for finished inventories.

The study thus suggests some recommendations to improve certain matter in the company inventory policy. If these recommendations are considered, the company's inventory management situation will raise a lot.

a) Review of stock-levels –There is no guarantee of future presentation by following past results. However, "A" items have greater influence on projected investment and purchasing capacity, and therefore should be managed most in terms of minimum and maximum inventory levels.

b) Cycle counting – For higher usable items, There is more possibility in inventory errors. Therefore higher priority items are cycle counted more frequently to ensure accurate record balances.

c) Identifying items for potential Consignment – Since A items tend to have a greater impact on investment, these would be the best inventories to consider the potential for alternative stocking arrangements that would reduce investment liability and associated carrying costs.

References

- Bassin, W. M. (1990). A Technique for Applying EOQ Models to Retail Cycle Stock Inventories. Journal of Small Business Management, 28(1), 48-55.
- Coyle, J. J., Bardi, E. J., & Langley, C. J. Jr. (2003). The Management of Business Logistic: A Supply Chain Perspective (7th ed.). Mason: South-Western.
- Bloomberg, D., LeMay, S., & Hanna, J. (2002). Logistics. Upper Saddle River: Prentice Hall.
- Fuerst, W. L. (1981). Small Business Get A New Look at ABC Analysis for Inventory Control. Journal of Small Business Management, 19(3),39-44.

- Onwubolu, G. C., & Dube, B. C. (2006). Implementing an Improved Inventory Control System in a Small Company: A Case Study. Production Planning & Control, 17(1), 67-76.
- Hakansson, H., & Persson, G. (2004). Supply Chain Management: The Logic of Supply Chains and Networks. The International Journal of Logistics Management, 15(1), 11-26.
- Pramod Kumar, Mohd. Anas, An ABC-Analysis for the Multiple- Products Inventory Management - Case Study of Scooters India Limited, IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 1, Issue 5, Oct-Nov, 2013.
- Source: Boundless. ABC Technique. Boundless Finance. Boundless, 26 May. 2016. Retrieved 27 Aug. 2016 from https:// www.boundless.com/ finance/ textbooks/boundless-finance-textbook/working capitalmanagement-18/ inventory- management-129/abctechnique-525-875.
- Source: Boundless. ABC Technique. Boundless Finance. Boundless, 26 May. 2016. Retrieved 27 Aug. 2016 from https://www. boundless.com/ finance/ textbooks/boundless-finance-textbook/working-capitalmanagement-18/inventory-management-129/abctechnique-525-875.



Shri. Shishir Kumar currently working as an Technical Officer in CIPET-Bhopal. He completed his M.Tech in Plastics Technology from Anna University, Chennai. His areas of specialization and interest are Advance Plastic Processing & Tooling. He has the work experience of more than 8 years in relevant field.



Shri. Shailendra Kumar Singh currently working as an Assistant Technical Officer in CIPET-Bhopal. He completed his M.Tech in Mechanical Engineering from Rayat and Bahra Institute of Engineering and Bio-technology, Punjab. He did his B.Tech in Mechanical Engineering from Chitkara Institute of Engineering and Technology, Punjab. He did his Diploma

in Mechanical Engineering from Government Polytechnic, Hoshiarpur, Punjab. His areas of specialization and interest are Advance Manufacturing Techniques and Material Science. He has authored several research papers in International journals of repute. He actively takes parts in presenting his Research papers in International and National level Conferences/ Seminars/ workshops.