Evaluating Obsolete Inventory in Health Care

Dr. Erick C. Jones
University of Texas at Arlington
Arlington, Texas

Maurice D. Cavitt
University of Texas at Arlington
Arlington, Texas

Abstract

Numerous organizations are currently facing inventory management problems such as distributing inventory on time and maintaining the appropriate inventory level to satisfy the customer or end users. Organizations understand how critical it is to maintain accurate inventory levels but sometimes underestimate leading to wide performance gap in maintaining inventory accurately. The inventory inaccuracy can consume much of the investment on purchasing and many times lead to excessive inventory increasing holding cost and total cost. This paper presents a feasible solution in providing decision-making criteria for management for closing or maintaining a warehouse supported from purchasing and holding cost information. From purchasing and holding cost information it is envisioned to be able to analyze the impact of inventory carrying cost, obsolete inventory and inventory turns. The methodology section explains the carrying cost ratio that will support inventory manager's ability to adopt best practices in avoidance of obsolete inventory as well as reduction in excessive inventory levels. The proposed model provides decision-making criteria based on the performance metric developed. The model and performance metric validation support is from warehouse data and results from this validation presents utilizing the one-echelon model known as Just in Time (JIT) model. Recommendations from the case study were utilized by a health care organization to facilitate their supply chain resulting in the reduction of excessive inventory. In addition, decreasing the carrying cost ratio demonstrates consolidating commodities into fewer facilities will lower costs. Also the paper discuss cost justification, and priority quantification on which facilities should be eliminated and in what order provides the best solution for an organization to maximize profit. Our results from the analysis of the model include the evaluation of warehouses using carrying costs ratio, identifying obsolete as well as premature inventory. The future benefits for the current organization include a reduce building and facility costs, decrease in annual operating budgets, reduction in warehouse operational cost, improvement in labor productivity, warehouse space utilization, and establish performance measures.

Keywords: Obsolete Inventory, Supply Chain, Healthcare

Dr. Erick C. Jones, Maurice D. Cavitt

Introduction

This article discusses the key component of organizations. A key component for success within an organization is a reliable supply chain. Successful investments in the supply chain are evaluated and optimized continuously to yield positive strategic results (Montgomery Research 2008). Savings from implementation of these strategic decisions can be utilized in the overall improvement of the organization.

This article focuses on continuous improvement recommendations for managing inventory costs in a health care facility. It is envisioned that a decision tool developed from this research can achieve these improvements. Different components within the supply chain will be evaluated including warehouses, storerooms, purchasing and distribution practices, and end customer. Each component is critical for overall success of the supply chain. The scope of the paper is to focus on overall continuous improvement efforts in the organizations supply chain.

Improvements consist of evaluation of current processes, problem quantification, and documentation of relevant best practices within the supply chain (including supply chain facility types and amount inventory held). The improvement criterion in the article is based upon the development of a decision tool that allows managers to make efficient decisions with limited data. Illustration of Supply Chain from procurement to end user is provided below in Figure 1.1

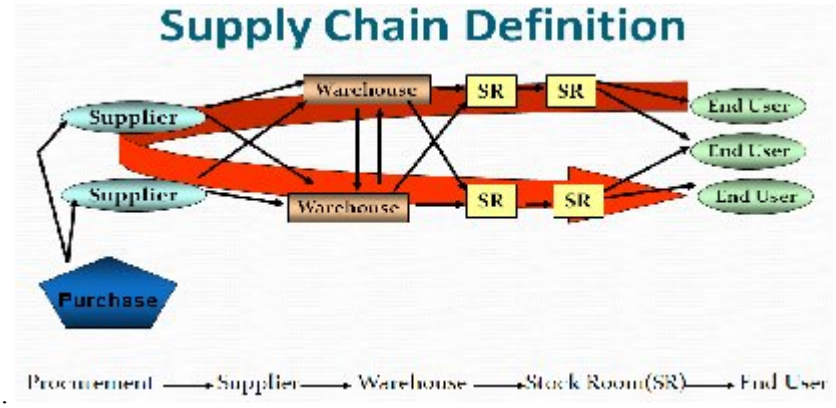

Figure 1: Supply Chain in an Organization

Dr. Erick C. Jones, Maurice D. Cavitt

Background

There are many supply chain researchers that investigate the closing or moving of facilities. Oftentimes they look at overall profitability and the subcomponents of profitability. Researchers who focus on inventory as the focal point for closing facilities include Caglar, Li, and Simchi-Levi. An article by Caglar, Li, Simchi-Levi the researchers investigated a problem faced by a manufacturer of electronic machines with expensive parts located at various customer locations. The researchers developed a continuous review stock policy for a two-echelon inventory system. From the policy, a formulated model to minimize system-wide inventory cost subject to response time constraints at each field depot presented the optimal solution to minimize system wide inventory. This paper will focus directly on the one-echelon model and its components to build upon a carrying cost ratio model.

The use of the Caglar model to make supply chain decisions has been shown by Li (2003) and Simchi-Levi (2003). Each describes the one echelon also known as the Just in Time (JIT) model, in the form of optimization models, manufactured lead times, and inventory control principles. Our research builds on some of these concepts.

From the background, we suggest there is a need for development of decision tools that allow managers to make sufficient decisions with limited data. The proposed model seeks to provide decision criteria to decide rather to continue operational procedure of the warehouse or too close the warehouse based on easy to collect data related to facility, procurement, and distribution cost. The model called upon is the carrying cost ratio model which is utilized to compare total cost of purchasing inventory from retailer to the amount of money spent receiving, stocking and delivering to the warehouse.

The proposed carrying cost ratio model builds upon the one-echelon also known as the JIT model. The model compares total cost of purchased inventory to the amount of money spent holding inventory as well as delivering items to the desired location. The fundamental research question for our research is can a simplified carrying cost ratio be utilized to make effective warehouse closing decisions. Utilizing the carrying cost ratio allows the ability to compare total cost of purchasing inventories from the retailer, to the amount of money spent on receiving, stocking and delivering inventories to the warehouse.

The specific objective of this paper is to describe the carrying cost ratio and its components. We seek to show the components of the derivation and then show a numerical example of its use. Our model supports three specific objectives but this paper will focus primarily on Specific Objective #2.

- Specific Objective #1: Demonstrate how the suggested metric compare to other metrics.
- Specific Objective #2: Development of carrying cost ratio.
- Specific Objective #3: Demonstrate methodology for applying metric

For this paper we hypothesis that the carrying cost ratio will determine which warehouse is more profitable to close. Our null hypothesis is that the carrying cost will determine the more profitable warehouse to close. We seek to reject the null hypothesis at an alpha level of .10. In other words, we seek to determine if the ratio will provide a different answer if we change the sensitivity of the answer by 10%.

Methods

This paper utilizes the one echelon model by Caglar 2003 due to the simplicity of modeling a warehouse and end-users only. We suggest that this is the common point of interest for warehouse managers. The JIT concept is a very popular model and many organizations utilize this model to improve return on investment by reducing in-process inventory and carrying cost that may be associated with inventory. If correctly implemented the model provides lower inventory levels and decreases cost of maintaining inventory but procurement cost many be increased for organizations. The one-echelon model has a unique characteristic in that there is not an intermediary present between vendor and the offices (Caglar et al 2003; Wang, Cohen, and Zheng 2000). Simplification of Caglar's et al model is provided below in Figure 1.2 below.

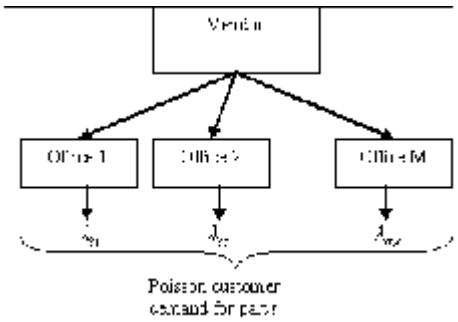

Figure 2: One Echelon Model (Caglar et al 2003)

Case Study

A medium sized Veterans Affair hospital in the United States had interest in closing one of its warehouse facilities. The city operated from one primary warehouse and seven secondary warehouses, a total of eight warehouses. Preliminary analysis of the organization indicated that warehouses were subject to stock-outs affecting the company's profit. The Veterans Affair followed a one-echelon model concept. The one-echelon model concept is provided above in figure 1.2.

One performance metric is utilized in this study due to constraints in the collecting data process. This metric is the turn's ratio metric. The expected result from this case study is the introductions of a new supply chain model were holding/storing inventory is reduced. In addition, this model will also suggest a technique for reducing obsolete inventory as well.

We utilized data collected from a research project annual report in which closing of warehouses was required. The organization primary warehouses had an inventory value of $189,848.82. The inventory carrying cost calculations can be made from the developed models and its respective subcomponents. The four major components that make up inventory carrying cost represented in this paper are capital cost, inventory service cost, storage space cost, and inventory risk cost. Flow diagram of Inventory Carrying Cost provided below in Figure 1.3.

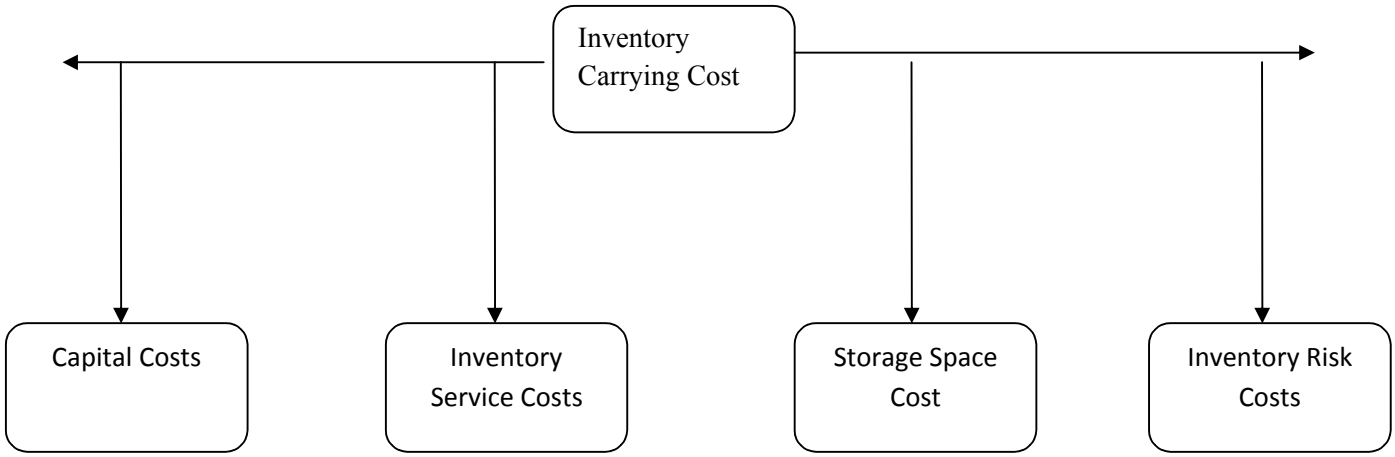

Figure 3: Inventory Carrying Cost Components

Table 1: Primary Warehouse from April 2009 - April 2010

Warehouse	Labor Cost	Utilities & Supplies	Facility
Warehouse 1	$10,440.50	$189,848.82	$10,440.50
Average	$10,440.50	14,603.80	$10,440.50
Total Cost	$10,440.50	$189,848.82	$10,440.50

Labor Cost

Labor cost from this project is assumed a total of $83,524.00 for primary warehouse and secondary warehouse combined. The total labor cost was divided by the total number of warehouses bringing the total to $10,440.50 for labor cost/ per warehouse.

Utilities and Supplies

Utilities and Supplies cost per warehouse was determined by summing the total number of utilities and supply cost per month for each warehouse. Table 3 and 4 below provides a detailed explanation for utilities and supplies cost for each month over a one-year period starting in April 2009 until April 2010.

Facility Cost

Do to constraints of collecting data, assumptions made where labor cost has a direct relationship with facility cost

Table 2: Utilities and Supply Cost for Secondary Warehouse for April 2009-Octocber 2009

Secondary Warehouses	Apr. 09	May 09	June 09	July 09	Aug.09	Sep.09	Oct. 09
Warehouse 1	$494.00	$162.00	$289.00	$62.00	$165.00	$400.00	$156.00
Warehouse 2	$265.00	$361.00	$603.00	$603.00	$2230.00	$1446.00	$2233.00
Warehouse 3	$2992.00	$3077.00	$2659.00	$1043.00	$2611.00	$2818.00	$1506.00
Warehouse 4	$620.00	$710.00	$209.00	$721.00	$722.00	$516.00	$39.00
Warehouse 5	$4847.00	$5418.00	$4025.00	$5597.00	$4529.00	$4097.00	$0.00
Warehouse 6	$3112.00	$2869.00	$2902.00	$1585.00	$4824.00	$3675.00	$1428.00
Warehouse 7	$4839.00	$4862.00	$3946.00	$1288.00	$2694.00	$4350.00	$4025.00
Average	$2453.00	$2494.00	$2090.00	$1577.00	$2539.00	$2472.00	$1348.00
Total	$17170.00	$17460.00	$14633.00	$10899.00	$1777.00	$17301.00	$9436.00

Table 3: Utilities and Supply Cost for Secondary Warehouse for November 2009-April 2010

Secondary Warehouses	Nov. 09	Dec. 09	Jan.10	Feb.10	Mar. 10	Apr. 10	Apr. 09-Apr.10
Warehouse 1	$366.00	$182.00	$362.00	$525.00	$601.00	$128.00	$3890.00
Warehouse 2	$664.00	$777.00	$1093.00	$707.00	$2171.00	$1089.00	$14242.00
Warehouse 3	$2635.00	$1971.00	$1758.00	$2356.00	$1187.00	$2014.00	$28629.00
Warehouse 4	$88.00	$390.00	$24.00	$525.00	$293.00	$228.00	$5086.00
Warehouse 5	$3685.00	$4251.00	$2198.00	$728.00	$3285.00	$396.00	$43057.00
Warehouse 6	$2494.00	$4199.00	$3811.00	$2123.00	$3251.00	$3401.00	$39725.00
Warehouse 7	$3784.00	$3879.00	$2242.00	$2597.00	$4081.00	$4779.00	$47302.00
Average	$1959.00	$2235.00	$1641.00	$1366.00	$2115.00	$1719.00	$25990.00

Total	$13716.00	$15648.00	$11488.00	$9561.00	$14806.00	$12035.00	$181929.00

Table 4: Inventory Turns Ratio for Primary Warehouse

Primary Warehouse #	**Turns/Year**	**Total Receipts**
Warehouse 1	13.00	$ 189,848.82

The proposed model does not solely depend on the inventory turns ratio. The variables involved in the calculation of the inventory turns directly relate to the model to reduce stock-outs for Warehouse 1. Generally, if an organization displays a high inventory turnover there is no concern of obsolete inventory. In this particular situation, the warehouse displayed a high turn's ratio, which is evident that the organization is subject to stock-outs, which may be deferential to the organizations bottom-line. The carrying cost ratio calculation for Primary Warehouse is displayed in Equation 1 below.

Inventory Turn Ratio = Cost of Goods Sold from / Average Inventory (Equation 1)

Calculation for inventory turns ratio for secondary warehouse is not available due to constraints in the collecting data process.

Decision

Recommendation to consolidate the primary warehouse with the secondary warehouses may be best option for the organization. Consolidating the primary and secondary warehouses will allow the organization to maximize profit and reduce associated cost with the primary warehouse. Some of the advantages the organization could potential seize are a reduction in material cost, labor cost, obsolete inventory, holding cost, carrying cost, floor space, facilities cost, and the complexity of locating inventory.

Conclusion

Many organizations operate warehouses in order to reduce costs. Oftentimes in governmental operations, if not carefully managing these warehouse operations become bloated with inventory not needed or much lower demanded. Unless managers periodically analyze the contents of their warehouses, the carrying cost of all items purchased can outweigh savings from procurement when purchasing in bulk.

Decrease in carrying cost ratio demonstrates consolidating commodities into fewer facilities will lower costs. Allow cost justification, and priority quantification on which facilities should be eliminated and in what order provides the best solution for a organization to maximize profit.

In today's fast-paced business world, the time to evaluate business operations is not available, and quick decisions need to be made. This carrying cost ratio, based on easily found data, shows when a warehouse's operations are inefficient and not cost-effective. This model speeds up the process and thereby speeds change and cost savings in a company.

Our results from the analysis of the model include the evaluation of warehouses using carrying costs ratio, identifying obsolete as well as premature inventory. The future benefits for the current organization include a reduce building and facility costs, decrease in annual operating budgets, reduction in warehouse operational cost, improvement in labor productivity, warehouse space utilization, and established performance measures.

References

1. La Londe, Bernard J., Lambert, Douglas. (1977). Methodology for Calculating Inventory Carrying Costs, International Journal of Physical Distribution & Logistics Management, **7(4)**, 193–231.
2. Caglar, D., Li, C.L., and Simchi-Levi, C. (2003). Two-echelon spare parts inventory system subject to a service constraint, IIE Transactions, **36**, 655-666.
3. Dong, Y., KXu, K. (2002). A supply chain model of vendor managed inventory, Transportation Research. Part E: Logistics and Transportation review, **38(2)**, 75-95.
4. Gossard, Gary. (2003). Best Practices for Inventory Reduction, Supply Chain market.13 Jan.2003 Web 23 Mar.2010.
5. Graves, S.C. (1985). A multi-echelon inventory model for a repairable item with one-for-one replenishment. Management Science, **31**, 1247-1256.
6. Holsenback, E. J., Henry J. McGill. (2007). A survey of inventory holding cost assessment and safety stock allocation. Academy of Accounting and Financial Studies Journal, **11(1)**, 111-120.
7. IOMA: Managing Logistics (2002). Inventory Carrying Costs: Is There a "Right' Way to Calculate Them?
8. Nicholson, L, Vakharia., Erenguc S. S. (2004). Outsourcing inventory management decisions in healthcare: Models and application, European Journal of Operational Research, **154**, 271–290.
9. REM Associates. (n.d.). Methodology of Calculating Inventory Carrying Costs. Princeton, New Jersey.