A Comparison of Purchase and Inventory Management System of two Educational Institutes

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Abstract

Every organization has inventories of some kind and the economics and techniques of inventory management are critical for competitiveness. Inventory management basically aims at providing both internal and external customers with the required service levels in terms of quality, quantity and order fill rate, to ascertain present and future requirements for all types of inventory to avoid overstocking while avoiding bottleneck in production and to keep costs to a minimum. As customer satisfaction is given more importance in academic institutions, quality and timely material is the primary consideration due to the fact that loss caused due to poor quality and late supply can not be measured in academic institutions like it can be measured in manufacturing industry where they operate on profit or loss. The inventory management system has therefore, to be designed in such a way that it should provide higher customer satisfaction. As some of the systems may not require substantial stores to be warehoused, the best ordering and procurement policies may be at variance with respect to traditionally inventory control system prevailing in production / manufacturing industry. In this paper I analyze the purchase and inventory Management system followed in two academic institutions. This study addresses the overall purchase and inventory management system followed at these two organizations. The study focuses on understanding and analyzing current inventory system being practiced by them. I provide a frame work to optimize purchase and inventory management system in academic institutes. This is the first attempt to evaluate and compare the purchase and inventory management system in academic institutes. Another important contribution of the research is that I address the purchase and inventory management issues in technology and management institutes

Key Words: Academic Institutions, Inventory Management, Overstocking

1. Introduction

Inventory holding and warehousing continue to play an important role in modern supply chains. A survey of logistics costs in Europe identified the cost of inventory as being 13 per cent of total logistics costs, whilst warehousing accounted for a further 24 per cent (Baker, 2007). However, determination to control purchase and inventory cost in academic institutions is not as strong as it is in production enterprise. They in many cases have not been motivated to control purchasing costs in the same way that competitive industry has. Academic institutions focus more on keeping the consumer more satisfied and comfortable so that their teaching and research activities do not suffer. In this sense, quality of material and timeliness is kept in mind. Supply chain management offers great potential for organizations to reduce costs and improve customer service performance (Jeffery, et al, 2008). However, it should not be forgotten that money saved by cutting inventory cost could be used for academic development of the organization. Therefore, while quality material should be provided in time to facilitate the teaching and research activities, minimization of inventory cost must be ensured.

This study includes two Academic Institutions in the field of Technology and Management of world class level

Literature Review:

Literature review of Educational Institutions was carried out and it was found that (Mohynihan, et al, 1996) had studied the inventory control situation in the Central Storeroom of The University of Alabama and had developed a Decision Support System for Inventory Control wherein the demand for special projects was communicated by all customer groups to the storeroom. The data was then compiled into an aggregate planned demand schedule for each item. Depending upon the schedule, an appropriate ordering scheme was generated by INFORMM (Integrated System For Materials Management). In the case of a material demand based on the item re-order point listing, INFORMM will utilize the item data (e.g., unit cost, item class, annual demand to provide the decision maker with an inventory analysis. The system is divided into five distinct modules. Module 1 contains the INFORMM database. Module 2 provides system utilities, such as the modification of system variables for what-if analysis. Module 3 deals with planned demand i.e. demand due to special projects. Module 4 addresses the unpredictable demand arising from preventive and corrective maintenance activities on campus. This module also deals with single item and grouped item

decisions. Module 5 addresses the disposal of excess stock. The system was developed as a stand-alone entity. Later integration with the main frame-based inventory tracking system was planned.

Literature review of some current results on Inventory management was carried out and it was found that Rajeev (Rajeev, 2008) had made an impressive study of 40 SMEs (small and medium sized enterprises) in Bangalore (India) and he observed that even in an inventory intensive manufacturing industry sector such as the machine tool industry, IM (Inventory Management) practices were poor. The use of formal practices for managing inventories was also inadequate. Poor IM practices were characterized by a lack of an integrated approach in the form of the absence of links between physical stock and accounting system. A lack of appreciation for IM among the entrepreneurs and the lack of qualified staff were the two major factors contributing to low IM practices. This situation was complicated further by other factors such as constraints on working capital, a lack of T&D, a lack of progress in the area of HRD and the organizational characteristics of the SMEs. The use of a formal inventory ordering policy, such as fixed quantity ordering or fixed period ordering policy was not observed in the SMEs. Instead, a random policy was followed by the SMEs for material procurement. The study also identified the use of rule of thumb for IM, a low importance given to forecasting and random ordering for material procurement, low level use of computers and a low level of importance given to purchasing and variable lead-time. Three important aspects used to judge the quality of a firm's IM practices were the systematic character of the operation, the use of computers and the application of modern methodology (Chikan, 1990). In this context, the level of computerization for IM activities in Bangalore was low. While the SMEs were equipped computers, the capabilities of software and hardware were not exploited to their full potential. For the SMEs in the machine tool sector in Bangalore, there is a profound scope for development in IM practices.

(Nasiri, et al, 2010) in their study have formulated an integrated model for the location of warehouse, the allocation of retailers to the opened warehouses, and finding the perfect policy for inventory control to managing order quantity and safety stock level. The goal was to select the optimum numbers, locations, capacities of the opening warehouses and inventory policy so that all stochastic customer demands can be satisfied. The model was developed as a non-linear mixed integer programming and solved using Lagrange relaxation and sub-gradient search for the location/allocation module and a procedure for the capacity planning module.

(Saeed, 2008), has used the trend forecasting to determine ordering policy in supply chains by viewing it as a part of the control process for making the supply responsive to demand. Trend forecasting is often used to assess demand — a tracked variable in the control context, which drives supply — a tracking variable. Used in this way, it is often observed to increase instability creating the so-called bullwhip effect. Trend is used on the other hand with reliability to increase stability in controller control, but with the difference that a trend of a tracking variable is used to drive correction. While both processes involve use of trend to determine policies for achieving reliable performance, the outcomes of the former are variable while those of the later can create improvement in control with certainty. Saeed has discussed the similarities and differences between the two processes and has developed guidelines for applying trend forecasting to enhance stability in supply chains.

(Mattsson, 2007) in his study has revised and enhanced existing inventory control models in a way that allows them to be used more efficiently in environments with short lead times. Results from the simulation show that traditionally used inventory control methods fail to ensure that desired service levels are attained in environments with short lead times. The simulation also shows that, by using the developed model, the differences between desired and attained service levels can be reduced to fall within limits acceptable in practice.

In another study, What is the "right" inventory management approach for a purchased item (Wallin, et al, 2006) have asked an important question – i.e. how best to manage inventory of a purchased item that is critical to the firm? In answering this question, they have offered, as a starting point, the decision framework, one that is conceptually derived from anecdotal data – with the hope that it could not only provide some pragmatic guidance as to how to tackle this question but also augmented existing scientific research on this question.

(Kros et al, 2006) in their Impact of just-in-time inventory systems on OEM suppliers, have analyzed the impact of the adoption of just-in-time (JIT) production systems by different equipment manufacturers (OEMs) on the inventory profiles of their suppliers (Razi and Tarn, 2003) in An applied model for improving inventory management in ERP system, have provided a simple approach to improving inventory management for spare parts in an ERP environment. The model they have employed uses pooled distribution according to similarities in their demand histories and lead times, which is certainly a feasible and practical alternative to complex theoretical distributions

(Braglia,et, al 2004) have designed a Multi-attribute classification method for spare parts inventory management. The spare parts inventories management in industrial plants represents a very complex problem due to the difficulties concerning data collection, the number of factors to be considered, and the large amount of the items involved. A new multi-attribute technique to define the "best" strategies of spare inventories management is presented in their method.

(Natarajan, 1991) discussed the linkages between IM and competitive advantage, bringing into focus the integration of strategic and competitive factors such as cost, delivery and quality. (Natarajan, 1991) argues that reducing the throughput time by faster value addition to the materials provides a firm with a distinct edge in competitive environments. However, inventory costs are

determined not only by their level of inventory but also by the time the materials spend in the system. (Mantho, 1994) classified IM into three broad areas:
(1) Inventory record keeping: due to the availability of computers at a reasonable price, SMEs have found it appropriate to automate their inventory records through computerization.
(2) Inventory decision-making: many models can be integrated into computer based inventory systems.
(3) Material requirement planning (MRP) system: MRP is an IM information system concerned with getting the right materials to the right place at the right time.
However, contemporary IM systems are more challenging because of several variables. In a fluid IM environment, these factors include high inflation rates at certain periods, low availability of traditional materials, high costs of labour leading to less making and more buying, increasing numbers of suppliers entering the procurement market and rapid development of micro-processors and software in decision-making support systems. In addition, new technological innovations lead to the development of substitutes (for example, smart materials replacing steel and aluminum), which add to the challenges for IM (Mohanty, 1985). In this light, IM must be oriented to the quite specific needs of the particular enterprise. The IM practices of SMEs in Finland and Greece were studied by (Chikan and Whybark, 1990) to identify the experiences of managers concerning IM. In Finland, 15 case studies of IM were undertaken, including examining the role of IM in corporate planning, inventory decision-making and performance measurement. The findings revealed that IM decisions are made at the operational level with minimal guidance from the top. Furthermore, the lack of accurate, real-time and suitable aggregate information of material flows and stock levels prevented these enterprises from setting precise quantitative goals for IM. Furthermore, financial pressures forced the enterprises to reduce their inventories, which eventually led to internal as well as external stock outs (Chikan and Whybark, 1990).

2. Objective of the Study

The basic aim of this study is to critically examine and analyze the practices and performance of purchase and inventory management situation in two Academic Institutions and to appreciate the basic requirement of management study. Inventory decisions in academic institutions are frequently based on the personal judgment, intuition and experience of management. These settings provide a unique area for the application of materials management techniques. This type of case study not only widens the information on functioning of an organization, but also highlights the various problems being faced within the organization.

This study focuses on inventory management system followed in two Academic Institutions and brings out the detailed contents analysis of inventory management system, problems, and solutions.

3. Methodology

1. Data collection through field visits, telephonic interaction and personal interviews
2. Using Case study method
3. Analysis of contents and
4. Summary of observations and Recommendations

4. Current System of Purchase and Inventory Management at Academic Institutes: A comparison between the two

4.1. Academic Institution (Technical):

Objective and Size of the Organization:
This is an Educational Institution in the field of Technology having approximately 700 employees. The objective of the Institute is to provide high quality education and to conduct original research of the highest standard.

4.2. Academic Institution (Management):

Objective and Size of the Organization:
The objective of this Management Educational Institution is teaching, training, research, and consultancy of highest standard. It has approximately 75 employees.

4.3. Similarities and Dis-similarities in the present system of the two organizations are shown in Table -1

Table -1

Similarities and Dis-similarities of the current system

SIMILARITIES			
S. No.	**ISSUES**	**Service Industry "Academic Institute" (Technical)**	**Service Industry "Academic Institute" (Management)**
1	**Man power Training**	The Institute is not very serious to impart training to its employees on materials functions.	This Institute too is not cautious on giving training to its employees on Inventory control system.
2	**Purchase Cost Control**	For controlling purchase cost,, the following measures are taken 1. Cost reduction through its own Freight Forwarder in the case of imported equipments. Freight Forwarder arranges the delivery from foreign supplier. The equipment is procured on FOB (Free On Board) basis and not on CIF (Cost Insurance and Freight) basis. On comparison, it was found that CIF value through freight forwarder agent was much cheaper than the CIF value arranged by the foreign supplier. Demurrages at port are also avoided through freight forwarder. 2. Through price negotiating after the tender is opened. 3. By purchasing in lot size.	Following steps are taken for cost reduction at this Institute: 1. Cost reduction by purchasing in lot size. 2. By cutting down consumption. 3. Through price negotiation.
3	**Rate Contract**	This organization has the system of rate contract. Computer cartridges, photo copying machines, Air conditioner and Refrigerator under DGS&D Rate contract are covered. Chemicals are too covered under rate contract.	Similar rate contract system is in practice in this organization also. About 85% of Consumable items are covered under rate contract.
4	**Man Power planning**	Most of the manpower working in the Stores and Purchase department do not have the materials management degree. The function of the Materials management is a specialized one and therefore, the persons who have the expertise in materials management field should carry it out.	None of the persons except the Stores and Purchase officer working in the Stores and Purchase department have the materials management degree.
5	**Materials Issue Policy**	Issue policy is similar to Production unit. Issues to consuming departments are made against issue requisition. All issues are entered in the stock ledger. Issues of Consumable items are recorded in stock ledger and non consumables in central asset register and inventories are updated accordingly.	Issue policy is similar to other two organizations.

DIS-SIMILARITIES			
1	**Pre – Audit:**	All purchase proposals above Rs.20, 000 (USD 444.00) are pre-audited. For this purpose, a separate department called Internal Audit is established who examines / scrutinizes the purchase proposals. On investigation, it was found that in the financial year 2007 – 2008, there were no Audit observation / Audit paras from External Audit in the purchase files that were pre-audited by the Internal Audit department. Hence, the pre-audit concept has been undoubtedly yielding fruitful results at this institute.	There is no *pre-audit* concept being followed to scrutinize the purchase files / proposals. There must be pre-auditing of all purchase proposals to make sure that nothing goes wrong and audit observations by the external audit can be avoided.
2	**Delivery Schedule:**	Delivery of the material from the vendor is taken on F.O.R (Free On Road) destination basis. Generally, delivery time is given 4 weeks. However, it depends upon item to item. There is no provision for incentive for timely delivery. Penalty for late delivery is levied @ 1% of the order value per week**.** However, if the supplier is not directly responsible for late delivery, he is allowed time extension and no penalty is deducted in that case.	Delivery of the material from the vendor is taken on F.O.R (Free On Road) destination basis. Delivery time generally is given from 15 days to 30 days. There is no provision for incentive for timely delivery. Penalty for late delivery is levied
3	**Inventory Holdings**	Inventory holding at this Educational Institute (Technical) is negligible due to the fact that majority of items / equipment procured are essentially for research purposes and are not useful for any other purpose / research as such. Also, due to fast change of the technology, these items become obsolete within very short period. New equipment is purchased every time for every new research and hence, hardly any stock is kept in the stores. The Institute Works Department maintains the stock of its works related materials like cement, electrical items and other building related materials. Institute Health Centre maintains 6-month stock of medicines on an average.	This Educational Institute (Management) carries very less inventory for a period of two months. Following items are carried in the inventory as stock items at this Institute: 1) Stationery items 2) Computer consumables 3) Electrical items 4) General cleaning material items 5) Miscellaneous hostel items. 6) Sports items
4	**Lead Time**	Lead-time is 44 days on an average. Lead time covers the time from indenting an item to its receiving at the consumer's end.	Lead-time depends upon nature of the item. For non-consumable items, approximate lead-time is 50 days. For consumables it is 15 days approximately.

5	**Purchase Limit on Single Quotation**	Purchases up to Rs.15000.00 (USD 333.00) are made directly by the purchaser on single quotation basis from the market/seller through an advance drawn for the purpose. This advance is subsequently adjusted for which cash memo/bill/receipt and proof of entry in the appropriate stock and Asset (if relevant) register is submitted.	Purchases up to Rs.5000.00 (USD 111.00) are allowed on single quotation basis from the market/seller. For item(s) valuing more than Rs.15000.00 (USD 333.00), matter goes in purchase committee.
6	**Application of Inventory Control Techniques**	No inventory control technique is in operation. Inventory decisions are based on the personal judgment, intuition and experience of management. These settings provide a unique area for the application of materials management techniques	At the moment only **JIT (Just In Time)** technique is being followed. However, other techniques are under consideration by the stores & purchase department
7	**Repeat Order:**	A purchase order is allowed to be repeated within a period of 6 months if the specifications are identical to a purchase order made earlier and there is no change in the rates.	Although, no provision is made in the purchase manual by the institute to repeat the order, it is repeated occasionally after assessing the market value of the item and if the supplier is ready to give the item on the same rate.
8	**Segregation of Scrap / Obsolete or Surplus materials and their disposal :**	There is hardy any scrap generated in this institute. Every year items / spares become obsolete or surplus to the requirement which is unavoidable and could be due to various reasons like product substitution, change in technology and design change etc. A committee consisting of Stores officer, Accounts officer, a Technical expert, departmental store keeper and a faculty member of the concerned department is appointed by the Head of the concerned department dully approved by the Executive Director. This committee examines the items to be declared Obsolete / Surplus or Unserviceable and submits its report to the director for his approval. The Estate Office is responsible for disposal of Obsolete / Surplus or Unserviceable items through open tender. **Capital stock and Equipments are not depreciated** as per the Government of India norms. They are only written off when they exhaust with the lapse of time.	There is no scrap generated at this institute too. For items / equipment that become obsolete or surplus to the requirement, Internal Auditor presents the report based on asset verification. On the basis of this report, a committee is constituted by the Director comprising of one faculty, Stores & Purchase officer, Estate officer and Finance and Accounts officer to review the items and submit the list of items along with their recommendation. **Capital stock and Equipments are depreciated.**

5. Observations

5.1. Academic Institution (Technical & Management):

1. Ordering System

In some cases, it was found that separate orders were issued to the same firm for the same item resulting in extra ordering cost. On inquiring, it was learnt that since payments were to be made from two different project funds, accounting became difficult and therefore, separate orders were placed.

2. Stock Verification

There is no provision for central stock verification team. All items are verified once in a year by all the departments themselves. A department wise committee is formed every year by each department to verify the stock. No person from Central Stores or Audit/Accounts is the member of departmental stock taking committee. After verifying the stocks, the verification report is submitted to the stores & purchase department for compilation

3. Man power Management

No one from the staff except the Stores and Purchase officer working in the Stores and Purchase department have the materials management degree. The function of the Materials management is a specialized one and therefore, it should be carried out by the persons who have the expertise in materials management field.

4. Man Power Training

Periodical training in materials function will help the staff to carry out their material functions in a better and productive way. However, materials staff has not been undergoing training periodically.

5. Limited Items on Rate Contract

Only few items are covered under rate contract. Many more items should find place in the rate contract list. There are many more items like computer consumables and stationery items which are not covered under rate contract, although their consumption is very high.

6. Purchase Control

There is no provision for central Material scrutiny committee to scrutinize the purchase proposals. The proposals of purchases are sent directly to the Director for his approval. All purchase proposals are discussed and finalized by departmental purchase committees only.

7. Application of Inventory Control Techniques:-

No inventory control technique is in operation. Inventory decisions are based on the personal judgment, intuition and experience of management. These settings provide a unique area for the application of materials management techniques.

8. Performance Criteria

Customer satisfaction can be measured through timely availability of quality material. Most of the users in Educational Institutes feel that bureaucratic procedures are being followed that result in time delay leading to high user dissatisfaction

9. Tendering System

Mostly, users invite quotations. Quotations are opened in the user's department by the committee duly approved by the competent authority. After finalizing the quote, the file (proposal) is handed over to the Stores and Purchase department for placing the order. At a time the quotations are not invited in comprehensive fashion resulting in delay in finalizing the purchases. It may also be noted that purchase of technical and scientific equipment and supplies is relatively complex, and at a time can not be straight – jacketed in a specification. This may require certain flexibility in evaluation of different quotations as each of them may have varying specifications, but can perform the intended function (Gopalakrishnan and Sundaresan, 1994).

6. Suggestions:

6.1. Educational Institution (Technical & Management):

1. Development of Good Data Base

A good data base should be developed which should provide the information on existing status of the stock / order information and analysis, the exact location of the item, usage of items, Vendor's history, Vendor rating report, determination of Economic Order Quantity, movement of items, out standing and over due orders, value of orders placed in period, value of orders to any one supplier, variations in prices from standards and budgets with price increases related to material and labor indices and ABC classification.

2. Stock Verification and Accounting
To reconcile the stock records and documents for their accuracy and usefulness, to identify areas which require more disciplined documents control, and to back up the balance sheet stock figures, a provision for independent central stock verification team instead of departmental committees be made to verify the stocks annually. A policy of centralized stock verification is likely to result in better reconciliation of the assets as per the balance sheet and the actual assets in the stock.

3. Man power planning
A policy of professional management be evolved in order to place right persons on right jobs. Persons without specialized back ground at times are unaware of the right kind of procedures / practices and as a result may add up to procurement cost and litigation in some cases. The function of the Materials management is a specialized one and therefore, it should be carried out by the persons who have the expertise in materials management field. Hence, the materials department must have the persons with specialized back ground. They should have the degree / diploma in materials management. Since the budget for import is approximately USD 4444444.00 approximately per year, an Import specialist having master degree in materials management be deputed to look after the Import functions. The person with such back ground will be able to monitor and control purchasing, supply, storage and distribution and transport chain in a better way and would certainly help in avoiding / reducing the demurrage charges at port. Import is a specialized field and in the absence of an import officer with specialized back ground, it may add up to procurement cost and litigation in some cases.

4. Man Power Training and Development
Periodical training in materials function will help modify attitudes, knowledge or skill behavior through learning experience to achieve effective performance in an activity or range of activities related to materials functions. It will enable the staff to carry out their material functions in a better and productive way. Hence, the materials staff should undergo such training periodically. Training needs can be identified by a job training analysis. A job analysis will reveal the 'training gap' which is the difference between a person's existing knowledge, skills and experience and the knowledge, skills and experience required for a specific job.

5. Rate Contract Policy
More items should be covered under rate contract as rate contract leads to lower cost and fast supplies as the ordering and procurement time is reduced. Rate contract also reduces the paper work. Rate contract can be used as an effective tool both for vendor management, less paper work and cost effectiveness. A good database of the usage of such items will help in identifying items which can be brought under rate contract.

6. Purchase Control
Controlling purchase cost will lead to profitability. Provision for central Material scrutiny committee to scrutinize the purchase proposals should be made in order to control the purchase cost. Purchasing in lot size will result in Cost reduction. Consolidation of purchases as well as good vendor relationship and Vendor development can assist in cost reduction and better cost management. Cost reduction can also be achieved through good negotiations.

7. Inventory decisions
Inventory decisions should be based on various inventory control technique. The personal judgment, intuition and experience may provide further inputs. A good data base about item usage and analysis of the same as well as vendor rating will improve the quality, reduce the time of procurement, rapid calculation of order quantity, EOQ (Economic Order Quantities) and variation in prices from standards and budgets with price increases related to material and labor indices (Gopalakrishnan and Sandilya, 1978).

8. Performance Criteria:
As the practice is to procure on the basis of user's indent, advantage of large size lots and consolidated purchases should be taken into account in all cases to avoid higher ordering cost. Delivery time and quality of the goods purchased are the primary consideration of the user and hence, user satisfaction has to be measured on these criteria. A balanced policy which results in higher user satisfaction and lower cost need to be evolved. It may include systems like rate contract, vendor approved rate list and on-line purchases on a competitive basis.

9. Tendering System
Quotations should be invited through central stores and purchase section and to be opened there itself by the purchase committee having persons from stores & purchase department, Audit / Accounts and a technical person from the consuming department. *If all sources of supplies are dealt centrally by Stores & purchase department, a higher order of skill can be expected. Consolidation of quantities can take place resulting in quantity discounts or rebates.* At a time the quotations are not invited in comprehensive fashion resulting in delay in finalizing the purchases. It may also be noted that purchase of technical and scientific

equipment and supplies is relatively complex, and at a time can not be straight – jacketed in a specification. This may require certain flexibility in evaluation of different quotations as each of them may have varying specifications, but can perform the intended function (Gopalakrishnan and Sundaresan, 1994).

Conclusion:

To conclude, this study focuses on the current practices of Inventory management system being followed in two world class Institutions in the field of technology and management education. I provide a frame work to optimize purchase and inventory management system in these institutes. This is the first attempt to evaluate and compare the purchase and inventory management system in academic institutes. Another important contribution of the research is that I address the purchase and inventory management issues in technology and management institutes. Further, I have made a set of observations and recommendations in the study. Some of the recommendations can be adopted with immediate effect while some of them could be adopted in phases as it may not be possible to alter the whole system instantly at few places. The suggestions are likely to improve the management of the inventory system in both the organizations which would ultimately result in better customer satisfaction, reduce cost of inventory purchased and carrying costs and achieve the best results. The study has however been limited to only two organizations. To understand the differences as well as cause- effects, a more detailed study across other service organizations like Health care and Banking as well as Manufacturing organizations like Textile and Defence should be undertaken. This would enable us to comprehensively develop a framework for procurement policies and inventory management.

References:

Gary P. Mohynihan, Rohit Bedi, Samory Pruitt (1996) A Decision Support System for Inventory Control in a University Environment. International Journal of Industrial Engineering, 3 (2), 77-85,

Eberhard E. Scheuing (1989) *Purchasing Management*. Prentice Hall, Inc. A division of Simon & schuster Englewood Cliffs, New Jersey 07632 P. 301-302.

B.K. Mishra (1989) *Theory and Practice of Inventory Management.* Akashdeep Publishing House, Delhi P. 1, 168- 171.

Kenneth Lysons (1996) *Purchasing* – Financial Times Pitman Publishing, Great Britain P. 395.

P Gopalakrishnan and M Sundaresan (1994) *'Materials Management' An Integrated Approach*– Prentice –Hall of India Private Limited New Delhi P. 65-66.

Kenneth Lysons (1996) *Purchasing* – Financial Times Pitman Publishing, Great Britain P. 204.

Tursine R. (1988) Principles of Inventory and Materials Management- North Holand New york. P. 448.

P Gopalakrishnan and M S. Sandilya (1978) *'Inventory Management' Text and Cases*– Prentice – S G Wasani for The Macmillan Company of India Limited, Prabhat Press Meerut P. 53 – 65.

B.K. Bhar (2001) *Cost Accounting – Methods and Problems,* Academic Publishers, Calcutta. P. 2.21-2.22.

Kenneth Lysons (1996) *Purchasing* – Financial Times Pitman Publishing, Great Britain P. 104-105.

J. R. Tony Arnold and Stephen N. Chapman (2001) *Introduction to Materials Management,* (Fourth Edition) Prentice Hall International, Inc. New Jersey P. 308.

S. N. Chary (1988) *Production and Operations Management* – Tata McGraw – Hill Publishing Company Limited, New Delhi P. 122-129.

Rajeev N (2008) Inventory management in small and medium enterprises: A study of machine tool enterprises in Bangalore, Management Research News Vol. 31 No. 9 pp. 659-669

Chikan, A. (1990), Characterization of production-inventory systems in the Hungarian industry, Engineering Costs and Production Economics, Vol. 18, pp. 285-92.

Cynthia Wallin, M. Johnny Rungtusanatham and Elliot Rabinovich (2006) What is the "right" inventory management approach for a purchased item? International Journal of Operations & Production Management Vol. 26 No. 1, pp. 50-68

John F. Kros, Mauro Falasca, and S. Scott Nadler (2006) Impact of just-in-time inventory systems on OEM suppliers, Industrial Management & Data Systems Vol. 106 No. 2, pp. 224-241

Muhammad A. Razi and F. Michael Tarn (2003) An applied model for improving inventory management in ERP system, Logistics Information Management, Volume 16, Number 2 pp. 114-124.

Chikan, A. and Whybark, C.D (1990), ''Cross-national comparison of production and inventory management practices'', Engineering Costs and Production Economics, Vol. 19, pp. 149-56.

Mantho, V. (1994), ''Concepts and applications of inventory management in Northern Greece'', International Journal of Production Economics, Vol. 35, pp. 149-52. Mohanty, R.P (1985), ''Inventory problems under multiple constraints: some studies'' Engineering Costs and Production Economics, Vol. 9, pp. 355-67.

Natarajan, R. (1991), ''Inventory management – the big picture'', Production and Inventory Management Journal, Vol. 32 No. 4, pp. 29-31.

Marcello Braglia, Andrea Grassi and Roberto Montanari (2004 ·)" Multi-attribute classification method for spare parts inventory management" Journal of Quality in Maintenance Engineering Volume 10 · Number 1 · pp. 55-65

Mohanty, R.P. (1985) 'Inventory problems under multiple constraints: some studies', *Engineering Costs and Production Economics*, Vol. 9, pp.355–367.

Khalid Saeed (2008) "Trend forecasting for stability in supply chains", Journal of Business Research 61, 1113–1124

Stig-Arne Mattsson, (2007) "Inventory control in environments with short lead times", International Journal of Physical Distribution & Logistics Management, Vol. 37 Iss: 2, pp.115 – 130

G. Reza Nasiri, Hamid Davoudpour, Behrooz Karimi, (2010) "The impact of integrated analysis on supply chain management: a coordinated approach for inventory control policy", Supply Chain Management: An International Journal, Vol. 15 Iss: 4, pp.277 – 289

Mariah M. Jeffery, Renee J. Butler, Linda C. Malone (2008), "Determining a cost-effective customer service level, Supply Chain Management: An International Journal Volume 13, pp: 225-232

Peter Baker, (2007) "An exploratory framework of the role of inventory and warehousing in international supply chains", International Journal of Logistics Management, The, Vol. 18 Iss: 1, pp.64 - 80