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Effects of Overstocking and Stockouts on the Manufacturing Sector

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ABSTRACT:The purpose of this submission is to discuss the literature on the inventory, with a view to understand what it is, and look at the likeliness of the applications to the analysis based on the secondary data collected for the creation of conceptual framework. Design/methodology/approach – The discussion will address the issues and decisions which are of consideration for determining the inventory research characteristics so that there is an identification of the issues/phenomena that lend themselves to the research approach for analysis; and will go further by comparing and contrasting the challenges encountered within the manufacturing and other business operations. This analysis will explore the control measures and recognize the need to undertake studies to solve the individual organizational problems, and view the general framework of the study that will allow identifying the choices to be made as a researcher about what is to research and how to research it, and the logic that guides the particular choices. The study will draw the research insights from publications and books that have contributed to the revelations about the nature and issues that may be an important part of study. Findings – The literature's main focus will be to get findings on the nature of the literature collected, and with the empirical study, should look at the detailing of data presentation in the analysis, and look at how the systems employed by sectors can prove to be of relevance, and will try to compare and contrast the different literature research methodologies.

Keywords— Cost of overstocking, Inventory management, systems for integration, Material requirement planning, Enterprise resources Management, cost of stockouts.

I. INTRODUCTION

Stocks are the stores of materials kept until needed, a factory keeps a stock of raw materials for its production. In general, inventories are the stocks of raw materials, packaging materials, work in process and finished goods that appear in numerous points throughout the company's production and logistic channel [7]. Stock consists of all the goods and materials that are stored by an organization. Stocks are formed whenever an organization acquires materials that it does not use immediately. A common practice has a delivery of material arriving from a supplier, and this is kept in stock until needed. For any business entity, the profitability depends heavily on the effectiveness of the inventory management via reduction of stock-handling cost and proper streamline of the production process. This is supported by [18], who found that US manufacturing firms that recorded lower ratios of inventory to sales have higher profit margins.

It has also been noted that the risk of small-cap stocks can be up to double that of large-cap stocks, and the impact on return volatility due to vulnerability to a dependent-buyer effect could also be subjected to higher operating risk, which can adversely affect future cash flows [9]. This increase in operating risk or at least a firm's vulnerability to it should manifest itself in higher stock price volatility. Although manufacturers may recognize this risk, just how much more of it is involved with small-cap dependent-buyer firms than small-cap firms that have a diversified customer base for an unexplored empirical in order to gain better insights of supply chain performance.

II BACKGROUND OF STUDY

The intensity of the competition globally has brought about the evolution in the organizations driving innovations to the increased levels of customer service in order to survive. Managers have been working on modalities to develop a competitive capability of manufacturing flexibility requiring a choice of which conceptual approach to adopt for strategy formulation [16]. It has also been realised that materials handling flexibility gives an ability of the materials handling process to effectively deliver materials to the appropriate

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stages of the manufacturing process and position the part (and its production tool) or the material in such a manner as to permit value adding operations. What is of particular interest about these dimensions is that it creates the ability to adapt to process unreliability, for example machine breakdowns.

However, each organization management has been working on means to measure its cost of delivering to the customer. Job shop-type operations such as tool and die facilities or prototype shops has been focusing at the due-date driven, and expecting to end up with requirements that include minimizing maximum lateness, or no late orders. The batch facilities have more frequently been working to build up stock, and other requirements. Minimising total cost of inventory and setups and maximising throughput of bottleneck operations are some typical examples of those types of requirements. Batch facilities for the building components through assembly has been seen to typically requiring minimization of inventory costs without allowing a shortage to occur.

In any case, feasibility as a performance criterion has been seen as acceptable for a scheduling implementation [4]. Once the scheduling process is in place, the structure should be considered necessary for a continuous improvement effort while creating methods to identify additional opportunities to improve profitability. Manufacturing industry have been seen to be looking at means of improving on the supply chain structure, safety stock review period and, lead time and standard deviation for the benefits of information sharing in terms of lowered inventory related costs and improved logistic efficiencies.

In managing inventory, several costs must be considered in determining optimum inventory levels. The cost of purchasing and holding inventory should be considered which usually account for as much as 60 to 80 per cent of the total cost of a product or service (Owoeye et al. 2014). This holding or carrying cost may include storage, insurance, taxes, obsolescence, theft and interest on funds or borrowing in financing the goods. These costs are seen to increase as inventory level rises. To minimize the carrying cost, some managers do consider some measure of typically making frequent orders of small quantities; but this practice do reflect some difficulties inherently to quantify specific cost per unit cost like obsolescence [6]cost for consumables with expiry dates.

III STUDY PROBLEM

While Just-in-time availability of material for the manufacturing operations is desired to occur at exactly the time they stocks are needed, but stocks have been seen as a waste of resources that can be eliminated by coordinating supply and demand. While some recognition from the customer's perspective could be of the two levels of service: either 100 per cent or 0 per cent. But the challenge is how the customer could get exactly what they ordered at the time and place required or they don't. The characteristic approach has been seen as being difficult in identifying problems and then solving them, hence hiding them under excessive stock, and so if service performance is to be controlled then it must be determined by which set standards available for the sectors, as customer's viewpoint is only about one lead time and that is the elapsed time from order to delivery.

These problems include long lead times, unbalanced operations, constrained capacity, equipment breakdowns, defective materials, interrupted operations, unreliable suppliers, poor quality, too much paperwork and too many changes. Managers have been seen trying to overcome the effects of these problems by holding large stocks, buying extra capacity, keeping back-up equipment, employing 'trouble-shooters. But these methods do not solve the problems, they only cover them up. The study is focusing on how the manufacturing organizations should find the reasons for differences between supply and demand, and then take whatever action is needed to remove them.

IV RESEARCH QUESTIONS

i) Why are organizations moving towards lower stocks despite the cost effects?
i) Why does keeping of stock make the operations expensive in the manufacturing sector?
ii) How does the decision to do away with the stock buffering likely to affect production operations in organisations?
iii) Is the objective of minimizing the costs of stock holding the same as minimizing stock?

V. SIGNIFICANCE OF THE STUDY

Every organization including those in manufacturing holds stock of some kind as inventory reduction and closer integration with suppliers at a planning level are considerable. Approaches to inventory based on materials requirements planning (MRP) and just-in-time (JIT) methods and, perhaps most important of all, a sustained emphasis on total quality management (TQM) are significant to inventory management and materials control [1].There are many different materials that the manufacturing organization may hold and arrangements for storage, but they all need careful inventory management to avoid both the overstocking or stockouts. The main purpose of

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stocks is to act as a buffer between manufacturing operations. They do allow manufacturing operations to continue normally through variations and uncertainty in supply and demand. Stocks are to be held at various points in their supply chains.

In the past these stocks were largely considered as independent, but there are clear advantages in coordinated management [6]. Organizations may be going through a period of considerable change. Many of these changes may have direct effects on stocks. These may include trends towards higher technology, improved customer service, global operations, and so on. Partly as a result of changing operations, the manufacturing organisations are changing their view of management of stocks. So, the study is focused on finding out on the view that stocks are expensive and should be reduced to the minimum level that can give acceptable customer service.

VI. LITERATURE REVIEW

STOCKHOLDING

This sequence of stock replenishment and reduction to meet demand is repeated continuously in a stock cycle [21]. Typically, each cycle has the following elements: an organization buys a number of units of an item from a supplier, at an arranged time, these units are delivered, unless they are needed immediately, the units are put into storage, replenishing the stock; customers, either internal or external, create demands for the item, units are removed from stock to meet these demands, and at some point, the stock gets low and it is time for the organization to place another order.

Rampant stockouts creates massive, expensive expediting. The smaller lot sizes drive up the product cost, and profits plummeting. In short, strategic competitive advantage can have a significant effect on the determination of the appropriate inventory turnover number [17]. Decision making in production, inventory, and supply chain management is therefore basically a problem of coping with large numbers and with a diversity of factors external and internal to the organization. Given that a specific item is to be stocked at a particular location, three basic issues must be resolved: a) how often the inventory status should be determined, b) when a replenishment order should be placed, and c) how large the replenishment order should be.

Lack of communication between departments also can lead to the failure of inventory management. For instance, the supply chain department does not inform the plant and operations department on the status or balance of stock available for raw materials. When an urgent order needs to be produced and raw materials are required, it will affect the production process, and the customer cannot receive the goods as per their request on time.

VII. OBJECTIVES FOR INVENTORY CONTROL

The first consideration is the overall objective of the work of stock control. Like all other activities in the company, inventory management has to contribute to the welfare of the whole organization [6]. Management of inventory is important because it ensures smooth production and prevents loss of operation because of stockout and which may lead to customer dissatisfaction. The logistic operation must aim to contribute to profit by servicing the marketing and financial needs of the company [23]. The aim is not to make all items available at all times, as this may well be detrimental to the finances of the company. The normal role for stock control is to meet the required demand at a minimum cost. Our aim towards long-term profitability has then to be translated into operational and financial targets which can be applied to our daily operations.

The purpose of the inventory control function in supporting the business activities is to optimize the three targets: customer service whereas in a supply to customer specification, the service expected
would be delivery on time against customer requested date, inventory costs requiring a minimum of cash tied up in stock [1]. This target has to be considered carefully, since there is often the feeling that having any stock in stores for a few months is bad practice. In reality, minimizing the stock usually means attending to the major costs: very low-value items are not considered a significant problem. Low inventory can also be considered in terms of space, or other critical resource.

Where the item is voluminous, or the stores space restricted, the size of the items will also be a major consideration. The third target, avoiding operating costs, has become more of an issue as focus has been placed on inventory management. The prime operating costs are the stores operations, inventory control, purchasing and the associated services. The development of logistics, linking distribution costs
with inventory, has added this new set of transportation costs to the analysis.

Inventory Control As A Means Of Balancing Conflicting Requirements

Inventory or stock is one of the most important and difficult assets in a statement of

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financial position that can be effectively and efficiently managed by a company, irrespective of its size, whether a large corporation or small or medium enterprises [15]. Failure of inventory management in any company may lead to the increase in the amount of losses, which can affect a company's financial performance. It can be detected from the increasing number of stock losses during cycle count activity at the financial year end. Purchasing consider that stock control provides the opportunity for goods to be purchased so that optimum prices can be obtained. Even more efficiency in physical inventory control can be achieved through placing items within the A-B-C zones.

Buying items in bulk often reduces the purchase price and it improves the efficiency within the purchasing department. The store is a means of keeping the bulk purchase items after buying advantageously. Finance departments have a problem with stock because it consumes vast amounts of working capital and upsets the cash flow. One benefit of stock from a financial standpoint is that provisions can be made in case the stock turns out to be unsaleable, and this value can be adjusted to modify the profit figure in times of good or bad financial results. High stock levels arise because too much stock has been purchased [1], through bad forecasting, monitoring or controls. High stock and poor availability are caused simultaneously as a result of poor control.

Stocks are expensive, because of the costs of tied-up capital, warehousing, protection, deterioration, loss, insurance, packaging, administration, and so on. In manufacturing operations, inventory in excess of that needed to support current operations or research and development efforts would certainly be waste [18]. However, is the inventory of a distributor that uses immediate availability of a large cross-section of items as an effective, profitable marketing tool unnecessary. For an organization to actually have useful inventory, it must understand its own objectives for the product it will have on hand, on-order, or in-transit at any one time [3]. What inventory level is required for your organization to profitably and effectively operate? Until the answers to these questions are determined, it will be difficult to get everyone within the organization to work toward the common, shared goal of eliminating inventory waste.

XIII. THE COSTS OF STOCK OUT

Stockouts result from holding too little stock for the offending lines, because the forecasts, monitoring or controls are inadequate. Typically, for low-value items, most a manufacturing company should try to keep a relatively large number of units on hand to minimize the amount of inconvenience that could be caused by a stockout of such insignificant parts [17]. The cost of the stockout could be significant. These costs could also be called the costs of avoiding stockouts and the costs incurred when stockouts take place. In the case of a producer, they may include the expenses that result from changing over equipment to run emergency orders and the attendant costs of expediting, rescheduling, split lots. All these costs can be estimated reasonably well.

However, there could also be costs, which are much more nebulous, that can result from not servicing customer demand [5]. These stockout costs may include sales that are lost, both short and long term, because of inability of the company to fulfill the customer's order. The customer may switch to the competitors to buy their products temporarily or permanently, which may result in loss of valuable revenue. This cost is probably the most difficult cost to compute but arguably the most important because it represents the cost incurred by customers (internal or external) when inventory policies falter. Failure to understand these costs do lead management to maintain higher or lower inventory levels than customer requirements may justify.

The customer may not be willing to wait while the item is backordered, resulting in the loss of a sale for good. There could as well be a loss goodwill as a result of the poor service and some of the customers may not even ever return. The customer may also tell colleagues about the disservice. The causes of stock outs are an indication that mostly occur at the store level, primarily through ordering and replenishment practices [21]. Shortage costs are may be very difficult to find, but it is agreeable that they are high in relation to holding costs. This is why organizations are willing to incur the relatively lower costs of holding stock, in order to avoid the higher cost of shortages.

IX. CALCULATION FOR THE COST OF SHORTAGE

The calculation for the cost of shortage may be based and calculated on the costs of overtime, administration, clerical, loss on sales, losses on goodwill and others. The costs on shortages may not only depend on the quantities that may be discovered short but the actual time for replenishment as well [3]. But we can go further than this and say that to avoid shortage costs, organizations should hold additional stocks above

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their perceived needs to add a margin of safety [6]. In other words, they should hold an extra reserve of stock, knowing that it will not normally be used, but it is available when deliveries are late or demand is higher than expected. This reserve stock forms the safety stock. An impending stockout usually generates an overreaction on the part of the person responsible for purchasing. The current order size is inflated, causing excess inventory when the order arrives. If the impending stockout is due to a real increase in demand.

X. CONSEQUENCES OF LATE DELIVERY

Avoidance of significant late delivery penalties and loss of credibility are great motivators for maintenance of safety stocks. It is also difficult when demand quantity and frequency are unstable with patterns including a high fraction of zero-demand periods. Moreover, in some cases, buffer inventories are considered unavoidable when supply side risks are present [25]. For example, when spare parts are at the point of discontinuation but the useful life of the product they serve is yet to expire. In these instances, panic bulk purchases are likely regardless of forecasted demand, in order to avoid reliance on the unofficial gray market. Every reasonable effort should be made to eliminate variability in the lead time, and one can use the models developed in this section to quantify the value of reduction in lead time variability [3]. A key component of the lead time in which uncertainty exists is the shipping time from the supplier to the stocking point under consideration.

Satisfying the demand for spare parts. is a challenge for both the supplier and the customer. On the one hand, the supplier aims to reduce the requirement for holding of slow-moving/ excess inventory without causing adverse impact on customer satisfaction. On the other, the customer aims to maximise equipment availability, thus, requires access to spare parts quickly without suffering the adverse impact of high procurement costs [14]. Several studies indicate that Additive Manufacturing technology usage may have an impact on different actors in the supply chain such as: suppliers, manufacturing firms, and customers. Choices among transportation modes can affect the variability, as well as the average duration, of the lead time. Ordering process and information technology improvements can also reduce the average lead time and lead time variability

THE COST OF OVERSTOCKING

Erroneous initial overstocking (due to overestimating the usage rate) can be extremely expensive.

Often, it is best to avoid stocking an item at a given location if there is an internal supplier

(a central warehouse, for example) that can hold inventory for several locations [5]. Of course, it is important to examine the replenishment lead time and ascertain that customers are willing to wait the additional transportation time. If not, the cost of a temporary shortage should be included in the analysis. In what follows, we assume that the replenishment lead time is quite short.

However, the existence of these provisions in the first place is detrimental to the finances of the company. The traditional view of manufacturing companies has been that large batches reduce the direct production costs. Manufacturing management tends to aim more for plant and labour efficiency and allow high stocks in order to avoid the disruptions caused by shortages, breakdowns and changing customer demand [21]. Good stock controllers (or materials management) will keep the stock down as long as they are responsible for stocks of everything, including raw materials, finished and semi-finished stocks, consumables, tools, work on the shop floor and, in fact, all inventory items.

If the Distribution Centre is regarded as a supplier for the store then unless distribution centre stock need to be balanced with store customer demand as any excess will result in the propensity to hold excess balancing stock at the store [12]. While the data does not allow differentiation as to where and how much stock is held in the supermarket's system. It seems probable that the excessive stock cover is as a result of holding just-in-case stock rather than just-in-time stock. The overstocking in the supplier network may also be as a result of buffer variations in customer's demand.

At some point, industry loses confidence and cuts back on production to reduce the excessive stocks, and the economy contracts. This recession or at best stagnation continues until stocks are lower, production is not meeting expected demand, and industry again expands. It is, however, widely accepted that long-term business cycles and stocks are closely related [21], and that stock levels as one of the easiest factors to change tend to fluctuate more than the business cycle itself. One view has variations in stocks as actually causing business cycles.

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COLLABORATIVE SUPPLY AND DEMAND INFORMATION SHARING

Many manufacturing enterprises are collaborating partners in elaborate logistic supply chains whose overall success pivots on the extent and level of cooperation between them. However, competition between these enterprises often hinders the seamless information exchange of demand that is paramount for streamlining the logistic function [11]. It has been discovered that the impact that this information sharing has had on the overall performance of the supply chain, the impact of partial information sharing has remained largely unexplored. By partial, we imply that, the upstream echelon receive the information of demand in form of orders only from the downstream echelon. In a full information sharing mode, the information of demand at point-of-sale is also shared throughout the supply chain network.

NETWORKED SUPPLY CHAINS PIVOTS

The performance of such networked supply chains pivots on the seamless coordination between the partnering echelon members. The relevance and importance of demand information sharing to facilitate the above coordination aspect between the echelon members. Supply chain dynamics have been defined as the variation of orders or inventory level [11]. This effect is obviously undesirable as it raises the supply chain costs (e.g. stock holding, backlog, late delivery, under/over resource utilization, etc.).

The source of such fluctuation and amplification of orders and inventory is mainly due to the lack of timely sharing of information, including delays and feedback in the decision rules between enterprises in the supply chain. It has been reported that the benefit of information sharing is significant, especially in reducing the bullwhip effect [6]. The manufacturing sector with product and market characteristics defines relevant aspects of the goods that influence customer demand and customers' reactions to product delivery (both modeled in the customer demand sector). The production planning sector includes bounded-rational decision rules that convert the demand rate in a production rate [20]. It receives information from both the customer demand and the production system sector. As this study focuses on the maturity phase of the market cycle, new product diffusion components are not included in the demand sector.

PHYSICAL ASPECTS OF PRODUCTION

The sub-model of the production system focuses on the physical aspects of production, specifically on material flows between (work in process and finished goods) inventories. It also includes equations on production capacity and utilization [20]. Quality breakdowns are modeled in the (quality) disaster sector. These have a severe impact on the production system. The delivery sector should include the equations that reflect the shipment of the physical goods to the customers who might or might not react to the perceived service level (depending on the product and market characteristics). The performance sector covers all measures needed to evaluate and compare the various scenarios where a lean inventory policy is advantageous and a range is better to implement a high inventory policy [1]. The lean approach to manufacturing will be applied to minimise inventory of components and work-in-progress and to move towards a 'just-in-time' environment wherever possible. Hence, inventory management lean inventory policies are advantageous when inventory holding costs are high and contribution margin and stock-out costs are low.

To find means of communication and management of inventory and in order to survive in the fierce competitive world today, organizations deploying MRP must operate this system in an optimum manner [13]. The material requirement planning (MRP) systems which consist of computer-based techniques to plan the requirement of dependent-demand materials to meet the business production plan. The material requirement planning helps with planning for the production and purchase of the components to be used in making items in the master production schedule [22]. Using information on the end-product demand, the MRP system is seen and considered for identifies the requirement of materials, increasing in the number of management operations in the procurement-production-delivery cycle (receipts, records, tests, work cycle issue, controls, deliveries, etc).

MATERIAL REQUIREMENTS PLANNING

Material requirement planning (MRP) is deployed in order to model integrated business systems. MRP is computer-based information system designed to handle ordering and scheduling of inventories (e.g. Raw materials, component parts, and subassemblies).It has been designed primarily for complex production planning environments [13]. Significant benefits such as improved customer service, better production scheduling, and reduced manufacturing costs are some of the key benefits. MRP has evolved from simplistic representation in the 1980s to today's powerful and comprehensive versions, i.e. manufacturing resource planning (MRPII) and enterprise resource planning (ERP).

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MRP needs a lot of information, with three main sources being the master schedule, the bill of materials and inventory records [21]. We know that the master schedule shows the number of units of a product to be made in each period, and the inventory records show the current state of the stocks. The bill of materials, or parts list, is an ordered list of all the materials needed to make a product, and also the order in which the materials are used. Uncertainties should be avoided when there is a clear picture of the demand for a particular item for minimizing of the stock [24]. No stockholding would be needed if demand were known precisely and far enough in advance because supply could be matched exactly with demand. For items outside the range stocked, the customer orders and receives the supply after a lead time.

There may be some transient stock because the supplier is asked to deliver in advance of the time that the customer requires it. The greater the confidence in supply, the shorter time items can spend in stores. The situation with non-stock supply is mirrored for raw materials in manufacturing and for production components in assembly. Stock is required to feed the process, and firm plans exist for usage rate just as for scheduled customer orders and non-stock supplies [21]. The approach to these types of inventory is to treat them as dependent demand rather than the independent demand. The essential feature of dependent demand is that it is calculated from the demand of the next item up the supply chain; the aim is to have stock when it is to be used and no stock the rest of the time. The differences in categorizing of the dependent and independent stock assists in the application of the material requirement planning stated as follows:

INDEPENDENT	DEPENDENT
Inventory-level system	MRP system
Forecast	Calculated
Keeps stock	Supply as required
All lines separate	Lines Co-ordinated
Reactive	Proactive
Good customer service	Very Good customer service
High inventory	Low inventory

Material requirements planning as a business planning tool

Material requirements planning is a business planning tool as well as a material supply calculation. The process, known as manufacturing resource planning (or MRP II), starts with a long-term plan, which identifies what range of items are offered [21], how fast, with what market focus, and all the policy decisions to enable inventory control to operate successfully. As a result of this long-term process, actions should have been taken to ensure that the resources (people, plant, systems, logistics, organization) are available to make the policies work successfully [24]. The MRP backward scheduling process starts by identifying the customer requirement in the master schedule. A bill of materials is required to cover this. At the same time, information on how long the supply will take and where it will be done the lead times and routings is needed.

All this information is fed into the MRP calculation. If the inventory is sufficient to cover the demand, then the same calculation is carried out for the next period. If the inventory is insufficient then delivery (order receipt) is required. Dependent demand systems, however, are manufacturing oriented. The objective of dependent demand inventory control is to support the master production schedule [13]. Even if you have a low stock level of an item, it won't be ordered unless and until it is needed to produce something for the master schedule a true requirements philosophy of inventory control. MRP dependent demand inventory control is directed inward rather than outward like RE-Order Point inventory control. MRP works well because it is a forward-looking system. The predictability of events allows for careful planning and a reduction.

MASTER PRODUCTION SCHEDULE (MPS)

The manufacturing organization could apply the material requirements planning (MRP) to support the following processes [13]: identification of stock that planned production calls for; determining the lead time to get the stock from suppliers; calculating safety stock levels; calculating the most cost-effective order quantities and producing purchase orders for needed stock items in the right amounts. MRP will then use inputs from the Master Production Schedule (MPS) which could set out what will be built, when, and in what quantities. The MPS will then use the sales forecast to identify the products needed and when they are needed. The ideal production and manufacturing environment are a just-in-time (JIT) system, in which enough inventory is on hand to serve needs.

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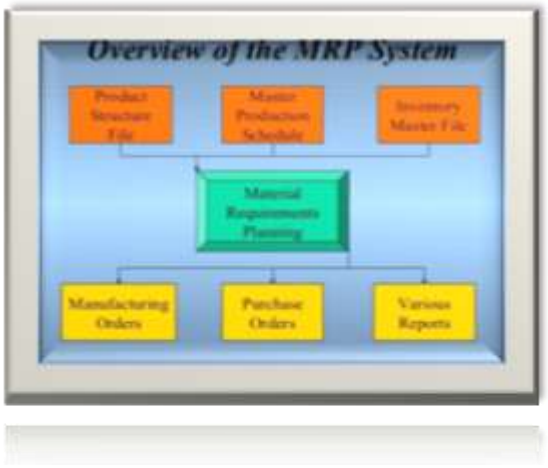

To make a just-in-time system work, suppliers need to deliver enough material to meet the production schedule. The company needs to develop close working relationships with suppliers to make this work. Suppliers can use Electronic Data Interchange (EDI) or the Internet to monitor the manufacturer's inventory levels by linking into their inventory systems. In this way, they can replenish the manufacturer's inventory on a JIT basis.

BILL OF MATERIALS

The bill of materials (BOM) is the recipe of raw materials, parts, subassemblies, and so on required to build or make something. Classic stock control deals with each item individually, independent of all others. A bill of materials provides the list of parts, ingredients or materials needed to produce or assemble the required end product. The bill of materials for a product is not simply a parts list. It contains more information. Most products are packaged and the box, packaging material, pallet and even the documentation is part of the full bill of materials [24].

The bill of materials can also include essential tooling for production. This is a useful way of planning for all the resources necessary for the process. In manufacturing, an assembly is made up of components. If they are all bought out and given to an operator to assemble and pack, then the BOM. For the continued of Work in process, raw materials, parts, and subassemblies should be maintained as they are being used to produce the next higher-level component or finished item in a bill of materials (the recipe of materials going into an assembly of some type).

THE INVENTORY FILES

The planned order receipts are calculated to minimize stock and, at the same time, give the information necessary to supply forecast. The resultant stock level is shown in the next column headed 'Projected available', that is, the stock levels resulting from these actions [24]. With a four-week supply lead time, the order release (last column) has to precede the order receipt by four weeks. If a planned order release occurs in the current week, then an order has to be placed. Material requirements planning uses a bill of material to explode a master schedule and find the gross requirements for materials needed for production. Information about current stocks, orders outstanding, reserved stocks, etc. are then used to find order quantities. Lead times are to be used to time phase for these orders so that materials arrive in time for use. MRP is supposed tallows purchases to be made as and when needed to ensure that items will arrive when needed.

ENTERPRISE RESOURCE PLANNING (ERP).

The ERP is considered as a significant way for any organization to pull together all of the diverse elements of information it needs to be more effectively acquire and control inventory is to use enterprise resource planning. Through the enterprise resource planning the organization will have an integrated computer-based information system that could be used to manage both internal and external resources serving all departments within an enterprise [19]. ERP will involve the use of packaged software rather than proprietary software written by or for one customer. With this software, which integrates all departments and functions of a company into a single, integrated computer system does run off as a single database, one department is able to see the information contained in another department to help improve the performance level of a supply chain network by helping to reduce cycle times.

The successful implementation of an ERP system in a manufacturing organisation will help increase competitiveness by increasing quality, reducing redundancy, speeding up processes, reducing lead times and inventory levels and increasing customer satisfaction [2]. The integration allows all departments within a company to share information more easily and to communicate with each other more effectively. Integrated ERP software is divided into software modules that roughly approximate the old stand-alone systems, such as manufacturing [6], order entry, accounts receivable and payable, general ledger, purchasing, warehousing, transportation, and human resources. Departments get the equivalent of their former standalone system, however, now the modules are linked so that someone in accounting can see if an

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order has been shipped, and the sales department can determine when an item will be available for sale or use.

ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS FOR INTEGRATION

Enterprise Resource Planning (ERP) systems are software packages composed of several modules, such as human resources, sales, finance and production, providing cross-organization integration of data through embedded business processes and to help organizations deal with the supply chain, receiving, inventory management, customer order management, production planning, shipping, accounting, and other business functions [19]. ERP uses the characteristic approach of MRP, but with a focus on the whole supply chain. It extends MRP beyond a single organization, to include suppliers and customers.

ERP obviously relies on complete trust between organizations, and a free flow of information. In principle, this organized using the Internet and e-commerce. Organizations have a business justification for implementing ERP systems [6]. The business benefits of ERP include improved accessibility of information, realtime access to data across the organization, improved cycle time for orders, decreased financial close time, reduced operating costs, and lowered inventory levels. In addition, ERP systems provide the opportunity to re-align business processes with best practices and to integrate enterprise-wide information supporting financial.

THE INTEGRATED SYSTEMS APPROACH

ERP systems impose an integrated systems approach by establishing a common set of applications supporting business operations. In fact, successful implementation of an ERP system typically requires re-engineering business processes to better align with the ERP software (Brown and Vessey, 2003). An ERP system overcomes the inefficiencies of independent systems and non-integrated data by providing integrated data to support multiple business functions. Most important, an ERP system integrates information throughout the supply chain. From a business standpoint, this means cost reduction, inventory reduction, and improved operating performance.

THE BENEFITS OF INSTALLING ERP

The benefits of installing ERP can be tremendous. Imagine the efficiencies gained if a salesperson can immediately know the credit limits of a customer from the finance module as well as if the warehouse has in stock the items that customer wants from the warehouse module, and so on. The five main reasons organizations implement ERP are: 1) for integration of financial units: information all business units use the same set of metrics. 2) for integration of customer order information: customer information is available to all business units on a realtime basis. 3) for standardization of manufacturing processes: standardization of processes leads to operating efficiencies. 4) for reduction of inventory: excess inventory is held to a minimum.5) for standardization of human resources information: uniformity of information and access leads to better administration. Potential benefits include drastic declines in inventory [10], breakthrough reductions in working capital, abundant information about customer wants and needs, along with the ability to view and manage the extended enterprise of suppliers, alliances and customers as an integrated whole.

In the manufacturing sector, ERP implementation is helping in reducing inventories anywhere from 15 to 35 per cent where successful implementation has been achieved. One of the greatest challenges to ERP implementation isn't so much the installation of the software itself, it's getting employees to actually change the way they perform their jobs in order to conform to standardized procedures. Unless willing to undertake a focused training program together with sustained managerial vigilance, may not want to attempt the effort at all. ERP is now considered to be the price of entry for running a business, and at least at present, for being connected to other enterprises in a network economy to create business to business electronic commerce. ERP system traces its roots commencing from standard inventory control packages to material requirements planning (MRP), manufacturing resource planning (MRP II). An inventory control system was the software designed to handle traditional inventory processes.

MANAGING CONSIGNED INVENTORY PURCHASING

Consignment inventory is also a supply chain management strategy which manufacturing organisation may consider to reduce the holding cost and assist with the overstocking or stockouts by having goods stored in a business unit without paying the vendor until the goods are consumed. As the vendor owns consigned stock until it is consumed, warehouse stocking with consignment items enables reduction in carrying costs and defers payment of liabilities [9]. A single-manufacturer, single-buyer supply chain is considered where a manufacturer produces a single item product and

periodically delivers it to the buyer on the basis of a consignment policy. An integrated inventory control model, making decisions of the manufacturer's production batch and the replenishment lot subject to consignee's warehouse space capacity constraint as a means constructed to minimise the manufacturer's total cost.

VENDOR MANAGED INVENTORY

Vendor managed inventory as a supply chain management strategy may also be used by having a vendor manage inventory located in a customer's warehouse. With VMI, a vendor merely moves inventories from retailers up-stream to wholesalers or manufacturers, so where do the benefits from VMI surface among participating parties [26]. Buyers can share sales and inventory information with suppliers on a real time basis. Suppliers can then use this information to plan production runs, schedule deliveries, and manage order volumes and inventory levels at the buyer's stock-keeping facilities. The goods may be consigned or non-consigned. As the vendor, a Vendor Managed Inventory (VMI) business unit will be created which can represent customer inventory and improve supply chain performance thereby decreasing inventory levels and increasing fill rate. This includes items, quantities and storage space.

CONCLUSION

Generally, inventories exist because of differences in the rates of supply and demand. The advantages resulting from inventories are that they buffer against various types of operational risks (such as uncertain demand, uncertain supply and/or uncertain processes). Furthermore, inventories allow fast deliveries to customers even in cases of long production lead times. Out-of-stock events caused by, for instance, machine breakdowns or unreliable suppliers very likely dissatisfy customers, cause extra costs and harm future demand because demand depends on organizational behavior and is not exogenous from it. From this perspective, having an appropriate level of inventory even though it lowers profit in the short term is important for the sustainable development of the firm and the supply chain.

However, it has been empirically demonstrated and the literature cited therein) that lower inventory levels lead to improved financial performance because of a reduction in capital bound and other costs associated with holding inventory (e.g. the risk of goods becoming obsolete or lost) and the objective of minimizing the costs of stock holding is also meant to minimise stock. To support inventory managers in the manufacturing sector in determining a good balance between inventory investment and customer service, increasing uncertainty in demand typically will require rising inventory levels to maximize profits. Similarly, ascending uncertainty in supply, modeled, e.g. by increasingly variable lead times.

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