STRATEGIC INVENTORY AND STORE CONTROLMANAGEMENT

CHAPTER ONE

DETERMINATION OF STOCK HOLDING POLICY

Definition Inventory: A stock of materials kept for future sale or use.
Inventory is a list for goods and materials, or those goods and materials themselves, held available in stock by a business. It is also used for a list of the contents of a household. In accounting inventory is considered an asset.

INVENTORY TYPES

Generally, inventory types can be grouped into four classifications: raw material, work-in- process, finished goods, and MRO goods.

1. RAW MATERIALS

Raw materials are inventory items that are used in the manufacturer's conversion process to produce components, subassemblies, or finished products. These inventory items may be commodities or extracted materials that the firm or its subsidiary has produced or extracted. They also may be objects or elements that the firm has purchased from outside the organization. Even if the item is partially assembled or is considered a finished good to the supplier, the purchaser may classify it as a raw material f his or her firm had no input into its production. Typically, raw materials are commodities such as ore, grain, minerals, petroleum, chemicals, paper, wood, paint, steel, and food items. 1-lowever, items such as nuts and bolts, ball bearings, key stock, casters, seats, wheels, and even engines may be regarded as raw materials if they are purchased from outside the firm.

Generally, raw materials are used in the manufacture of components. These components are then incorporated into the final product or become part of a subassembly. Subassemblies are then used to manufacture or assemble the final product. A part that goes into making another part is known as a component, while the part it goes into is known as its parent. Any item that does not have a component is regarded as a raw material or purchased item.

2. WORK-IN-PROCESS

Work-in-process (WIP) is made up of all the materials, parts (components), assemblies, and subassemblies that are being processed or are waiting to be processed within the system. This generally includes all material—from raw material that has been released for initial processing up to material that has been completely processed and is awaiting final inspection and acceptance before

inclusion in finished goods. Any item that has a parent but is not a raw material is considered to be work-in-process.

3. FINISHED GOODS

A finished good is a completed part that is ready for a customer order. Therefore, finished goods inventory is the stock of completed products. These goods have been inspected and have passed final inspection requirements so that they can be transferred out of work-in-process and into finished goods inventory. From this point, finished goods can be sold directly to their final user, sold to retailers, sold to wholesalers, sent to distribution centers, or held in anticipation of a customer order. Any item that does not have a parent can be classified as a finished good. By looking at the rolling cart product structure tree example one can determine that the finished good in this case is a cart.

4. MRO GOODS INVENTORY

Maintenance, repair, and operating supplies, or MRO goods, are items that are used to support and maintain the production process and its infrastructure. These goods are usually consumed as a result of the production process but are not directly a part of the finished product. Examples of MRO goods include oils, lubricants, coolants, janitorial supplies, uniforms, gloves, packing material, tools, nuts, bolts, screws, shim stock, and key stock. Even office supplies such as staples, pens and pencils, copier paper, and toner are considered part of MRO goods inventory.

5. OTHER TYPES INVENTORY

Inventories can be further classified according to the purpose they serve. These types include transit inventory, buffer inventory, anticipation inventory, decoupling inventory, cycle inventory, and MRO goods inventory. Some of these also are know by other names, such as speculative inventory, safety inventory, and seasonal inventory. We already have briefly discussed some of the implications of a few of these inventory types, but will now discuss each in more &tail.

(i) TRANSIT INVENTORY

Transit inventories result from the need to transport items or material from one location to another, and from the fact that there is some transportation time involved in getting from one location to another. Sometimes this is referred to as pipeline inventory. Merchandise shipped by truck or rail can sometimes take days or even weeks to go from a regional warehouse to a retail facility. Some large firms, such as automobile manufacturers, employ freight consolidators to pool their transit inventories coming from various locations into one shipping source in order to take advantage of economies of scale. Of course, this can greatly increase the transit time for

e inventories, hence an increase in the size of the inventory in transit.

(ii) BUFFER INVENTORY

As previously stated, inventory is sometimes used to protect against the uncertainties of supply and demand, as well as unpredictable events such as poor delivery reliability or poor quality of a supplier's products. These inventory cushions are often referred to as safety stock. Safety stock or buffer inventory is any amount held on hand that is over and above that currently needed to meet demand. Generally, the higher the level of buffer inventory, the better the firm's customer service. This occurs because the firm suffers fewer "stock-outs" (when a customer's order cannot be immediately filled from existing inventory) and has less need to backorder the item, make the customer wait until the next order cycle, or even worse, cause the customer to leave empty- handed to find another supplier. Obviously, the better the customer service the greater the likelihood of customer satisfaction.

(iii) ANTICIPATION INVENTORY

Oftentimes, firms will purchase and hold inventory that is in excess of their current need in anticipation of a possible future event. Such events may include a price increase, a seasonal increase in demand, or even an impending labor strike. This tactic is commonly used by retailers, who routinely build up inventory months before the demand for their products will be unusually high (i.e., at Val; Christmas, or the back-to-school season). For manufacturers, anticipation inventory allows them to build up inventory when demand is low (also keeping workers busy during slack times) so that when demand picks up the increased inventory will be slowly depleted and the firm does not have to react by increasing production time.

(iv) DECOUPLING INVENTORY

Very rarely, if ever, will one see a production facility where every machine in the process produces at exactly the same rate. In fact, one machine may process parts several times faster than the machines in front of or behind it. Yet, if one walks through the plant it may seem that all machines are running smoothly at the same time. It also could be possible that while passing through the plant, one notices several machines are under repair or are undergoing some form of preventive maintenance. Even so, this does not seem to interrupt the flow of work-in-process through the system. The reason for this is the existence of an inventory of parts between machines, a decoupling inventory that serves as a shock absorber, cushioning the system against Irregularities. As such it "decouples" or disengages the plant's dependence upon the requirements of the system (i.e., one machine feeds parts to the next machine).more inventory a firm carries as a decoupling

inventory between the various stages in its manufacturing system (or even distribution system), the less coordination is needed to keep thesystem running smoothly. Naturally, logic would dictate that an infinite amount of decoupling inventory would not keep the system running in peak form. A balance can be reached that will allow the plant to run relatively smoothly without maintaining an absurd level o inventory. The cost of efficiency must be weighed against the cost of carrying excess inventory so that there is an optimum balance between inventory level and coordination within the system.

(v) CYCLE INVENTORY. Those who are familiar with the concept of economic order quantity(E.O.Q) is an attempt to balance inventory holding or carrying costs with the costs incurred from ordering or setting up machinery. When large quantities are ordered or produced, inventory holding costs are increased, but ordering/setup costs decrease. Conversely, when lot sizes decrease, inventory holding/carrying costs decrease, but the cost of ordering/setup increases since more orders/setups are required to meet demand. When the two costs are equal (holding/carrying costs and ordering/setup costs) the total cost (the sum of the two costs) is minimized. Cycle inventories, sometimes called lot-size inventories, result from this process. Usually, excess material is ordered and, consequently, held in inventory in an effort to reach this minimization point. Hence, cycle inventory results from ordering in batches or lot sizes rather than ordering material strictly as needed.

WHY KEEP INVENTORY?

Why would a firm hold more inventory than is currently necessary to ensure the firm's operation? The following is a list of reasons for maintaining what would appear to be "excess" inventory.

(1) To MEET DEMAND.

In order for an organization to stay in business, it must have the products that the customer wants on hand when the customer wants them. If not, the retailer will have to back-order the product. If the customer can get the good from some other source, he or she may choose to do so rather than electing to allow the original retailer to meet demand later (through back-order). Hence, in many instances, if a good is not in inventory, a sale is lost forever.

(2).KEEPING OPERATIONS RUNNING.

A manufacturer must have certain purchased items (raw materials, components, or subassemblies) in order to manufacture its product. Running out of only one item can prevent a manufacturer from completing the production of its finished goods.

Inventory between successive dependent operations also serves to decouple the dependency of the operations. A machine or work center is often dependent upon the previous operation to provide it with parts to work on. If work ceases at a work center, then all subsequent centers willshut down for lack of work. If a supply of work-in-process inventory is kept between each work center, then each machine can maintain its operations for a limited time, hopefully until operations resume the original center.

(3). LEAD TIME.

Lead time is the time that elapses between the placing of an order (either a purchase order or a production order issued to the shop or the factory floor) and actually receiving the goods ordered.

If a supplier (an external firm or an internal department or plant) cannot supply the required goods on demand, then the client firm must keep an inventory of the needed goods. The longer the lead time, the larger the quantity of goods the firm must carry in inventory.

(4). HEDGE.

Inventory can also be used as a hedge against price increases and inflation. Salesmen routinely call purchasing agents shortly before a price increase goes into effect. This gives the buyer a chance to purchase material, in excess of current need, at a price that is lower than it would be if the buyer waited until after the price increase occurs.

(5). QUANTITY DISCOUNT.

Often firms are given a price discount when purchasing large quantities of a good. This also frequently results in inventory in excess of what is currently needed to meet demand. However, if the discount is sufficient to offset the extra holding cost incurred as a result of the excess inventory, the decision to buy the large quantity is justified.

(6). SMOOTHING REQUIREMENTS.

Sometimes inventory is used to smooth demand requirements in a market where demand is somewhat erratic. In fact, this is often called anticipation inventory. In essence, the use of inventory has allowed the firm to move demand requirements to earlier periods, thus smoothing the demand.

CONTROLLING INVENTORY

Inventories play a major role in the economy and businesses. From the firm's view point, inventories represent an investment in capital; capital is required to store materials at any stage of completion. Thus the proper balance must be struck to maintain proper inventory level with the minimum financial impact to the organization.

Inventory management, or inventory control, is an attempt to balance inventory needs and requirements with the need to minimize costs resulting from obtaining and holding inventory. Inventory may be 'kept "in house" meaning on premises or nearby for immediate use, may be held in a distant warehouse or distribution center for future use. With the exception offirms utilizing just-in-time methods, more often than not, the term "inventory" implies a stored quantity of goods that exceeds what is needed for the firm to function at the current time (e.g., within the next few hours).

BALANCING INVENTORY AND COSTS

As stated earlier, inventory management is an attempt to maintain an adequate supply of goods while minimizing inventory costs. We saw a variety of reasons companies hold inventory and these reasons dictate what is deemed to be an adequate supply of inventory. Now, how do we balance this supply with its costs? First let's look at what kind of costs we are talking about.

There are three types of costs that together constitute total inventory costs: holding costs, set-up costs, and purchasing costs.

1. Holding Cost.

Holding costs, also called carrying costs, are the costs that result from maintaining the inventory. Inventory in excess of current demand frequently means that its holder must provide a place for its storage when not in use. This could range from a small storage area near the production line to a huge warehouse or distribution center. A storage facility requires personnel to move the inventory when needed and to keep track of what is stored and where it is stored. If the inventory is heavy or bulky, forklifts may be necessary to move it around.

Storage facilities also require heating, cooling, lighting, and water. The firm must pay taxes on the inventory, and opportunity costs occur from the lost use of the funds that were spent on the inventory. Also, obsolescence, pilferage (theft), and shrinkage are problems. All of these things add cost to holding or carrying inventory.

If the firm can determine the cost of holding one unit of inventory for one year (H) it can determine its annual holding cost by multiplying the cost of holding one unit by the average inventory held for a one-year period. Average inventory can be

computed by dividing the amount of goods that are ordered every time an order is placed (Q) by two. Thus, average inventory is expressed as Q/2. Annual holding cost, then, can be expressed as H(Q/2).

2. Set-up Cost.

Set-up costs are the costs incurred from getting a machine ready to produce the desired good. In a manufacturing setting this would require the use of a skilled technician (a cost) who disassembles the tooling that is currently in use on the machine. The disassembled tooling is then taken to a tool room or tool shop for maintenance or possible repair (another cost). The technician then takes the currently needed tooling from the tool room (where it has been maintained; another cost) and brings it to the machine in question.

There the technician has to assemble the tooling on the machine in the manner required for the good to be produced (this is known as a "set-up"). Then the technician has to calibrate the machine and probably will run a number of parts, that will have to be scrapped (a cost), in order to get the machine correctly calibrated and running. All the while the machine has been idle and not producing any parts (opportunity cost). As one can see, there is considerable cost involved in set-up.

3. Ordering costs

If the firm purchases the part or raw material, then an order cost, rather than a set-up cost, is incurred. Ordering costs include the purchasing agent's salary and travel/entertainment budget, administrative and secretarial support, office space, copiers and office supplies, forms and documents, long-distance telephone bills, and computer systems and support. Also, some firms include the cost of shipping the purchased goods in the order cost.

If the firm can determine the cost of one set-up (S') or one order, it can determine its annual setup/order cost by multiplying the cost of one set-up by the number of set-ups made or orders placed annually. Suppose a firm has an annual demand (D) of 1,000 units. If the firm orders 100 units (Q) every time it places and order, the firm will obviously place 10 orders per year (D/Q). Hence, annual set-up/order cost can be expressed as S(D/Q).

4. Purchasing costs. Purchasing cost is simply the cost of the purchased item itself. If the firm purchases a part that goes into its finished product, the firm can determine its annual purchasing cost by multiplying the cost of one purchased unit (P) by the number of finished products demanded in a year (D). Hence, purchasing cost is expressed as PD.

Now total inventory cost can be expressed as:

Total = Holding cost ± Set-up/Order cost + Purchasing cost
Or Total = H(Q/2) + S(D/Q) + PD
If holding costs and set-up costs were plotted as lines on a graph, the point at which they intersect (that is, the point at which they are equal) would indicate the lowest total inventory cost. Therefore, if we want to minimize total inventory cost, every time we place an order, we should order the quantity (Q) that corresponds to the point where the two values are equal. If we set the two costs equal and solve for Q we get:
H(Q/2) = S(D/Q) Q=2DS/H
There are a number of assumptions that must be made with the use of the EOQ. These include:
• Only one product is involved.
• Deterministic demand (demand is known with certainty).
• Constant demand (demand is stable through-out the year).
• No quantity discounts.
• Constant costs (no price increases or inflation).
While these assumptions would seem to make EOQ irrelevant for use in a realistic situation, it is relevant for items that have independent demand. This means that the demand for the item is not derived from the demand for something else (usually a parent item for which the unit in question is a component). For example, the demand for steering wheels would be derived from the demand for automobiles (dependent demand) but the demand for purses is not derived from anything else; purses have independent demand.

SUPPLIER MARKET CONDITIONS/ EVALUATIONS

Is a term used in business and refers to the process of evaluating and approving potential suppliers by factual and measurable assessment. The purpose of supplier evaluation is to ensure a portfolio of best in class suppliers is available for use. Supplier evaluation is also a process applied to current suppliers in order to measure and monitor their performance for the purposes of reducing costs, mitigating risk and driving continuous improvement.

Process

Supplier evaluation is a continual process within purchasing department and forms part of the pre-qualification step within the purchasing process, although in many

organizations it includes the participation and input of other departments and stakeholders.. It often takes the form of either a questionnaire or interview, sometimes even a site visit, and includes appraisals of various aspects of the supplier's business including capacity, financials, organizational structure and processes and performance Based on the information obtained via the evaluation, a supplier is scored and either approved or not approved as one from whom to procure materials or services. In many organizations, there is an approved supplier list (ASL) to which a qualified supplier is then added. If rejected the supplier is generally not made available to the assessing company's procurement team. Once approved, a supplier may be reevaluated on a periodic, often annual, basis. The ongoing process is defined as supplier performance management.

Scope

This focuses on obtaining and interpreting the following supplier information:

-Organization;

- Core business;
- Capability and reputation;
- Working procedures related to the service

-Requirement;

- Finances;
- Capacity; and
- Track record.

This information enables the contracting organization to determine the overall capability and capacity of the prospective service provider. It is crucial to the achievement of best value for money that only competent suppliers are selected.

Obtaining Market Information

A request for proposal (referred to as RFP) is an invitation for suppliers, often through a bidding process, to submit a proposal on a specific commodity or service. A bidding process is one of the best methods for leveraging a company's negotiating ability and purchasing power with suppliers. The RFP process brings structure to the procurement decision and allows the risks and benefits to be identified clearly upfront. The RFP purchase process is lengthier than others, so it is used only where its many advantages outweigh any disadvantages and delays caused. The added benefit of input from a broad spectrum of functional experts ensures that the solution chosen will suit the company's requirements.

The RFP may dictate to varying degrees the exact structure and format of the supplier's response. The creativity and innovation that suppliers choose to build into their proposals may be used to judge supplier proposals against each other, at

the risk of failing to capture consistent information between bidders and thus hampering the decision making process. Effective RFPs typically reflect the strategy and short/long-term business objectives, providing detailed insight upon which suppliers will be able to offer a matching perspective.
Similar requests include a request for quotation and a request for information.

Key objectives

• Obtain correct information to enable sound business decisions.
• Decide correctly on strategic procurement.
• Leverage the company's purchasing power to obtain a favorable deal.

Key benefits

• Informs suppliers that your company is looking to procure and encourages them to make their best effort.
• Requires the company to specify what it proposes to purchase. If the requirements analysis has been prepared properly, it can be incorporated quite easily into the Request document.
• Alerts suppliers that the selection process is competitive.
• Allows for wide distribution and response.
• Ensures that suppliers respond factually to the identified requirements.

By following a structured evaluation and selection procedure an organization can demonstrate impartiality — a crucial factor in public sector procurement.

Benefits and Drawbacks

There are various benefits associated with an effective supplier evaluation process ,such as mitigation against poor supplier performance or performance failures. The benefits typically include sourcing from suppliers that provide high standards of product and service levels whilst offering sufficient capacity and business stability. Supplier evaluation can help customers and suppliers identify and remove hidden cost drivers in the supply chain. The process of evaluating performance can motivate suppliers to improve their performance.
Associated challenges with supplier evaluation include resource and cost commitments in establishing and maintaining a robust and effective system, challenges with specifying and gathering meaningful and relevant information, data integrity, scorecards that do not get at the root causes of supplier problems, and subjective or inconsistent scoring which may result in inaccurate assessment Another challenge is making sure that evaluation of current suppliers goes beyond measurement to actual performance improvement by providing feedback to suppliers on their performance and working on continuous improvement

opportunities. Thus, management commitment to and support of a supplier evaluation process is essential

RFPs often include specifications of the item, project or service for which a proposal is requested. The more detailed the specifications, the better the chances that the proposal provided will be accurate. Generally RFPs are sent to an approved supplier or vendor list.

The bidders return a proposal by a set date and time. Late proposals may or may not be considered, depending on the terms of the initial RFP. The proposals are used to evaluate the suitability as a supplier, vendor, or institutional partner. Discussions may be held on theproposals (often to clarify technical capabilities or to note errors in a proposal). In some instances, all or only selected bidders may be invited to participate in subsequent bids, or may be asked to submit their best technical and financial proposal, commonly referred to as a Best and Final Offer (BAFO).

Other requests

Request for Quotation (RFQ) is used when discussions with bidders are not required (mainly when the specifications of a product or service are already known) and when price is the main or only factor in selecting the successful bidder. An RFQ may also be used as a step prior to going to a full-blown RFP to determine general price ranges. In this scenario, products, services or suppliers may be selected from the RFQ results to bring in to further research in order to write a more fully fleshed out RFP.

RFP is sometimes used for a request for pricing.

Request for Information (RFI) is a proposal requested from a potential seller or a service provider to determine what products and services are potentially available in the marketplace to meet a buyer's needs and to know the capability of a seller in terms of offerings and strengths of the seller. RFIs are commonly used on major procurements, where a requirement could potentially be met through several alternate means. An RFI, however, is not an invitation to bid, is not binding on either the buyer or sellers, and may or may not lead to an RFP or (RFQ).

Request for Qualifications (RFQ) is a document often distributed before initiation of the RFP process. It is used to gather vendor information from multiple companies to generate a pool of prospects. This eases the RFP review process by preemptively short-listing candidates which meet the desired qualifications.

CATEGORIES OF RISK AND THEIR EVALUATION

Creating an Effective Risk Management Strategy

Does your company have a risk management strategy? What will happen if one of your key suppliers has a service disruption due to a labor issue such as a strike? How will it affect your operations? More importantly, how will it affect service to your customers?

Progressive organizations are implementing a risk management strategy to enable them to react to potential issues in a streamlined fashion. By having a plan, organizations are able to minimize a large ripple effect other operations within their organization.

RISK IDENTICATION

1. Supplier capacity

If you have a sole supplier for a major product line, your operation may be at risk if there is a supply issue. Determine what percentages of your products (dollar or unit volume) are sourced from your top suppliers.

2. Internal processes (i.e. Manufacturing, Assembly)

Review everything from equipment maintenance to quality control procedures. Ensure there are back-up plans in the event of equipment failure. Identify a back-up supplier if you source a specialty item from a supplier that may have a quality issue in the future (i.e. company sold, new management, etc.).

3**. Warehouse capacity**

Monitor seasonal trends to identify the peak volumes in your operation. Forecast volumes at least 1-2 months in advance to determine if your operations will be able to meet demand. Have a plan to use a preferred supplier for outside storage space if required — don't wait until it's needed.

3**. Transportation availability & rates**

Ensure that your organization has relationships with other carriers in the event of a disruption with your current one. Review other modes of transportation (i.e. Air) if the primary mode fails to meet your customer's needs.

4**. Assign Risk Owners**

Ensure accountability, once each potential risk has been identified, a risk owner should be assigned to each area. It will be their responsibility to report on the risk strategy on a periodic basis. If no-one owns it, it will not get done.

REQUIREMENT OF THE BUSINESS AND THE NEED FOR STOCK

Stock management is defined as the control of stock to ensure that it is adequate for immediate needs without using up excessive financial resources. Stock costs are an important aspect of a firm's overall costs. This means that firms ensure that efficient stock management is used. Hence any proficient method of stock

management used to reduce the cost of holding stock increases profitability and that is a major objective of any firm.

Firms understand that they have to incur an expense to hold stock but this will ensure that the business can remain functioning. So the central aim of stock management is to effectivelyminimize the cost to stockholding while allowing the business to operate smoothly by retaining sufficient stock.

A firm must ensure efficient stock management to ensure that enough supplies of raw materials for the production process. The business must be supplied with enough raw materials to meet requirements. If the firm cannot meet demand of the consumers because it does not have enough stock to do so, it will start to lose sales. This is especially true in the growth stage of the product's lifecycle where there is an anticipated increase in demand for the product. This is also true of seasonal which have variations in demand. Too much stock can't be kept when demand is low otherwise depending on the nature of the stock it may go bad, become obsolete or lose its quality.

If a business does not ensure efficient stock management then a lot of wastage can arise as a result. A stock out happens when a firm experiences total depletion or runs out of stock. Stock outs lead to lost profits and loss of customer goodwill and loyalty therefore future sales. If the customers cannot get their goods at one firm they will leave and purchase it somewhere else that has it in stock. Continuously unfavorable stock outs by that firm will cause them to lose future sales. These are reasons is why it is of major importance for a firm to have efficient stock management.

Stock management teams must use some method of stock management in order to ensure that they do not experience an unwanted stock out. The stock management team must decide whether to make large occasional orders to hold in stock or small frequent orders.

METHOD OF AVOIDING CARRY1NG STOCK

Two major methods utilized are the 'Buffer Stock' technique and the 'Just in Time' system.

JUST-IN-TIME (JIT).

The Just in Time System is a manufacturing practice developed by the Japanese in order to minimize holdings of stock. Suppliers deliver materials needed for production at the exact moment they are required. Goods are produced only as they are needed for the next phase ofproduction. Stock is frequently delivered therefore

there is a zero inventory situation. The firm only produces something when there is actual customer demand for it (First sell it, then make it).

Just in Time system only work when there is high employee flexibility and commitment and a well coordinated production system to ensure quality and continuous improvements to minimize bottlenecks.

• The Just in Time system has a much less risk of their stock becoming obsolete or going bad (losing its quality).

• The firm keeps a small inventory hence using less space required, lower maintenance costs and capital requirements.

• As a result of the 'First sell it, then make it' method of operation the right quantities are produced at the right time.

• There is increased workforce participation as a result of their employment flexibility and commitment.

• The continuous emphasis on improvement and problem solving results in higher quality, good customer service and reduced costs.

The Buffer stock technique

BST is referred to as a conventional method of stock management. The firm has a fixed amount of stock held in inventory. They specify a certain stock level that if stock reaches that point, a reorder must be made to bring it back to normal level. There is a time lapse between the actual order of stocks and its delivery. During this time supplies are still decreasing. A buffer stock is held as reserve stock in the event that the reorder takes longer than expected. Buffer stock ensures that the firm always has reserve stock, enough to fend off a stock out experience.

Advantages

The Buffer Stock method is beneficial:

• given that they can benefit from purchasing economies of scale.

• Profits that derive from the rise of the price of stock they purchased at a previously lower price.

• They also have the security of an emergency source of supplies.

Firms must place emphasis on their stock management system. This is a vital part of business operations because it affects crucial parts of the business such as profitability and customer relations. The business' environment will determine what method of stock management they employ and how effective it turns out to be.

GENERAL METHODS

ABC APPROACH

The ABC approach classifies inventory items according to some measure of important usually annual naira usage, and then allocates control efforts accordingly. In this method, inventories are grouped into three categories as follows:

Class A Very important

Class B Moderately important

Class C Least important

Items in Class A generally account for 15-20% of the number items in stock but about 60-70% of the Naira usage. At the extreme end are Class C items which account for about 60% of items but only about 105 of Naira usage in inventory.

What this means is that items in class A should be given close attentions by management through constant review of stock in-hand and their withdrawal to avoid stock-out. Items in Class C should receive only loose control, while Class B control lies between the two.

Kanban Method

Kanban is a Japanese word meaning "signal" or "visible record". In a pull system workflow is dictated by "next-step demand". A system can communicate such demand by using a kanban card. When a worker needs material or works from the preceding station, he/she uses a kanban card. The kanban card is an authorization to move or work on parts. In kanban system no part can be worked or move without one of the card.

It worked like this. Each container is affixed with a card. When a process or work station needs to replenish its supply of parts, a worker goes to the area where these parts are stored and withdraws one container of parts. Each container holds a predetermined quantity. The worker removes the kanban card from the container and posts it in a designated spot where it will be clearly visible. The worker moves the container to the work station. The posted kanban card is then picked up by a stock person who replenished the stock with another container and so on down the line.

The number of kanban card need for a given production level can be calculated using this formular:

NDT(l+X)/C

Where: N = Total number of containers (1 card per container)

D= Planned usage rate of a center

T= Average waiting time

X Policy variable set by management

C Capacity of a standard container (should not be less than 10% daily usage)

Note that D & T must use the same units (e.g. minutes or days)

Advantages

• Kanban system is very simple to implement

• Kanban usually have a very small lot size.

• It handles changes very easily.

• Kanban has short lead time, and high quality output, and simplifies teamwork.

• Kanban is two-bin types of inventory management. Suppliers are replenished as soon as inventories reach predetermined level.

CON WIP CONTROL .

stands for Constant Work-In-Process, and designates a control strategy that limits the total number of parts allowed into the system at the same time. Once the parts are released, they are processed as quickly as possible until they wind up in the last buffer as finished goods. One way to view this is that the system is enveloped in a single kanban cell: Once the consumer removes a part from the finished goods inventory, the first machine in the chain is authorized to load another part.

Advantages

• First of all, like kanban, the CON WIP system only responds to actual demands that have occurred, so it is still a "pull" type system.

• New parts will not be released if the finished goods buffer is full.• The inventory in finished goods is now available to serve the customer, and there is no internal inventory to collect dust.

CHAPTER TWO

CONTROL OF STOCK RANGE

Its aim is to control the quantity and quality of stocks to enable production and sales to continue whilst minimizing costs. The following technique/method are used; coding and classification

What is coding and classification?

Broadly speaking, coding and classification are about using a number or set of alphanumeric characters to: Identify a specific thing; or Group similar things together.

For example, a bar code number on a can of drink identifies what the drink is, who manufactures the drink and the unit and pack size of the drink. This particular code is known as an identification code as it has no relation to other codes and wouldn't be used to group products together for analysis. It is important to distinguish between coding and classification as they support totally different business roles. Adoptingthe wrong approach can present significant challenges by distorting the information available to the point that it cannot support the business requirement for which it was intended.

Coding for identification

Identification codes are used for recording and tracking items and are used for inventory management, point of sale transactions or historical record keeping. An identification code can also identify other

information such as:• Address/Location identifiers• Language identifiers• Unit of measures or issue• Currency identifiers • Country identifiers Price/cost identifiers

Coding and classification of information brings uniformity across business divisions, business functions and even across business units within an organization. It allows purchasing activity to be viewed from macro or micro level, it demonstrates the value of spend with a particular supplier, or at a higher level the value of spend within a corporate structure. This spending power may be greater than you think. Unless an organization has analyzed sources and levels of supply, it is hard to quantify overall spend with a group of related companies.

CODIFICATION OF MATERIALS

— The use of materials specification code numbers is an advantage, not only to the purchase department and drawing office, but also to the pricing clerk in the cost department, in that ambiguity is eliminated.

— Each material or item in the stores should be clearly identified so that the same can be easily located at the time of need. This is achieved by allocating CODE numbers.

— The code should be meaningful and impart a unique identity to each material.

If a material is described by its trade name, as well as by a serial ii umber and also by its function, it is quite likely that different quantities of the same material might be located at three different places in the same store. This increases size of the inventory and creates an unnecessary confusion. Codification of materials removes this difficulty and avoids duplication of materials.

Examples of material codes

(a) — B.S. 609 means Brass Screw 6 mm x 9 mm

— S.S. 815 means Steel Screw 8 mm x 15 mm

(b)--- Another code may be made up as follows:

Class 1 * * * — * * Primary material

Sub-class * * * — * * Iron and carbon steel

Group **6* **Bar

Series * * * 4 — * * Mild Steel

* * * * — 8*8mm diameter

* * * * _. *B Bright(bar)

Thus I 164-8B implies a bright mild steel bar 8 mm diameter.

(c) ACC,ITA/6—implies air-conditioner compressor, top assembly part number 6.

Variety Reduction and Standardization

Variety reduction

The deliberate elimination of the number of variants in a product range or line, in order to improve efficiency and secure scale economies, usually accomplished through Pareto analysis .Part variety reduction. Drastic reductions in existing part variety are possible through Product Line Rationalization which eliminates or out-sources products and product variations that are problem prone, don't "fit" into a BTO, have low sales Not only is rationalization an important prerequisite for spontaneous BTO, it can have the immediate benefits of raising profits and freeing valuable resources.

Part variety can also be reduced by designing new products around standard parts.

Part variety can be further reduced by consolidating many inherently inflexible parts into a few very versatile standard shapes

As raw material variety is reduced, it becomes more feasible to use automatic re-supply techniques, like kanban, mm/max or bread-truck

Too many types of raw materials can thwart spontaneity and make the manufacturer have to choose between stocking all types or ordering them and waiting for delivery. The solution is to aggressively standardize incoming raw Materials

Standardization

Standardization can be defined as: The development and implementation of concepts, doctrines, procedures and designs to achieve and maintain the required levels of compatibility, interchangeability or commonality in the operational, procedural, material, technical and administrative fields to attain interoperability.In material management, standardization refers to approaches for increasing commonality of part, process, product or procurement. Such change will enable making of manufacturing or procurement decisions, thus reducing variability found in hating many non-standard components.

Application and approval of new stock items

The actual purchase of all materials is usually made by the purchasing department headed by a general purchasing agent. In some small and medium size companies, however, department heads or supervisors have authority to purchase materials as the need arises. In any case, systematic procedures should be in writing in order to fix responsibility and to provide full information regarding the ultimate use of materials ordered and received. The purchasing department should receive purchase requisitions formaterials, supplies, and equipment; keep informed concerning sources of supply, prices, and shipping and delivery schedules; prepare and place purchase orders; and arranging for adequate and systematic reports between the purchasing, the receiving, and the accounting departments. An additional function of the purchasing department in many enterprises is to veri' and approve for payments all invoices received in response to purchase orders placed by the department.

Control of slow moving, obsolete and redundant stock

Slow moving goods

Every manufacturer runs into the problem of having slow moving merchandise. Unused, dated, end-of- line, discontinued and un-useable merchandise is the bane of all businesses no matter what the products are. Rather than the problem being a

negative, trying to solve it will open up many opportunities for having a more profitable business.

• Close-out sales — usually done after Christmas or in January.

• Selective temporary retirement. This relates to #1. Where it differs is that these goods are perennials, ones that would be reordered the next year anyway.

• Trade-back agreements. Some suppliers offer trade-back agreements. This gives the store the opportunity to exchange slow moving merchandise against an order of faster selling items.,

• Buying less. Oh my, what an easy thing to say, what a difficult thing to do. Many buyers believe or are told by their management that the savings gained by ordering and shipping larger orders are a justification for the large order.

• Moving goods around. It is not unusual to find that some goods haven't sold because of where they are placed. Moving goods around has, on occasion, made a slow seller into a good, if not great, seller.

• Grouping — putting like things with like things. One aspect of having leftovers is that they are treated as left over. Pulling things into groups separated by space makes each group important.

• Signage — something that allows customers to know what the price is without having to turn it over to see the price. Many items remain unsold because the price was not where it could be seen

• Market Trends — very often some goods become less desirable because the market changed. Watching for market trends takes time and effort. Trade shows and trade journal good methods for seeing trends.

• Inventory control — and not automatic inventory control! When working with products. important thing is "rate of sale. Every item cycles differently.

•• Alliances with other stores better known as "buying groups". Buying together may ' the group some advantages not available to the individual stores. The real benefit for these alliances is that one store's slow seller may be another store's good seller

• Liquidators. Liquidators usually need larger quantities. It may be possible that if a group of stores with like items/lines wishes to put their inventories together, they may have a better chaw
to sell to a liquidator.

Obsolete Goods

In every business or institution, machinery, equipment and materials can become obsolete, surplus or worn. The actual disposal of such equipment is the responsibility of the Purchasing Department.

There are several ways to dispose of equipment. If replacement equipment is to be purchased, every effort should be made to obtain a reasonable trade-in-allowance for the old equipment. In this case, Purchasing would negotiate with the vendors interested in supplying the replacement equipment. Obsolete materials are defined as stocked materials that can no longer be used for their original purpose or any other purpo5 and therefore require disposal.

Redundant Stock

Materials which at present have no demand are regarded as dormant or redundant stocks. There is a possibility that in future they may be required. Consultation between purchasing department, production cost accountants and storekeeper is important in deciding what to do with redundant stock. The decision may be either to disposed of it in order to cut cost in term of losses and warehouse space or to continue t hold the in stock if there is a chance that there may be a demand in the future.

Role of other functions in determining stock range

Purchase department received requisition and buy material on behalf of the organization. They process the requisition and make necessary contacts with suppliers for contract negotiation, inspections of materials for specification and receipt of material falls within their purview.

The finance department takes the responsibility for processing bills and act promptly by settling the huh as directed by the purchase department. Finance must checks the purchasing department punitive purchase behavior in order to ensure prudent buying. They make payment as stipulated in the contract an to take advantages of prompt payment rebates.

The production department is responsible for production of goods within the firm. Production does not exist in a vacuum, it must interact with the purchasing department for the materials which are needed. Purchasing must ensure that they liaise with production in term of material specification requirements an quality.

The role of marketing in stock control can not overstate. Marketing management are responsible for finding out what the consumers want in terms of varieties, functionalities and quality. They transmit this information to production who

informs purchasing as the materials required. Marketing must ensure that the final product is sold at a profit so that the firm will continue to be in business.

The purchasing department must communicate to HR department in matters connected with their professional expertise, performance evaluations, rewards etc. This is to ensure that the people who are responsible for spending about 80% of organizations money in terms of material purchases have therequired knowledge and experience to carry out the task. These other department makes inputs in one way r the order in deciding the level and quality of material held in stock.

Chapter three

CONTROL OF STOCK LEVEL.

Forecasting techniques in relation to demand an lead time

A forecast is statement about the future. There are two uses for forecast.

1. Planning the system. Forecast helps managers plan the system. planning the system generally involved long-range plan about the type of product or service to offer, what facilities and equipment to use, where to locate the plant, etc.

2. Planning the use of the system: This involved short range and intermediate range planning, which focuses on such task as planning inventory and work force level, purchases and production planning, budgeting, and scheduling. Business forecasting pertains to more than predicting demand. Forecast is also used to predict profits, revenues, cost and availability of materials etc. Demand can be forecast using the following techniques:

Definition and Concept

1. Forecasting means estimation of type, quantity and quality of future work e.g. sales etc.
2. The survival of a manufacturing enterprise depends on its ability to assess, with reasonable accuracy, the market trends several years ahead.
3. Forecasters will be able to make use of sales trends, but these must be considered in the light of expected introduction of new materials, fashion changes, policies of competitors, unseasonable weather, threat of war and the general economic situation expected in the country and foreign markets. These circumstances and others necessitate changes in sales forecast from time to time during the forecast period.
4. Forecast represents a commitment on the part of the sales department and each of its divisions of expected sales. It becomes a goal against which the effectiveness of the sales department will be measured.
5. Forecasting plays a crucial role in the development of plans for the future.

6. Sales budget (estimate) forms the basis for manufacturing budget. It is the sales forecast which enables to determine production quantities, labour, equipment and raw material requirement.
7. A sales forecast should be
    - Accurate,
    - Simple and easy to understand, and
    - Economical.

Purpose (or Need) of Sales Forecasting

(i) Sales forecasting is essential because,
(ii) It determines the volume of production and the production rate.
(iii) It forms basis for production budget [step (6) above], labour budget, material budget, etc.
(iv) It suggests the need for plant expansion.
(v) It emphasizes the need for product research development.
(vi) It suggests the need for changes in production methods.
(vii) It helps establishing pricing policies.
(viii) It helps deciding the extent of advertising, product distribution, etc.

Sales forecasting. Basic elements.

- Forecasting means predicting future events by the best possible means.
- In any sales forecasting analysis, there are four basic elements of economic data that should be
- used:
    1. Trends
    2. Cycles
    3. Seasonal variations
    4. Irregular variations.
- Trends are the long term, long range movements of a series of economic data. They have little relationship to the month-to-month changes that take place, and they manifest their direction slowly.
- Cycles are of shorter duration and they are usually featured by alternate periods of expansion and contraction.
- Seasonal variations occur within a certain period of year and recur at about the same time and to approximately the same extent from year to year.
- Irregular variations are the result of unforeseen or non-recurring events that have an economic influence. A strike in a key industry might cause an irregular variation.

Sales Forecasting Techniques

Forecasting is the formal process of predicting future events that will significantly affect the functioning of the enterprise.

- Sales forecasting techniques may be categorized as follows:
  a. Historic estimate,
  b. Sales force estimate,
  c. Trend line (or Time series analysis) technique,
  d. Market survey,
  e. Delphi method,
  f. Judgmental techniques,
  g. Prior knowledge,
  h. Forecasting by past average,
  i. Forecasting from last period's sales,
  j. Forecasting by Moving average,
  k. Forecasting by Weighted Moving average,
  l. Forecasting by Exponential Smoothing,
  m. Correlation Analysis,
  n. Linear Regression Analysis.

(a) Historic estimate

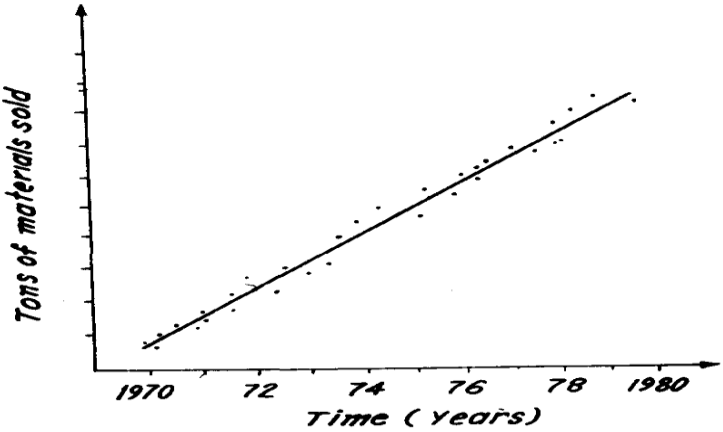
- This technique makes use of the assumption that what happened in past will happen in future. For example if a concern has sold 5000 blankets in winter last year, it will be able to sell the same quantity in winter this year also.
- Historic estimate is useful if the activity is affected by pattern of seasonality.
- It is useful for determining model, size and colour distribution.
- It is successful only when pattern of events remains unchanged, i.e., if economy is static. This is rarely true except for short periods of time.
- Historic estimate is not scientifically valid and thus it is not an accurate method; the total sales forecast provided by this method should be modified by other techniques.

(b) Sales force estimate

- This technique is based upon the principle—that the persons in contact with the market know best about the future market trends.
- Individual salesmen make sales estimates of their territories and submit it with the District Sales Manager who analyses it, modifies it and sends the same to Factory Sales Manager. Factory SalesManager in consultation with other related factory executives formulates the final estimate of sales.
- This technique is useful when an industry is making a limited number of products (e.g., commercial power generating equipment) and there are a few large customers.

(c) Trend line technique

- Trend line technique is employed when there is an appreciable amount of historical data. This technique is more reliable than the historic estimate (a) above.
- This technique involves plotting historical data, i.e., a diagram between activity indicator, e.g., tons of material (say past sales) on Y-axis and time on X-axis.
- A single best fitting line (using statistical technique) is drawn and projected to show sales estimate for future.
- This technique is more accurate as it makes use of a large past data and possesses scientific validity.



Trend line technique

- However, it is time-consuming, involves long mathematical calculations and assumes an infinite population of relatively small customers so that the decision of an individual customer cannot have an appreciable effect on total product demand.

(d) Market Survey, i.e. Market Research Technique

- This technique finds application when a concern introduces a new product in the market and is interested to estimate its sales forecast. For a new product, naturally, no historic or past data regarding sales will be available.

- This technique may be very informal, utilizing the sales force to feel out the potential customers in order to establish the extent of the market or it maybe a systematically conducted survey using special mathematical tools.
- Generally, the new product is introduced in a relatively small critical trial area, market reaction is noted and the total sales (country-wide) is projected from these results.

(e) Delphi Method

- A panel of experts is interrogated by a sequence of questionnaires in which the response to one questionnaire is used to produce the next questionnaire. Any set of information available to some experts and not others is thus passed on to the others, enabling all the experts to have access to all the information for forecasting. The method solicits and collates opinion from experts to arrive at a reliable consensus. This technique eliminates the bandwagon effect of majority opinion.
- Delphi method has fair to very good accuracy for short and long term forecasts.
- The method is applicable to forecasts of long-range and new-product sales.

(f) Judgmental techniques. **They involve,**

1. Opinions of consumers and customers. Questionnaires related to buying the product may be sent to a selected group of consumers and to the customers who have already purchased the product. The information thus received can be very useful in estimating product performance and its probable demand in future.
2. Retail and wholesale dealers can provide some insight into the pace of current and future sales.
3. The opinion of area sales managers can also be quite useful.

(g) Prior knowledge

- This is used by ancillary units which are more or less a part of the large organization. The large organization informs each ancillary unit how many component parts to make.
- The forecast estimate is needed only to establish the material and tool requirements, etc.

(h) Forecasting by Past Average

If our objective is the forecast or predict the sales of an item for the next sales period, then using this method,

Forecasted sales for next period = Average sales for previous period

Example

Period No.	Sales
1	7
2	5
3	9
4	8
5	5
6	8

Forecasted sales for period no. $7 = \frac{7+5+9+8+5+8}{6} = 7$

(i) Forecasting from last period's sales

The method eliminates the influence of past (old) data and bases the forecast only upon the sales of the previous period. Using this technique, the forecasts would look as in table given on page below

Period No.	*Actual Sales*	*Forecast Sales*	*Errors in Forecast*
1	5		
2	4	5	+1
3	8	4	−4
4	7	8	+1
5	4	7	+3
		4	

(j) Forecasting by Moving Average

- This method represents a compromise between the two above explained methods, in that the forecast is neither influenced by very old data nor does it solely reflect the figure of the previous period.
- The use of simple moving average is an adequate method of forecasting, provided sales are subject to neither seasonal variation nor marked secular trends. A secular trend is one which causes sales steadily to increase or decrease.

(k) Weighted Moving Average Method for Forecasting

- Whereas the simple moving average gave equal effects to each component of the moving average data base, a weighted moving average allows any weights to be placed on each element, providing, of course, that the sum of all weights equals one.
- As an example, suppose that in a four-month period the best forecast is derived by using 40% of the actual sales for the most recent month, 30% of two month ago, 20% of three months ago, and 10% of four months ago. If actual sales experience was as follows,

the forecast for month-5 would be

F5 = 0.40 (95) + 030 (105) + 0.20 (90) + 0.10 (100) = 97.5

Suppose sales for month 5 actually turned out to be 110, then

Month-1	Month-2	Month-3	Month-4	Month-5
100	90	105	95	?

the forecast for month-6 would be:

F6 = 0.40(110) + 0.30 (95) + 0.20 (105) + 0.10 (90) = 102.5

- The weighted moving average method has a definite advantage in being able to vary the effects of past data, but it also has the disadvantage of remembering the total history for the time period.

(l) Forecasting by Exponential Smoothing

- The main disadvantages of the moving average method are:
  1. The lengthy calculations involved.
  2. The need to keep quantities of historical data.
  3. The fact that the normal (or simple) moving average method places equal weight on each of the historical figures used.
  4. The age of the data, which increase with the number of periods used.
- All of these disadvantages are overcome by the exponential smoothing technique.

Using this technique it is necessary only to retain the previous forecast figure and to know the latest actual sales figure. The technique works by modifying the old forecast in the light of new sales figure, i.e.

New forecast = a (latest sales figure) + (1-a) (old forecast)

Where a is known as the smoothing constant.

For example, let

Forecast sales for last period = 24

Actual sales for last period = 22

Forecast sales for next period =a(22) + (1 —a)24

Assuming a = 0.1

Forecast sales for next period = 0.1(22) + (0.9)24 = 23.8

The use of this technique permits the forecast to respond to recent actual events, but at the same time retain a certain amount of stability. The amount by which the new forecast responds to the latest sales figure, or the extent to which it is damped by the previous forecast, is, of course, determined by the size of the smoothing constant α. The size of α should be carefully chosen in the light of the stability or variability of actual sales, and is normally from 0.1 to 0.3.

The smoothing constant, a, that gives the equivalent of an N-period moving average can be calculated as follows:

$$\alpha = \frac{2}{N+1}$$

For example, if we wish to adopt an exponential smoothing technique equivalent to a nine-period moving average, can be found as follows:

$$\alpha = \frac{2}{9+1} = 0.2$$

- When a secular trend is present, the forecast sales obtained by the normal exponential smoothing method will lag behind actual sales, in just the same way as the moving average forecast.

Econometric Forecasting

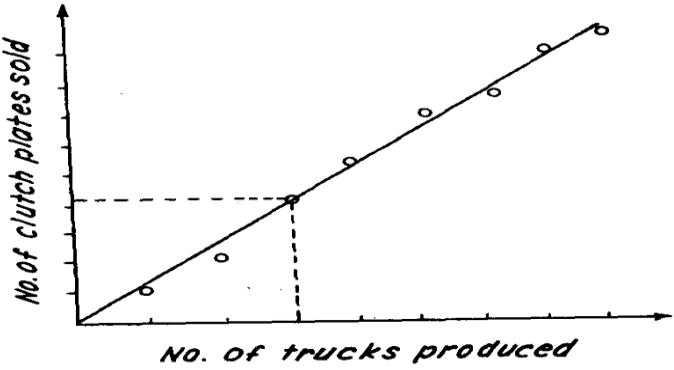
- In Econometric forecasting the analyst tries to uncover the cause-and-effect relationship between sales and some other phenomena that are related to sales. For example, an appliance manufacturer might discover that the sales of television sets respond to the disposable income of customers with a 1-month lag. That is, 1 month after a change in disposable income, there a proportionate change in the sales of T.V. sets. This process is called econometric forecasting. Here, the analyst tries to identify those factors that best explain the level of sales for a product.
- Econometric forecasting utilizes correlation and Regression techniques. The objective is to establish a cause-and-effect relationship between changes in the sales level of the product and a set of relevant explanatory variables.

(m) Correlation Analysis

- Correlation Analysis is frequently used if a relationship can be found between sales and other economic and non-economic phenomena, such as the national income, defense expenditures, population growth, and the weather.
  Such forecasts are generally concerned with the sales volume for the entire industry. The forecaster arrives at his company forecast by estimating the company's share of total industry demand.
- One difficulty with correlation analysis is that a past relationship may not continue into the future.
- Correlation techniques are most reliable when a casual relationship can be established between the variables and sales.
- Correlation techniques have been used to develop demand functions for a number of products. such as furniture, refrigerators and automobiles.
- It makes use of cause-and-effect relationship between sales and some other phenomena that are related to sales.
- This technique is employed when an organization finds that the sale of its product has a remarkable relationship with the sales of a leading product of another organization, e.g., sales of clutch plates is correlated with the sales of trucks produced, (Fig. 7.5).

- In correlation technique, total sales for an industry (e.g., truck manufacturing concern) is found and then based upon the market conditions, the volume of sale for one's own product (e.g., clutch plates) is predicted.

Such past data when plotted on the graph paper (refer Fig. below) with line of best fit drawn, can predict sales estimate for future.



Correlation data.

Sources of correlation data

(i) Economic data
- Survey of current business.
- Monthly labour review.
- Business magazines.

(ii) industry data
- Trade journals.
- Annual survey of manufacturers.
- Industrial trade associations.
- A Correlation Coefficient is a measure of the extent to which two variables (e.g. number of trucks sold and clutch plates sold) are associated, in other words, a correlation coefficient is an indication of the extent to which the knowledge of the value of one variable is useful for the prediction of the value of the other. This is the basis of a method of forecasting variously known as associative predictions or economic indicators.

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TECHNOLOGICAL FORECASTING

- Since the pace of technological change is so great, and since new products and processes may be keys to a company's future plans, an increasing

number of companies are emphasizing regular and complete technological forecasts affecting their industry.

- Technical forecasting may be defined as-forecasting the future technology that may affect the operations of an enterprise.
- Those companies which have gone far in developing planning premises from their technological forecasts have tended to be high-technology enterprises. What has been done in these instances is to encourage members of their technical staffs to be alert to future development; to arrange frequent contacts of suppliers customers with development staffs; to think in terms of the impact of current scientific developments on the future state of technology; and to develop orderly forecasts of how these developments affect the company's products, processes or market

— One of the attempts to make technological forecasting more accurate and meaningful is the use of Delphi technique.

— Another method used to forecast the state of technology is opportunity-oriented. It looks at the future and raises the question of whether a certain product may be made obsolete by a new development - and, if so, what development—or whether there is any technological break through that might be expected which would solve a problem seen to exist in the development of a certain product. For example, the opportunity-oriented forecast might look at the possible development of an atomic power plant for an automobile and ask whether certain known limitation will probably be solved and when. Or one might forecast when economic desalination of sea-water will occur.

— Another approach has been referred to as the goal-oriented forecast. In this case, a decision is made to reach a certain goal, the technological needs for accomplishing it are identified, and analysis is made as to when, and perhaps how, these might be accomplished. Thus, after a decision was made to put a man on the Moon by 1970, the technological requirements of so doing were identified, and time and resource estimates were made as to how to achieve the target.

Lead time:

A lead time is the period of time between the initiation of any process of production and the completion of that process. Thus the lead time for ordering a new car from a manufacturer may be anywhere from 2 weeks to 6 months. In industry, lead time reduction is an important part of lean manufacturing.

Lead time in Supply Chain Management

A more conventional definition of Lead Time in the Supply Chain Management realms is the time from the moment the supplier receives an order to the moment it is shipped. In the absence of finished goods or intermediate (Work In Progress) inventory—it is the time it takes to actually manufacture the order without any inventory other than raw materials or supply parts.

Lead time in Manufacturing In the manufacturing environment, Lead Time has the same definition as that of Supply Chain Management, but it includes the time required to ship the product to the purchaser. The shipping time is included because the manufacturing company needs to know when the parts will be available for Material requirements planning. It is also possible for lead time to include the time it takes for a company to process and have the part ready for manufacturing once it has been received. The time it takes a company to unload a product from a truck, inspect it, and move it into storage is non—trivial. With tight manufacturing constraints or when a company is using Just In Time manufacturing it is important for supply chain to know how long their own internal processes take. Example

Company A needs a part that can be manufactured in two days once Company B has received an order. It takes three days for company A to receive the part once shipped, and one additional day before the part is ready to go into manufacturing.

• If Company A's Supply Chain calls Company B they will be quoted a lead time of 2 days for the part.

• If Company A's manufacturing division asks the Supply Chain division what the lead time is, they will be quoted 5 days since shipping will be included.

• If a line worker asks the Manufacturing Division boss what the lead time is before the part is ready to be used, it will be 6 days because setup time will be included.

Lead Time

Lead time begins with the first receipt of a customer order and ends with customer receipt of the product or service. Everything in between is the lead time. The scope of the lead time can varyfor the purposes of analysis. For example, the extreme might be from the point of the ore being in the ground to the customer selecting a vehicle at the dealership. Another lead time study could be on any process within that larger extreme. This brings up an important point. The "customer" can be external or internal to an organization. The next person or process down the assembly line is the "customer" for the preceding process. Talk about who the customer is for the study area.

Independent demand situations and the use of fixed order quantity and periodic review systems

In planning, and controlling inventories forecasting is based on whether demand for items in inventories is independent or dependent

Dependent items are usually subassemblies or components parts that will be used in the production of final or finished products. Demand (i.e. usage) of subassemblies and components parts is derived from the numbers of finished product to be produced. And example is demand for wheels for new cars. If each

car is to have four wheels, then the total number of wheels require for a production run is simply a function of the
'number of cars that are to be produced in that run. For instance; if 500 cars are to be produce in a run, then the numbers of wheels required is 500 x 4 2000 wheels**.**

Independent demand items are the finished goods or other end items that are sold to someone. There is usually no way to determine precisely how many of these items wilt be demanded during any given time period because demand typically includes an element of randomness. Forecasting plays an important role in stocking decision, whereas stock requirements for dependent demand items are determined by reference to the production plan.

EOQ, Perpetual inventory, and Two- bin system etc, all deals with dependent demand.

Inventories are used to satisfy demand requirements, so it is essential to have reliable estimates of the amount and timing of demand it is important to know how long it will take for orders to be delivered. Managers need to know the extent to which demand and lead time might vary; the greater the potential variability, the greater the need for additional stock to reduce the risk of shortage between deliveries. Thus there is a crucial link between forecasting and inventory management.

Chapter four

Techniques For Dealing with dependent demands.

MRP and MRP11

MRP Material Requirements planning is a computer-based information system designed to handle ordering and scheduling dependent demand inventories. (E.g. raw materials, components parts, and subassemblies). A production plan for a specified number of finished products is translated into requirements for component parts and raw materials working backward from the clue date, using lead times and other information to determined when and how much to order. Thus MRP is designed to answer the questions: what is needed? How much is needed? And when it is needed?

To implement MRP you need:

• The master schedule: master schedule also refers to as mater production schedule, states which end items are to be produced, when they are needed, and what quantities.

• Bill—of-Materials file: BOM contains a listing of all the assemblies, subassemblies, parts, and raw materials that are needed to produce one unit of a finished product. Thus each finished product has its own bill of materials.

• Inventory Record file: This is used to store information on the status of each item by time period. This includes gross requirements, scheduled receipts, and expected amount on hand. It also includes other details for each items, such as supplier, lead-time, and lot-size, changes due to stock receipts and cancelled order, withdrawals and similar events are also recorded in this file.

• Hardware and Software: Computers and appropriate software program to handle computations and maintained records.

Advantages of MRP

• Low level of in-process inventories

• The ability to keep tract of material requirements

• The ability to evaluate capacity requirements generated by a given mater scheduled.

o A means of allocating production time.

Disadvantages of MRP

• Need to maintained accurate record in master record and BOM.

Inaccuracy can lead to unpleasant surprises, ranging from missing parts, ordering two many of some items or too few of others and failure to stay on schedule.

• It is very tedious and costly to implement MRP1

Manufacturing Resource Planning MRPII.

It represents an effort to expand the scope of production resources planning, and to involve other functional areas of the firm in the planning process specially the marketing and finance. In too many instances, production, marketing, and finance operate without comp knowledge or regards for what other areas of the firm are doing. For the firm need to focus on a common set of goals. This is the major purpose of MRP2, to integrate all functions. The rationale for having functional areas work together is the increased likelihood of developing a plan that works and with which everyone can live by. Again, because each of the functional areas is involved in formulating the plan they will have reasonable knowledge of the plan and more reason to work towards achieving it.This is where MRP2 comes into play. Next, management must make more detailed capacity requirements planning to determine whether these more specific capacity requirement can be met. Note that, MRP2 is not a replacement of MRP1 nor is it an improved version of MRP1.

DRP:

Distribution Requirement Planning is a system for inventory management and distribution planning. It is especially useful in multi-echelon warehouse system. (factory and regional warehouse) It extends the concepts of material requirements planning to multi—echelon warehouse inventory, starting with demand at the end of the channel and working that back through the warehouse system to obtain time phased replenishment, schedules for moving inventories through the warehouse network. DRP is used to plan and coordinate transportation, warehousing location, workers, equipment, and financial flows.

THE PULL OR PUSH SYSTEM

The term push and pull are used to describe two different systems for moving work through a production process. in traditional production

environments, a push system is used; when work finished at a workstation, the output is pushed to the next station, or, in the case of the final operation, it is pushed on to final inventory. In a Pull system, control of moving the work rests with the following operation, each work—station pull the output from the preceding station as it is needed; output of the final operation is pulled by customers demand or the master schedule. Thus in a Pull system, work moves on in response to demand from the next stage in the process, whereas in a Push system, work moves on as it is completed, without regard to the next station's readiness for the work. As a result, work may pile up at work stations that fell behind schedule because of equipment failure or the detection of a problem with quality.

Coping with uncertainty in achieving require service levels

To make successful and skillful decisions, a plan is essential and the key to an effective plan is a good forecast. The forecast begins with the understanding of the business cycle in the economy and the series of economic events which repeat themselves regularly and in the same basic sequence. Specific forecast consider unique characteristics of firm's economic sector, its products or services, and the items and services purchased, taken with the context of the overall economy. Historical data are essential for forecasting, as is the assumptions that what has happened in the past will continues to prevail in the future.

in order to cope with businesses uncertainties, you need to:

• Understand the economic business cycle and a sequence of events in all business cycle:

• Gather historical data in terms of price changes for the items over several economic cycles, or at least five years period:

• Assess the present economy, market and conditions for the items in order to develop a scenario for the future.

Suppliers contribution to controlling stock

1. Suppliers' suggestions can lead to important cost saving in terms of material specification and design which do not reduce product quality but reduce production cost significantly. Thus making the buyer to buy at a lower price.

2. The supplier can also present the buyer the experience of other customers who have identical production and procurement problems and how they solve them
3. Continuously meeting the buyers needs and expectations at the upon price.
4. Conformance to mutually agree upon requirements.
5. Suppliers can recommend changes in the buyer's production process that will make it blend more perfectly in its own for mutual benefits of the two.

Types of commodities and their characteristics

commodities are segregated into different forms. All these exist to facilitate the comparison of prices. Marking the variations between different types of commodities also provide room for simple research and profitable trading. Yet for several commodities types out there, it is imperative to know some basics knowledge to get started. When it comes to which one is best to trade, there are a few categories to choose from.

Commodity Types

Energies •The first commodity type in the list has been very influential in recent times. This one features several products that offer energy to power and heat homes as well as businesses. This includes crude oil, petroleum, by products of petroleum, heating oil, natural gas, propane and even coal. In this section of forms of commodities there is a minimum price tag that is fixed by the exchange along with a standard contract volume, which is the amount covered by the future contract.

Grains .The second one on the list of commodity type is grains. In this category the commodities features wheat, rice, corn, oat and soybean. It can also include certain agricultural products as well. These are stored for future trading. They always come bound with a predefined, but minimum contract size.

Soft Coffee, cotton, sugar, orange juice, and cocoa are generally regarded as soft commodities. The general mode of exchange for these commodities is the Sugar, Coffee, and Cocoa Exchange or CSCE. As oranges themselves are not traded as commodity types because eighty percent of them are

transformed into frozen concentrate, so this is what is traded instead of raw orange.

Livestock .Meat is yet another famous commodity type which includes live cattle, pork lean hogs and bellies. This is in fact where primarily, livestock have been traded. The commodity appears to be less volatile than others. A number of times this specific commodity type is dependent on grain also, as the grain feeds most of the livestock.

Financials •The last commodity types are termed as financials. This exchange also trades stocks in the form of financial commodities. There are certain types of commodities out there. There are several exchanges where these different commodities are traded. Basically commodities are products that are bought, sold and generally not processed. A lot of products that had been traded locally have now explored and the global market as well.

Chapter five
Control of Substances Hazardous to Health Regulation

The Regulations provide the legal framework for controls on exposure to hazardous substances arising from work activities. The recent publication (on April 2005) of the 5th edition of the approved code of practice on the regulations has introduced a number of significant changes, which are reflected in this policy statement.

2. Exposure to hazardous substances

The definition under of hazardous substances (substances hazardous to health) is very wide ranging and includes

(a) Substances used directly in work activities (e.g. laboratory chemicals, pesticides, cleaning products, adhesives)

(b) substances generated by work activities (solder or welding fumes.)

(c) naturally occurring substances that are present in the work place.

(d)biological agent that are associated with work.

Definition of hazardous substances

The regulation defines the following as hazardous substances

(a) Chemicals or mixtures of chemicals classified as dangerous to health under the chemicals (Hazard Information packaging for Supply) Regulations 2002. these can genenër1ly identified by the orange hazard warning label on the package and by information supplied on the materials safety data sheet (MSDS).

(b) Substances that have been assigned a Workplace Exposure Limit (WEL). These are listed in the HSE publication which is published annually.

(c) Any kind of dust, if its average concentration in air exceed the levels specified in (i.e.>1 Omgm-3 of inhalable dust or 4rngrn-3 of respirable dust, as time-weighted average exposure over an 8 hour period)

(d) Biological agents that are directly connected with work (e.g. those used in laboratories) or work activities or process (e.g. legionella bacteria from water cooling towers).
(e) Any other substances that is hazardous to health, but which does not fall into the above categories. This category includes asphyxiate gases, some pesticides and products or byproducts of chemical reactions.
What the regulation requires
(a). The regulations set out a number of duties on employers. Heads of departments must comply with these duties in respect of work activities that are under their control

(1)Assess the risks to workers (and others likely to be affected by the work) from hazardous substances present or generated in the workplace
(2) Prevent, or adequately control the exposure to hazardous substances of workers and others likely to be affected by the work.
(iii) Ensure that any control measures identified, including engineering control and personal protective equipment (PPE) are properly used and maintained. Ensure that defined working practices or standard operating procedures (SOPs), where identified as a control measure, areappropriated, workable and being followed.
(iv) Where necessary, arrange for monitoring of workplace exposures to hazardous substances.
(v) Where necessary, arrange for health surveillance for workers.
(vi) Ensure that workers are provided with information, instruction and training, so that they understand the possible effects of exposure to hazardous substances and how to use the control measures provided
(b). The regulation also set out a number of duties on employees. Employees must:
(i) Follow defined working practices or SOPs, where these are intended to minimize the risk of exposure to hazardous substances
(ii) Use all control measures (including PPE) properly and report any defects to their supervisor or line manager.
(iii) Attend health surveillance appointments at the appointed time.

The employer's duties are explained in more details below.

1. Risk Assessment

The purpose of the assessment is to identify how to prevent or adequately control workers exposure to hazardous substances. The companies' assessment pro-forma and the accompanying notes on completion are designed to help the assessment process. Other assessment formats are also acceptable (e.g. incorporating assessments into laboratory SOPs). It is usually preferable to adopt an activity-based approach to assessments, rather than making individual assessments for all substances to which workers may be exposed. The assessment should be made by someone who is familiar with the activity, who has access to relevant information and who has the knowledge and experience to make good judgments about the risks involved and the actions needed to minimize them. In many cases, further advice will be needed and this can be obtained from the departmental safety officer, area safety officer etc.

The assessment must be carried out before work with hazardous substances takes place. It must consider the following points.

(a) Is it likely that a work activity could endanger someone's health? The assessment should

(i) Consider the substances that are present, used or produced

(ii) Identify the properties of the substances (e.g. are they volatile, or dusty)

(iii) Identify the hazard associated with those substances (e.g. are they toxic, harmful, irritant?)

(iv) Identify possible exposure routes (e.g. by inhalation, skin absorption, ingestion from contaminated hands)

(v) Identify all those at risk of exposure (e.g. workers, cleaners, maintenance staff, other visitors)

(vi) Pay special attention to those who may be usually vulnerable, either by virtue of their physical condition (e.g. pregnant or nursing mothers: or people with certain

medical conditions). Or because their relative inexperience requires a high degree of supervision (work experience or undergraduate students)

The information provided on safety data sheets will help in assessing points (i) to (iii). However, safety data sheets do not, in themselves, constitute a assessment, as they take no account of the circumstances in which the substances are used.

(b) Have significant risks of exposure been identified?

If so, then control measures will need to be specified. In general, engineering controls such as laboratory fume cupboards or local exhaust ventilation (LEV) for woodworking machinery and for welding or other fumes are already available, although the assessment may identify the need for more. Personal protective equipment (for respiratory, skin or eye protection) may also be needed, as may be specified by working procedures.

(c) Should the assessment be recorded?

In general, it should, although the information recorded should be proportionate to the risk identified. For work using substances commonly found in offices (e.g. correcting fluids, adhesives, photocopier toners), it is sufficient to make a generic assessment. This can be done by listing the substances, noting that they must be used in accordance with the suppliers or manufactures instructions, and concluding that their use in this way presents little or no risk to health. A more comprehensive record will be needed occasionally where works presents a greater risk to health and the assessment form should be used.

(d) Does the assessment have to be reviewed?

The assessment is intended to be a working document and it must be reviewed if there is an evidence that it is no longer valid (e.g. following a change in the substance or the form of a substance used in a procedure, or a major change in work practices; following defects or a breakdown in control measures, where results of health surveillance have identified work-related ill health; where there is new information on the health effects of exposure to a substance)It is good practice to carry out periodic reviews of assessments. As a minimum, assessment rnay be reviewed every five years.

2. Control of exposure and control measures.

The regulations set out a hierarchy of control, which must be followed.

(a) Prevent exposure to hazardous substances where reasonably practicable, e.g. Note that where tight-fitting respiratory protective equipment (RPE) is provided as a control measure, then face fit testing will be required.

3. Use and maintenance of control measures

If they are to be effective, control measures must be properly used and departments must have adequate supervision arrangements in place to ensure compliance. Workers also have a duty to use control measures properly and to report any defects (in equipment, PPE or working practices) to their supervisor.

Control measures also need to be maintained to ensure they are still effective.

(a) Users should check before use that there is an inward airflow to their LEV (e.g. by using a tissue or ribbon tell-tale), or that any display or indicators provided on the equipment are confirming proper operation.

(b) LEV must be maintained according to the manufactures instructions.

(c) LEV must be thoroughly examined and tested at least annually by a competent person.

(i) In the case of microbiological safety cabinets, regular test are the responsibility of the department, which must be carried out according to the companies Biological Safety Policy using competent contractor.

(ii) In the case of ducted fume cupboards, this service is provided through the company's estate department.

(iii) In the case of other LEV, a thorough examination and test is provided through the companies Insurance Section. Department are responsible for ensuring that the Insurance section has up to date information about the inventory of equipment that needs testing.

(d) Where RPE (other than disposable RPE) is provided, then this must also be maintained, examined, and test according to the manufacturers recommendations.

4. Monitoring of exposure

Where techniques exist, monitoring of airborne containments may occasionally be required, for example:

(a) Where failure of control measures may result in a serious health effect

(b) Where it is necessary to check that a WEL has not been exceeded.
(c) Where it is necessary to check the effectiveness of control measures (e.g. where a case of work-related disease has been diagnosed).
The Safety office can advise when monitoring is required and will make the appropriate arrangements**.**

5. Health surveillance

Health surveillance is intended to protect individual employees by the early detection of work-related adverse health changes, to help the efficiency of control measures; and to evaluate hazard to health by collecting and analyzing data.
(a) When is health surveillance required? Health surveillance will be required in the following circumstances.
(i) Where workers are exposed to hazardous substances that is linked to an identifiable disease or adverse health effect; and
(ii) Where there is a reasonable likelihood that the disease or health effect may occur under the particular conditions of their work; and
(iii) Where there is a valid techniques for detecting disease or health effect.

(b) Occupational Health Service (OHS) registration.

Where the criteria in (a) are met, department must register workers with the OHS. Work with the following classes of hazardous substances may require registration, depending on the **circumstance of exposure**:
(i) Substances of recognized systemic toxicity (i.e. those that can be inhaled, ingested, or adsorbed through skin or mucus membranes and affect parts of the body other than those where they entered), e.g. metals like mercury, thallium, lead and their salts.
(ii) Substances known to cause occupational asthma, e.g. laboratory animal excreta, colophony (rosin-based solder flux fume), some wood dusts, glutaraldehyde, some plant pollens.
(iii) Substances known to cause dermatitis or severe irritation of the mucous membrane.
e.g. nickel, cobalt, arsenic and chromium compound; some adhesives or their components.
(iv) Some pathogens or genetically modified organisms.

Where workers are registered with the OHS, departments will need to provide the OHS with adequate information so an appropriate health surveillance programme may be devised. This will include the properties ties of substance, the potential exposure routes, the intensity, frequency, and duration of exposure, and any other information that may be considered relevant. The OHS or the Company Safety Office will advise in case where there is any doubt about the necessity for health surveillance. Departments should ensure that individuals are registered with the OHS whenever there has been a change in exposure and that the OHS is notified when exposure ceases. Where no such changes have occurred, then individuals should be re-registered every two years.

(c) Health Records

The format of the record of health surveillance (the health record) is prescribed by. It does not include clinically confidential information (i.e. it is not a medical record). The OHS keeps these records on behalf of the company and they will be retained for at least 40 years.

The OHS will inform individuals of the results of their surveillance. They will also inform departments of the collective result of health surveillance, so as to provide assurances about workers continuing fitness to work.

(**d) Health Surveillance Appointments**

In order to provide more meaningful information to departments to use in reviewing the control measures, the OHS will attempt to assess groups of workers from the same working environment at the same time and, wherever possible, at a location close to their workplace.

If this is not possible, then appointment will be offered at an OHS centre Attendance for health surveillance is compulsory and departments are responsible for ensuring that their staffs attend. Failure to attend will result in steps being taken to ensure that the worker is removed from the work that requires health surveillance.

(e) instances of Suspected Ill Health.

If an individual (either between planned health surveillance appointments, or not undergoing health surveillance at all) shows symptoms that may be associated with exposure to a hazardous substances then they should report

this to their supervisor and the department should refer them to the OHS. Alternatively, they may wish to self-refer to the OHS. Where an individual is given a medical certificate linking sickness absence to possible work-related

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Whenever health surveillance indicates that ill health may be associated with exposure to hazardous substances, then the department, together with the safety office and the OHS, must I review the control measures. Every effort will be made to allow individuals to continue with their work, using appropriate control measures. Where this is not practicable, then the individual will be removed from further exposure and further risk to their health.

6. information, instruction and training

Departments must provide those working with hazardous substances with the information contained in the assessments and SOPs relating to their work. Where appropriate, they must also be provided with information about the health surveillance process (including the purpose of health surveillance, their duty to attend for health surveillance on the appointed date and the arrangement for access to their health records).

Departments must also provide instruction and training so workers know

(a) When and how to use the control measures provided

(b) How to use PPE, and especially RPE, correctly (e.g. how to fit and remove gloves and masks; how long to use disposable gloves and masks before they must be replaced)

c) how to clean and store reusable PPE, including RPE
(d) How to act in an emergency involving hazardous substances.
7. Prohibitions on certain substances
The regulations impose prohibitions certain substances. The relevant prohibitions for the company are:
(a) The use or production for any purpose of 2-napthylamine; benzidine; 4-aninodiphenyl; 4- nitrodiphenyl, their salts; and any substance containing any of these compounds, in a total concentration 0.1% by mass
(b) The use of sand or other substance containing free silica as an abrasive for blasting articles in any blasting apparatus

Chapter six

Analysis of Optimum Location For Storage And Warehousing Facilities

A simple definition of a warehouse: 'A warehouse is a planned space for the storage and handling of goods and materials 'In general, warehouses are focal points for product and information flow between sources of supply and beneficiaries. However, in humanitarian supply chains, warehouses vary greatly in terms of their role and their characteristics.

Global Warehouses

The global warehousing concept has gained popularity over the last decade as stock pre-positioning becomes one of the strategies for ensuring a timely response to emergencies. They are usually purpose built or purpose designed facilities operated by permanent staff that has been trained in all the skills necessary to run an efficient facility or utilizing 3PL staff and facilities. For such operations, organizations use, information systems that are computer based, with sophisticated software to help in the planning and management of the warehouse. The operating situation is relatively stable and management attention is focused on the efficient and cost effective running of the warehouse operation. Numerous organizations have centralized pre-positioning units strategically located globally. Some of these offer extended services to other humanitarian organizations on a cost plus operating charges basis.

Field Warehouses

They are usually temporary in nature. They may be housed in a building which was not designed to be used as a warehouse or in a temporary building/structure, in mobile units such as rub halls, Wok halls and sometimes are little more than a tent in a field. The initial staff may be a casual workforce that has never worked in a warehouse before and the

inventory system is more likely to be paper based. Often the situation is initially chaotic, sometimes dangerous coupled with a humanitarian need which may be very urgent. The management style must therefore be practical and action oriented with a focus on making the humanitarian goods available as quickly and efficiently as possible, but yet at the same time accountable.

Policies and Procedures Policies

The policies contain hard and fast rules and regulations that define the general conduct of the warehouse operation. Examples of the types of policies that organizations will define are as follows:

- organizational specific warehouse management policy and procedures guideline outline
- health and safety
- human resources management
- security
- pest control
- warehouse maintenance and cleaning
- quality control
- record keeping and reporting
- reverse logistics— Return of goods and exit strategy in the event of downscaling or shutting down operations
- disposal of obsolete and damaged goods.

Procedures

The procedures' document defines step by step how the activities in the warehouse should be carried out and clearly defines the processes to be adopted. These can be adopted as 'best practice'. The procedures provide visibility of the operations for managers and donors.

However, in creating such procedures, care must be taken to avoid constraining the use of local initiative which might be required to deal with local conditions. Procedures should be considered as streamlining the business processes and providing checks and balances. They provide

guidance to warehouse managers and must have some level of flexibility to cater for unique situations, than to be rigidly can be achieved by limiting the level of detail that the procedures document defines, allowing flexibility and/or by arranging 'dispensations' to allow departure from the procedures in local performance, especially in emergencies. The procedures will normally provide the guidance on how to manage each aspect of warehousing and may cover:

• receiving and issuing of supplies;
• quality control or verification;
• storage of goods;
• how to control stock movement (stock control);
• documentation flow;
• how to detect and deal with stock losses;
• how rejected material will be managed; and

Types of Warehouse Space

• Commercial: in rented building used for business.
• Government or state: such as at the ports or harbours. This is common in emergency
• Transit: for temporary storage of goods destined for different locations and need very short time.
• **Bonded warehouses**: for storage of goods whose duty is unpaid and especially where the goods are destined to another country. pre-position stock is often held in bonded warehouses so that export is quick and can be stored for long periods sometime.
• Open storage: not ideal for perishable products but in emergencies, sometimes the only alternative.
• Space that is owned and managed by the organization.
• Pre-fabricated warehouses where there are no permanent structures available. This is common practice in emergencies.

Basic Principles of Warehouse and Inventory Management

• Planning inbound receipt procedures.
• Storage formalities e.g.:
o location management

o inventory control
o occupational heat hand safety
.Outbound delivery Procedure

How to select and set-Up a Warehouse

Determining Needs

In determining needs, one should look beyond the basic need of a warehouse to things whilst this is correct there are also other Consideration
• the volume of goods;
• speed of through put required;
• as a transit point;
• breaking bulk location;
• an area for sorting and consolidating different goods;
• to enhance the speed of the response;
• to protect and account for inventor; and
• as a buffer in the event of a break-down or delay in the supply pipeline.
Determining Storage Requirements
Selecting a Suitable Location
There are a range of factors to consider when deciding on the location of a new warehouse facility and these may vary depending on whether you are selecting a location for a temporary building or selecting from one of a number of existing buildings.
These may include:
• proximity to ports of entry and beneficiaries
• existing buildings
• security
• the context
• site condition
• access
• services
• land size available

• purpose of warehouse
• previous use of the facility
• floor weight
• access to labour

Warehouse Selection

Factors to consider:

• nature and characteristics of goods to be stored;
• nature of handling equipment available;
• duration of storage needed i.e. short term or long term;
• the need for other activities, e.g. repackaging, labeling, kitting, etc;
• access and parking for vehicles;
• number of loading docks required; and
• secure compound.

Warehouse Preparation Planning

Space layout

The areas that should be planned are both the general storage areas and the areas for goods receipt, consignment picking and goods dispatch. It is also desirable that space should be set aside for the following activities:

• equipment maintenance and parking;
• charging of equipment batteries such as pallet trucks;
• refueling of trucks;
• an area for garbage disposal e.g. empty packaging;
• a quarantine area for keeping rejected goods, goods to be sent back or destroyed;
• an employee rest area;
• washroom; and
• an administration office.

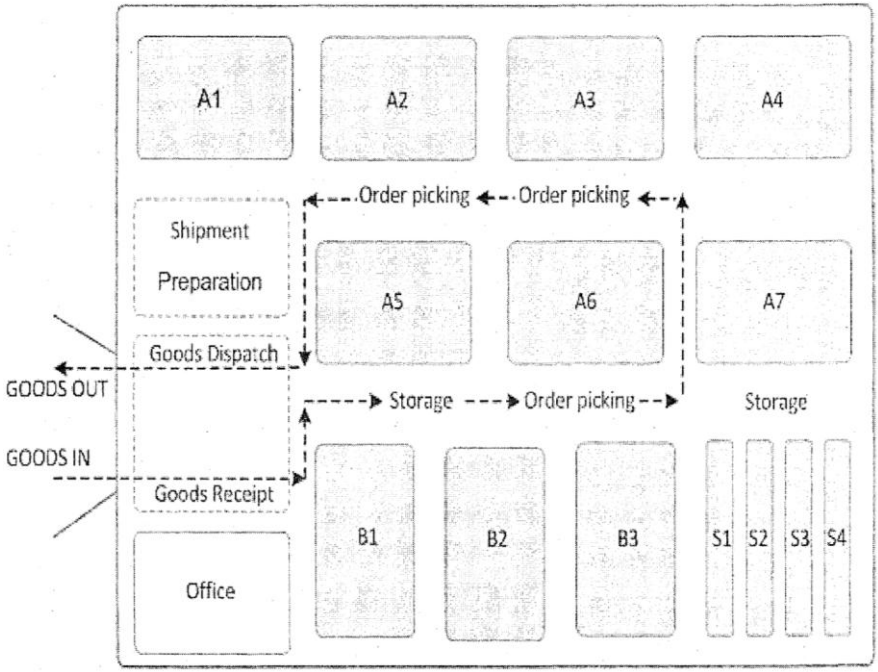
Planning

It is worth keeping these requirements in mind during the planning of the main operating areas. Planning consideration needs to be given to the following:

• allocate space for each type of product and locating number;
• allow sufficient space for easy access to the stacks for inspecting, loading and unloading. Stacks should be one meter from the walls and another meter between stacks;
• sizing the goods receipt and dispatch area;
• allow space for storage of cleaning materials and supplies;

• allocate areas for damaged items by consignment number;
• allow sufficient space to repackage damaged items and place it in separate stacks;
• sufficient free space is needed to operate a warehouse effectively. When planning the size of a warehouse consider:
o planning on having about 70-80% utilization of available space, whilst considering:
o throughput rate
o number of sku
o handling characteristics of items, etc.
Special storage needs
Some relief items require special attention in terms of the type and security of the storage area. For example:
• Medical supplies and drug shipments can contain a large number of small, highly-valued and, often, restricted items, many with a limited shelf-life. Thus, a secure area is required, as well as judicious attention to expiry dates.
• Hazardous products such as fuels, compressed gases, insecticides, alcohol, ether and other flammable, toxic or corrosive substances must be stored separately, preferably in a cool, secure shed in the compound but outside the main warehouse.
• Antibiotics and vaccines may require temperature-controlled cold storage arrangements, with sufficient capacity and a reliable, as well as a back-up, power source.
• With combustible items, such as alcohol and ether, specific attention is required when storing and handling. Inventory management techniques need to be implemented to prevent wasteful surpluses and to ensure proper stock rotation to avoid costly losses due to expired goods. Procedures for controlling, preserving and releasing medical supplies and drugs should be established in consultation with the medical experts.

Space utilization and handling



Al to A7 - Household and shelter materials

B1 to B3 Medical Equipment

SI to S4 Camp Supplies

Diagram 1: Space utilization

As shown above, the warehouse operation is composed of four key work activities:

• goods receipt

• storage

• picking

• goods dispatch

To estimate the resource requirement for the whole warehouse, one should start by estimating the requirements for each of the key work activities in turn and the level

of demand. Then, the resource requirements for all activities should be combined together, taking into account the way that the activities are phased during the working day, in order to make an estimate of the total resources required.

Aspects to consider when managing Warehouse Operations

- planning the workload
- allocating resources
- space utilization & handling
    - o receiving goods;
    - o storing goods.
- assembling consignments
- dispatching consignments
- disposal of goods
- pest control
- security
- inventory management
- handling and stacking techniques
- occupational health and safety

Managing Inventory Levels

It has been established that the role of inventory management is to ensure that stock is available to meet
the needs of the beneficiaries as and when required.

Inventory represents a large cost to the humanitarian supply chain. This is made up of the cost of the inventory itself, plus the cost of transporting the goods, cost of managing the goods (labor, fumigation, repackaging, etc) and keeping the goods in warehouses. The inventory manager's job is to make inventory available at the lowest possible cost.

In order to achieve this, the inventory manager must ensure a balance between supply and demand by establishing minimum holding stocks to cover lead-times. To achieve this, the inventory manager must constantly liaise with the programs to keep abreast of changing needs and priorities. The warehouse must always have sufficient stocks to cover the lead-time for replacement stocks to avoid stock-outs.

Inventory Control

There are two methods of inventory control that are applicable to emergency situations: -

1. reorder level policy
2. reorder cycle policy.

Both are applicable to humanitarian situations and have associated pros and cons. Note that EOQ in practice only works in a fairly stable environment where demand variability and replenishment lead-time are reasonably stable and predictable. This is not the case in an emergency. Economic order quantity is applicable in more stable environments such as refugee camps and perhaps later in a relief/recovery phase.

Inventory management in an emergency is more 'project based', matching supply with demand in a rapidly changing environment. This requires building a supply chain that has a high level of flexibility and adaptability, with rapid identification of need and rapid fulfillment of that need through the supply chain.

In managing this sort of system, inventory should be considered in relatively small quantities (inventory packages of associated relief items) that are attached (pegged) to an identified need then moved (and tracked) through from source to the identified need (the user).

Optimization comes from having logistics systems that can configure, procure and consolidate these

packages quickly and at least cost and a distribution chain that is flexible and can adapt to changing requirements quickly and at least cost.

Information systems that facilitate transparency of the supply chains inventory levels and location + peg supply to demand provide the visibility necessary to facilitate good planning and decisions that maximize service and reduce cost.

Stock control and movements

The warehouse/inventory manager is responsible for monitoring the movement of goods as they are transported from the supplier and for the control of stock movement in the warehouse facility. The vital stock control measurements include:

• establish levels of operating stocks based on consumption/rate of usage. The stock levels shall be reviewed from time to time depending on current needs.

• ensure that weekly and monthly stock balances reports of each stock item and the total value are prepared;
• maintain monthly stock usage report of each item kept in the store and the overall in the usage trend in last six months;
• review and report on six monthly basis slow moving items indicating the last movement date the unit value and total value and liaise with user department;
• establish quantity, lead -time and availability of each item supplied on the market;
• keep a record of all non- stock items received from suppliers, returned to suppliers and issued out to users.

Monitoring Goods in Transit

• order lead time
• tracking orders for goods
• controlling stock movements:
    o establishing minimum stock levels and monitoring the same;
    o goods receipt quality inspections;
    o physical stock control in the warehouse;
    o controlling Specialized Items; and
    o releasing stock from storage and goods dispatch.

To facilitate and account for movement of stocks the following documents could be used:

• delivery notes or waybill samples or packing list samples
• goods received notes,
• stock card
• bin card and
• consignment notes.

Stock Records - Documentation

• stock identification
• stack cards,
• bin cards
• stock Checks: see inventory section for different samples or in the Annexes
• stock loss reporting
• reporting of stock levels.

Resource Requirements

In addition to the work methods, equipment and space requirements it is essential that the warehouse is adequately resourced. This is done by planning or estimating

the requirements for people and equipment in order to operate the warehouse facility.

There is a trade-off to be made between the people and handling equipment requirements for any given workload.

In global warehouse operations, which are run like commercial operations, the focus is on minimizing the cost of running the operation. In this situation, it is often better to invest in handling equipment and reduce the dependence on people resources.

However, in field operations, many humanitarian organizations prefer to hire local labor which provides employment instead of relying on handling equipment.

The requirement for the total amount of resources required will be determined by the amount of goods flowing into and out of the warehouse, as shown in the diagram below.

Basic Warehouse Equipment

Various types of equipment are required to ensure the smooth execution of work in a warehouse. All equipment should be properly stored when not in use and a regular maintenance schedule posted. Warehouse staff should be trained in standard daily maintenance practices and the correct use of equipment. Where necessary, they should be equipped with personal safety equipment such as work gloves, work boots, goggles, etc.

Required equipment may include:

• sufficient quantities of standard forms, calculators and stationery to keep proper storage records;

• small tools for opening cases, such as hammers, pliers, crowbars, steel cutters;

• tools and materials for store repair and simple maintenance;

• supplies for reconditioning damaged packaging, such as bags, needles, twine, oil containers, stitching machine, strapping machine, adhesive tape and small containers or cartons;

• a sampling spear for inspecting foodstuffs;

• scales for weighing goods;

• standard wooden pallets in sufficient numbers — ideally, international standardization organization's ISO type (120 x 80cm);

• two-wheel hand trolleys for moving supplies within the warehouse;

• a pallet-jack to move pal lets;

• a forklift where pallets are to be loaded and offloaded from trucks;

• brooms, dust pans, brushes, shovels, sieves, refuse bins for cleaning and disposing of collected waste;

• first aid kits, flashlights, fire extinguishers and Other fire-fighting equipment both inside and outside the warehouse;
• weighing scales; and
• ladders.

Care of Warehouse equipment

Warehouse equipment is maintained to prevent accidents and breakdowns from occurring. Maintenance activities consist of inspections, regular servicing and monitoring performance for failure trends, as this will enable symptoms to be recognized before failure occurs. Equipment maintenance has a strong health and safety bias. Often health and safety legislation will impose on management an obligation for safe systems of work. Ensuring safe policies and procedures of work will require an examination of men, machinery, methods, materials and environmental aspects. Some areas to pay attention to:
• planned maintenance
• maintain equipment
• maintain building
• completion of maintenance records

Legal Considerations

Leasing Temporary Warehouses/Contracting.

The common practice in emergencies is to lease or rent, not purchase warehouses. In this situation. there is often a shortage of suitable buildings or locations for warehouse space and this can often cause the costs to increase significantly. Therefore, it is often necessary to utilize temporary warehouse space for as short a time a possible.

Care must be taken with the drawing up of the lease agreement with the owner. The following items are basic inclusions in a lease agreement:
• the cost for the lease;
• the duration of the lease agreement;
• exit clause: the period of notice required for terminating or extending the lease period. Confirmation of the existence of property insurance, covering third-party, fire, water damage, window breakage, etc;
• details of any security arrangements;
• a detailed inventory of any equipment, fixtures and fitting included with the building and detailed description of their condition;
• confirmation of either sole tenancy or details of other tenants;
• information about the ground or floor strength per square metre;

• the weight capacity of any equipment such as forklifts, racks and shelves;
• in situations where neutrality is important, care must be taken to establish the actual owner of the building, which might be different from the 'lessor' of the building e.g. the military, religious groups or government;
F***orce majeure;***
• indemnity; and
•insurance.

LOCATION AND LAYOUT OF STORE

Location

1. Location of the stores should be carefully decided and planned so as to ensure maximum efficiency.
2. The best location of stores is one that minimizes total handling costs and other costs related to stores operation and at the same time provides the needed protection for stored items and materials.
3. Store location depends upon the nature and value of the items to be stored and the frequency with which the items are received and issued.
4. In general, stores are located close to the points of use

Raw materials are stored near the first operation, in-process materials close to the next operation, finished goods near the shipping area and tools and supplies in a location central to the personnel and equipment served.

.5. All departments should have easy access to the stores and especially those which require heavy and bulky materials should have stores located nearby.

6. In big industries having many departments, stores department possibly cannot be situated where it is convenient to deliver materials to all departments and at the same time be near the receiving department ; thus it becomes often necessary to set up substores conveniently situated to serve different departments.

This leads to the concept of decentralized stores.

7. In decentralized stores system, each section of the industry (e.g., foundry, machine shop, forging, etc.) has separate store attached with it ; whereas in centralized stores system, the main store located centrally fulfills the needs for each and every department.

— Advantages of centralization of stores

(i) Better supervision and control.
(ii) It requires less personnel to manage and thus involves reduced related costs.
(iii) Better lay out of stores.
(iv) Inventory checks facilitated.

(v) Optimum(minimum) stores can be maintained.
(ii) Fewer obsolete items.
(vii) Better security arrangements can be made.
— Advantages of decentralization of stores
(I) Reduced material handling and the associated cost.
(ii) Convenient for every department to draw materials, etc.
(iii) Less risk of loss by fire or theft.
(iv) Less chances of production stoppages owing to easy and prompt availability of material, etc.
An idea about the disadvantages of centralized and decentralized stores can be had from the advantages of decentralized and centralized stores (as explained above) respectively.

Layout

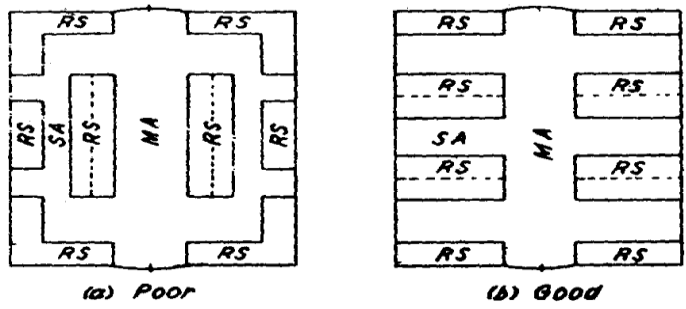
1. A good stores layout practice is one which usually brings the point or origin, store-room and point of use in adjacent and proper sequence for best flow of material.

2. Stores layout should be planned with the following objectives,
(i) To achieve minimum wastage of space.
(ii) To achieve maximum ease of operating.
3. Before planning the stores layout
(a) Classify' all store items as follows,
(I) By measurement (i.e., size)
(ii) By quantities (i.e. No. and weight) to be stored.
(iii) By frequency of handling.
(iv) By (material) handling arrangements.
(v) By possibility of perishing the items and the susceptibility to damage.
(b) List the available storage space

(i) Plat form	(v) Bins
(ii) Floor space	(vi) Trays
(iii) Racks	(vii) Drums
(iv) Shelves	(viii) Barrels

(c) Determine the sequence of laying out storage space for locating the materials
(I) A Unit. It is the smallest space for storage which is given a particular identity.
(ii) A Tier. A Tier consists of a number of units placed vertically.

(iii) A Row. A row consists of a number of units joined together and spread horizontally.
(iv) A section. A section is made up of a group of rows.
(d) Study the size and shape of the space available for laying out the stores.
4. The following factors should be considered while planning the stores layout;
(a) A section adjacent to the store-room should be kept reserved for the receipt of materials and for its inspection before storage.
(b) Store layout should be such that it provides for easy receipt, storage and disbursement of materials, preferably, nearest to the point of use.
(c) Store-room layout should minimize handling and transportation of materials.
(d) An ideal store-room layout makes optimum utilization of the floor space and height.
(e) Shelves, racks, bins, etc., should be situated in clearly defined lanes, so that items are quickly stored and located for physical counting or issuing.
(f) Main lanes or aisles should usually be between 1.5 and 3 metres wide, depending upon the type of material and the amount of traffic involved.
Sub-aisles between racks and bins may be a minimum of 80 cm wide.
(g) Storage spaces should be clearly marked to ensure easy and quick identification.
(h) Storage space should be adequately protected against waste, damage, deterioration and pilferage.
(i) A place for storing a material should be decided depending upon the material characteristics, e.g. fuels and flammable gases will require separate locations, cement, welding electrodes and ferrous parts need a dry place for storing, etc.
— Portable and salable items should be stored in areas enclosed with wire-mesh partitioning so that all unauthorized persons can be kept outside that area.
(j) Store layout should be such that for its efficient operation it can make use of modern material handling equipments such as fork-lift conveyors, etc.
(k) Store layout should be such that the storekeeper is not compelled to put newly arrived material on the top of the old. As a rule, all the old stock should be consumed first before using the new one.
(1) Due space (20 to 25%) should be left in each portion of the store to allow for expansion. the fig. below show a poor and a good layout of storage space.



MA-Main aisle
SA-Side aisle
RS-Racks, shelves, platforms, etc.

A Store Space Layout

STRUCTURE OF SUPPLY CHAIN MANAGEMENT

In its simplest form, SCM system can be described as a linked system of operations and stock points. The essential building blocks of the system are stock point, transportation operations, manufacturing and processing operations, communication link and control centers. The steps involved in the SCM system are as follows:

(a) Finished products are produced against procurement orders and may be either:

(i) Made to stock, i.e. produced to replenish the inventory in the distribution point or the sales point, or

(ii) Made to order, i.e. produced only after receiving a customer order.

(b) The procurement orders are sent to the location which can best provide a delivery promise. Finished products are patched from the production point, either

(i) Directly to the customer, or

(ii) To the distribution point in transit for further shipment to a selling point, or

(iii) Directly to the selling point, or

(iv) To the distribution point for stocking.

Various levels of stocking, or 'echelons' as they are called, are created in typical SCM systems.

Typical SCM System

There are three typical SCM systems, viz.

(a) Echelon Systems
(i) Multi-Echelon System
(ii) Safety stock systems - Independent & coupled
(b) Direct Systems
(c) Flexible Systems
(a) Echelon Systems
(i) Multi-Echelon System: A multi-echelon system essentially involves a number of warehouse. These can be either break-bulk warehouse or consolidation warehouse. Break-bulk warehouse receive large volume shipments and sort out for services to individual customers (e.g., wholesalers), whereas consolidation warehouses receive small lots at a central point and ship large
(e.g., freight forwarders)
The demand for the product is generated in multi-echelon distribution system at the lowest echelon, i.e. at the consumer's level and is transmitted upward to the manufacture through the intermediate levels, i.e., distributors or intermediate warehouse. In this respect, it differs from p multi-echelon manufacturing system in the sense that the demand arises in the level of the, finished product and is transmitted downwards through the demand for the semi-finished products and then for the raw materials.
(ii**) Safety Stock System**: Safety stock systems are created because of uncertainties in consumption as well as lead time, procurement lead time, transit lead time. In an independent safety stock system, a major portion of the safety stock in stored in the central warehouse, and in a coupled safety system, the major portion is located at the remote warehouse, which is also associated or 'coupled' with the procurement system, hence, the name. The formed system offers protection against demand variations during transit as well as procurement lead times. It is to be noted, however, that this only reflects the degree of centralization of physical inventory and not of inventory control, i.e., centralized inventory control is retained in the central warehouse.
The choice of the safety stock system depends on the demands of the situation. For instance, if there is a value addition to the product between the central warehouse and remote warehouse, an independent safety stock system is to be preferred. On the other hand, if a long lead time item or one which required fast service is involved, a coupled system is favored.

A coupled system 'pulls' the inventory from the central warehouse to the remote warehouse, since it is the latter which generates the demand. An independent safety

stock system, on the other hand, 'purchase' it from the central to the remote warehouse, since the procurement process is initiated by the central warehouse.

Classification of Multi-Echelon System:

The classification of multi-echelon system is made according to:

(a) **Degree of Certainty of Demand**: The classification of an inventory model according to the degree of certainty of demand follows from the consideration as to whether it is a 'deterministic' model, or a 'stochastic' one. In deterministic model, external demands of each facility are known with certainty. In the stochastic model, the demands are assumed to be known with a given probability distribution.

(b) **Number of Products**: A single product mode deals with only one product at a time assuming no interaction between products, i.e., all products are dealt with independently. In a multi-product model, there is at least one interaction variable between products, e.g., budget constraints, storage limitations, etc., leading to mutual adjustment in stocking levels.

(c**) Nature of Product**: The consideration here is whether the product is consumable or repairable. In a repairable model, the items issued to meet external demands are regenerated partly or wholly in the system after repair. In the case of consumable product models, they are permanently lost to the system.

(d) **Consistency of External Product**: In a stationary model, parameters used to define external demands are assumed to remain the same over period of time. In a nonstationary model, this may vary from time to time.

(e**) Mode of Review**: The mode of review of the inventory level would obviously affect the safety stock. A system based on the re-order level ('Q' system) would require less safety stock than one which follows a fixed review period ('P' system), since the later has to provide also for the consumption during the review period.

(J) **Backing Policy**: In backlog model, an unsatisfied demand is added on to the demand for the next indent, whereas in 'no backlog' models an unsatisfied demand is assumed to be lost. (In the army ordnance corps non-supplied Quantity is added as 'dues out' for clothing etc., items, whereas as expendable stores like soap washing etc., are notconsidered.

Parameters of an Echelon System:

The factor affecting an echelon system are:

(a**) Consumer Demand**: This parameter would rather be called 'Frequency of Consumer Demand'. If an item is demanded less often than a particular minimum frequency, it will not be stocked, i.e., there will be no surge inventory in-transit quantities. On the other hand, if a item is required regularly at all levels of supply, it will be distributed throughout pipeline.

(b**) Number of Echelon in the Network**: The average amount of stock in the supply system or pipeline will increase with the number of levels in the system with the result that there will be 'surge', additional handling and delay. What is now, every one is striving to reduce.

(c) **Lead (Time & Distance) between Supply and Demand Points**: Greater lead, in terms of time as well as distance, will mean greater amount of pipelines or in-transit inventory.

(d) Maintenance Philosophy: Each repair point will build up a stock of repairable and in process inventory. The total maintenance float will generally be greater for a system with more levels involved. 'Modular replacement can reduce the number of items on inventory'. Applicable to prevent fire maintenance.

(e**) Response Time**: Response to demand cannot always be prompted instantaneously. One has to contend with a time lag between the demand and the response time, or 'system inertia'. This, however, cannot be confused with 'lead time' which reckoned after the system has responded to the demand.

(f**) Associated Costs**: Costs involved in this system are acquisition costs, transportation costs and inventory maintenance costs.

(g) **Fluctuating Demands**: Variations in the quantity of demand, like, fluctuation in frequency of demand enumerated as the first of the factors mentioned herein, would also affect the stock levels.

Direct System: A direct system is the antithesis of an echelon system, i.e., it involves no intermediary levels. It is characterized by high-speed transportation.

Flexible System: A flexible system represents a combination of both the echelon system and direct system, the choice being dictated by market condition

Inventory planning for retailing.

In recent years, power within most supply chains for consumer products has lain very firmly in the hands of retailers rather than manufacturers. This has applied to all but the strongest

brand names. If anything, this power has continued to increase even further, and so far the development of internet and home shopping has had little if any impact in changing this. Many retailers have tended to outsource their distribution and logistics activities but, although this continues to be the case, retailers are now taking a much closer interest in the impact an effective logistics operation can have on their overall service offering and consequent company profitability. This applies to distribution and also particularly to inventory management policy and practice.

Inventory management at distribution centre (DC) level for both retail national distribution centres (NDCs) and retail regional distribution centres (RDCs) poses similar problems to those experienced by manufacturers. At the retail store, however, inventory requirements can be quite different, depending on the product availability strategy and the merchandising policies that are used. New types of inventory management systems have been developed to cater specifically for these different requirements. Some of these approaches have significant similarities, but the overall aim is to promote the greater visibility of information within the supply chain, to enable inventory to be reduced and to enhance customer service in terms of product availability. The main planning techniques are:

Vendor-managed inventory (VMI). This is where the manufacturer is given the responsibility for monitoring and controlling inventory levels at the retailer's DC and in some instances at the retail store level as well. Specific inventory targets are agreed, and it is the responsibility of the manufacturer to ensure that suitable inventory is always available. Such arrangements depend on accurate and timely information, and suitable computerized systems have become available in recent years. The main advantage for retailers lies in the reduction of operating costs and also the delay in payment for the products in question. For manufacturers, it is suggested that running a VMI system for a retailer provides the opportunity to develop a much closer, and hopefully more binding, relationship with the retailer as well as giving a much better visibility of real demand. This can make the planning of production much easier and can lead to significant reductions in inventory holding right through the supply chain.

Continuous replenishment (CRP). The aim with CRP is to develop free-flowing order fulfillment and delivery systems, so that pipeline inventories can be substantially reduced. Such systems use up-to-the-minute point-of-sale information

(via electronic point-of-sale — EPOS— systems) to identify real-time demand and to pull product through directly from the supplier, through the DC and on to the retail outlet. CRP systems are thus able to synchronize this flow of product by focusing on end-user requirements via the use of real-time demand, linked to flow-through distribution systems that allow for cross-docking, store-ready packaging and automated handling. Once again, pipeline inventory is kept to a minimum or completely eliminated.

Quick response (QR). A further development of the JIT approach is that of quick response (QR). Here the aim is to link the manufacturer more closely to the actual demand at the retail level. There are strong similarities with continuous replenishment systems, but with QR the emphasis is on time compression and the opportunity for the manufacturer to redesign production operations to allow for a 'little and often' approach to resupply. Short production changeovers and small batch sizes enable the manufacturer to respond to changes in demand in a very short timescale. A classic example is the Benetton operation. This demonstrates most of the key characteristics of a QR system. It has allowed the company to offer an extremely responsive supply to its retail outlets to reflect the fast-changing nature of the fashion industry. Figure 13.6 provides more information.

Efficient consumer response (ECR) is another concept that uses the most recent advances in information technology to allow a streamlined approach to the supply of products to retail stores. ECR was originally set up and run in the USA with the aim of improving service and reducing costs in the grocery industry by focusing on the efficiency of the supply chain as a whole rather than on individual components in individual companies. The goal of ECR is therefore to develop a customer-driven system that works across the supply chain. One original definition is still very applicable today: 'A seamless flow of information and products involving manufacturers and retailers working together in joint planning and demand forecasting. Both sides might take on functions traditionally handled by the other if they can do it better and at a lower cost' ECR combines a number of different concepts and strategies. The basic tenets of ECR are:

• a heavy use of EDI for exchanging information with suppliers;

• an extremely efficient supply chain using cross-docking and direct store deliveries, thus keeping inventory holding to a minimum;

• the use of sales-based ordering, notably through continuous replenishment programmes (CRP);

• much greater co-operation with suppliers, using where appropriate co-managed inventory (CMI) or full vendor-managed inventory (VMI).

There are four key strategies in the use of ECR. These are the areas that companies believe should improve significantly:

1. replenishment — to get the right product into store at the right time, etc;
2. store assortment — ensuring the right mix of products in the store to maximize consumer satisfaction;
3. promotion — to link trade promotions with retail availability;
4. new product introduction — streamlining all processes to get new products to the consumer more quickly.

In general, the greatest benefits are to be found with the improvement in the first two of these

— speedier replenishment and better store assortment. Overall, benefits can be found in both cost reduction and service improvement. The main benefits are:

• Automated systems reduce labour and administrative costs.
• Sharing information leads to more timely deliveries and falling inventory levels at the store.
• Cross-docking reduces inventory levels at the DC.
• Concentrating on fewer suppliers reduces transaction and administration costs.
• Offering the right products to the right customers increases volume sales and economies of scale.
• Customer needs are more fully addressed.
• The ability to tailor the products and services on offer in the store allows a company to take account of local preferences.
• Rapid replenishment can reduce stock-outs, and this means that customers seeking a particular product or brand will not leave empty-handed.

A common approach for the implementation of ECR by a retailer is to focus on the consumer and then to develop a particular IT strategy and capability. This is likely to include the use of EDI, EPOS, computer ordering, computer routeing, etc. It is important to create a climate forchange and to re-engineer existing business practices, as they are unlikely to be adequate for the successful implementation of ECR. The next requirement is to develop a responsive replenishment strategy jointly with key suppliers for key products. Finally, a workable flow-through distribution operation must be planned and implemented. A typical flow-through operation is likely to involve:

• **Pre-distribution identification**. Vendors pick, sort and pre-label final orders using barcodes.

Automated cross-docking. This will require conveyors, diversion lines and bar-code readers.

A disciplined appointment scheduling procedure. Inbound receipt scheduling will need to match available labour and minimize vehicle waiting.

New facility design. This should ideally include shipping doors around the circumference of the building. The use of conveyors will eliminate put-away and picking.

Floor-ready merchandise. Suppliers should provide tags and labelling to reduce DC and retail store work and handling.

In fact, many cross-docking operations in an ECR environment can work well with much less automation than indicated above. Clearly, this becomes problematic for very large-scale operations. The major tenet for any quick response system is that the product should be continually moving.

Category management (CM) has been developed to provide greater support for product and inventory control and management. It is essentially a means of categorizing products into 'families' that have very similar characteristics in terms of their selling profile. Thus, SKUs from very different product groups may be categorized together and their inventory holding planned in the same way because they have the same order or usage patterns. Typical examples of these categories are:

Vital and expensive: products that require close control and monitoring. Supply sources need to be reliable, and delivery performance must be consistently good. A continuous stock review policy should be applied to products in this category

Desirable and expensive: inventory should be held at minimum levels and a continuous stock review policy should be applied.

Vital and inexpensive: these should be stocked at maximum levels, and a reliable source of supply should be substantiated. Delivery performance should be carefully monitored. A weekly periodic stock review policy should be used.

• **Desirable and cheap:** hold maximum stock levels and use a monthly periodic stock review policy. Keep order frequency to a minimum number of times per year.

inventory

• **Common usage spares:** hold stocks at reasonable levels and use a monthly periodic stock review policy.

Note that this approach emphasizes the important factor that product requirements can be very different and therefore that companies that adopt a 'one size fits all' approach to inventory planning are likely to suffer either high-cost or low-availability issues for some of their portfolio of products.

Collaborative planning, forecasting and replenishment (CPFR) combines multiple trading partners in the planning and fulfillment of customer demand. Sales and marketing best practice (eg category management) is linked to supply chain planning and operational processes to increase product availability at the same time as minimizing inventory and logistics costs. A general framework is used to help the retailer/buyer and manufacturer/seller to work together to satisfy the demand of the customer.

• Strategy and planning: identifying and agreeing the overall rules for the collaboration, including product mix and placement, and event plans.

• Demand and supply management: forecasting of consumer demand at the point of sale and replenishment requirements.

• Execution: the placing of orders, delivery shipments, restocking of products on shelves, etc. These are all of the events in the 'order to cash' cycle.

• Analysis: monitoring of exception orders, calculating KPIs and assessing continuous improvement opportunities.

Vendor-managed inventory (VMI)

Where VMI is used, the vendor takes responsibility for the inventory held in the client's premises. The vendor monitors inventory levels and organizes replenishment. Ownership of the inventory passes to the client when the inventory is utilized. For VMI to be effective, the management of information is crucial. Vendor and client have linked computer systems, often using electronic data interchange (EDT). This allows the vendor to monitor inventory levels and for purchase orders and invoices to be effectively transmitted between the partners.

The main advantage of VMI is that the overall level of inventory in the client's warehouse can be reduced. The vendor is able to schedule deliveries efficiently, as it has better visibility of the client's requirements,

and it can incorporate these requirements at an early stage into its production schedules. For the process to work, there need to be high levels of trust between the two partners. This is often derived from the cultural compatibility of the companies involved. The partners' IT systems also need to be compatible.

Where the client retains an element of involvement in managing the vendor's inventory, this is referred to as co-managed inventory (CMI).

The quality of supplies

Ensuring that the goods and services purchased are of the right quality is important in that sub-standard supplies cause waste and a variety of problems:

• If the goods are unusable then their presence has created a shortage in the required quantity, which in JIT environments may be crucial.

CHAPTER SEVEN

Maintenance of Security and prevention of theft

Unfortunately terrorist attacks and crimes against vehicles and property have become almost an everyday feature of life in today's world. The costs associated with the disruption caused by these events are difficult to quantify but are all too real to the victims. Management time, replacement of assets, service failures, increased insurance costs, legal costs and general upheaval are some of the consequences that may be expected. Since the attacks on the World Trade Center in New York and the Pentagon in Washington, DC on 11 September 2001, the whole area of logistics security has attracted a lot of attention from national governments. One direct response to these terrorist outrages is a number of initiatives instigated by the United States government. Customs—Trade Partnership against Terrorism (C—TPAT), Free and Secure Trade (FAST), Container Security Initiative (CSI), and Advanced Manifest Regulations (AMR) — the '24-hour rule' — were introduced to reduce the likelihood of another attack. As we all know, terrorist attacks have by no means been limited to the United States, and this has led to questions being asked about supply chain vulnerability.

The aim of this chapter is to provide an outline of the measures that should be considered when planning logistics security. The most common areas and equipment will be briefly described, but any specialist requirements will not be covered. Vehicle, distribution centre and personnel security will be examined. A section on safety in distribution centres has also been included. International measures to combat terrorist attacks will be briefly described, and supply chain vulnerability will be discussed.

International security measures

US cargo security measures

Given that the United States is the largest economy in the world and was the victim of the 11 September attacks, it seems appropriate to look in more detail at some of the measures the United States has put in place to avoid any further attacks.

It must be understood that the regulations briefly outlined below are continually being developed and enhanced.

Customs—Trade Partnership against Terrorism (C—TPAT)

This is a voluntary system established by the United States Bureau of Customs and Border Protection (CBP). It aims to create an environment of close co-operation between US importers, carriers and international exporters to the United States. Participants are required to conduct a comprehensive assessment of security in the supply chain (SC), submit a SC security profile questionnaire to CBP, develop and implement a programme to improve security, and communicate C-TPAT guidelines to other companies in the participant. In return, C—TPAT participants benefit from expedited cargo release, a reduced number of inspections, an assigned C-TPAT supply chain security specialist, access to the C—TPAT membership list, eligibility for account-based processes, an emphasis on self-policing, and access to 'FAST' lanes along the Canadian and Mexican borders.

Free and Secure Trade (FAST)

This initiative covers the borders between the United States and both Canada and Mexico. It aims to offer faster clearance of C—TPAT participants' cargoes at these borders. It is aimed at increasing SC security without unnecessarily hampering trade.

Container Security Initiative (CSI)

Under this system, customs officers from CBP are stationed around the world at the major departure ports of containers bound for the United States. As almost half of all imports by value into the United States arrive in ISO containers by sea, this is seen as a major step in preventing suspect containers being dispatched to the

United States. Approximately 7 million cargo containers arrive at US sea ports annually. CSI is based on four main elements:

1. the use of intelligence and automated information to target containers that pose a risk of terrorism;
2. the pre-screening of these target containers at the port of departure rather than when they arrive in the United States;
3. the use of detection technology to pre-screen these suspect containers quickly;
4. the use of tamper-proof containers.

Secure Freight Initiative (SF1)

The Secure Freight Initiative (SF1) adds a new layer to the Container Security Initiative (CSI).

(SFI) uses the latest sophisticated technology to identify any containers that pose a risk. At the time of writing CSI is based at 51 seaports in various countries where it performs targeted screening covering the full scope of conventional threats and weapons of mass destruction.

X-ray and radiation detection equipment are used to examine containers consigned to the USA.

Advanced Manifest Regulations (AMR)

These US regulations require both importers and exporters using any mode of transport to send electronically advance information regarding the cargo to be shipped. If the information submitted is incomplete, misleading or late, it can lead to the CBP issuing a 'no load' order to the carrier. It could also result in the cargo receiving additional inspection by customs officials or a withholding of permission to unload the cargo at a US port. The CBP require the advance information to be submitted using the automated manifest system. The timings are: 24 hours before loading for sea vessels, four hours before 'wheels up' from NAFTA and Central and South America above the equator for aircraft, two hours prior to arrival for rail, and one hour before arrival for trucks not covered by FAST. FAST truck carriers need to submit information only half an hour prior to arrival.

Strategic security measures

Supply chain vulnerability

The vulnerability of networks has increased as a result of longer, leaner supply lines between focused facilities within consolidating networks.

The findings of a 2003 study carried out by the Cranfield Centre for Logistics and Supply

Chain Management (CLSCM) in the UK illustrated that whilst many risks to supply chain integrity come from the external environment there is growing evidence that the very structure of supply chains themselves is a cause of vulnerability. The emphasis on leaner inventories and outsourcing to third-world countries has created a situation where supply lines are longer and inventories leaner. Therefore when the supply chain is broken due to inclement weather, political instability or, for example, the recent SARS and Hi Ni (popularly known as 'swine flu') epidemics, the consequences for individual businesses, industries or economies may be disastrous. The purpose of the study was to provide managers with some practical tools to ensure the resilience of their supply chains. Four levels of risk were identified as:

• Level I — process/value stream;

• Level 2 — assets and infrastructure dependencies;

Operational management

• Level 3 — organizations' and inter-organization networks;

• Level 4 - the environment.

Recommendations from the study suggest that there are four issues that may generate improved supply chain continuity management. They are:

1. risk awareness among top managers;
2. risk awareness as an integrated part of supply chain management;
3. understanding by each employee of his or her role in risk awareness;
4. understanding that changes in business strategy change supply chain risk profiles.

Ensuring the integrity of supply chains is a strategic issue and should focus the minds of senior managers. The problems associated with extended vulnerable supply lines has always been an issue for military logisticians. Many military campaigns have failed because extended supply lines were broken and armies isolated.

Tactical security measures

Vehicle security

Vehicles may be attacked because the thieves wish to steal the load, the vehicle itself or both. In recent years commercial vehicles have been targeted by thieves either to dismantle or to sell on intact. Sometimes vehicles are dismantled, loaded

into containers and shipped abroad with extraordinary speed. In this type of situation, speed of response is essential. On other occasions, vehicles are simply driven away, sold in countries where checks on ownership are lax and never seen again. Therefore when specifying vehicles, one should consider security of the vehicle, the load carrying area and the driver.

The keys

Obviously, if a thief has access to the vehicle's keys then the thief s job is made very simple. Never leave keys in the ignition, and ensure that keys are securely locked away in the office when vehicles are at base. Keys should only be issued to known drivers or those with clear authority. A commonly used ploy is to pose as an agency (temporary) driver in the early hours of the morning, who requests the keys and drives away with a valuable vehicle and load.

Windows should be etched with the registration number of the vehicle. It is worth remembering that rubber surrounds to windows may simply be cut away, allowing access. Small panel vans with glass in the rear doors should be replaced with vans with complete steel door panels. Existing windows may be protected by grilles or bars if necessary.

Where vehicles have a walk-through arrangement between the driving area and the load area, a builthead should be installed that hinders easy access to the load.

Immobilization

The aim of this type of security is to prevent the vehicle being driven away or at least to buy time. It does not prevent the vehicle being unloaded where it stands. There are many types of immobilizer to choose from, but these are the more common varieties:

- steering locks;
- air brake immobilizers;
- starter motor immobilization;
- fuel valve immobilization;
- wheel clamps;
- kingpin locks.

Vehicle alarms

As with immobilizers, there are several different types of alarms for different circumstances. An alarm system will be either manual or automatic. The manual

system relies on the driver to activate it before leaving the vehicle, and the automatic system sets itself. The manual system's weakness lies in the fact that if the driver fails to activate it then it is of no use. The use of automatic systems overcomes this problem.

Depending on the level of security required, alarm systems may require an independent power source, which is housed in a secure area of the vehicle. Commercial vehicles that have their batteries exposed would be vulnerable to the power supply being cut and the alarm deactivated. Even cars that have their batteries secure under the locked bonnet are not immune from someone cutting the power supply from beneath the car. A four-hour back-up requirement is specified by the British Standard BS6803.

This standard also specifies a minimum 115 dB (a) for audible warning alarms, but often the output is higher. As with the power supply, the audible alarm should be housed in a secure area of the vehicle to avoid the wires to the sounder being cut by a would-be thief.

The alarm wiring system may be of the single or twin circuit variety. Single circuit wiring may be suitable for cars, but twin circuit wiring is required if the driver's compartment needs locking whilst the loading area is open. Most security specialists recommend that the wiring is closed circuit, which means that the alarm is activated if the circuit is broken by someone cutting the wires. Monitor loops are another way of protecting the wiring from attack. Open circuit wiring does not provide this type of protection.

Alarm contacts should be fitted to all points of access into the vehicle. Some urban delivery vehicles have been robbed whilst they are stuck in slow-moving traffic. If this is a possibility then consideration should be given to fitting a rear-door ignition alarm. This alarm will sound if the rear doors are tampered with whilst the engine ignition system is still running, thus alerting the driver and hopefully warning off the criminals.

The internal spaces inside the vehicle may be protected in several ways listed below. However, it is important to note that commercial vehicle bodies that have glass-fibre roofs are vulnerable to being cut open and may need protection through the addition of steel mesh. Similarly, load protecting curtains are vulnerable to being cut by sharp knives. Neither the glass-fibre roofs nor the curtains will be protected by internal space detectors.

Internal space detectors include:

• Ultrasonic detectors. These work by emitting and receiving high-frequency sound waves. They are activated by air movement inside the space being monitored.
• Inertia sensors. These sensors work by monitoring vibration levels. Vibrations caused by someone attempting a break-in will trigger the alarm system.
• Break-glass detectors. These clever devices recognize only the sound of breaking glass and work if a window is broken (but not if the rubber surround is cut out).
• Dual tec sensors. These work by using two different types of sensors that only trigger if they both detect something is amiss. These types of sensor obviously reduce false alarms.
• CO2 detectors. These devices are used to detect unwanted human passengers (stowaways).

The alarm system can be fitted with a pager that alerts the driver, when away from the vehicle, if the alarm system is activated. Alternatively, a radio panic alarm allows the remote activation of the alarm system if the driver feels that is needed. If required, the driver's personal security may be enhanced through the fitting of a panic button that sounds an audible alarm when pushed.

The driver's behaviour whilst going about daily duties can help avoid many opportunist-type crimes. The following is a list of dos and don'ts produced by Freight Transport Association (FTA):

.Lock your vehicle and its load space whenever it is left unattended — even when making a delivery.
• Do not leave windows open when away from the vehicle.
• Lock the doors while sleeping in the cab; back the vehicle up against a wall or other barrier to prevent access to the rear doors; remember the top of the vehicle will remain vulnerable.
• Remove the ignition keys and lock the door when you go to pay for fuel. Also remember to lock the fuel cap when you put it back on.
• If anti-theft devices are fitted to your vehicle — use them!
• Never leave the vehicle unattended in a secluded area or, at night, in an unlit area. Try to keep your vehicle in sight if you leave it unattended.
• Never leave vehicle keys hidden for collection by a relief driver.
• Don't leave trailers unattended in lay-bys. Where possible use pre-arranged secure parking areas for overnight stops. Particularly avoid using insecure casual parking places as a routine practice.

• Don’t chat about your load or your intended route in public or over the radio.
Avoid asking unknown people for advice on local off-road parking facilities.
Remember that the first breach of security occurs when the existence of the target becomes known to the thief.
• Do not carry unauthorized passengers in your vehicle.
• After a driving break or other stop where the vehicle is left unattended, look out for signs of tampering with doors, straps or sheets — someone may be back to finish the job later.
• Be vigilant and cautious when returning to the vehicle alone. Check for other suspicious vehicles nearby or persons in the immediate vicinity, particularly if seen taking undue interest in the vehicle. Note descriptions, registration number, etc. Get assistance from other drivers if seriously concerned or telephone the police for advice.
• In the event of a breakdown, consider the possibility of tampering or sabotage. Always take into consideration the security of the load if it is necessary to leave the vehicle.
• Treat unsolicited offers of assistance from unknown persons with caution and treat signals from other drivers that something is amiss with your vehicle with extreme caution.
• If you make the same journey frequently consider whether the route/schedule can be varied, if this is possible or permitted.
Where high-value loads are carried, travel in convoy with other known and trusted drivers if possible. Beware of bogus officials or staff — ask for identification. Carry a ‘vulnerable load’ card for production if stopped by the police — if in doubt keep going to the nearest police station!
On arrival at your delivery destination, do not allow yourself to be persuaded to leave your vehicle in charge of anyone else or to deliver to any other location unless certain that such action is legitimate.
Never leave valuables on view in your cab, whether these are loose equipment or your personal belongings.
Look out for and report any security defects on your vehicle — faulty locks, bolts, straps, anti-theft devices, etc. Report unserviceable security equipment at once and insist on prompt rectification.
Keep documentation about the load in a secure place. This can be used as authority tocollect goods.

Satellite tracking/in-transit visibility

There are many systems available on the market today that allow operators to track their vehicles whilst away from base. Some use geostationary satellites and others use different technologies. For operators who need real-time visibility of their vehicles for service or security reasons, these systems are readily available at a reasonable price.

As mentioned in the list above, maintenance of anti-theft equipment is extremely important and should be included as a regular service item when vehicles are being maintained. Any vehicle-based equipment will be exposed to the elements to a far greater extent than static equipment and will require a higher level of maintenance as a consequence.

The distribution centre

The very nature of distribution centres (DCs) presents many headaches from the point of view of security. Access for large vehicles 24 hours a day requires large access gates that may be left open most of the time. Company employees, visiting drivers, customers, suppliers' representatives, contracted maintenance staff such as tyre fitters, and agency staff will all require access to the site at different times of the day. Most will be going about their business in a diligent fashion but this freedom of access also allows criminals similar freedom. Stories of commercial vehicles being driven away in broad daylight under the eyes of the DC staff are all too commonplace. The following are some suggested actions that will help reduce or eliminate this possibility.

Distribution centre location

Insurance companies are able to categorize different areas into those that are more or less likely to suffer from criminal activity. The same will be true for different areas within a region. DCs are located, by andlarge, in the best location to service their customers cost-effectively. In many cases the opportunity will not exist to relocate the DC. However, where it does the level of crime in the target location may be worth considering, along with all the other factors.

Fencing

Perimeter fencing should create an effective barrier to the would-be criminal. Security experts recommend that palisade fencing topped with barbed wire and at

least 2.4 metres high should be used. The top of this fencing should be angled outwards and all the links in the fencing should be welded to minimize the possibility of the fence being dismantled from the outside.

It is most important that vehicles are not parked next to the fencing. The vehicles could aid the criminals in their endeavours either by shielding them from view or by acting as a platform for them to gain access to the depot. Do not stack pallets or other materials against the fencing, as these too could be used in a similar fashion. Once fencing has been installed, ensure that it is well maintained.

Gates

There is little point in having good fencing if the gates to the distribution centre are left wide open at all times. Electric sliding gates are expensive but very effective. If the price of electric gates is prohibitive then any gates that are fitted should have their hinges and bolts secured to prevent them being lifted off.

Pedestrians will require access, and this could involve them having to pass through a secure gatehouse where they are booked in and out by a competent security guard. Regular employees could be issued with swipe cards or identification cards complete with photographs to speed their access. The close control of visitors will discourage all but the boldest criminal, but it also helps from a health and safety point of view.

Some high-security establishments photograph all visitors every time they visit, and in some cases a video of all people and vehicles visiting the site is made and retained for a given period, say four weeks.

Road blockers that raise and lower may also be used to protect entrances, but these are very expensive as well as being very effective.

Closed circuit television (CCTV) and intruder alarms

The security of perimeter fencing can be enhanced through the use of intruder alarms that are activated when the beam is broken. In the same way, CCTV can help improve security, but again it is expensive. There are some shortcomings with CCTV. They are:

• The monitors need to be constantly viewed for them to be effective.

• Tapes need to be managed carefully to ensure that they do not get taped over or wear Out.

• If the criminal is dressed in dark clothing at night with the face disguised, the tapes are of little value for identification after the event. If the monitors are being watched constantly then immediate action can be taken.

• If the equipment is not turned on then its value is compromised.

• The positioning of cameras needs to be well thought through. This is not only to ensure that the cameras have a good field of vision but also to ensure that they can be seen but not attacked and put out of action. The sight of CCTV cameras can have a deterrent value in itself.

Where intruder alarms and CCTV are used, advertise the facts prominently through the use of signs to aid the value of the deterrent.

Security guards

Employing your own guards will be expensive if seven-day, 24-hour cover is required. However, employed guards of the right calibre will know your business and your staff and can be an asset. Contract guards who visit the site on a mobile basis are an alternative, but the danger is that they fall into a routine visiting time that the criminals simply avoid. In this regard you get what you pay for, and the decision must be made in the light of the level of security required.

Lighting

Criminals in general do not like to operate where the area is well lit. Ensure that there is sufficient lighting to deter would-be thieves. In residential areas, lighting may also be a nuisance, so this must be borne in mind when positioning lights. Lights that are activated by heat or movement are an alternative to full-time lighting.

Personnel

Extreme care should be taken when recruiting new staff. Criminals have been known to insinuate themselves into the organization by applying for jobs either as direct employees orthrough employment agencies. The following useful advice regarding recruitment was prepared by the FTA:

Take references for all previous employers.

If possible speak person to person with the previous employer and discuss the applicant's work record and character.

When checking references by telephone, obtain the number you need from a telephone directory. Any number supplied by the applicant could be that of an accomplice.

Do not accept open references, such as 'To whom it may concern'.

Beware of unexplained gaps in the employment record — query them.
Avoid employing anyone with a known record of alcohol abuse, extreme habitual gambling or serious financial irresponsibility. A stable domestic background is to be preferred.

7. Insist on seeing the applicant's original birth certificate, not a photocopy.

8. Check driving licenses thoroughly. Compare the date of birth against the birth certificate. An ordinary licence will expire the day before the holder's 70th birthday.

9. Examine the license closely in a strong light for signs of alteration, discoloration or erasure. Ensure that the pink or green background is intact. Be suspicious of stained or damaged licences. Check for endorsements, photocopy the licence and retain this on file.

10. Be suspicious of duplicate licences, which usually have 'duplicate' printed on them. Most duplicate licences are issued for quite legitimate reasons but disqualified drivers have been known to apply for and receive a duplicate licence before their trial and use this to gain employment.

11. Obtain a photograph of the applicant and get the applicant to sign it in your presence.

12. Exercise special care when recruiting temporary drivers, unless they are personally known to you.

13. Agency drivers should be employed only from reputable agencies whose staff are vetted and ideally fidelity bonded. In any event, all agency drivers should be photographed before being allowed to drive any company vehicle. Driving licences should be examined, as described above. Do not rely on the agency to do this for you.

CHAPTER EIGHT

SAFETY AT WORK PLACE

SAFETY Engineering

Safety in Industry

— The modern safety movement started around 1912 with the First Cooperative Safety Congress and the organization of the National Safety Council in U.S.A.

From 1912 to the present time, remarkable advances have been made in reducing the rate and severity of accidents.

— The importance of industrial safety was realized because every year millions of industrial accidents occur which result in either death or in temporary and permanent disablement of the employees and involve a good amount of cost such as resulting from wasted man-hours, machine hours etc.

— In 1952 in U.S.A., fifteen thousand workers were killed in industrial accidents, 2,000,000 were injured and the total cost of these accidents was about $ 2,900,000,000.

— Loss of lives and accidents costs gradually led to the formation of Factories act, Office, Shops and Railway Premises Act etc.

— The requirement for consideration of safety by management as part of its responsibility arises primarily from these Acts.

— Safety begins on the drawing board when in the original design of tools or workplace layout, accident hazard may be built in or eliminated.

— Safety results

(i) from safe plant, processes, and operations, and

(ii) by educating and training workers and supervisors regarding safe practices on the shop floor.

— In an industry, safety maybe considered from the mechanical side (equipment, tools etc.) or from legal angles of workmen's compensation or even as a matter of training in and motivation towards safe work practices for workers (especially newly recruited ones).

Need for Safety

Safety in industry helps,

(I) Increasing rate of production.

(ii) Reducing production cost.

(iii) Reducing damage to equipment and machinery.

(iv) Preventing premature death of talented workers who are an asset to the society.

(v) Preventing needless pain and suffering to its employees. Organization for Safely

— In a small concern each shop supervisor may be made responsible for safety in his shop.

— Each shop supervisor may report to top executive as regards safety matters.

— Since the shop supervisor has its main job to turn out production, he may treat safety as a secondary aspect.

— For this reason sometimes the safety function is taken care of by personnel officer or general foreman.

— With the growth in the size of the industry and depending upon the hazardousness of processes! operations, a full fledged safety department may be created with the safety Director/Manager as its chief executive and a number of persons under him at different levels.

The safety Director/Manager may be given a line position or staff position depending upon the conditions in the industry.

— Sometimes the responsibility for safety rests on a safety committee. Safely Committee

— A safety committee may consist of executives, supervisors, and shop floor workers.

— Thus the lower level employees get a channel of communication on safety matters direct to executive level.

— It was observed that those organizations which made safety committees had lower record of accidents than those without safety committees.

— Safety committees aid in developing safety consciousness as well as it is a policy making body on such safety matters as come before it.

— The Safety Manager/executive requires a degree of firmness and ready discrimination to exclude personal and union matters in which safety is merely the pretext for their airing.

— The safety executive should guard jealously the responsibilities of management and supervision.

— Lastly, to get maximum out of a safety committee

(i) It should be assigned specific problems and duties such as planning safety rules, publicizing them etc.

(ii) Its members should be asked to go on the shop floor and watch what is being done about it (i.e., the safety).

(iii) It should be asked to report periodically as what improvements have been made and what more can be done.

Safety Programmes

— A safety programme tends to discover when, where and why accidents occur.

— A safety programme aims at reducing accidents and the losses associated with them.

— A safety programme begins with the assumption that most work-connected accidents can be prevented.

MANAGEMENT ISSUES

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— A safety programme aims at reducing accidents and the losses associated with them.

--- A safety programme begins with the assumption that most work-connected accidents can be prevented.

— A safety programme does not have an end; rather it is a continuous process to achieve adequate safety.

— A safety programme tries to reduce the influence of personal and environmental factors that cause accidents.

- A safety programme involves providing, safety equipments and special training to employees.

— A safety programme is composed of one or more of the following elements:
(i) Support by top management.
(ii) Appointing a Safety Director.
(iii) Engineering a safe plant, processes and operations.
(iv) Educating all employees to work safely.
(v) Studying and analyzing the accidents to prevent their occurrence in future.
(vi) Holding safety contests, safety weeks etc., and giving incentives/prizes to departments having least number of accidents.
(vii) Enforcing safety rules.
— A safety programme includes mainly four E's (as explained above also):
(i) Engineering he., safety at the design and equipment installation stage.
(ii) Education of employees in safe practices.
(iii) Enlightenment. It concerns the attitude of employees and management toward the programme and its purpose. It is necessary to arouse the interest of employees in accident preventionand safety-consciousness.
(iv) Enforcement, i.e., to enforce adherence to safety rules and safe practices.
Safety Instructions and Training
— This is essential for educating the employees to think, act and work safely so that the number of accidents can be minimized.
— Safety training/education gives knowledge about safe (and unsafe) mechanical conditions, personal practices and of the remedial measures.
— Safety training involves:
(i) Induction and orientation of new recruits to safety rules and practices.
(ii) Explaining safety function, during, on the job training.
(iii) Efforts made by the first level supervisors.
(iv) Formulating employees safety committees.
(v) Holding of special employee safety meetings.
(vi) Displaying charts, posters, films etc., to emphasize the need to act safely.
Educating Employees to Develop Safety Consciousness
— A worker will usually accept the use of a safety measure if he is convinced of its necessity.
Therefore, suitable measures should be adopted to increase the awareness of a need for safety in the environment of work.
— Some such measures to develop safety consciousness among workers/employees are as follows:
(i) Display of safety posters and films to remind workers of particular hazards/accidents.

(ii) Providing simple and convenient safety devices.
(iii) Providing allowance (in the standard time) to the worker for setting, removing and replacing any necessary safety devices.
(iv) Ask the employee from the first day he starts work to adopt safety measures because a worker who has commenced work and has become familiar with it would never feel the need for safety measures at a later date.
(v) Hold safety competitions and award prizes to the winners.
(vi) Give due respect and recognition to safe workers and create in employees a feeling of pride in safe work.
(vii) Elaborate on the safety theme until all the employees are safety-conscious.
(viii) Hold regular safety meetings. They stimulate ideas and workers get more safety conscious as the time of meeting approaches near.
(ir) - Lay out work areas to reflect safety considerations.
(x) Mail information and literature pertaining to safety at the homes of all employees.
(xi) Report safety activities to all employees.
(xii) Welcome all safety suggestions.
(xiii) Cross-mark all accident areas.
(xiv) Conduct safety training lectures periodically.

ACCIDENTS

— An industrial accident may be defined as an event, detrimental to the health of man, suddenly occurring and originating from external sources, and which is associated with the performance of a paid job, accompanied by an injury, followed by disability or even death. An accident may happen to any employee under certain circumstances.

Economic Aspects (Cost) of Accidents

— An accident can be very costly to the injured employee as well as to the employer of the concern.

— There are definite costs associated with the accident, e.g.,direct and measurable costs and indirect, i.e., somewhat intangible but nevertheless real costs.

Direct Costs of an Accident They associate:

(i) Compensation insurance, including Payment, and Overhead costs.

(ii) Uncompensated wage losses of the injured employee.

(iii) Cost of medical care and hospitalization. Indirect Costs of an Accident They associate:

(1) Costs of damage to equipment, materials and plant.

(ii) Costs of wages paid for time lost by workers not injured.
(iii) Costs of wages paid to the injured worker.
(iv) Costs of safety engineers, supervisors and staff in investigating, recording and reporting of accidents and its causes.
(v) Costs of replacing the injured employee.
(vi) Cost of lowered production by the substitute worker.
(vii) Cost of delays in production due to accident.
(viii) Cost of reduction in efficiency of the injured worker when he joins the concern after getting recovered.
And lastly the influence of accident on the morale of employees.
Example 20.1. Cost of an accident. A foundry worker got burns on his foot while pouring molten metal from the ladle into the mold.

Direct costs	
Compensation paid for burns	#. 350
Medical expenses	#. 150
Total compensation cost	#. 500
Uncompensated wage los	#. 100
Total direct cost	#. 600
Indirect cost	
Material spoiled and labour for cleaning it up	#. 200
Injured worker's make up pay while at home	#. 80
Fellow workmen standing and watching at time of accident	#. 300
Supervisor's time in investigating and recording	#. 110
Down time on casting	#. 150
Slowed up production rate of other employees	#. 120
Total indirect cost	#. 960
Total cost of accident [Not including overhead charges which may raise the total cost of accident by as much as 50%]	#. 1560

Causes of Accidents

— An accident is an unplanned incident and for each such incident there is usually a specific cause or causes if one could but discover them.
— Accident may be caused due to
1. Technical causes_ — — _Unsafe conditions — — Mechanical factors
— Environmental factors
2. Human causes — — — — Unsafe acts --------- Personal factors.

— Technical causes or unsafe conditions reflect deficiencies in plant, equipment, tools, materials handling system, general work environment, etc.
— Human causes or unsafe acts by the person concerned are due to his ignorance or forgetfulness, carelessness, day-dreaming, etc.
It has been estimated that there are four accidents caused by human causes to every one that is caused by technical causes.
— Mechanical causes or factors
1. Unsafe mechanical design or construction.
2. Hazardous arrangement (piling, over-loading etc.)
3. Improper machine guarding.
4. Unsafe apparel.
5. Defective agencies or devices.
6. Improper material handling.
7. Broken safety guards.
8. Protruding nails.
9. Leaking acid valve.
10. Untested boilers or pressure vessels.
Environmental Factors
Environmental factors indicate improper physical and atmospheric surrounding conditions of work which indirectly promote the occurrence of accidents.
Environmental factors include
1. Too low a temperature to cause shivering.
2. Too high a temperature to cause headache and sweating.
3. Too high a humidity (in textile industry) to cause uncomforted, fatigue and drowsiness (especially when the atmosphere is also hot).
4. Defective and inadequate illumination causing eyestrain, glares, shadows, etc.
5. Presence of dust, fumes and smokes (e.g., in foundry or welding shop) and lack of proper ventilation.
6. High speed of work because of huge work load.
7. More number of working hours and over and above them the tendency of the employer to insist for over-time work.
8. Inadequate rest pauses or breaks between the working hours.
9. Noise, bad odour and flash coming from the nearby machinery, equipment or processes.
10. Poor housekeeping.

Personal Factors

1. Age.
2. Health
3. Number of dependents.
4. Financial position.
5. Home environment.
6. Lack of knowledge and skill.
7. Improper attitude towards work.
8. Incorrect machine habits.
9. Carelessness and recklessness.
10. Day-dreaming and inattentiveness.
11. Fatigue.
12. Emotional instability, e.g., jealousy, revengefulness, etc.
13. High anxiety level.
14. Mental worriness.
15. Unnecessary exposures to risk.
16. Non-use of safety devices.
17. Working at unsafe speeds.

i8. Improper use of tools.

l'pes of Accidents

1. Near accident — i.e., An accident with no damage or injury.
2. Trivial.
3. Minor.
4. Serious.
5. Fatal.

Accident Prevention

— Accident prevention is highly essential in an industry, in order to

(i) Prevent injury to and premature death of employees.

(ii) Reduce operating and production costs.

(iii) Have good employer-employee relations.

(iv) High up the morale of employees.

— Above all, prevention of accidents is a true humanitarian concern.

— Accident prevention does not occur by itself; there should be consistent implementation of

---- safety measures and safety programmes emphasizing the need for

1. Safe workplace layout and working conditions.
2. Safe material handling.
3. Personal protective devices.
4. Safety activities in the organization.

1. Safe Workplace Layout and Working Conditions Layout

— Although most accidents take place because of unsafe act of the employees, the role of the environments and surroundings cannot be ignored in determining the cause of accident.

— A good layout and working conditions play a major role in preventing many accidents which would have otherwise occurred.

— For preventing accidents, the layout should be such that:

(i) Every employee has enough space to move and operate.

(ii) Passageways between working places, roads, tracks and alleys, etc. must never be obstructed.

(iii) It prevents the inrush of cold/hot air and draughts to the working place.

— For adequate lighting, ventilation etc., the heights of the working rooms should be of 3 metres.

— Floors must be of nonskid type, satisfactorily plane and must possess such properties that they can be easily cleaned and absorb sounds.

— Windows should be of adequate dimensions in order to make full use of natural day light.

— Doors and gates leading to open should be provided with guards, etc., to prevent draughts at the neighboringworkplaces.

— Fire hazards can be reduced by utilizing fire walls to separate manufacturing area into several compartments.

— A worker operating on the machine should have easy access to the safety switches provided on the machine/near workplace.

Working Conditions

— In enclosed rooms, in order to have comfortable conditions, the following should be controlled. Air temperature, air purity, velocity of air, humidity of air, and heat radiations between bodies of different temperatures.

— Not only in enclosed rooms, even otherwise proper ventilation is a must if the manufacturing processes give rise to dust, smoke, fumes,etc.

— Whether natural or artificial, there should be sufficient illumination, of adequate colour of light, continuous and uniform and free from glare.

— A high noise level at the workplace impairs men at work and may even endanger them. Noise develops from riveting, grinding, forging, engines, compressors etc. To reduce noise level and to minimize detrimental effects (e.g., deafness) arising out of it:
(i) Select, purchase and make use of machines and processes which produce little noise.
(ii) Isolate and keep noise producing machines in separate closed cabins.
(iii) Use silencers to minimize the hissing sound of compressed air escaping from blow-off valves in pneumatic tools and machines.
(iv) Use suitable machine mounts to damp down the vibrations.

2. Safe Material Handling

— Careless handling of heavy materials and components is a major source of back and foot injuries.
— To avoid premature fatigue of transport workers, full use should be made of mechanized
materials handling equipment.
— Use mechanical means of conveyance to ensure the safety of men engaged in material handling.
— The transport workers should not be asked to lift more than the permissible load, e.g., for a boy of 16 to 18 years of age, this load is 19 kgs.
— During transport, sharp materials, sharp edged goods, poles etc., should be covered, placed in stable holders and retained by means of wire.
— Goods should be piled up such that they do not collapse due to impact or vibrations.
— Containers or vessels employed to transport liquids or small parts:
(i) should not be too large to limit the range of vision and impede lifting and carrying,
(ii) should be light, and
(iii) should not be defective/leaking.
— Depending upon the condition of material, use a proper material handling equipment, (Refer chapter on Material Handling).
— All material handling equipments should be promptly repaired and adequately maintained on priority basis.

3. Personal Protective Devices for
(a) Protection of head
— Safety hard hats.
— Rubberized hats for protection against liquids (chemicals).
— Ear protectors.
(b)Protection of face
— Face mask.
— Face shields.
— Welding helmets.
(c) Protection of eyes
— Goggles of case-hardened and clear glass for protection against impact.
— Eye cup goggles for protection against flying objects and dust.
— Eye cup goggles impervious to chemicals for protection against acids/alkalizes splashes.
(d) Protection of lungs
— Air line respirators
— Cartridge respirators

— Oxygen or air-breathing apparatus.
— Gas mask.
(e) Protection of other body parts, e.g., han4 foot, leg, etc.
— Protective asbestos clothing.
- Gloves.
— Safety shoes.
— Foot guards.
— Safety body belt. Aprons.
— Safety (molder's) shoes.

4. Safety measures Essential in Industry

— Other safety measures which may be adopted are:
— Provide wire mesh safety guards to all rotating parts, e.g., pulleys etc.
— High voltage equipments and other machines which cannot be properly guarded should be fenced.
— Pressure vessels and their component parts (e.g., valves, gauges, etc.) should be periodically tested as per their specifications, the defective parts should be replaced.
— Material handling equipments should have unobstructed paths to move on.

— Defective tools, e.g., hammers, spanners, etc., should be immediately replaced.
— Power should be switched off before repairing the equipment.
— Inflammable material should be stored separately and away from the general store.
— Electrical connections and insulation should be checked at regular intervals.
— To avoid electrical accidents
(i) None except the electrician should be permitted to touch electrical connections.
(ii) All live wires should be isolated and insulated from each other.
(iii) Electrical connections and ground connections of all portable and importable machinery should be checked periodically.
(iv) Damp environmental conditions (floor etc.) should preferably be avoided.
— Fire extinguishers should be kept in proper condition and at key places.
Accident Proneness
— Examination of safety records often show that out of all the workers doing the same job and being subjected to the same physical environments, only a few have substantially more accidents than the rest.
— Such few workers who are found consistently to experience more accidents than the average (other) workers, are classified as ACCIDENT-PRONE workers/employees.

— ACCIDENT PRONENESS

It may be defined as the continuing tendency of a person to have more accidents as a result of his persisting characteristics etc.
— Accident proneness is perhaps because of peculiar psychological and physiological make up of certain persons.
Causes of Accident Proneness
(i) Inattentiveness and day-dreaming.

(ii) Poor eyesight and hearing and lack of stamina.
(iii) Poor adjustment of work; distaste for the job.
(iv) Too much sensitivity and tendency to get perturbed easily, (Emotional stresses).
(v) Dislike of the supervisor/foreman, etc.
(vi) Lack of training, proficiency and skill to do a work.
(vii) Insufficient intelligence.
(viii) Unsafe behavior of the worker (e.g. ,intentionally not using safety devices and safe practices).

Methods to Reduce Accident Proneness

(i) Depending upon the job conditions select only those applicants who possess appropriate standards of physical and mental ability.

(ii) Transfer accident prone workers to comparatively less hazardous job situations.

(iii) Impart adequate training to a recruit before putting him on the job.

(iv) Encourage employees working under you and see that they do not get unnecessarily perturbed, frustrated or emotionally disturbed.

First-Aid

— Even after taking all safety precautions and measures, accidents occur in factories.

— An injured worker needs immediate and proper treatment : in the absence of which, his conditionmay become critical.

— To take care of such situations, factories employ full time, at least a person who has successfully completed his Red-cross first-aid course, and who can give preliminary treatment to the injured person, who may later on be taken to the hospital as the ambulance arrives.

— Besides the above service,a first-aid personnel can look after those workers who get minor cuts, burns or electric shock.

— A first-aid box which contains the following is always kept ready during working hours.

Contents of a First-aid Box

	Items	*Numbers*
(*i*)	Rolled bandages 10 cm wide	12
(*ii*)	Rolled bandages 5 cm wide	12
(*iii*)	Pair of scissors	1
(*iv*)	Bottle (4 oz) of salvolative having the doze and made of administration indicated on label	1
(*v*)	Large size sterilized dressings	12
(*vi*)	Medium size sterilized dressings	12
(*vii*)	Small sized sterilized dressings	24
(*viii*)	Safety pins	2 packets
(*ix*)	Large size burn dressings	12
(*x*)	Packets of sterilized cotton wool	2
(*xi*)	Eye drops	1 small bottle
(*xii*)	Adhesive plaster	2 roller
(*xiii*)	4 oz bottle containing a 2% alcoholic solution	1
(*xiv*)	4 oz bottle containing $KMnO_4$ crystals, etc.	2

GOOD-HOUSEKEEPING

Definition and Concept

— The term housekeeping has been borrowed from the maintenance of domestic properties in the home/house and is now liberally applied to the maintenance of both cleanliness and order in all kinds of business establishments, e.g., industries etc.

Cleanliness is a condition wherein buildings, work and rest areas, machinery, equipments and tools are kept free from dirt, dust filth, stain etc.

Necessity of Good Housekeeping

Good plant housekeeping is essential in order to:

1. Make and maintain a clean, neat and orderly factory work area and its surroundings.
2. Make work areas look pleasant, more satisfying and motivative for a worker to work.
3. Minimize fatigue and discomfort to the workers.
4. Minimize injury and accidents.
5. Increase the life of plant, building and the facilities it contains.
6. Avoid fire and other hazards.
7. Permit effective natural illumination and ventilation.

Advantages of Good Housekeeping

1. Fewer accidents.
2. Increased life of building, machinery, tools, etc.
3. Improved employee morale.
4. Increased production.
5. Better product quality.
6. Continuous cleaning reduces housekeeping costs because intermittent clean up is more expensive.
7. Little or no time is lost in searching for tools etc.
8. Material handling and transportation pick up speed.
9. Inspection, maintenance and production control functions become easier.
10. Much floor space otherwise occupied by unused raw material and tools, etc. is released for production.

Good Housekeeping Procedure

1. Plan and project the housekeeping programme carefully and completely. Associate the employees in this venture.
2. Divide the plant and offices into cleaning zones and assign a person to each zone. This person is responsible for the good housekeeping and orderliness of his zone.
3. Keep an eye on the performed housekeeping schedule and conduct periodic housekeeping inspections. The following check-list may help in carrying out inspection properly.

(a) Machinery and Equipment
— General cleanliness.
— Containers for waste materials.
— Machine guards on and operating.
— Oil, air, water, steam leakage.
— Portable equipments
—Do they hamper personnel and material movements?
(b) Materials and Storage
- Piling and stacking
—Can material slip easily?
— Materials protruding out of racks, bins, benches, machines etc.
(c) Building
— Windows clean and unbroken.
— Painting and upkeep.

— Door jambs clean.
— Fire extinguishers and sprinklers clear.
(d) Floors Slippery, wet or oily.
— Badly worn or rutted.
---- Garbage, dirt or debris.
— Loose materials.
(e) Stairways and Aisles
— Clear and unblocked
— Well lighted.
(f) Employee facilities
— Drinking taps clean.
— Toilets and locker rooms clean.

----Soap and towels available.

(g) Other Aspects

— Lamps and lamp reflectors clean.

— Bulletin boards and safety signs clean.

— Protective equipment and clothing clean and in good condition.

— Electrical motors clean.

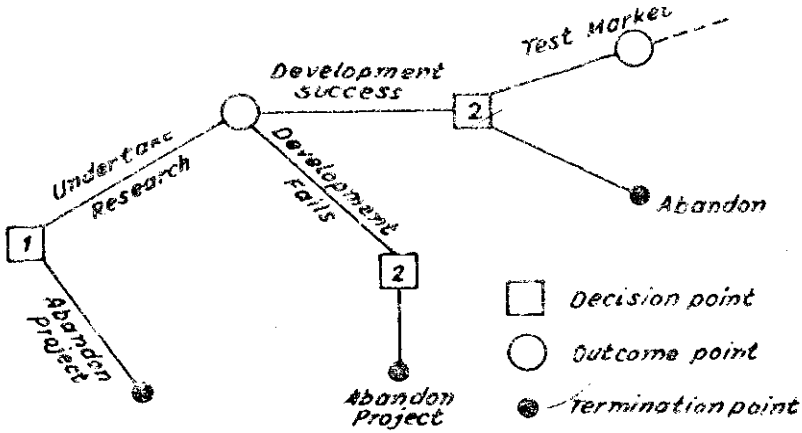
— Ventilation unobstructed

Chapter Nine

RELEVANT TECHNIQUES IN INVENTORY MANAGEMENT

DECISION TREE

Another increasingly useful tool for management decision-makers is the so called decision tree. This is basically a conceptual map of possible decisions and outcomes in a particular situation. It is useful in cases where a manager is required to make a number of sequential decisions ie., where earlier decisions will affect later ones, A simple decision tree appears below:



Decision Tree

— The above diagram focuses attention on outcomes or consequences as well as decisions. These outcomes can be further elaborated in terms of their probability and their anticipated pay off. It is also possible to add a time dimension to the whole diagram, so that, for example in Fig. 18.3 the period from decision point into decision point 2 could be one year. These additional features help to make the use of decision trees a salutary exercise for managers.

SIMULATION

— Simulation techniques are especially applicable to what if problems, in which a manager or technician wants to know, If we do this, what will happen.

Simulation can, of course, be conducted by the manipulation of physical models. For example, one might have a physical model of a machine and actually keep on increasing its speed to determine at what point it would begin to jam, fly apart or walk across the floor.

With no loss, one may, instead, use a mathematical model in which each of the terms represents one of the variables, and observe the effect on the others when different values are given to one or more of the terms. With the help ofa computer, it is possible to examine what will happen in an enormous number of cases-without spending a prohibitive amount of time,

— Because large electronic computers have become easily accessible in recent years, management can simulate complex situations in order to determine the best course of action.

— Simulation is the process of building, testing and operating models of real-world phenomena through the use of mathematical relationships that exist among critical factors.

— This technique is useful for solving complex problems that cannot be readily solved by other techniques.

-- A simulation model can be deterministic if the manager knows exactly the value of the factors he employs in the equations.

- However, simulation is essentially probabilistic, since the manager typically must estimate the future values of these factors.

Simulation is very helpful in engineering and design problems, where the medium maybe either the mathematical model ora diagram on a screen (VDU) connected to the computer. In the latter case, the engineer-designer can modify the design by using a light pen. The technique is equally applicable to management decision-making.

It is obviously much cheaper, safer and easier to experiment with a mathematical model or diagrammatic simulator than to experiment with real machine or even physical models of machines.

— In some cases, however the variables that one manipulates are not exact quantities but probabilities. Then what are known as Monte Carlo techniques must be used (refer article 8.24). These make it possible to stretch as far as possible such few actual data as are available to begin with.

QUEUING OR WAITING LINE THEORY

— Queuing theory is an O.R. technique which aids the manager in making decisions involving the establishment of service facilities to meet irregular demands.

— cost problems arise when there are more service facilities available than are needed, or when too few facilities are available and consequently, long waiting lines form.

For example, in a battery of machines, breakdowns will occur randomly, and whenever the maintenance service falls below that demanded by the breakdowns, a waiting line of unrepaired machines forms. This idle capacity is a cost that has to be balanced against the costs of keeping maintenance services available.
Queuing theory is applied to any situation producing a need to balance the cost of increasing available service against the cost of letting units wait.
To arrive at the best number of service facilities, the manager and the O.R. team must first determine (in the example above) the breakdown rate and the time required to service each machine. These data can then be used to construct a mathematical model of the problem, which can become extremely complex.
Simulation methods are widely used to solve waiting line problems.
Simulation is a systematic, trial and error procedure for solving waiting line problems that are too complex for easy mathematical analysis. Reasonably good solutions may often be obtained by simulating important elements of the problem which events occur with assigned or computed probabilities is as the Monte Carlo Method. This method utilizes the mathematics of probability, and is often run on the computer.