



Enterprise Resource Planning

From Supply Chain and Inventories
to the Enterprise Asset
and Maintenance Management

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January 2011

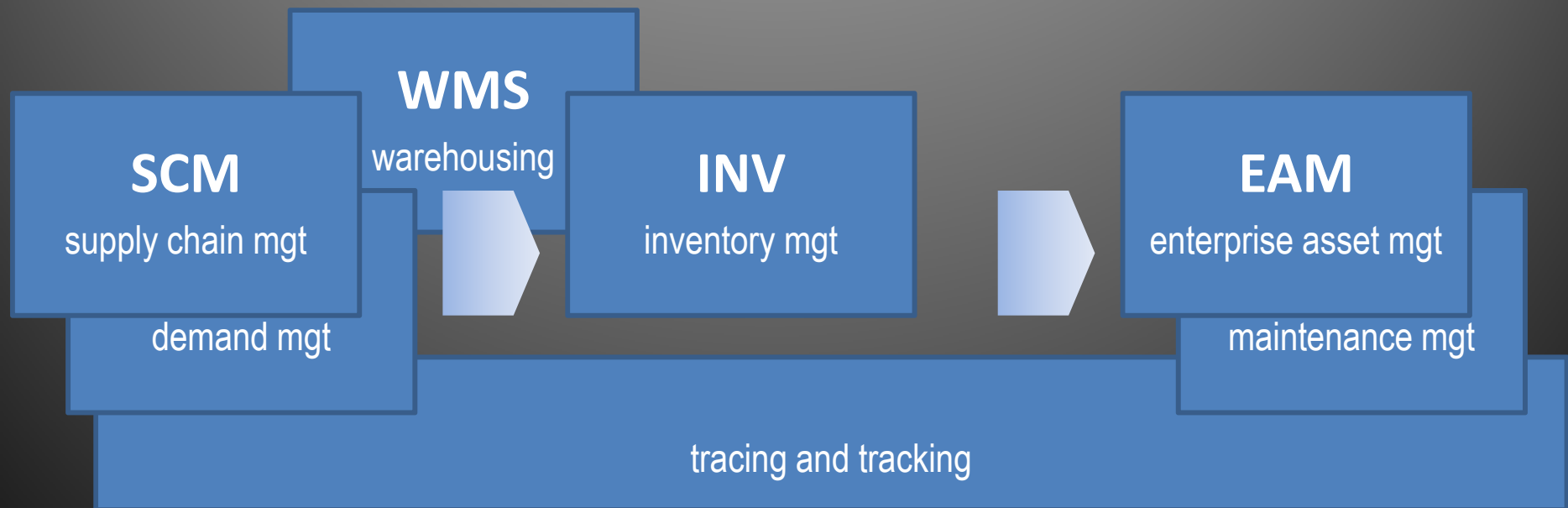
Introduction

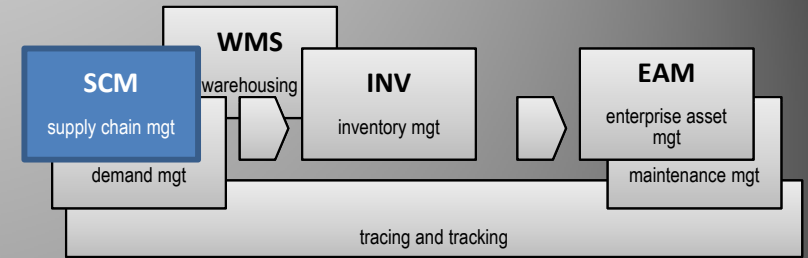
- This presentation has been structured with the aim of introducing the audience to certain parts of an Enterprise Resource Planning system.
- The primary parts are:
 - Enterprise Assets Management
 - Supply Chain Management
 - Inventory Control

The Macro-Picture

The efficient management and operation of the enterprise is highly dependent on the established framework of processes, workflow compliance and culture.

The subsystems stated in the previous slide, constitute a business operations continuum, as graphically depicted below:





Part - I

SUPPLY CHAIN MANAGEMENT

Supply Chain Management

- Supply chain management (SCM) is the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers
- Supply chain management spans all movement and storage of supply materials (supply chain), until they reach the inventory.

Supply Chain Management *(cont'd)*

- According to the Council of Supply Chain Management Professionals (CSCMP), supply chain management encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management.
- SCM also includes the crucial components of coordination and collaboration with supply partners, which can be suppliers, intermediaries, third-party service providers, up to the end customers.
- In essence, supply chain management integrates supply and demand management within and across supply chain stakeholders.

SCM: At the Strategic Level

- Strategic network optimization, including the number, location, and size of warehousing, distribution centers, and facilities.
- Strategic partnerships with suppliers, and their distributors creating communication channels for critical information and operational improvements such as cross docking, direct shipping, and third-party logistics.
- Product life cycle management, so that new and existing products can be optimally integrated into the supply chain and capacity management activities.
- Information technology chain operations.
- Where-to-make and make-buy decisions.
- Aligning overall organizational strategy with supply strategy.

SCM: At the Tactical Level

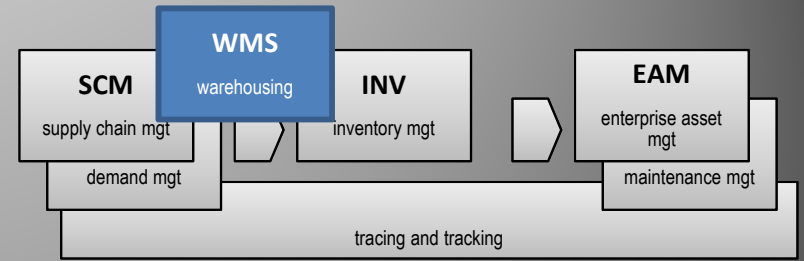
- Sourcing contracts and other purchasing decisions.
- Production decisions, including contracting, scheduling, and planning process definition.
- Inventory decisions, including quantity, location, and quality of inventory.
- Transportation strategy, including frequency, routes, and contracting.
- Benchmarking of all operations against competitors and implementation of best practices throughout the enterprise.
- Milestone payments.
- Focus on consumption demand.

SCM: At the Operational Level

- Daily planning, including all nodes in the supply chain.
- Demand planning and forecasting, coordinating the demand forecast of all consumption points and sharing the forecast with all suppliers.
- Sourcing planning, including current inventory and forecast demand, in collaboration with all suppliers.
- Inbound operations, including transportation from suppliers and receiving inventory.
- Outbound operations, including all fulfillment activities, warehousing and transportation to end consumption points.
- Order promising, accounting for all constraints in the supply chain, including all suppliers, manufacturing facilities, distribution centers, and other supply chain stakeholders.
- From production level to supply level accounting all transit damage cases & arrange to settlement at end consumption point level by maintaining company loss through insurance company.

Management Components of SCM

- There are various components that must receive managerial attention when managing an effective supply chain. They are:
 - Planning and control
 - Work structure
 - Organization structure
 - Product flow enterprise structure
 - Information flow enterprise structure
 - Management methods
 - Power and leadership structure
 - Risk and reward structure
 - Culture and attitude



Part - II

WAREHOUSE MANAGEMENT SYSTEM

Warehouse Management System

- A **warehouse management system**, or **WMS**, is a key part of the supply chain and primarily aims to control the movement and storage of materials within a warehouse and process the associated transactions, including shipping, receiving, store, and picking. The systems also direct and optimize stock physical storage based on real-time information about the status of the specific physical storage location utilization.
- Warehouse management systems often utilize **Auto ID Data Capture (AIDC)** technology, such as barcode scanners, mobile computers, wireless LANs and potentially Radio-frequency identification (RFID) to efficiently monitor the flow of products.
Once data has been collected, there is either a batch synchronization with, or a real-time transmission to a central database. The database can then provide useful reports about the status of goods in the warehouse.

Warehouse Management System

- The objective of a warehouse management system is to provide a set of computerized procedures to handle...
 - the receipt of stock and returns into a warehouse facility
 - model and manage the logical representation of the physical storage facilities (e.g. racking etc)
 - manage the stock within the facility
 - enable a seamless link to order processing and logistics management in order to pick, pack and ship product out of the facility
- Warehouse management systems can be stand alone systems, or modules of an ERP system or supply chain execution suite
- The primary purpose of a WMS is to control the movement and storage of materials within a warehouse – you might even describe it as the legs at the end-of-the line which automates the store, traffic and shipping management.

Warehouse Management System

- Warehouse Management is not just managing within the boundaries of a warehouse today, it is much wider and goes beyond the physical boundaries, by making best use of inventory management, inventory planning, cost management, IT applications & communication technology.
- Efficient warehouse management gives a cutting edge to any enterprise with geographically dispersed storage facilities.
- Warehouse management does not just start with receipt of material but it actually starts with actual initial planning when physical storage facilities are designed.
- Warehouse design and process design within the warehouse is also part of warehouse management, supply chain management and logistics.

Warehouse Management System

- Warehouse Management monitors the progress of goods through the warehouse. It involves the physical warehouse infrastructure, tracking systems, and communication.
- Warehouse management deals with receipt, storage and movement of goods, to intermediate storage locations or to final end consumption points.

Warehouse Receiving

- At its most fundamental level, receiving is the process of confirming that you received what you ordered.
 - Does the material received match your purchase order?
 - Do you place it in your warehouse quickly?
- When you consider that the average warehouse receives, counts, and inspects thousands of items of varying shapes and sizes from hundreds of vendors whose picking, packing, and shipping practices are all different, it is not surprising that receiving can be one of the most complicated functions and warehouse processes.
 - Errors in receiving, unlike most other errors in your warehouse, have a ripple effect.
 - If you can't get your receiving process working smoothly, you'll run into near-future scenarios where product will be sitting on your receiving dock, or on pallets in a corner.
 - Your employees will waste time looking for them.

Warehouse Receiving *(cont'd)*

- Consider a typical situation where:
 - data from your receiving department determines what your accounting department pays vendors.
 - If receiving doesn't highlight when pallets are missing a few cartons, you will overpay for the actual goods received as well as incur backorders.
 - If the received items differ from what was expected, you'll unnecessarily expend time and money to correct the problem.
- Everyone working on the distribution team should understand that outbound success and efficiency depends on the success of inbound efficiency and performance.
 - This is particularly important if you are talking about receiving and processing returns
 - Ideally, the best practice on receiving is to move items to their storage location with as few touches - few movements and barcode scans, etc. - as possible
- Good receiving is critical because when you move product faster with fewer employees, employee productivity is higher, you use less warehouse space, and you reduce the number of touches on items, which reduces opportunities to inadvertently damage them

Warehouse Receiving

(cont'd)

Labels

Good receiving starts with good labeling. Get your suppliers to correctly label materials before they arrive at your warehouse.

- Make sure the labels can be read by both human and Auto ID Data Capture (AIDC) devices.
- It goes without saying that you need to ensure that your warehouse has the proper data scanners in the receiving locations where you need them.
- Depending on your receiving system, the labeling standard you use and your vendors' willingness to customize printing for you, here are some of the data that you may want to include on your labels:
 - Shipper/supplier information (company name, tel. number)
 - Purchase order number
 - Pallet labels and quantity
 - Case labels and quantity
 - Product number and description
 - Package count
 - Part/unit labels or markings (each item in the case should have a unique product ID)

Warehouse Receiving

(cont'd)

An effective labeling component of your receiving system also includes a well-labeled warehouse.

- Identify areas, aisles, rack bays, and shelves with large, easy-to-read location labels.
- Use large barcode-readable “license plate” labels viewable from 30-40 feet to identify warehouse locations.
- Create and adhere to some rigid labeling policies in your warehouse and you will reduce your error rates.

Here are a few of the policies which will help you:

- Require that vendors (or your staff) label every case and pallet to identify it.
- Scan the label to confirm that you are moving the correct product.
- If products are not labeled by your supplier, you need to enable the receiving team to handle printing on your end. This means having the correct information, and output devices so they can print and apply the labels as needed.
- Mark all storage locations.
- Replace damaged location tags.
- Make sure labels are readable when shelved.
Train staff to shelve with labels facing outward.
- If you remove items from cartons or change their location or quantity, print new labels with the updated information.

Sure, the above ideas are all good ideas.

Good ideas mean nothing if you don't implement them.

When it comes to labeling, you need to build good relationships with your vendors

Warehouse Receiving

(cont'd)

Vendors

Vendor Compliance Standards

- Before a new and correctly labeled carton ever arrives at your warehouse, you need to collaborate with your vendors and agree on a plan for efficiency and success.
- Your vendors can help or hurt you. How your vendors ship product to you strongly affects the fate of your receiving operation and even the profit of your company.
 - For example, when a shipment arrives requiring extra handling, its receipt is slowed and you have to spend extra time completing the process.
 - Your overhead increases while the chance of a receiving error increases. Consider these time-wasters;
 - Do your vendors ship multiple items in one box?
How much extra time do you need to account for so that someone in receiving can open a box, sort the items, count and rebox them?
- Vendors' shipping decisions can really impact your business. Consider the following examples:
 - Has a vendor ever used the wrong freight method or carrier?
 - Do your vendors pack multiple items in a single carton?
 - Do they omit packing lists with their shipments?
 - Are items incorrectly packed or marked?
 - Has defective or damaged product ever arrived at your warehouse?
 - Are shipment counts incorrect?
 - Have vendors ever missed delivery dates?

Too many "positive" answers to these questions are negatively impacting your overheads.

Warehouse Receiving

(cont'd)

Vendors

Sure, it takes time, effort, discipline and two-way communication to develop - and refine - a system with your key vendors.

- You are the customer and you have to set the standards and compliance procedures.
- You also should aim for a system that you can apply to all of your vendors.
- Create, adopt, publish, and enforce vendor compliance procedures internally within your organization as well as with vendors.
 - Decide the details (how, what, and when) and require vendors to sign off on your playbook.
 - Some of the things that you may want to specify include: Request that vendors label the outer carton with the PO number, product or style number, carton count, and bar code. Request that vendors add pallet tags that be easily scanned to identify pallets, boxes or individual products.
 - Figure out what you want and formalize it in a written document.
For example, if you want single-SKU* cartons whenever possible, specify this in your manual.
- Things will go away so you must document repeated problems.
 - Is the vendor shipping you goods without a purchase order?
 - Are you continually receiving defective items?
 - When orders are imperfect, you need to record the invoice number, the non-conformance issue, and the shipment quantity.

(*) SKU = Stock Keeping Unit

Warehouse Receiving *(cont'd)*

Vendors


- There are a lot of scorecards around and you should be regularly tracking your vendor's performance or lack thereof.
 - If they fail to follow the mutually agreed upon procedures, you need to track and record shortcomings. Work with vendors to solve problems.
 - If they are reluctant to improve and unwilling to eliminate or otherwise reduce the error rate, you might just have to switch them..
- You need to institute vendor quality tracking as a regular practice.
 - One option is rank them on a dependability scale.
 - Knowing that certain vendors will be less dependable, receiving staff will be able to give their shipments more attention.

Warehouse Receiving

(cont'd)

Technology

Receiving in modern warehouses assumes that you have a warm and pleasant relationship with technology.

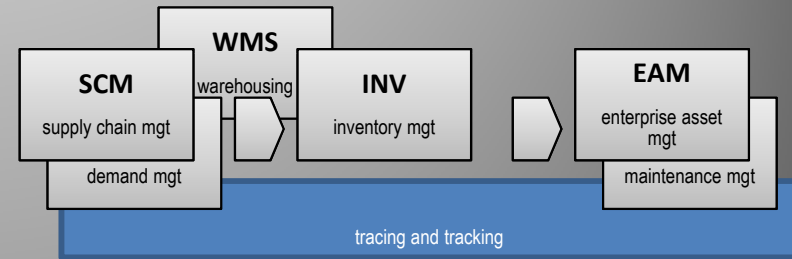
- If your current and projected business volume calls for it, the only thing stopping you from integrating technology is your capital investment budget.
 - The technology blueprint that you ultimately install, from docking technology and material handling equipment, to data entry and data management systems, should be both flexible and efficient.
- 
- For example, while it is assumed that you have the basic ability to scan bar codes (on pallets or in cartons), you should also have the flexibility to capture different common bar code conventions.
 - Radio Frequency (RF) terminals and systems have evolved at a rapid pace in recent years.
 - Prices have dropped sharply and you have a wide variety of basic as well as advanced options for scanning readers and transmitting stations.
 - If you aren't currently using wireless, you might want to revisit next year's capital budget and see if you can insert a "system upgrade to RF" line item.
 - Label printer prices have similarly dropped. You can buy lightweight portable printers and distribute them throughout your warehouse so staff can print on-demand and avoid returning unnecessarily to the desk.

Warehouse Receiving

(cont'd)

Technology

- While capturing data is of primary importance, you'll also need a system for managing and sharing these data.
- A specialized software on Warehouse Management System (WMS), will support all your “receiving” challenged, since it is able to:
 - Update inventory levels automatically upon receipt
 - View receipt details for single receipt or all receipts from a single vendor
 - Receive against multiple purchase orders simultaneously
 - Receive by purchase order, by product, or without a purchase order
 - Assign inventory to a location for put-away (move and store it on the self)
 - Store products in unique or multiple locations based on bin/inventory characteristics.



Part - III

TRACING AND TRACKING

Introduction to Tracing and Tracking

- Traceability refers to the completeness of the information about every step in a process chain.

- The formal definition:

Traceability is the ability to chronologically interrelate uniquely identifiable entities in a way that is verifiable

- Traceability is the ability to verify the history, location, or application of an item by means of documented recorded identification

Tracing and Tracking

- In distribution and logistics of many types of products, tracking and tracing, concerns a process of determining the current and past locations (and other information) of a unique item or property.
- This concept can be supported by means of reckoning and reporting of the position of products and/or their containers with the property of concern, stored, in a real-time database. This approach leaves the task to compose a coherent depiction of the subsequent status reports.
- Another approach is to report the arrival or departure of the object and recording the identification of the object, the location where observed, the time, and the status. This approach leaves the task to verify the reports regarding consistency and completeness.

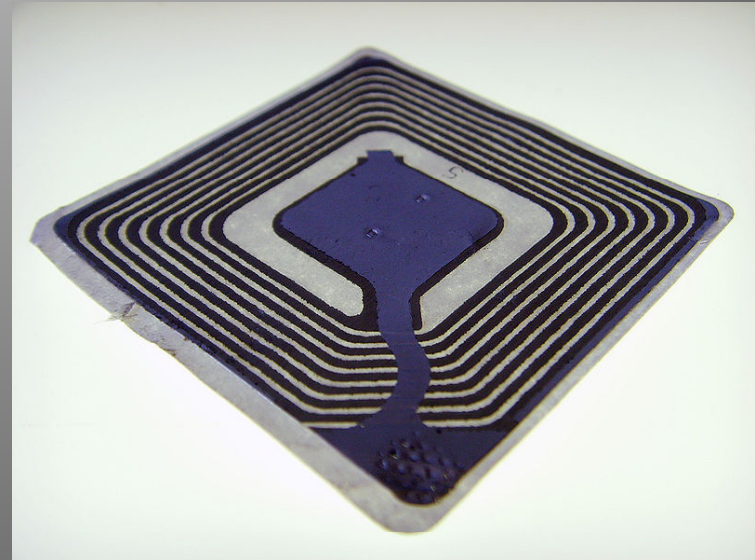
Technology

- The international standards organization EPCglobal under GS1 has ratified the EPC Network standards (esp. the EPC Information Services EPCIS standard) which codify the syntax and semantics for supply chain events and the secure method for selectively sharing supply chain events with trading partners. These standards for Track and Tracing have been used in successful deployments in many industries and there are now a wide range of products that are certified as being compatible with these standards.
- In response to a growing number recall incidents (food, pharmaceutical, toys, etc) , a wave of software, hardware, consulting and systems vendors have emerged over the last few years to offer a range of traceability solutions and tools for industry. Radio-frequency identification and barcodes are two common technology methods used to deliver traceability.



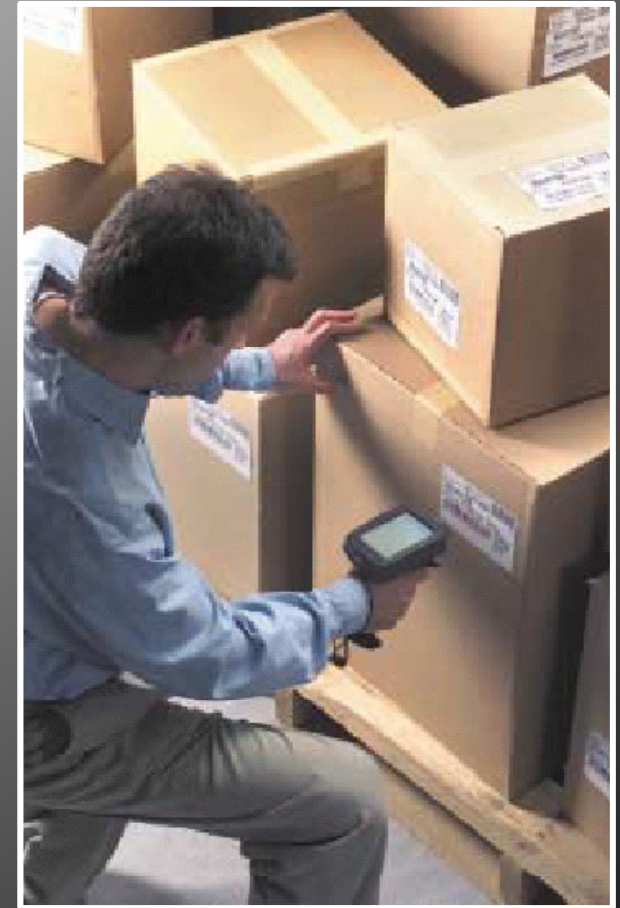
Technology

- RFID is synonymous with track-and-trace solutions, and has a critical role to play in supply chains. RFID is a code-carrying technology, and can be used in place of a barcode to enable non-line of sight-reading. Deployment of RFID was earlier inhibited by cost limitations but the usage is now increasing.
- Some produce traceability makers use matrix barcodes to record data on specific produce. Barcoding is a common and cost effective method used to implement traceability at both the item and case-level. Variable data in a barcode or a numeric or alphanumeric code format can be applied to the packaging or label. The secure data can be used as a pointer to traceability information and can also correlate with production data such as time to market and product quality.



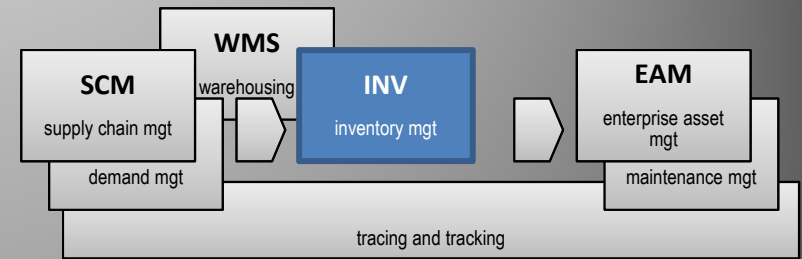
Product Packaging Labeling

- Technologies related to shipping containers are:
 - identification codes
 - bar codes or RFID
 - electronic data interchange (EDI)
- These three core technologies serve to enable the business functions in the process of shipping containers throughout the distribution channel, up to end recipient.
- Each has an essential function:
 - identification codes either relate product information or serve as keys to other data
 - bar codes and RFID, allow for the automated input of identification codes
 - EDI moves data between trading partners within the distribution channel



Product Packaging Labeling *(cont'd)*

- Elements of these core technologies include UPC and EAN item identification codes, the SCC-14 (UPC shipping container code), the SSCC-18 (Serial Shipping Container Codes), Interleaved 2-of-5 and UCC/EAN-128 (newly designated GS1-128) bar code symbologies, and ANSI ASC X12 and UN/EDIFACT EDI standards.
- RFID labels for shipping containers are increasing in usage. A Wal-Mart division, Sam's Club, has also moved in this direction and is putting pressure on its suppliers for compliance.
- Shipments of hazardous materials or dangerous goods have special information and symbols (labels, placards, etc.) as required by UN, country, and specific carrier requirements.



Part - IV

INVENTORY MANAGEMENT

Inventory Management

- As a result of an optimally working supply chain management system, we may ensure having the right products, at the right inventory/warehouse, at the right time. It is then, unfolded a new domain of activity and responsibility, namely the “**Inventory Management**”.
- Inventory management is primarily about specifying the size and placement of stocked goods.
- Inventory management is required at different locations within an enterprise or within multiple locations of a supply network to protect the regular and planned consumption rate against the random disturbance of running out of materials or goods. The scope of inventory management also concerns the fine lines between **replenishment lead time, carrying costs of inventory, asset management, inventory forecasting, inventory valuation, inventory visibility, future inventory price forecasting, physical inventory, available physical space for inventory, quality management, replenishment, returns and defective goods and demand forecasting.**
- Balancing these competing requirements leads to **optimal inventory levels**, which is an on-going process as the business needs shift and react to the wider environment.

Inventory Management

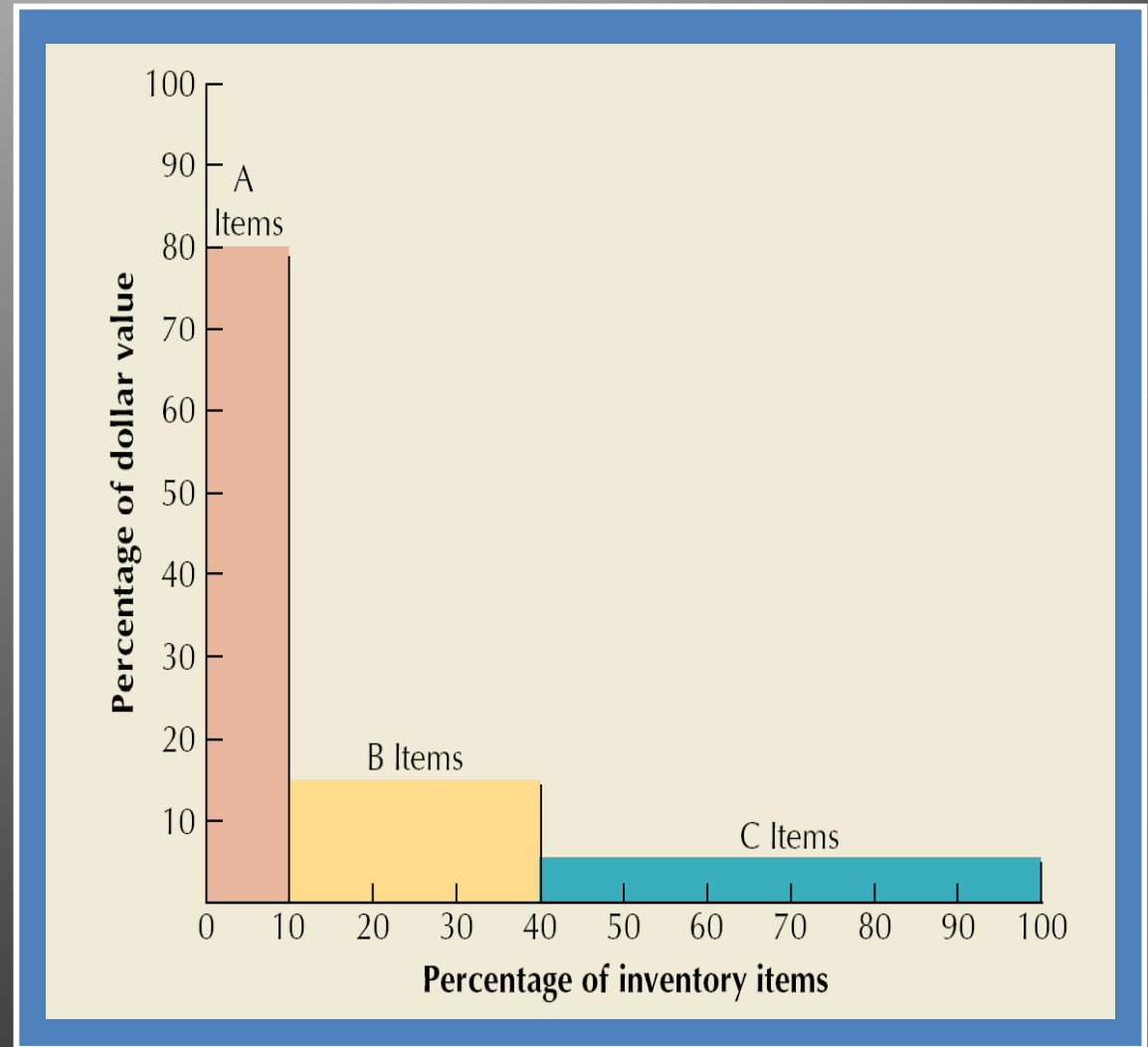
- Systems and processes that identify inventory requirements, set targets, provide replenishment techniques and report actual and projected inventory status
- Handles all functions related to the tracking and management of material
 - This would include the monitoring of material moved into and out of stockroom locations
 - The reconciling of the inventory balances
 - ABC analysis, lot tracking, cycle counting support etc.
- Management of the inventories, with the primary objective of determining/controlling stock levels within the physical distribution function to balance the need for product availability against the need for minimizing stock holding and handling costs

Inventory Costs

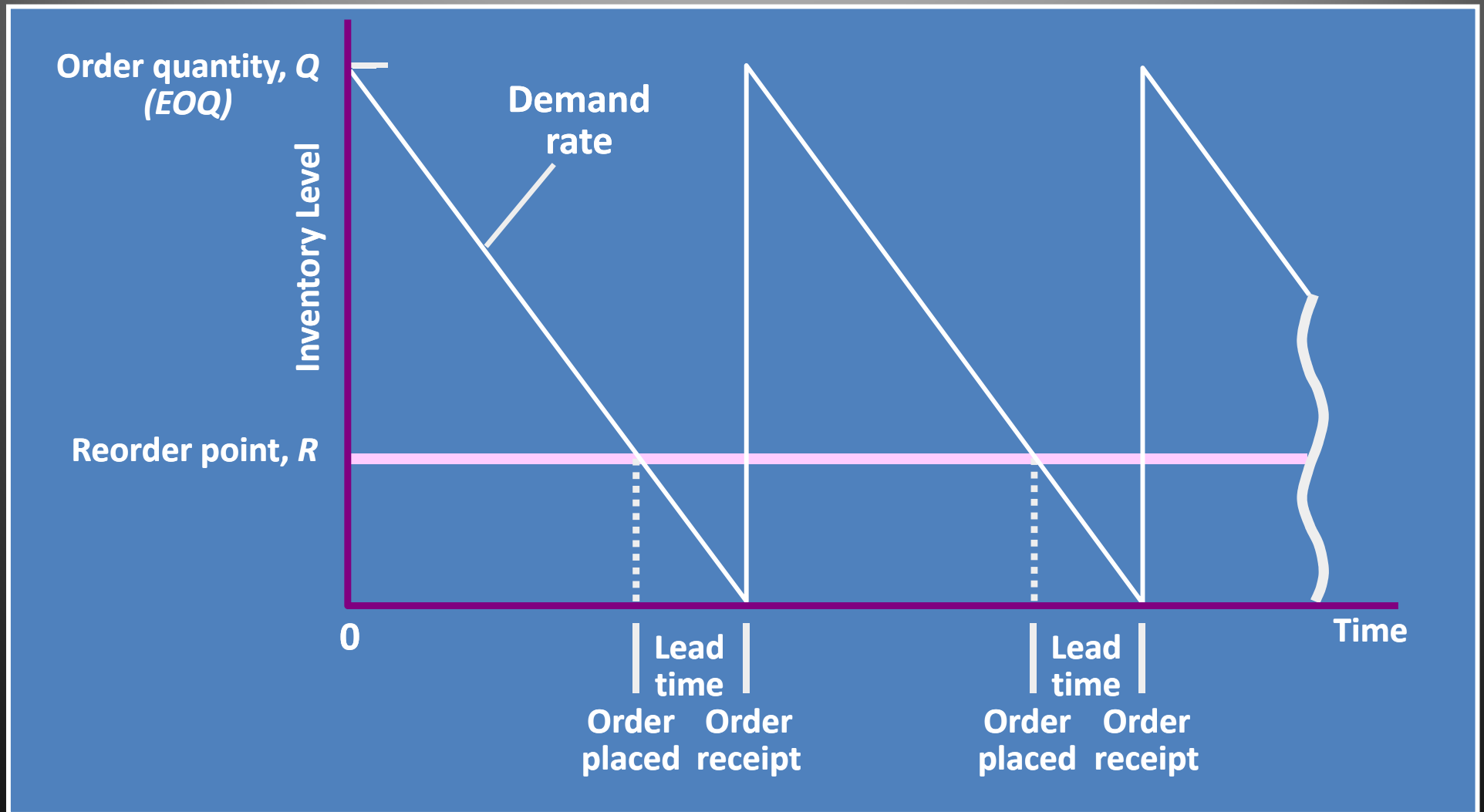
- Carrying cost
 - cost of holding an item in inventory
- Ordering cost
 - cost of replenishing inventory
- Shortage cost
 - temporary or permanent loss of sales when demand cannot be met

Inventory: ABC Classification

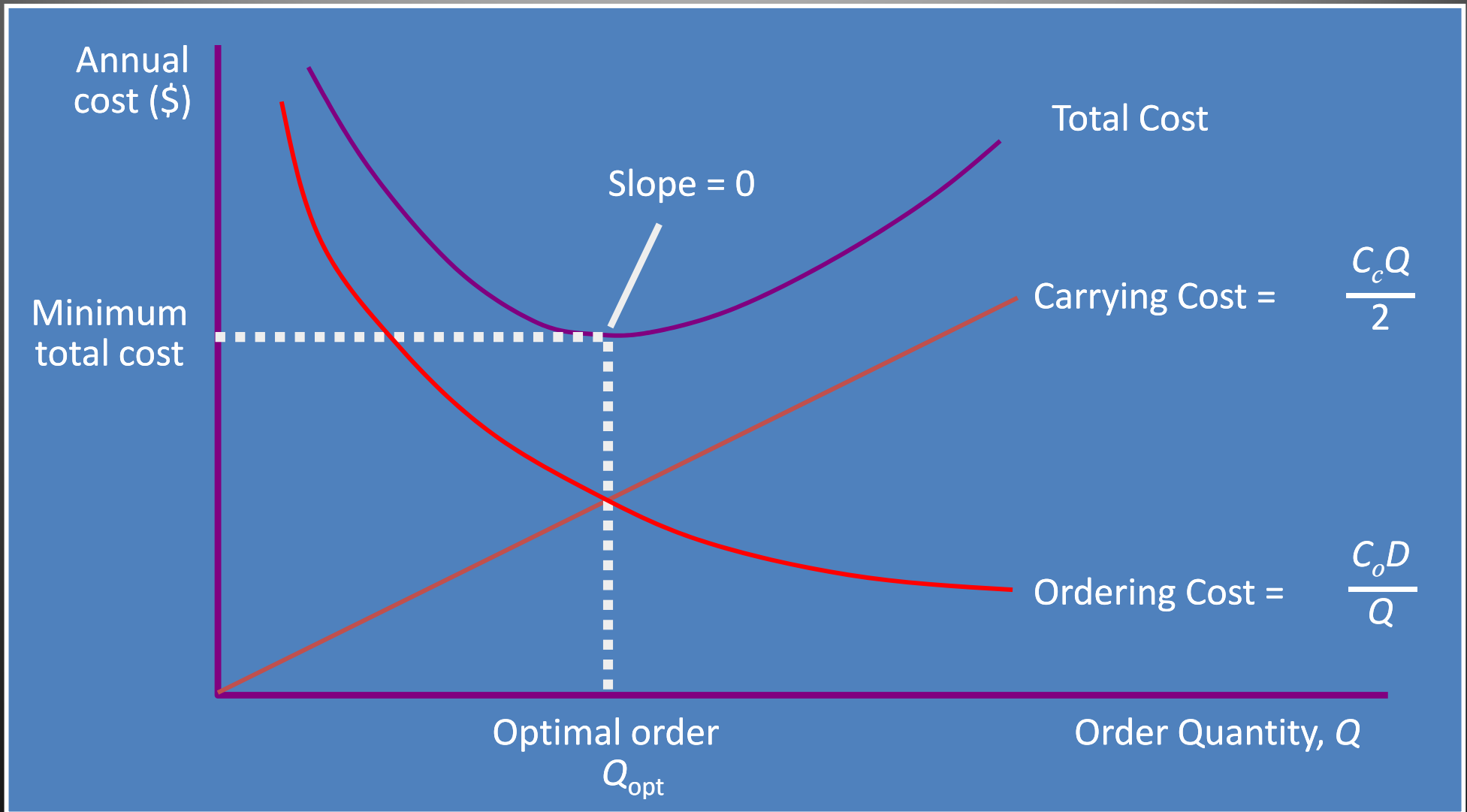
- Class A
 - 5 – 15 % of units
 - 70 – 80 % of value
- Class B
 - 30 % of units
 - 15 % of value
- Class C
 - 50 – 60 % of units
 - 5 – 10 % of value



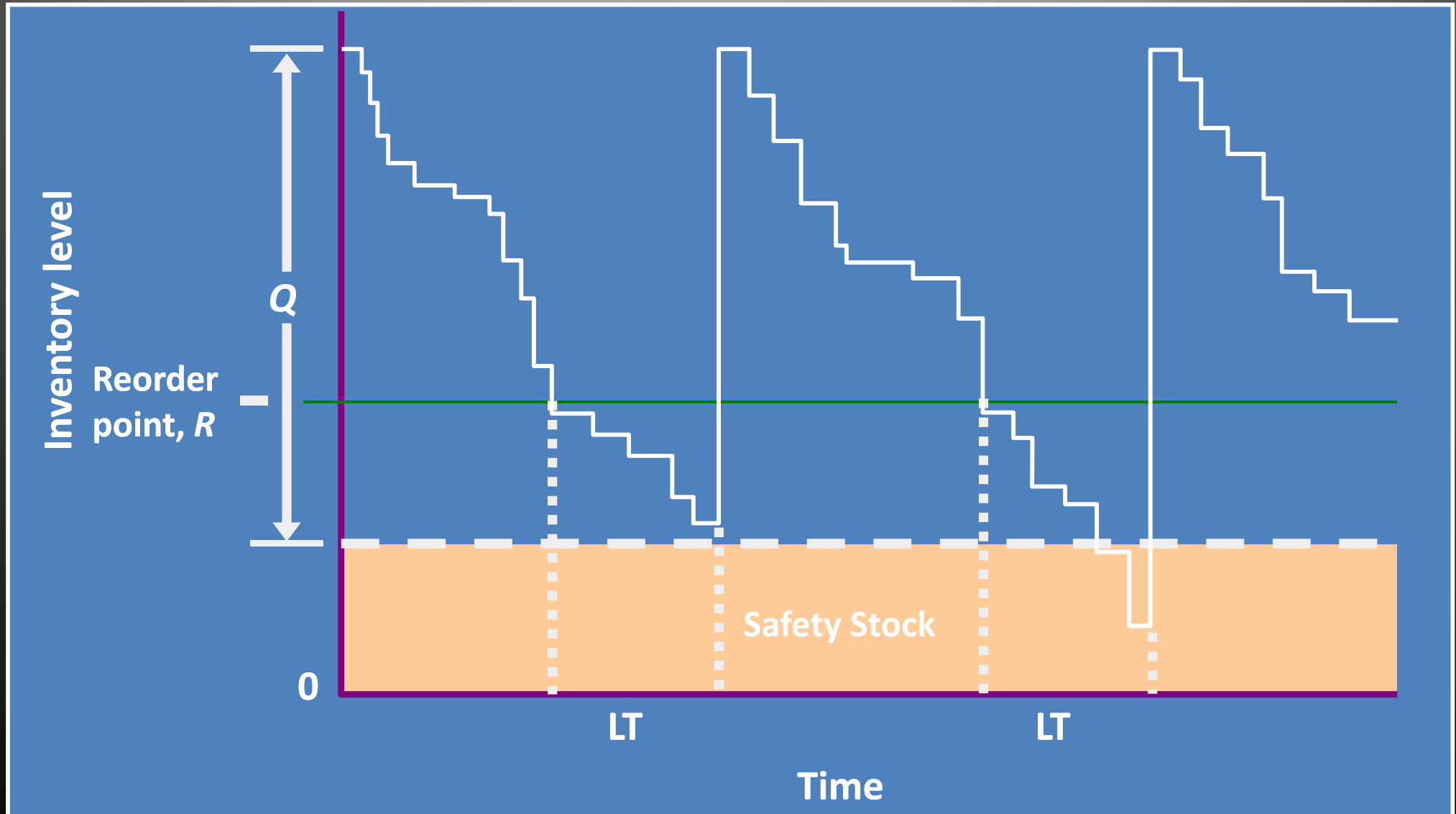
Inventory Order Cycle



Determination of EOQ



Reorder Point with Safety Stock



Inventory Service Level

$$R = dL + z\sigma_d L$$

d = average daily demand

L = lead time

σ_d = the standard deviation of daily demand

z = number of standard deviations corresponding to the service level probability

$z\sigma_d L$ = safety stock

Probability of meeting demand during lead time = service level

Probability of a stockout

Safety stock

$$z\sigma_d\sqrt{L}$$

$\bar{d}L$

Demand

R

Information Technology

- Information technology is in a position to effectively tackle the challenge of optimal setting-up and operating, both:
 - **Supply Chain Management**
 - **Inventory Maintenance and Control**

Resource Planning

using Information Technology

- Inventory management software is a computer-based system for tracking product levels, orders, sales and deliveries.
- Companies use inventory management software to avoid product overstock and outages, while keeping total inventory cost under control.

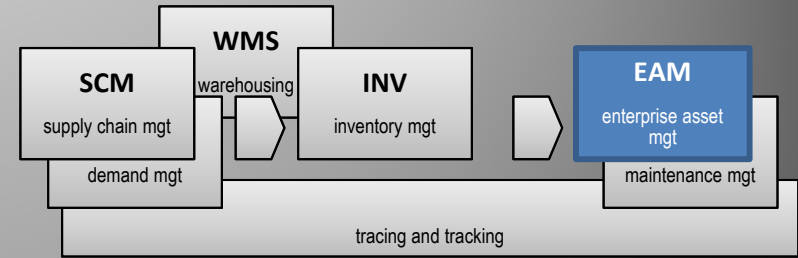
Components

- Inventory management software is made up of several components, all working together to create a cohesive inventory control system. These components include:
- **Asset tracking**
 - When a product is in a warehouse or store, it can be tracked via its barcode and/or other tracking criteria, such as serial number, lot number or revision number.
- **Barcoding**
 - Barcodes or RFID are the means whereby data on products and orders is inputted into inventory management software. A barcode reader is required to read barcodes and look up information on the products they represent. The barcode reader may be either on-line or off-line the inventory control system.
- **Order management**
 - Once products reach a certain low level, a company's inventory management system can be programmed to trigger automatic or manual reordering on that product. This helps companies avoid running out of products or tying up too much capital in inventory.
- **Service management**
 - Companies that are primarily service-oriented rather than product-oriented can use inventory management software to track the cost of the materials they use to provide services, such as machinery spare parts or consumables.

Benefits

An enterprise, advancing the next level of maturity in Inventory Control, is typically looking after a number of benefits. They are:

- **Cost savings**
 - In many cases, a company's inventory represents one of its largest investments, along with its workforce and locations. Inventory management software helps companies cut expenses by minimizing the amount of unnecessary parts and products in storage. It also helps companies keep lost sales to a minimum by having enough stock on hand to meet demand.
- **Warehouse organization**
 - Inventory management software can help optimize the warehousing. If certain products are often sold together or are more popular than others, those products can be grouped together or placed near the delivery area to speed up the process of picking, packing and shipping to end consumption points.
- **Updated data**
 - Up-to-date data on inventory conditions and levels is also an advantage inventory management software gives companies. Company management can usually access the software through a mobile device, laptop or PC to check current inventory numbers.
- **Time savings**
 - With the aid of restricted user rights, company managers can allow many employees to assist in inventory management. They can grant employees enough information access to receive products, make orders, transfer products and do other tasks without compromising company security. This can speed up the inventory-management process and save managers' time.



Part - V

ENTERPRISE ASSET MANAGEMENT

Enterprise Asset Management

- Company assets (re: vessels), their machinery and the associated spare parts inventory, is a key attention item in **capital-intensive enterprises**.
- The Enterprise asset management (**EAM**) means the **optimal management of the physical assets of an organization to maximize value, along the whole asset lifetime**.
- It covers such things as the **design, construction, commissioning, operations, maintenance and decommissioning/replacement of plant, equipment and facilities**.
- "**Enterprise**" refers to the management of the assets across departments, locations, facilities and, in some cases, business units.
- By managing assets across the facility, organizations can improve utilization and performance, reduce capital costs, reduce asset-related operating costs, extend asset life and subsequently **improve return-on-assets (ROA)**.

Enterprise Asset Management

- The **functions of asset management** are taking a fundamental turn where organizations are moving from historical reactive (run-to-failure) models and beginning to embrace whole chain of:
 - **life planning**
 - **life cycle costing**
 - **planned and proactive maintenance**
 - **As well as other industry best practices**
- Some companies still regard physical asset management as just a more business-focused term for maintenance management - until they begin to realize the **organization-wide impact** and interdependencies with:
 - **Operations**
 - **Design**
 - **asset performance**
 - **personnel productivity, and**
 - **lifecycle costs**
- This shift in focus exemplifies the progression from maintenance management to Enterprise Asset Management and is embodied in the British Standards specification **PAS 55** (Requirements specification for the optimal management of physical infrastructure assets).

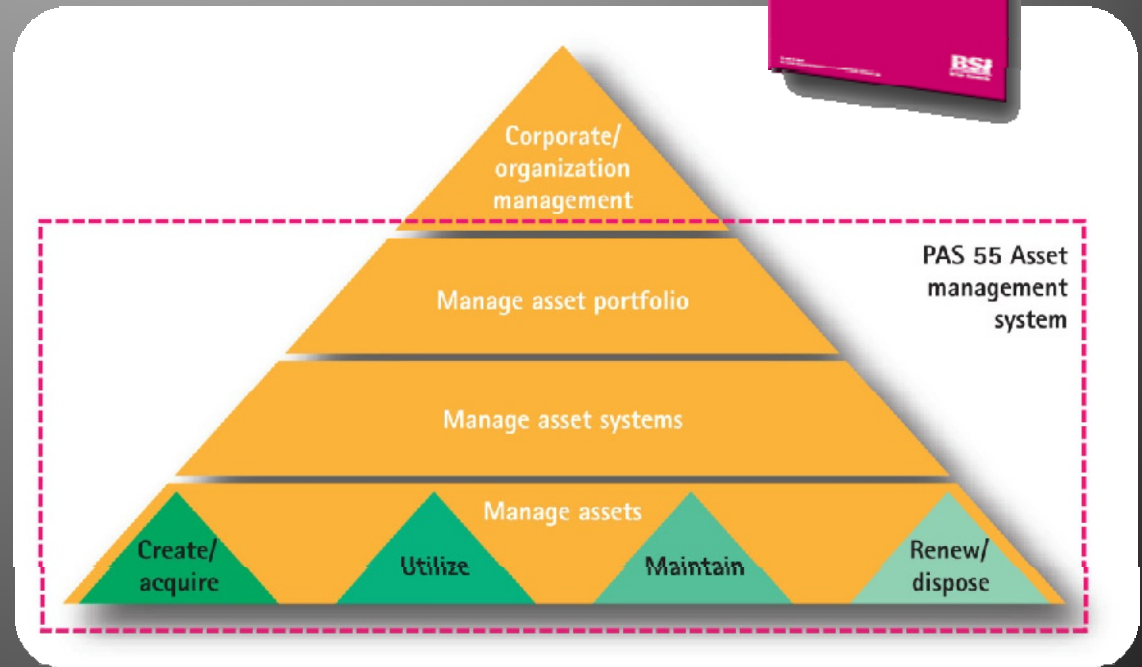
What is PAS-55

PAS 55 is the **British Standards Institution's (BSI)** Publicly Available Specification for the optimized management of physical assets - it provides clear definitions and a 28-point requirements specification for establishing and verifying a joined-up, optimized and whole-life management system for all types of physical assets.

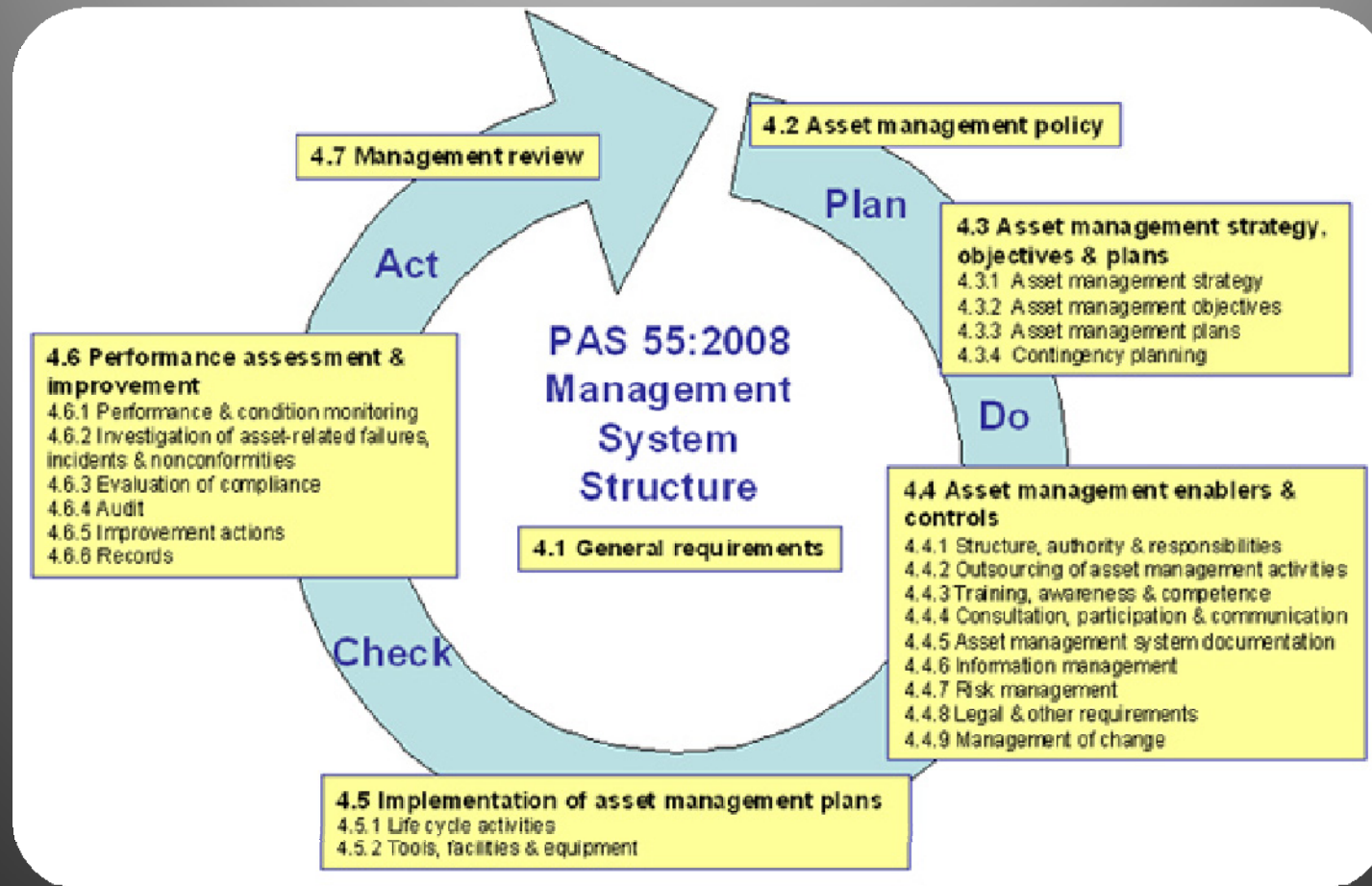
Now internationally recognized, PAS 55 is proving to be an essential, objective definition of what is required to demonstrate competence, establish improvement priorities and make better, clearer connections between strategic organizational plans and the actual day-to-day work and asset realities.

PAS 55 applies to any organisation that has a high dependency on physical infrastructure or equipment. It describes what must be done in joined-up planning and delivery, in the integrated management of acquisition/creation operation, maintenance and disposal/renewal, and in the many generic 'enablers' that underpin sustainable, optimized performance.

PAS 55:2008 is structured to interlock naturally with **quality management systems** such as ISO9001, and other ISO frameworks



Key Features of PAS-55



More on EAM

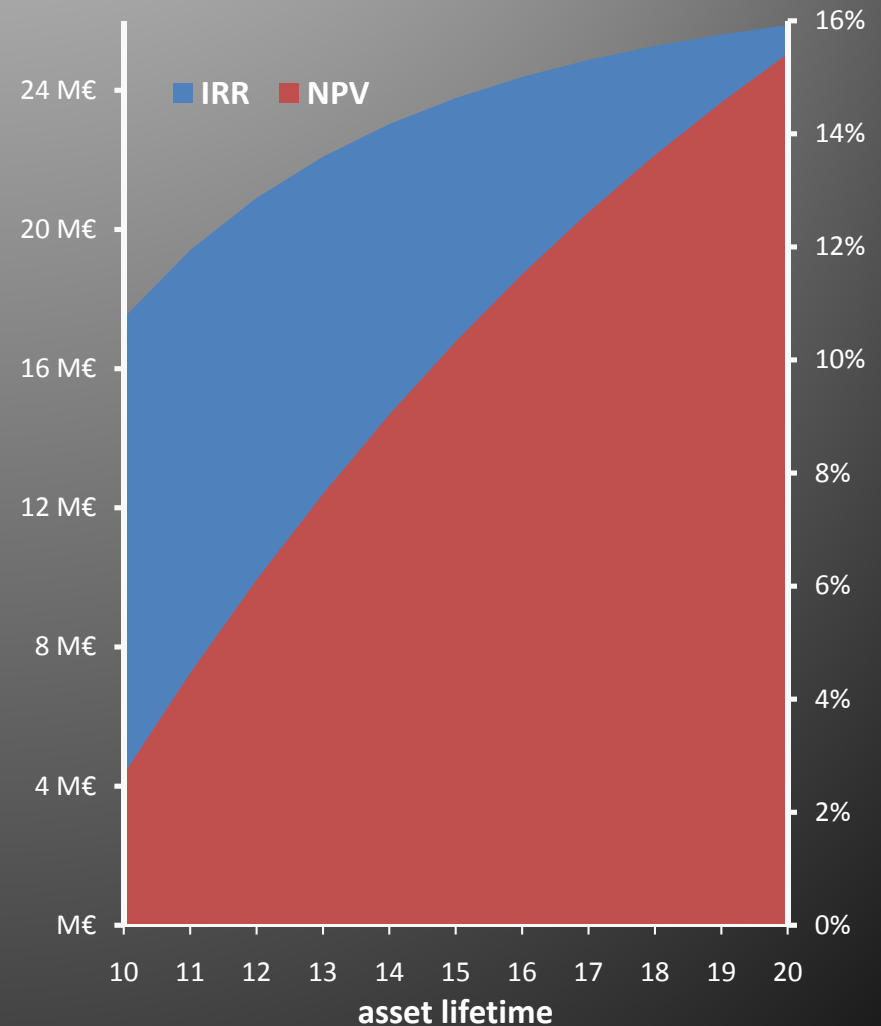
- In capital-intensive industries such as utilities, process/discrete manufacturing, shipping, healthcare as well as real estate, physical assets (buildings, fleet, infrastructure and equipment) form a significant proportion of the total assets of the organization.
- These industries face the harsh realities of operating in highly competitive markets and dealing with high value assets and equipment where each failure is disruptive and costly.
- At the same time, they must also adhere to stringent occupational and environmental safety regulations.

More on EAM *(cont'd)*

- It is thus important for organizations to maximize the return on investment from their asset base.
- Life Cycle Asset Management (LCAM) and EAM are paradigms employed to achieve that goal.
- Given a physical asset, the objective of LCAM is to extract maximum productivity from the asset and minimize the total costs involved in its acquisition, operations as well as maintenance.
- Quantitatively, the objective of asset management is to strike an optimal balance between maximizing Overall Asset Productivity (OAP) and minimizing **Total Cost of Ownership (TCO)**.
- Furthermore, LCAM provides guidance on whether it is more cost-effective to continue to maintain, overhaul or replace a failing asset.

More on EAM *(cont'd)*

- Proper Life Cycle Asset Management (LCAM) will prolong the productive and profitable asset life span, maximizing the Overall Asset Productivity (OAP) and minimizing **Total Cost of Ownership (TCO)**
- Diagram shows the typical effect that the increased life span has in asset Net Present Value and the return on investment



More on EAM *(cont'd)*

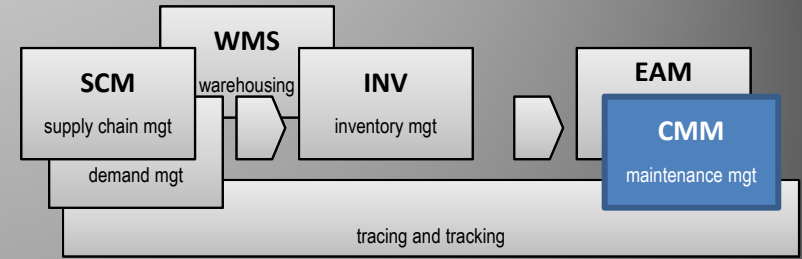
- When the entire asset portfolio of the organization is considered, EAM takes over.
- As business and market requirements are dynamic, the output specifications for the organization's assets change constantly (*e.g., increase in output capacity due to new customers*).
- EAM provides the framework for capital and labor allocation decision processes across the competing categories of equipment addition, reduction, replacement, over-hauling, redundancy setup and maintenance budgets in order to meet business needs.
- Correspondingly, it merges the collective LCAM efforts and re-evaluates decisions based on long and short-term economic considerations at the enterprise level.

Why EAM is important...

- Competitive pressures force organizations to minimize asset total cost of ownership and streamline their asset management operations (these typically involve myriad activities ranging from inventory, parts and labor management to contracts and vendor management for new works).
 - As downtimes become increasingly expensive, both in terms of lost production capacity and unfavorable publicity, organizations are compelled to maximize their asset productive life cycles via optimal maintenance programs.
 - When EAM is used in collaboration with all other forms of service-based operations to achieve better customer retention, it is called **Service Lifecycle Management (SLM)**.

Why EAM is important...

- In the event of asset failure, quick response time is critical.
 - In recent years, stringent industry-specific environmental health and occupational safety regulations are being enforced by government oversight agencies, with industrial owners and operators responsible for compliance.
 - Asset registers, risk registers, work planning and scheduling, life cycle costing and systematic methods for problem identification, root cause analysis and continuous improvement are increasingly seen as prerequisites for a robust asset management system.
- By providing a platform for connecting people, processes, assets, industry-based knowledge and decision support capabilities based on quality information, EAM provides a holistic view of an organization's asset base, enabling managers to control and optimize their operations for quality and efficiency.



Part - VI

MAINTENANCE MANAGEMENT

Maintenance Management

an integral part of EAM

- **Computerized Maintenance Management System (CMMS)** is an integral part of a full scale EAM system, incorporated into the Enterprise Asset Management
- A CMMS software package maintains a computer database information about an organization's maintenance operations, i.e. CMMIS - computerized maintenance management information system.
- This information is intended to help maintenance workers do their jobs more effectively (for example, determining which machines require maintenance and which storerooms contain the spare parts they need) and to help management make informed decisions (for example, calculating the cost of machine breakdown repair versus preventive maintenance for each machine, possibly leading to better allocation of resources).
- CMMS data may also be used to verify regulatory compliance (re: IMS)

Maintenance Management

an integral part of EAM

- CMMS packages may be used by any organization that must perform maintenance on equipment, assets and property.
- CMMS packages can produce status reports and documents giving details or summaries of maintenance activities. The more sophisticated the package, the more analysis facilities are available.
- Many CMMS packages can be either web-based, meaning they are hosted by an outsourced company on an outside server, or LAN based, meaning that the company buying the software hosts the product on their own server.

CMMS Components

A CMMS package may offer a wide range of capabilities. A typical package should deal with some or all of the following, interconnected with the respective IT subsystems:

- **Work orders**

- Scheduling jobs, assigning personnel, reserving materials, recording costs, and tracking relevant information such as the cause of the problem (if any), downtime involved (if any), and recommendations for future action. Typically, the CMMS schedules preventive maintenance automatically based on maintenance plans and/or meter readings.
 - Inspection
 - Details condition of assets.
 - Preventive maintenance
 - Keeping track of preventive maintenance jobs, including step-by-step instructions or check-lists, lists of materials required, and other pertinent details.
 - Machine breakdown
 - Incidence of machine breakdown, details of repairs completed and repairs "to do".
 - Preventive maintenance tasks are often undertaken during breakdown repair and so preventive maintenance tasks need to be rescheduled.

CMMS Components

(cont'd)

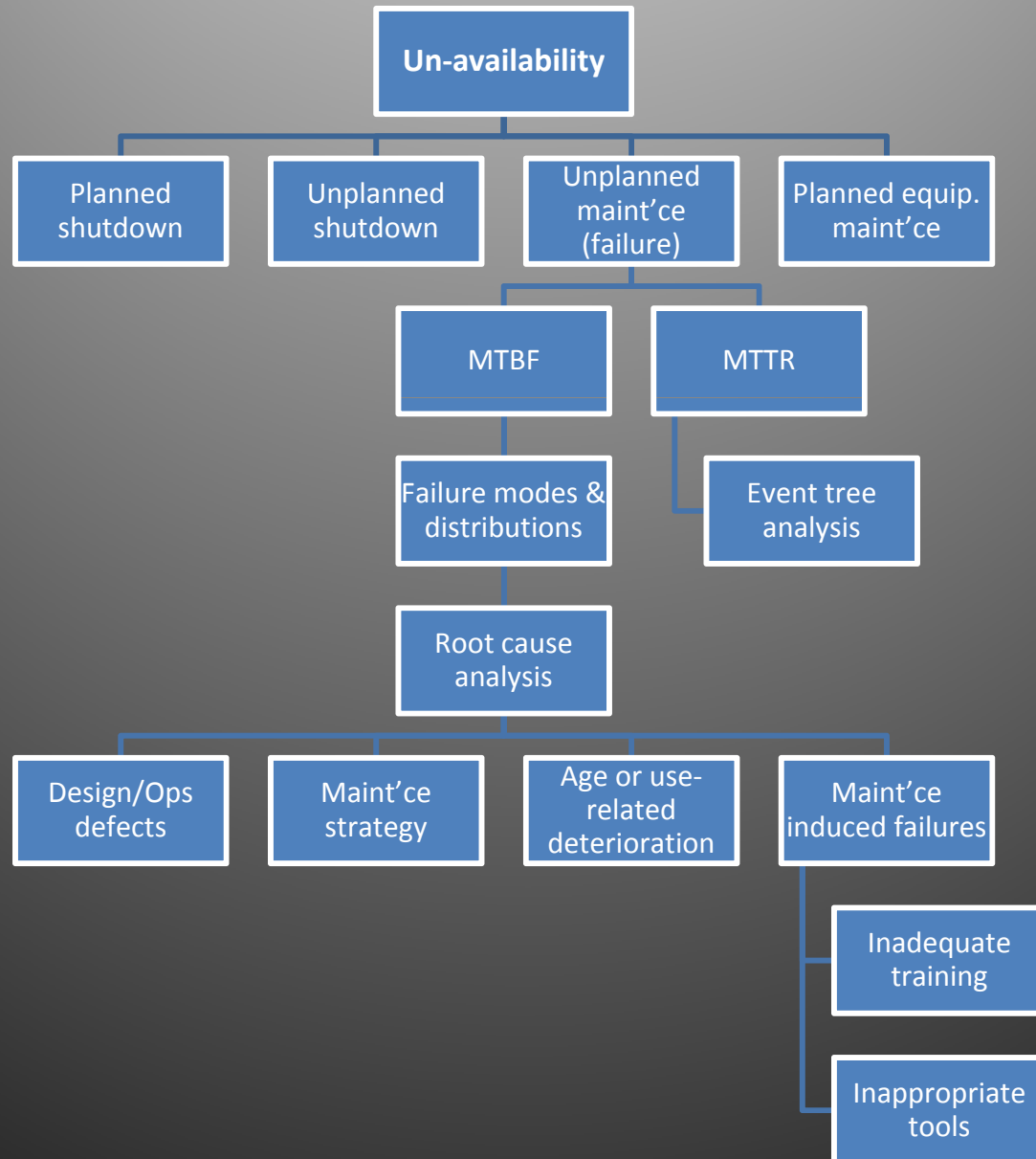
- **Asset management**
 - Recording data about equipment and property including maintenance activities, specifications, purchase date, expected lifetime, warranty information, service contracts, service history, spare parts and anything else that might be of help to management or maintenance workers.
 - The CMMS may also generate metrics such as the Facility Condition Index (FCI) to measure effectiveness of asset management.
- **Inventory control**
 - Management of spare parts, tools, and other materials including the reservation of materials for particular jobs, recording where materials are stored, determining when more materials should be purchased, tracking shipment receipts, and taking inventory.
- **Safety**
 - Management of permits and other documentation required for the processing of safety requirements.
 - These safety requirements can include lockout-tagout, confined space, foreign material exclusion (FME), electrical safety, and others.

CMM KPI*'s

- Overtime worked against plan
- PM schedule compliance
- Time taken to respond in maintenance calls
- Budget compliance
- PM Backlog man-hours
- Critical Equipment availability
- Number of breakdowns (*i.e. unplanned maintenance*)
- MTBF
- “Production” equipment performance
(*By output volume levels*)
- Equipment performance
(with respect to quality)

(* KPI = Key Performance Indicator)

CMM KPI*'s *(cont'd)*



eAM interconnection to company's ERP

