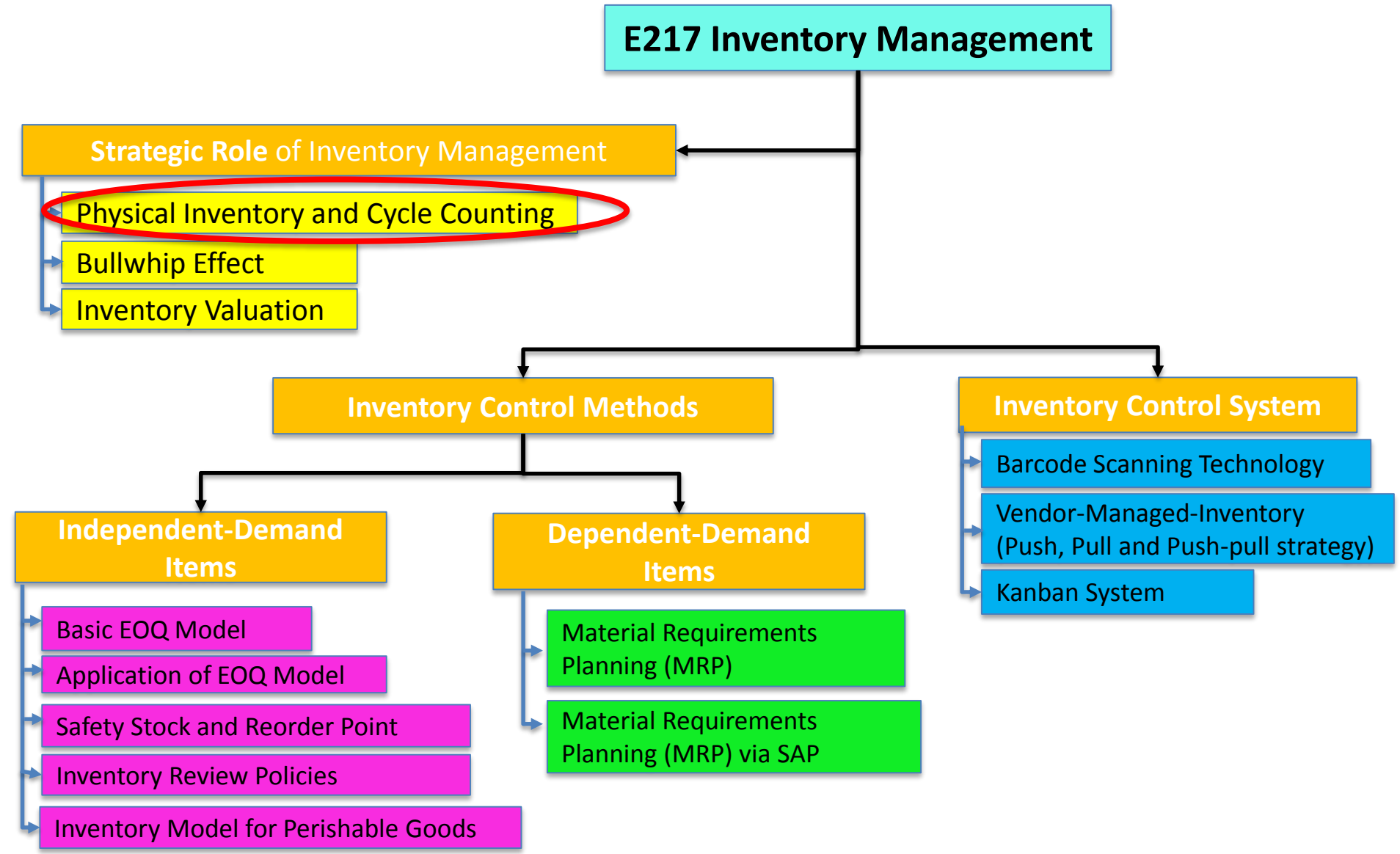
Problem 06

Stock is Available?

E217 – Inventory Management

SCHOOL OF ENGINEERING

E217 Inventory Management Topic Tree



Why Use Key Performance Indicators?

- It shows where improvements need to be made and if improvements actually happened.
- A set of quantifiable measures that a company or industry uses to gauge or compare performance in terms of meeting their strategic and operational goals.
- KPIs combine real, live data with your business objectives and strategies to provide insight into your performance.
- A comparison of actual results against a pre-specified benchmark.
- KPIs vary between companies and industries, depending on their priorities or performance criteria.

What is a Good KPI ?

- Measured frequently (for example, weekly, monthly, yearly)
- Must be linked to the strategic objectives (things that matter the most)
- All staff understand the measure and what corrective action is required
- Responsibility can be tied down to the individual or team
- Has a positive impact – it affects all other performance measures in a positive way
- A KPI has to be suitable for the specific business, industry and organization and related to the targets on the long run
- Easy to quantify
- Comparable over time
- Based on valid data

KPI Categories

- Direct: the raw facts and actual raw data value as measured (e.g. sales volume, stockouts, etc.)
- Percent/ratio: the comparison of the changes in performance of one value relative to the same value at a different time, geography, etc. (i.e. percentage change in sales vs. last year
- Index: a combination of several separate measures added together that result in an overall indicator of performance (i.e. sales growth)
- Composite average: the addition of the weighted averages of several similar measures that result in an overall composite indicator of performance (i.e. customer satisfaction composite is a mixture of results from surveys, focus groups and product returns)
- Statistics: multiple measures such as mean, variance, standard deviation that capture the spread and distribution of the performance measures (e.g. sales distribution by demographics, geography, channel)

KPI Examples

- SBS Buses:
  On-time bus arrival, Occupancy ratio, Mileage, etc.

- Quality control department of a manufacturing plant:
  no. of units rejected at Final Testing stage, no. of incidences of product mix at Packaging stage, etc.

- RP – IT services
  system availability/downtime, network speed, accessibility during peak hours, no. of data/network breaches, etc.

- Call Center/ Customer service department of a bank:
  % of calls answered in the first minute of a customer's call, duration of waiting time for each customer call, Average handle time, number of callers that hang up before they are served, etc.

KPI differs by industry:

- Inventory Turns is a very important KPI for Manufacturing and Distribution Companies.
- Inventory Accuracy is an important KPI for companies that carry inventory.
- For Retail, the average dollars per sale is a good KPI.
- For Accounts Receivable departments, the number of AR Days outstanding is important.
- For Managers, employee turnover is an important KPI. Etc.

Inventory Turnover

- Inventory Turnover (also known as Inventory Turns) is how fast or slow at which inventory flows through the supply chain.

$$\text{Inventory turns} = \frac{\text{Cost of goods sold}}{\text{Average aggregate value of inventory}}$$

- It shows how many times in one accounting period the company turns over (sells) its inventory.
- The higher the inventory turns, the faster the inventory is being moved out and the company gets the cash back faster
- On the other hand, an extremely high inventory turnover ratio, which indicates that the firm is keeping very little stock.
- It can also mean that the firm is unable to fulfil large and sudden orders, and is missing sales in some instances.

Inventory Turnover – Today's Case

- Inventory Turns = $100 million / $10 million = 10
- The company sold and replaced its inventory 10 times in the 12 month period.

- Instead of 10 inventory turns, if the company increases to 12 inventory turns per year
  - Inventory Turns = COGS / Average Inventory
  - Average Inventory = $100 million / 12 = $8.333 million
- Reduction in Inventory = $10 million - $8.333 million
- By increasing to 12 inventory turns, inventory reduction or savings would be $1.667 million.

- The appropriate Inventory Turnover that a company should have depends on the specific industry
- We should compare the Inventory Turnover against competitors and the average industry benchmark

Inventory Days of Supply

- A measure of the equivalent number of days of inventory on hand, based on usage.

Days of Supply = No. of Operating days in year / Inventory Turns

= 365 / 10 = 36.5 days

$$\text{Days of supply} = \frac{\text{Average aggregate value of inventory}}{\text{(Costs of goods sold)/(365 days)}}$$

- The company has 36.5 days worth of inventory on hand.
- Inventory turnover VS days/weeks of supply: They both measure the same thing.

- Days of Supply just gives you another way to think of it.

✓ *Instead of saying, "I turn my inventory over 10 times a year", you would say "I've got 36.5 days' worth of inventory on hand."*

✓ *Instead of saying, "I turn my inventory over 12 times a year", you would say "I've got 30.42 days' worth of inventory on hand."*

- It tells you how soon you will run out, if you don't re-order.

Other KPIs

Net-Sales-to-Inventory Ratio

- Net Sales to Inventory ratio = Net Sales / Average Inventory
- By comparing inventory to sales, this ratio indicates whether there is too little or too much inventory to support the given level of sales.

Total Asset Turnover

- This ratio compares the total assets to revenue (where revenue is the income from sales of products and services)
- This is a gauge of the company's efficiency is using all its assets.

Current Ratio

- Current Ratio = Current Assets/Current Liabilities
- This ratio tells us whether a business is able to settle its current liabilities from its current assets at the balance sheet date.

Need for Accurate Inventory Records

- Inventory = CA$H
- Control Over Inventory = Control Over Costs
- Inventory Record Accuracy (IRA) is a measure of how closely official inventory records match the physical inventory.
- Incoming and outgoing record keeping must be accurate.
- Accurate record is a critical ingredient in production and inventory systems.
- Necessary to make precise decisions about ordering, scheduling, and shipping.
- A measure of how closely official inventory records match the physical inventory.
- Errors lead to wrong planning and delays.

WHY DOES STOCK CONTROL WORK IN SOME SITUATIONS BUT NOT IN OTHERS?

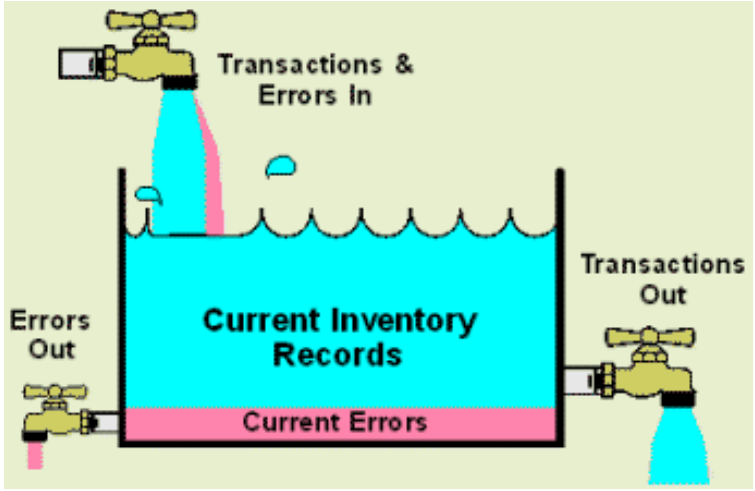
Causes to Errors in Inventory Records

Inbound transactions

- *Receiving*
- *Items misplaced on arrival*
- *Put away*
- *Scan errors (Barcoding, RFID, etc.)*

Outbound transactions

- *Products picked from wrong locations*
- *Shipments*
- *Scan errors, etc.*

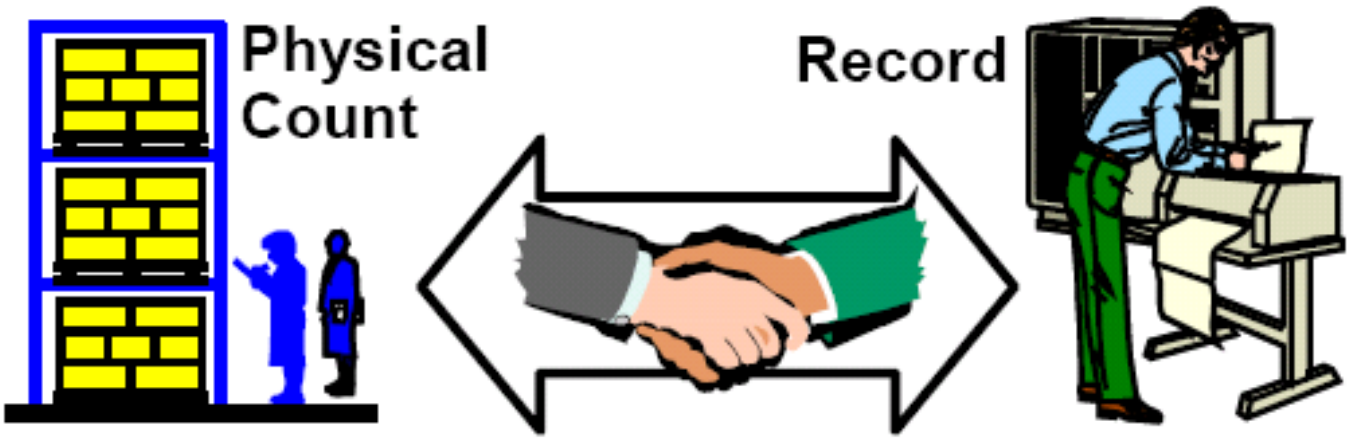


Others

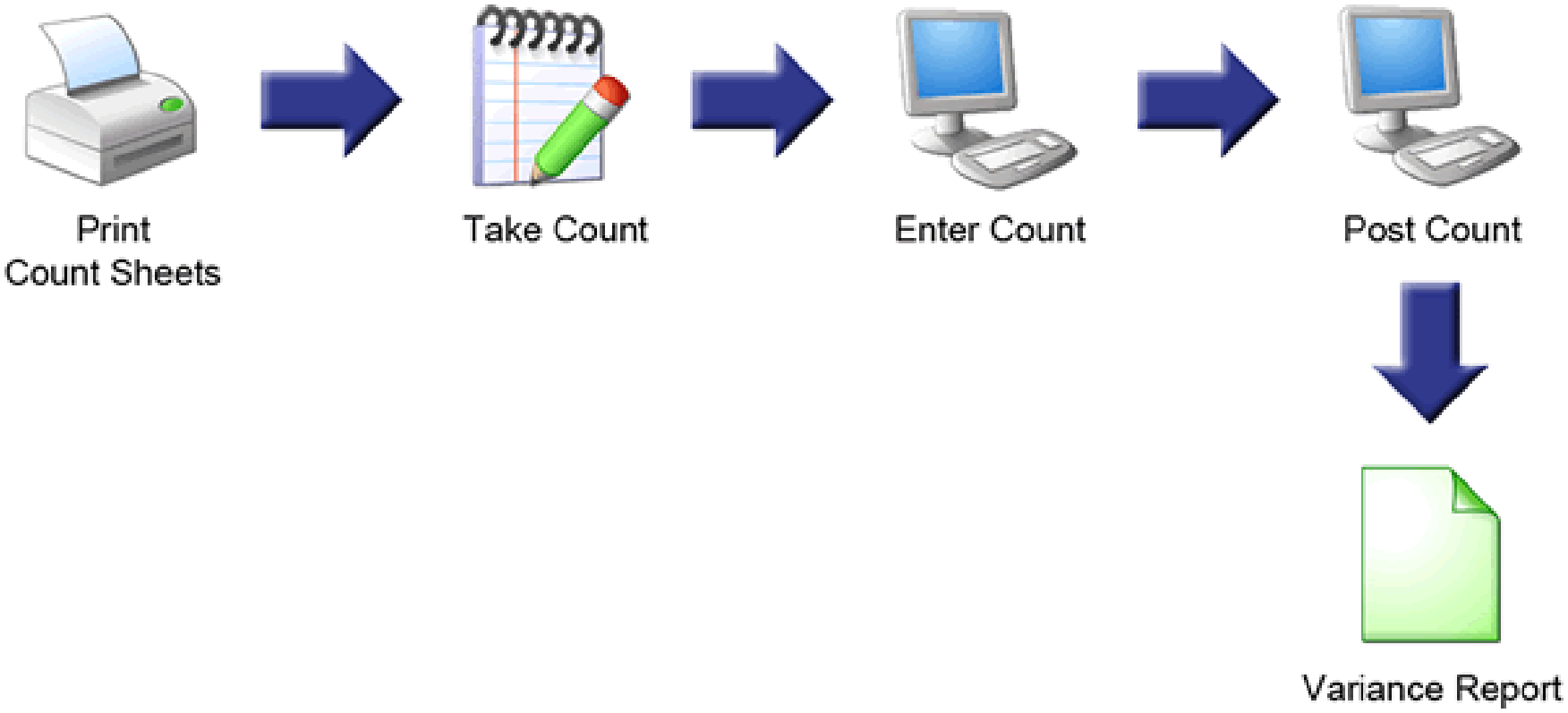
- *Bad units of measure*
- *Conversion errors*
- *Internal goods transfer*
- *Theft*
- *Extra material issue*
- *“Loans” to Sales, Engineering, R&D etc.*

Why Physical Inventory Counting?

- To identify and correct inventory record errors
- Periodic Physical Counting and Cycle Counting, both are manual processes
- Accurate on-hand quantities are essential for effective planning and minimizing inventory investment



Typical Inventory Counting Process



Periodic Physical Inventory Counting

- Periodic physical counting of inventory:
  - ✓ Annually
  - ✓ Semi-annually
  - ✓ Quarterly

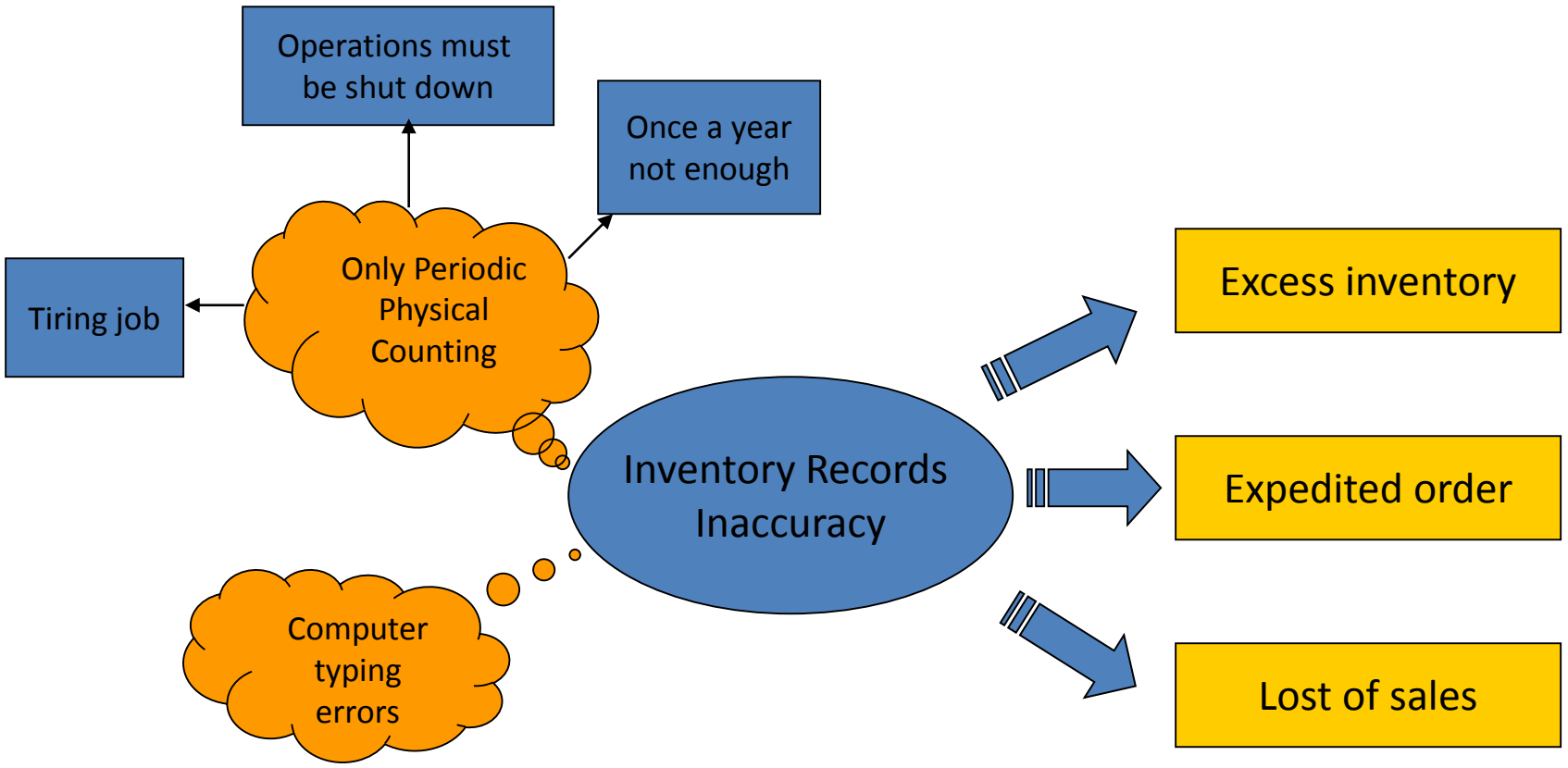
"How can the whole *Internet* be closed for inventory?"

- Expensive process

- Shut down production / shipping – few days to even a week.

- Material/goods remained unidentified or misidentified for long time

Periodic Physical Inventory Counting



Alternative Approach: Cycle Counting

- "*A method for auditing inventory accuracy and reconciles errors on a cyclical schedule rather than fixed once a year counting*."
  Operations Management; by Roberta S. Russell and Bernard W. Taylor III

- A dynamic inventory audit that allows for real time accuracy of inventory items.
- Can be tailored to focus on items with higher value or higher movement.

- Major Benefits:
  - ✓ *Eliminates shutdowns and interruptions*
  - ✓ *Eliminates annual inventory adjustment*
  - ✓ *Trained personnel audit inventory accuracy*
  - ✓ *Allows causes of errors to be identified and corrected*
  - ✓ *Maintains accurate inventory records*

Two Main Types of Cycle Counting

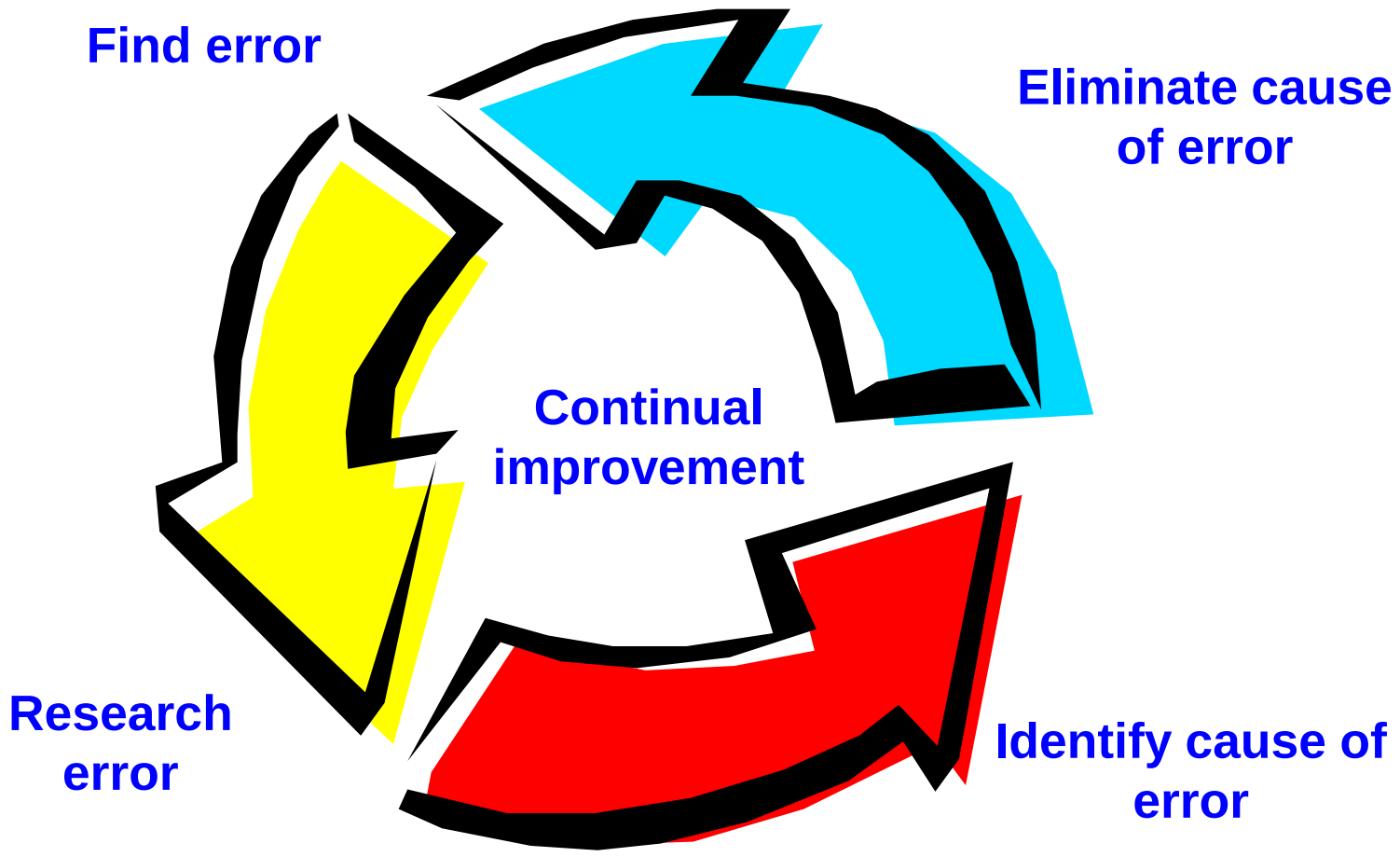
Random Sample Cycle Counting

- When a number of items to be counted are chosen at random, this process is known as random sample cycle counting.
- When a company's warehouse has a large quantity of similar items, they can randomly select a certain number of items to be counted. The count can be performed each day or workday so that a large percentage of the items in the warehouse are counted in a reasonable period.

ABC Cycle Counting (The Ranking Method)

- This method uses the Pareto principle as the basis for this technique.
- Before a cycle count can be performed, the items in the warehouse have to be identified as A, B or C items. Once each of the items in the warehouse has been assigned a category, the number of times each category should be counted needs to be determined.
- The items with the highest sales value should be counted more frequently than items that have low sales. Therefore, an item that has been assigned as an "A" item will be counted more frequently than items that are designated as "C" items

Cycle Counting Process



Cycle Counting - ABC Analysis

- ABC analysis is based on Pareto Principle.
- Pareto Principles is also known as “80/20 Rule”
- Cycle count inventory by percentage of inventory value
- ABC analysis classifies inventory into three classifications on the basis of dollar volume / value.
- The idea is to focus resources on the critical few and not on the trivial many.
- Counting frequency can be determined by ABC Analysis

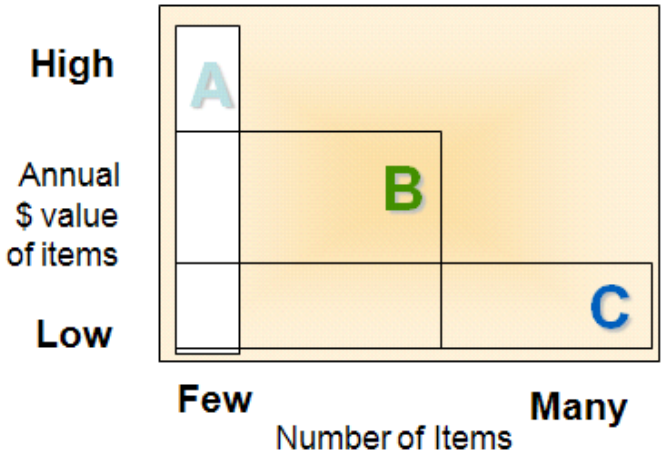
Cycle counting - ABC Analysis

- Divide on-hand inventory into three (3) classes based on annual $ volume (annual sales value).
- Annual $ Volume = [Annual Demand x Unit Cost (*alternately Moving Average Price*)]

- "A" class - Most important.
  Highest value / highest movement.

- "B" class - Less important.
  Less value / less movement.

- "C" class - Least important.
  Least value / least movement.



- Distribution may vary, from organization to organization.

- Counting the faster-moving / high $ items more frequently than the slower-moving/low $ items.

How Does ABC Analysis Work?

1. Determine the dollar volume (sales value)
2. Rank items.
3. Calculate the percentage dollar volume for each item.
4. Determine the cumulative percentages for number of items and dollar volume
5. Classify items as A, B, C, etc.

- ✓ Focus on “A” items.
- ✓ Give tighter physical control of “A” items.
- ✓ Forecast “A” items more carefully.
- ✓ Consider “B” items only after “A” items.
- ✓ Consider “C” items only after “B” items.

ABC Analysis

- Benefits:
  - ✓ Strict control of high dollar volume items
  - ✓ Higher inventory control level at minimum cost
  - ✓ Leads to inventory turnover and service level increases
  - ✓ Resources are better allocated to control efforts.

- Drawbacks:
  - ℘ Less control over B, C, (and remaining) items
  - ℘ Not an “all-purpose” inventory control method
  - ℘ Profit not necessarily maximized

Today's Problem - Determining ABC Items

Item Number	Inventory	Annual Demand	Unit Price S$	Value	% Value Usage	Unit Price S$	Class
RW106	45	250	$75.00	$18,750	34.67%	34.67%	A
RW110	125	500	$25.00	$12,500	23.11%	57.78%	A
RW115	130	300	$15.00	$4,500	8.32%	66.10%	A
RW104	25	80	$50.00	$4,000	7.40%	73.50%	B
RW105	20	90	$40.00	$3,600	6.66%	80.15%	B
RW111	150	450	$5.00	$2,250	4.16%	84.31%	B
RW107	125	500	$4.00	$2,000	3.70%	88.01%	B
RW101	25	80	$12.00	$960	1.77%	89.78%	B
RW102	5	18	$50.00	$900	1.66%	91.45%	C
RW112	45	120	$7.50	$900	1.66%	93.11%	C
RW114	250	900	$1.00	$900	1.66%	94.78%	C
RW113	75	250	$3.50	$875	1.62%	96.39%	C
RW103	17	55	$15.00	$825	1.53%	97.92%	C
RW109	175	375	$2.00	$750	1.39%	99.31%	C
RW108	50	250	$1.50	$375	0.69%	100.00%	C
		Total Annual Usage		**$54,085**			

Determining Counting Frequency

By usage

- Items more frequently accessed should be counted more often, irrespective of value
- Logical inventory zones can be set up to distinguish items depending on how frequently they are touched
- Volume consumed, volume transacted or volume moved are all ways of determining

Hybrid

- Most cycle counting frequencies are determined first by a computer running Pareto-like or frequency analysis, and then changing the count frequency as needed per item.

Counting Schedule

- Count physical products to verify inventory records:

  ✓ Count “A” items - most frequently (for example, once every month).

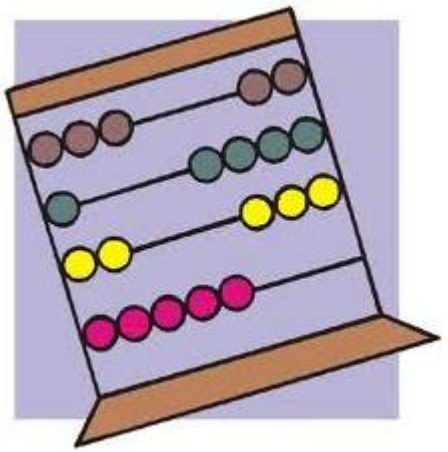
  ✓ Count “B” items - less frequently (every three months).

  ✓ Count “C” items - least frequently (once a year).

- Varies from company to company.

When to Cycle Count ?

- When an order is placed
- When an order is received
- When the inventory record reaches zero
- When a specified number of transactions have occurred
- When an error occurs
- By and large, postpone all counts to the last possible moment when there is no movement of records or items:
  - ✓ *At end of business day*
  - ✓ *Prior to start of day*
  - ✓ *Over the weekend*
  - ✓ *During the slowest shift*
  - ✓ *You would rather count the left or right?*



Today's Problem – Number of Counts

- Based on current company policy:
  - "A" Rank Items 12x per year
  - "B" Rank Items 4x per year
  - "C" Rank Items 1x per year

Item Classification	No. of Items	Counts per year	No. of Counts
A	3	12	36
B	5	4	20
C	7	1	7

- It allows the company to work out the desired number of counts for each product.

Tolerance Level

- An inventory record should be considered accurate if it matches the physical count within a reasonable tolerance.
- A tolerance level for each ABC classification should be defined. These tolerances should be based on the expected inventory accuracy levels.
- The larger the tolerance level allowed, the lower the overall inventory accuracy achieved.
- The calculation of inventory record inaccuracy:

  Inventory Record Inaccuracy(%) = [(Physical Count – Inventory Record) / Inventory Record] X 100%

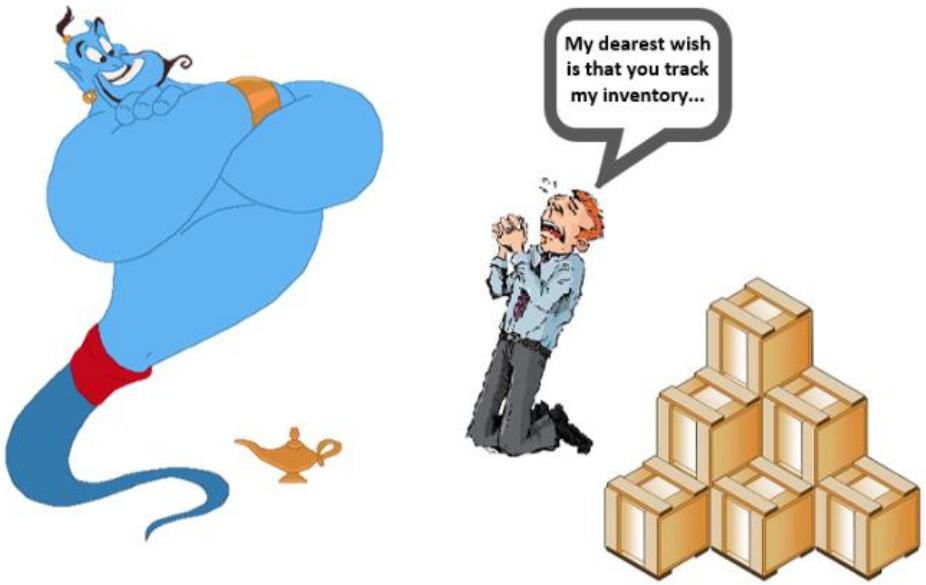
Tolerance Level

- The inventory inaccuracy for RW115, which is a Class A item, is (145-140)/140 = 3.57%.
- This is not acceptable for a Class A item (tolerance level should be ±1.0%.

- The causes of the inaccurate records, then take actions to eliminate these causes:
  - ✓ Poor training of people in materials movement
  - ✓ Bad units of measurements
  - ✓ Theft
  - ✓ Obsolescence
  - ✓ Poor security
  - ✓ Inadequate storage space
  - ✓ Untimely reporting of transactions

Going Further – Success Factors

- ✓ Set the count date/schedules
- ✓ Bar code readers to speed up the counting process
- ✓ Count cards / Count sheets for information recording
- ✓ Determine who will count
- ✓ Order the necessary supplies
- ✓ “Clean up” your warehouse or freeze transactions



Learning Objectives

- Describe the purpose of using the Key Performance Indicator (KPI)
- Calculate and analyse the impact of KPIs (Inventory Turnover, Days of Supply) for a given business case-study
- Recommend effective inventory reduction strategies for a given business case-study
- Understand the inventory record accuracy
- Understand the importance of physical inventory checks, and the difference between physical counting & cycle counting
- Understand ABC Cycle Counting
- Perform ABC classification and determine the counting schedule

E217 Inventory Management Topic Flow