TRL3707 – Exam Prep (S2-2015)

Extracts from Tutorial Letters

"Due to the various ways in which questions can be set, the whole of the study guide is covered and no part of the study guide can therefore be omitted from your exam preparations. The **types of questions asked are similar to those at the end of each study unit and it will be to your benefit to use these questions in your exam preparation.** It will also be to your benefit to work through the specimen examination paper as well as the self-evaluation questions that were posed. "

"you will not get marks if you don't fully discuss in your answers. Giving just headings is not enough. You must fully discuss, describe or explain to get full marks"

Format of the October/November 2015 Exam:

- Provisional Date: 18 November 2015 @ 11:30
- Duration: 2 Hours
- Marks: 70
- Type of Question: Compulsory Short Questions = 20 marks
  Long & Short Questions - to answer only any 2 of the 3 given = 25 marks each

Question Bank Index

(PE^{x} = Number of times a question featured in the previous ten exams, excl. 2011-M/J)
(LO = Learning Outcome)
(SAQ = Self-Assessment Question from the study guide)

Compiled using Amanda Badenhorst UNISA Study Guide TRL3707/1/2013-2020 &
Bowersox's Supply Chain Logistics Management 2013 – Fourth Edition

Things highlighted in red is not that they are important – it is that I don't know what to write there

Apologies: Some questions are incomplete. Tried to do it all, but time got away from me so I had to focus on the scope

Things in yellow were mentioned on the 2015-S2 Exam Mind Map / Scope

Question Bank from Self-Assessments, Exams & Learning Outcomes

STUDY UNIT 1, PAGE 2

*[2015-S2-EXAM SCOPE: SHORTER QUESTIONS – **STUDY TB**, READ SG]*

1) Additional Define Forecasting Ref. Par. 1.2; [Was not taken from Bowersox 2013:133-134 as indicated by the scope]

Forecasting entails predicting the demand for each type of product (stock keeping unit or SKU) during a particular period or at a specific place. Specific definition of what is projected to be sold, when & where. Identifies requirements for which SC must schedule inventory & operational resources.

2) SAQ Briefly explain main difference between dependent & independent demand Ref. Par. 1.2

Independent demand is when demand for an item is not related to/dependent on the demand for any other item. It cannot be calculated, only estimated by means of a forecast. E.g. finished goods & maintenance spares.

Dependent demand describes items whose demand is related to the demand for other items. Can be calculated i.e. no need to forecast demand E.g. subassemblies, raw & packaging materials.

3) [PE^{x2}] LO Name three reasons why logistics forecasts are necessary **(3 / 6)** Ref. TB 2013:134 [Forecasting Requirements]

To Support **Collaborative Planning**

- A collaborative forecast jointly agreed to by supply chain partners provides a common goal that can be the basis for developing effective operating plans.
- prevents never-ending cycle of inventory excesses/shortage that happens when independently forecasted;

To Drive **Requirements Planning** (a.k.a sales & operations planning)

- determines inventory projections & resulting replenishment/production requirements for planning horizon
- Integrates forecasts , open orders, available inventory & production plans into a definition of periodic inventory availability and requirements;
- Ideally operates collaboratively & interactively both internally across the firms operations & externally with supply chain partners to develop a common and consistent plan for each time period, location & item.

To Improve **Resource Management**

- Use completed plan to manage critical supp. chain processes e.g. production, inventory & transportation;
- Accurate forecast & consistent definition of SC resources & constraints → Enables timely identification and effective evaluation of trade-offs → better match requirements to resources & better resources utilisation.

4) LO SAQ Distinguish between centralised & decentralised approach to demand forecasting Ref. Par. 1.2 p4

Approach followed depends on uncertainty of demand in individual distribution centres.
Top-down (centralised): when demand is fairly stable / changes in demand appear to be uniform at all centres.

Bottom-up (decentralised): when demand in individual markets fluctuates / changes in demand in individual markets differ.

5) SAQ Write a formula for a basic forecast model containing all components & explain the symbols Ref. Bowersox 2013:135

Forecast Model:

$$(B_t \times S_t \times T \times C_t \times P_t) + I = F_t$$

F_t = forecast quantity for period *t*

B_t = base level demand for period *t*

S_t = seasonality factor for period *t*

T = trend component index (↑ or ↓ per time period

C_t = cyclical factor for period *t*

P_t = promotional factor for period *t*

I = irregular / random quantity

6) [PE^{x3}] SAQ Explain the components of a basic forecast model **(6 or 12)** Ref. Par. 1.2; Bowersox (2013:136-137)

Base Demand	• = *long-term average demand* •Represents long term average demand after removing remaining components •Forecast for items having *no* seasonality, trend, cyclic or promotional components
Seasonal	•*Annually recurring upward & downward* movement in demand •e.g. annual toy demand : low demand ¾ year with increased demand just before Xmas = consumer retail seasonality •wholesale seasonality precedes consumer demand by ± ¼ of a year
Trends	• = *long-range shift in periodic sales* caused by change in population or consumption patterns •May be positive, negative or neutral in direction. •Positive = sales ↑ over time •Trend component influences base demand in the successive time periods. Relationship: $B_{t+1} = B_t \times T$ with B_{t+1} = base demand in period $t + 1$; B_t = base demand in period t; T = periodic trend index •If T > 1 periodic demand is ↑. If T < 1 ↓ trend
Cyclic	•Characterized by *periodic shifts* in demand lasting *more than a year* •Cycles may be upward or downward e.g. business cycle (economic swings recession to growth)
Promotional	•*Demand swings initiated* by a firm's marketing activities e.g. ads, deals, promotions •Sales increase, followed by sales decline •Differ in that timing & magnitude are largely *controlled* by firm. Can be regular
Irregular	•Random/unpredictable quantities that do not fit with other categories •*Random Nature = impossible to predict* •Minimise magnitude of random component by tracking & predicting other components

7) [PE^{x1}] LO SAQ Explain the forecast process with the aid of a suitable sketch **(5)** Ref. Par. 1.3 & Bowersox (2013:137-139)

Selecting a Forecast Technique

Mathematical/statistical computation used to combine base, seasonal & cyclical components with elements of promotion history into a forecast quantity. Techniques include:

- Time series modelling: sales history is a major factor
- Correlation modelling: relationships with other independent variables are the major forecast drivers.

Providing a Forecast Support System

- Includes supply chain [SC] intelligence to gather & analyse data, develop forecast and communicate it to relevant personnel & planning systems.
- Allows consideration of external factors such as the impact of promotions, strikes, price changes.
- N.B that effective forecasting process includes a support system to facilitate maintenance, updates & manipulation of the historical database & forecast.

Administration of the total Forecast Process

- Includes organisational, procedural, motivational & personnel aspects of forecasting and its integration into other firm functions.
- Organisational aspect concerns individual roles & responsibilities.
- N.B. to specify these roles & responsibilities in detail when defining forecast administration function.
- If integrated forecast is desirable: specifically define each organisation's forecasting responsibility & hold it accountable with specific metrics.
- Effective forecast administration requires:
    - organizational responsibility & procedural guidelines are documented & measured;
    - forecast analysts be trained in both process & input of forecasts on SC logistics operations.

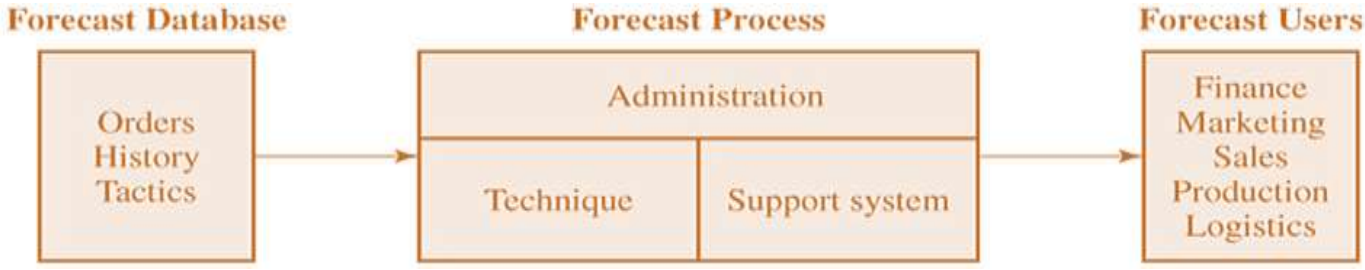


Fig 6.7: Forecast Management Process

8) SAQ Why should the forecast process be supported by an effective administrative system Ref. Par.

?

[2015-S2-Scope: Read SG]

9) [PE x4 Variations] LO SAQ Distinguish between qualitative techniques, time series techniques and causal techniques as forecasting techniques for logistical purposes **(3 or 4 or 7)** Ref. Par. 1.4. Bowersox (2010:147-150) or (2013:139-143) Table 6.4

Qualitative

- Rely on expertise
- Costly and time consuming
- Ideal when little historical data and much managerial judgement are required
- E.g. using input from sales force as basis of forecast for new region/product
- Developed using panels, consensus meetings and surveys
- Not appropriate for supply chain forecasting because of time needed to generate SKU forecasts

Time series

- Statistical methods
- Focuses on historical patterns & pattern changes to generate forecast of future behaviour
- Historical sales data contain clear and stable relationships: identifies trends, seasonality & cyclical patterns
- Assumes that future will reflect the past
- Assumption OK for short term: most appropriate for short range
- Not sensitive to turning points: integrate with other approaches to determine when turning points will occur
- Various techniques: [**see question 10 below**]

Causal

- Estimates variables on the basis of the values of other independent variables (e.g. regression).
- Can effectively consider external factors and events. Therefore more appropriate for long term forecasting or aggregate demand forecasting & not individual outlets, e.g. annual or national sales
- Not suitable for instances where demand assumes irregular pattern or is extremely erratic
- Use refined & specific info regarding variables to develop relationship between lead event & forecasted act.
- Work well when a leading variable such as price can be identified
- Cause-effect relationship. If a good relationship can be identified, a prediction can be made
- Regression use the correlation between a leading/predictable event and SKU sales that depend on that event
- A correlation assumes that forecasted sales are proceeded by some leading independent factor such as the sale of related products
- Not particularly common for supply chain applications
- Techniques are more appropriate for long-term forecasting (thus not for individual outlets).
- Generally used to generate annual or national sales forecasts.

[2015-S2-Scope: Read SG]

10) [PE x3+2] Name four time series techniques in forecasting. Could also ask to fully discuss **(4 or 8 or 9)** Ref. Par. 1.4

Moving Average

- Uses average of the most recent period's sales
- May use any number of previous time periods

- Time periods remain constant
- Easy to calculate
- Unresponsive to change
- Great deal of historical data must be maintained & updated to calculate forecasts
- If sales variations are large, average value is not reliable

Exponential Smoothing

- bases the forecast on the weighted average of previous demand & forecast levels
- only takes immediate previous period's actual sales into consideration & previous forecast as a correction
- Alpha factor = increment of adjustment between old forecast & actual sales realised
- Advantage: permits rapid calculation of a new forecast without substantial historical records & updating → highly adaptable to computerised forecasting
- However does not eliminate the need for judgement
- Does not detect cyclical patterns in the data.
- Both exponential smoothing & moving avg. are inadequate in cases where demand fluctuates dramatically.

Extended (exponential) smoothing

- Incorporates influence of trend & seasonality when specific values for these components can be identified.
- Allows rapid calculation of new forecasts with minimal data
- Higher smoothing constant values provide quick responsiveness but may lead to overreaction and forecast accuracy problems.

Adaptive Smoothing

- Provides regular review of alpha factor validity.
- Alpha factor value is reviewed at conclusion of each forecast to determine the exact value that would have resulted in a prefect forecast for the previous period.
- Once determined the alpha factor used to generate the subsequent forecast is adjusted to a value that would have produced a perfect forecast.

[2015-S2-Scope: Read SG]

11) **[PE^{x3}]** List the criteria for evaluating applicability of various forecast techniques **(6)** Ref. Par. 1.4

- Accuracy
- Forecast time horizon
- The value of forecasting
- Data Availability
- Type of data pattern
- Experience of the forecaster

[2015-S2-Scope: Read SG]

12) LO SAQ How can accuracy of forecasts be measured? Ref. Par. 1.5 [See "trl3707 study_unit_1_-forecasting-1.pdf"]

Accuracy of forecasts can be improved over time by measuring & analysing errors. Errors can be measured at different levels (centrally/depots) while various techniques can be applied to measure these errors, e.g.:

- Sum up errors over time. Calculate simple average.
  Concern: positive errors cancel negative errors masking significant forecasting problem.
- Alternatively, ignore "sign" and compute absolute error. Resulting in Mean Absolute Deviation (MAD).
  To compare: calculate error %. Calculate Mean Absolute Percentage Error (MAPE) by mean demand.
- Measurement level / aggregation assuming individual SKU detail is recorded.
  More aggregation = lower relative forecast errors

[PE^{x1}] Act Use given info & simple exponential smoothing to forecast demand **(4)** Ref. Par. 1.4

STUDY UNIT 2, PAGE 14

*[2015-S2-EXAM: **LONGER** QUESTIONS – **FOCUS ON SG, TABLES, SAQ &PE]***

13) LO SAQ What is the effect of inventory holding on an enterprise's profit margin? Ref. Par. 2.1

Risks of Inventory Holding

Inventory **Shortage**:	**Surplus** Inventory:
• Production line Shut down / Adjust production schedule • = ↑ expenses / shortage of final product	• more warehouse space required, working capital (could invest with interest), obsolescence, insurance, etc. • = ↑ costs & ↓ profitability

14) [PE^{x2}] LO SAQ Discuss relative risks of inventory holding for the manufacturer, wholesaler & retailer. **(6)** Ref. Par. 2.2

Take note of the time and variety kept by each

Manufacturers

- Inventory risk = Long Term
- Commitment begins raw material & component parts purchase → work-in-progress → finished goods (ends).
- Finished goods often positioned in warehouses in anticipation of customer demand
- In some situations manufacturers are required to consign inventory to customer facilities (stock shelves in retail store) shifting inventory risk entirely to the manufacturer (has to wait for payment until consumer purchases product).
- Typically narrower product line than retailer/wholesaler but commitment is deep & of long duration.

Wholesalers

- Purchases large qty.'s from manufacturer → sells smaller qty.'s to retailers.
- Economic justification = capability to provide customers an assortment of merchandise from different manufacturers in reduced quantities.
- Seasonal products increase depth & duration of risk (inventory position far in advance of selling season)
- Challenge = product line expansion to point where width of inventory risk approaches that of retailer while depth & duration remain characteristic of traditional wholesaling.

Retailers

- Inventory management is about velocity of buying & selling.
- Purchase wide variety of products & assume substantial risk in marketing process.
- Retail inventory risk = broad on wide variety but not deep on any one product (mass merchandisers).
- High cost of store location → place price emphasis on inventory turnover
- Inventory turnover = a measure of inventory velocity; calc. as ratio of sales for time period ÷ avg. inventory.
- ↓ risk by pressing invent. responsibility onto manufacturers & wholesalers [tendency to channel inventory holding upstream in distribution channel] → retailers demand for fast delivery ↑
- On the other hand, speciality retailers: less width with ↑ risk in depth & duration

15) Act 2.1 What can management do to reduce inventory levels thereby increasing productivity? Ref. Par. 2.2

- Implementation of JIT (Just-in-time) & other inventory strategies
- Exchange of info between different role players in the SC
- Management's attempts to reduce uncertainty.

16) LO Why do enterprises carry inventory in spite of the risk involved? SAQ Explain the necessity & give examples of trade-off options. Ref. Par. 2.3

- Inventory = current asset that should provide return on the capital invested.
- Return on investment = marginal profit on sales: could not occur without inventory

17) [PE x7 Variations] List and/or discuss 4 functions of inventory **(3 or 4 or 8)** Ref. Par. 2.3 Table 2.1 in SG / Table 7.1 Bowersox 2013

Geographic Specialisation
- Allows geographical positioning across multiple manufacturing & distributive units of an enterprise.
- Inventory maintained at different locations and stages of the value creation process allows specialization.
- Inventory invested can only be modified by changes in network facility location & operational processes.

Decoupling
- Is the separations of a manufacturing process from the selling process
- Allows economy of scale within a single facility
- Permits each process to operate at maximum efficiency rather than having the speed of the entire process constrained by the slowest
- Inventory invested can only be modified by changes in network facility location & operational processes.

Balancing Supply & Demand
- Inventory necessary when timing of product supply differs from demand pattern
- Necessary to match supply & demand patterns
- Accommodates elapsed time between inventory availability and consumption
- Modifying invested inventory depends on ability to estimate seasonal requirements

Buffer Stock (a.k.a. Safety Stock)
- Inventory necessary when uncertainty occurs in both supply (Product availability) & demand (customer requires)
- Accommodates uncertainty related to demand in excess of forecast or unexpected delays in delivery.
- Commitments are operational in nature and can be adjusted rapidly in the event of error or policy change.

18) LO What does an inventory policy involve? Ref. Par. 2.4

Inventory policy drives inventory performance and consists of:
- Guidelines of what to purchase/manufacture; when to take action; in what quantity
- Decisions regarding geographical inventory positioning e.g. postponement or speculative strategy
- Inventory management practice e.g. independently mange at each stocking location or central inventory management of all stocking locations
- Target inventory levels for each facility

5 Inventory related concepts that play a role in inventory management & policy:
- Average inventory: rolling mean across time Ref. Bowersox (201:159) o (2013:152)
- Reorder point: defines when a replenishment order is initiated Ref. Bowersox (2010:161) or (2013:153)
- Inventory turnover: = total sales ÷ average inventory
- Order Cycle
- Order Quantity: amount ordered for replenishment (difference between max & min stock levels)

19) LO SAQ What is the relationship between inventory and level of service? Ref. Par. 2.4 [CHECK]

Two key indicators of inventory performance = service level & average inventory.
One strategy to achieve high service level is to increase inventory.
Alternative: faster/more reliable transport & collaboration with customers & service providers to ↓ uncertainty

Service Level
- Performance target specified by management
- Defines inventory performance objectives
- Measured in terms of performance cycle time, case fill rate , line fill rate, order fill rate / any combination
- Performance cycle: elapsed time between release of a purchase order by a buyer to the receipt of shipment.
- Case fill rate: % of cases/units ordered that are shipped as requested e.g. 95% = 95 out of 100 cases filled from available stock
- Line fill rate: percent of order lines filled completely.
- Order fill: percent of customer orders filled completely.

Average Inventory (Comprising of cyclic inventory, safety stock & Transit inventory)

- Is a function of the reorder quantity: smaller quantities = ↓ avg. inventory
- ↑ avg. inventory = ↑ carrying cost
- Estimating Avg. Invent. N.B for calculating carrying cost
- **See also Question 20 Below**

20) LO SAQ What is meant by average inventory, cycle inventory, safety stock inventory & transit inventory? Ref. Par. 2.4

Average Inventory **see Bowersox** (2010:156-162) & (2013:151-154) for examples, figures & formulas

- Materials, components, work-in-progress & finished product typically stocked in logistical system is referred to as inventory
- and the typical amount [rolling mean] across time is referred to as average inventory
- **See also Question 19 Above**

- Cycle Inventory or base stock: Portion of average inventory that results from replenishment
  A replenishment order is initiated so that inventory will arrive before an out of stock occurs.
  Average cycle inventory / base stock = ½ order quantity
- Transit inventory: amount typically in transit between facilities or on order but not received
- Obsolete Inventory: stock that is out-of-date or has not experienced recent demand
  Eventually donated, destroyed or sold at a loss
- Speculative Inventory: bought prior to need to hedge a currency exchange, take advantage of a special discount or prepare for potential work force disruption.
- Safety Stock: remainder of inventory in typical logistics system.
  Maintained to protect against demand & performance cycle uncertainty
  Used only near the end of replenishment cycles when uncertainty caused higher-than-expected demand or longer-than-expected performance cycle times

21) LO What are the basic principles of inventory replenishment?

? Usage / rate of sale, performance cycles, safety stock, reorder point, economic order quantity ?

22) LO What are the costs involved in holding stock?

Inventory carrying cost is the expense associated with maintaining inventory. Financial accounts relevant to inventory carrying cost percent are:

- Capital [Typically based on managerial policy]
- Insurance
- Obsolescence
- Storage
- Taxes [expense related]

Carrying cost percentage can be calculated by adding the five components together

23) SAQ Using a suitable sketch, indicate the relationship between placing an order, the order cycle, order quantity & average inventory. Also show what the effect of a change in order quantity on the average inventory will be? TB

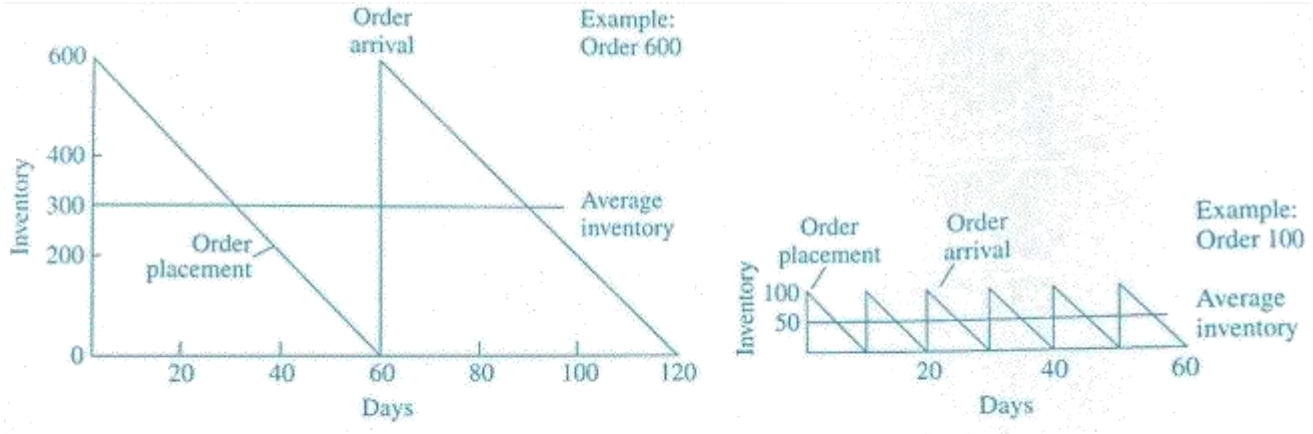


FIGURE 7.3
Alternative Order Quantity and Average Inventory

Policy ordering 600 units every 60 days	Policy ordering 100 units every 10 days
Avg. base Inventory of 300 units	Avg. Inventory on hand drops to 50 units
Turnover of ±8 times per year	Inventory turnover increase to 48 times per year

24) [PE^{x3}] LO SAQ How can inventory carrying costs and carrying cost % be calculated? **(11 or 17)** Ref. Par. 2.5.1 Table 2.2 in SG

Carrying Cost a.k.a. Inventory Expense = Avg. Inventory [½ Order Qty. + S.Stock] x Inventory Carrying Cost Percentage

E.G. R200,000.00 = R1,000,000.00 x 20%

Determining the inventory carrying cost PERCENTAGE is more difficult: [Table 2.2 & Table 7.2]

Cost Element	Quantification & Determinants	Example	% Ranges
Capital Investment	• Prime interest rate (cash to replace money invested in inventory to be purchased in money market) • Return on investment (funds invested in inventory lose earning power & limit other more lucrative investments) Hurdle Rates	17% Aggressive cash use High value/short life cycle = high rates	4 – 40%
Insurance	• Direct levy based on estimated risk/exposure • Insurance cost percentage on avg. inventory value of past year • Product value High value / hazardous = high insurance cost • Risk & Exposure of product & storage facility • Preventive Measures	2%	0 – 2%
Obsolescence Damage Shrinkage	• Deterioration of product while stored (cost of each unit that must be disposed of at a loss because can no longer be sold at the usual price) • Damage: net amount after claims • Problematic to quantify • Percentage of average inventory declared obsolete yearly • Direct loss related to inventory storage	2%	0.5 – 2%
Storage Space	- Depends on types of warehouses used (own, public, contract) - Allocated to specific products (not directly related to inventory value) - Private: Find standard cost per day per square/cubic metre. Multiply daily standard by space occupied per year for the specific product. - Public/Contract: Storage charges (not handling). Normally based on maximum required storage space	5%	0 – 4%
Taxes	- Direct levy based on inventory value on specific day or avg. inventory value over period of time [exemption as free port status might be available]	2%	0.5 – 2%
Total		28%	

25) SAQ Discuss the impact of inventory carrying cost on enterprise's financial records & logistical decision-making & strategy [Ref. Par. 2.5.2 & 2.5.3]

Financial Records & Finance

- Inventory is shown on balance sheet as Current Asset
- Major element of inventory carrying costs results from capital invested.
- To pay for inventory:
  - borrow funds as working capital – Enterprise pays interest on borrowed funds
  - reduce retained earnings – Enterprise cannot invest retained earnings in other projects

Logistics Decisions & Strategies

- Low Carrying Cost Percentage [e.g. 12%]
- Reduces influence of inventory cost on total cost decisions
- Makes transport costs relatively more important
- RESULT IN: Logistics strategies aimed at minimising transport costs by using more distribution centres
- Additional distribution centres → more sites → more safety stock → additional inventory
- ↓ carrying cost carrying cost % = strategies that replace expensive transport with cheaper inventory

- High Carrying Cost Percentages [e.g. 40%]
- Opposite effect
- Logistics strategies attempt to centralise inventory in small number of locations
- Allow for longer & more expensive transport movements

STUDY UNIT 3, PAGE 24

*[2015-S2-EXAM: SHORTER QUESTIONS- **CALCULATIONS, PE & PROBLEM SET 2**]*

[2015-S2-Scope: Calculations]

26) [LO] When and how often should inventory be ordered? [SAQ] Write down a formula for determining the reorder point for a specific item and explain how it works. [Ref. Par. 3.2.1. Bowersox (2010:161) & (2013:153)]

When to order: under conditions of demand & performance cycle certainty

- Determined by demand & Replenishment lead time average and uncertainty.
- Reorder point: defines when a replenishment shipment should be initiated.
  Specified in terms of units or days' supply
- Alternative form to e.g. below: define reorder point in terms of days of supply [i.e. days of supply reorder point = 10 days]

Formula: Basic Reorder Point	$R = D \times T$	R = Reorder point in units D = Average daily demand in units T = Average performance cycle length in days
Example:	$R = 20 \times 2 = 200$ units	D = avg. daily demand = 20 units/day T = avg. performance cycle = 10 days

When to order: when safety stock [SS] is necessary to accommodate uncertainty

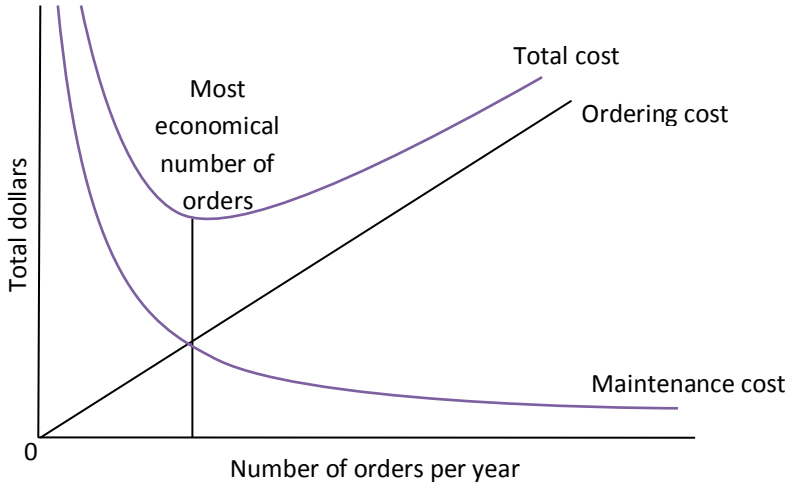
Formula: SS Reorder Point	$R = D \times T + SS$	R = Reorder point in units D = Average daily demand in units T = Average performance cycle length in days SS = Safety stock in units

27) [LO] How much inventory should be ordered at a time? [Ref. Par. 3.2.1]

How much to order is determined by order quantity.
Identify ordering quantity that minimizes total inventory carrying & ordering cost. i.e. EOQ
Lot sizing balances inventory carrying cost with the cost of ordering
Remember: Avg. Inventory = ½ order qty. Meaning ↑ order qty. → ↑ avg. inventory → ↑ annual carrying cost
However ↑ order qty.; ↓ orders required per planning period → ↓ total ordering cost.
Lot qty. formulations identify precise qty.'s at which annual combined total inventory carrying & order cost is lowest for given sales volume. [see figure below in question 28]

28) [PE^{x3}] Make use of a sketch to explain Economic Order Quantity [EOQ] **(4)** [Ref. Par. 3.2.1]

Figure: Economic Order Quantity



29) [SAQ] Explain EOQ With aid of a sketch & formula. Also name the assumptions underlying the simple EOQ model.

EOQ is the replenishment practice that minimizes the combined inventory carrying & ordering cost. Assumes:

- All demand is satisfied
- Rate of demand is continuous, constant & known
- Replenishment performance cycle time is constant & known
- A constant price of product that is independent of order quantity or time
- Infinite planning horizon
- No interaction between multiple items of inventory (individual product basis only)
- No inventory is in transit
- No limit is placed on capital availability

Formula: Economic Order Quantity

$$EOQ = \sqrt{\frac{2C_oD}{C_iU}}$$

C_o = Cost per order
C_i = Annual inventory carrying cost
D = Annual sales volumes, units
U = Cost per unit

Example: EOQ =

$$\sqrt{\frac{2 \times 19 \times 2\,400}{0.20 \times 5.00}} = \sqrt{91{,}200} = 302 \text{ (round to 300)}$$

C_o = Ordering Cost = R19.00 per order
C_i = Inventory carrying cost % = 20% Annually
D = Annual Demand Volumes = 2400 units
U = Unit value at cost = R5.00

30) [PE[x4]] With the data & formula given, calculate the Economic Order Quantity (5 each) Ref. Par. 3.2.1

Annual Sales Volume	4500 bottles
Unit Value of Cost	R30 per bottle
Inventory Carrying Cost	20% annually
Ordering Cost	R15 per order

$EOQ = \sqrt{\frac{2C_oD}{C_iU}}$

$$\sqrt{\frac{2 \times 15 \times 4500}{0.20 \times 30.00}} = \sqrt{22\,500} = 150 \text{ units}$$

Annual Sales Volume	4500 bottles
Unit Value of Cost	R30 per bottle
Inventory Carrying Cost	15% annually
Ordering Cost	R20 per order

$EOQ = \sqrt{\frac{2C_oD}{C_iU}}$

$$\sqrt{\frac{2 \times 20 \times 4500}{0.15 \times 30.00}} = \sqrt{40\,000} = 200 \text{ units}$$

Annual Sales Volume	2500 bottles
Unit Value of Cost	R12.50 per bottle
Inventory Carrying Cost	20% annually
Ordering Cost	R20 per order

$EOQ = \sqrt{\frac{2C_oD}{C_iU}}$

$$\sqrt{\frac{2 \times 20 \times 2500}{0.20 \times 12.50}} = \sqrt{40\,000} = 200 \text{ units}$$

Annual Sales Volume	3800 bottles
Unit Value of Cost	R30.00 per bottle
Inventory Carrying Cost	25% annually
Ordering Cost	R20 per order

$EOQ = \sqrt{\frac{2C_oD}{C_iU}}$

$$\sqrt{\frac{2 \times 20 \times 3800}{0.25 \times 30.00}} = \sqrt{20\,266} = 142 \text{ units}$$

31) SAQ Explain all the factors that influence the EOQ for a particular item. Ref. Par. 3.2.1 [Unsure if I'm using right factors]

Volume Transportation Rates

- Any EOQ must be tested for transportation cost sensitivity across a range of weight breaks
- Cost of transportation must be paid by supply chain participants.
- Collaborative efforts to order in qty.'s minimise total cost are essential to sound logistical arrangements
- ↑ order weight the ↓cost per pound of transportation from origin to destination
- Freight-rate discount for larger shipments is common across all transportation modes
- SC arrangements should utilise qty.'s that offer max transportation economies
  Qty.'s may be larger than EQO purchase quantity. ↑ order size has twofold impact on inventory cost:
  - Increases average base inventory = increase inventory carrying cost
  - Decrease in number of orders required to satisfy annual requirements = ↑ shipment size, facilitating lower per-unit transportation cost.

Quantity Discounts

- handled directly with basic EOQ formula: calculate total cost at any given volume-related purchase price
- viable if discount at any associated qty. is sufficient to offset added inventory carrying cost less reduced cost of ordering
- Qty. discounts & vol. transportation rates each drive larger purchase quantities.

Other EOQ Adjustments

- Production lot size: most economical quantities from a manufacturing perspective
- Multiple-item purchase: when more than one product is bought concurrently, qty. & transportation discounts must consider impact of product combinations
- Limited capital: budget limitations for total inventory investment across the product line
- Dedicated trucking: can influence order qty. sine truck has fixed cost consideration consider full capacity use / back-hauls
- Unitisation: storing & moving products in standard units e.g. cases/pallets to fit vehicles

32) LO How can inventory shortages be prevented?
? By keeping safety stock ?

33) SAQ Discuss the difference between the performance cycle uncertainty and demand uncertainty. Identify the activities necessary to make provision for this uncertainty. Ref. Par. 3.2.2. see Bowersox (2010:168-178) & (2013:162-171)

Performance Cycle Uncertainty

- Involves inventory replenishment time variation. Meaning operations cannot assume consistent delivery
- Performance cycle experience will cluster near expected value & be skewed toward delayed delivery
- Use Poisson Distribution if actual experience has been skewed in excess of expected cycle duration
  In Poisson Freq. Distribution: σ = square root of the mean. The ↓ the mean the ↑ degree of skewness

Demand Uncertainty

- Involves variation in sales during inventory replenishment
- Under conditions of demand uncertainty: avg. inventory = ½ order qty. + safety stock
- Sales forecasting estimates unit demand during inventory replenishment cycle
- To protect against stock-out when demand exceeds forecast: add safety stock to base inventory
- Standard Deviation[σ]: Basis for predicting demand during performance cycle using normal distribution. Provides a method of estimating SS required to achieve specified degree of out-of-stock protection

Combined Uncertainty

- Planning for both demand & performance cycle uncertainty requires combining two variables.
- Determine joint impact of probability of both demand & performance cycle variation.
- With basic relationship in mind, SS req. can be determined by either numerical or convolution procedures
- Use combined standard deviation: % reflects probability & not an indication of the relative magnitude

34) [LO] How much safety stock should be kept to make provision for variable demand and order cycle time to maintain a certain level of customer service? [Ref. Par. 3.2.2]

Calculating SS: no interest in cases where probability of demand < mean.
No problem meeting demand if SS ≤ mean. Therefore only interested in right-hand side of normal distr. curve:

Standard Deviation(s)	% Using Both Sides of Normal Distribution Curve	% Using Right-Hand Side of Curve
1σ	68.27%	84%
2σ	95.45%	98%
3σ	99.73%	99.9%

35) [PE[x1]] Explain what is meant by the term "fill rate" **(2)** [Bowersox (2010:176) & (2013:168)]

Fill rate: magnitude rather than the probability of a stock out.
Indicates safety stock necessary to ensure that customer's order is properly met; desired cust. service objective.
Case fill rate: the percentage of units that can be filled when requested from available inventory

36) [PE[x3]] Given the following information, answer the questions below: [Ref. Activity 3.2; 2015-S1-Assign.01 (slight variation)]

Suppose an analysis of daily sales:	20 cases
Standard deviation of performance sales:	1,634 days
Average order cycle:	10 days
Average daily sales:	100 cases
EOQ	1 000 cases

(a) Calculate the combined standard deviation. (5)

Formula: Standard Deviation

$$\sigma = \sqrt{\frac{\Sigma F_i D_i^2}{n}}$$

F_i = Frequency of observation *i*
D_i = Deviation of observation from mean for *i*
n = Total observations available

Formula: Combined σ

$$\sigma_c = \sqrt{TS_D^2 + D^2 S_t^2}$$

σ_c = Standard deviation of combined probabilities
T = Avg. Performance Cycle
S_t = Standard deviation of performance cycle
D = Avg. daily sales
S_d = Standard deviation of daily sales

Combined standard deviation

$$= \sqrt{10(20)^2 + (100)^2(1.634)^2}$$
$$= \sqrt{4\,000 + 26\,700}$$
$$= \sqrt{30\,700}$$
$$= 175$$

(b) How many cases should be kept in stock to make provision for a 98% level of service? (3)

98% = Two standard deviation (2σ) = 2 x 175 = 350 cases

(c) What is the fill rate with a safety stock of 280 cases? (7)

First calculate the K factor:	= 280/175
K	= 1.6
With a K of 1.6 (f)k	= 0.0232
(see table 7.14 in Bowersox et	= 1-(0.0232 x 175)/1 000
al (2010:177))	= 1 – 0.0041
Thus SL	= 0.9959 or nearly 100%

K Factor = SS ÷ combined σ

Thus for each 100 units of demand, there will be 99.59 on hand if the order quantity is 1 000 cases and the safety stock is 280 cases.

(d) How much safety stock should be kept to maintain a fill rate of 95%? (6)

Safety stock for 95% fill	= (1 – 0.95) x (1 000/175)
rate	= 0.2857
First calculate (f)k:	
f(k)	
The corresponding K factor	
is approximately 0.25	= 0.25 x 175
Thus SS	= 44 cases

Bowersox Table 7.14 is Crucial!

K Factor (or Safety factor) is N.B for both Fill Rate & Safe Stock in combined uncertainty

Formula: Fill Rate

$$SL = 1 - \frac{f(k)\sigma_c}{Q}$$

SL = Stock-out magnitude (Product availability level

f(k) = funciton of normal loss curve which provides (need corrosponding K factor)

σ_c = combined standard deviation considering both uncertainties

Q = Replenishment order quantity

Calculate Safety Stock:

First: $f(k) = (1 - SL) \times (Q \div \sigma_c)$

Then calculated value of *f(k)* is compared to Table 7.14 = closest approximation to find K

Finally: $SS = k \times \sigma_c$

SS = Safety Stock in units

K = K factor that corresponds with *f(k)*

σ_c = *combined standard deviation*

Table 7.14: Loss Integral for Standardized Normal Distribution Info was Given in Past Papers

k	*f(k)*	*k*	*f(k)*	*k*	*f(k)*	*k*	*f(k)*
0.0	0.3989	0.8	0.1202	1.6	0.0232	2.4	0.0027
0.1	0.3509	0.9	0.1004	1.7	0.0182	2.5	0.002
0.2	0.3068	1.0	0.0833	1.8	0.0143	2.6	0.0015
0.3	0.2667	1.1	0.0686	1.9	0.0111	2.7	0.0011
0.4	0.2304	1.2	0.0561	2.0	0.0085	2.8	0.0008
0.5	0.1977	1.3	0.0455	2.1	0.0065	2.9	0.0005
0.6	0.1686	1.4	0.0366	2.2	0.0049	3.0	0.0004
0.7	0.1428	1.5	0.0293	2.3	0.0037	3.1	0.0003

37) [SAQ] Discuss the assumptions underlying safety stock planning in the case of the demand for components in the motor manufacturing industry. Explain also possible approaches that can be adopted in planning safety stock.

2 Assumptions for not carrying safety stocks under conditions of <u>dependent demand</u>:

- Procurement replenishment to support planning is predictable & constant
- Vendors & suppliers maintain adequate inventories to satisfy 100%of purchase requirements

3 Approaches used to introduce safety stock into dependent demand situations:

- Put Safety Time into the requirements plan e.g. order component earlier than needed to assure timely arrival
- Over-planning top-level demand: ↑ requisition by a qty. specified by some estimate of expected plan error
  e.g. increase procurement of all components in a ratio to their expected usage plus a cushion to cover plan error
- Utilise previously discussed statistical techniques for setting safety stocks directly to the component rather than to the item of top-level demand

38) [SAQ] Explain logic behind "*Unreliable delivery times & therefore fluctuating performance cycles have a greater influence than variable demand on inventory holding.*"

[Unsure]

39) [SAQ] What is the difference between the probability of an inventory shortage and the magnitude of an inventory shortage? [Unsure]

Probability: the chance/likelihood of not having enough stock available to satisfy demand

Magnitude: the effect/extent to which stock will not be available. More stock-out opportunity & potential Relative magnitude of an inventory shortage indicates % of units out of stock relative to the demand

40) [LO] How should inventory levels be controlled?

[Unsure] The managerial procedure for implementing an inventory policy is inventory control. Inventory control defines how often inventory levels are reviewed to determine when and how much to order. Its performed on either a perpetual or periodic basis.

41) [LO] How often should inventory levels be checked and reviewed?

[Unsure]

42) [SAQ] Distinguish between perpetual & periodic review found in Reactive Systems.

Perpetual inventory control process continuously reviews inventory levels to determine inventory replenishment needs.

- To utilise, accurate tracking of all SKUs is necessary
- Implemented through a reorder point [ROP] & order quantity **See 2nd formula form Question 26 Above**
- Used by items of high volume & value to minimise inventory & stock-out risk
- If on hand inventory + on order quantity is less that established ROP, a replenishment order is initiated

Periodic inventory control reviews inventory status of item at regular intervals e.g. weekly/monthly

- Basic reorder point must be adjusted to consider the intervals between review
- Assume: inventory will fall below ideal reorder status prior to periodic count approx. ½ the review times
- Generally require larger avg. inventories than perpetual.
- Ideal review frequency depends on combination of item volume, value & replenishment process.
- Typically used by items which must be replenished as a group, since must be ordered together anyway.

[2015-S2-Scope: Calculations]

Formula: Periodic ROP	$R = D(T + (P \div 2)) + SS$	R = Reorder point in units D = Average daily demand in units T = Average performance cycle length in days P = Review period in days SS = Safety stock in units

43) Act 3.5 Briefly summarise the assumptions of reactive inventory systems & circumstance this method can be used SAQ Evaluate the relative merits of reactive methods and planning methods as inventory management methods with reference to the logic behind and the benefits, implications & application possibilities of each. Ref. Par. 3.3.1.2-3

Reactive/ pull methods – react to the demand for the product at individual inventory locations.

- Replenishment is initiated when the inventory level falls below a certain minimum level. It depends on the following assumptions:
  - All the clients, markets & products contribute equally to the profit of the enterprise
  - Infinite capacity at source i.e. produced & stored at production facility until required
  - Infinite inventory availability i.e. no back-orders/stock-outs when processing replenishment order
  - A predictable performance cycle length & independent cycle lengths
  - Reactive systems perform best when demand is predictable & consistent
  - Little potential to effectively coordinate inventory across multiple distribution warehouses
  - Performance cycle length cannot be correlated with demand

Planning / push methods –use common info base to proactively allocate products to variety of places.

- They improve effectiveness & efficiency of the inventory in terms of quantity & placement.
- Entails proactive schedules for product movement through supply chain according to est. demand
- Planning systems require accurate forecasts at distribution systems as well as consistent & reliable performance cycles. Plans are usually subjected to rescheduling.
- Two Planning methods:
  - Fair Share Allocation: **See Question 44 Below**
  - Distribution Requirements Planning [DRP]
    Integrates across supply chain, taking unique requirements into consideration

44) [PE^{x1}] Explain "fair share allocation" as one of the planning methods in inventory management **(2)** Ref. Par. 3.3.1.3

- Is a method that provides each distribution facility with an equitable distributor of available inventory.
- Involves fair allocation of available stock of each item to different participants in the supply chain.
- Consider inventory levels & demand during specific periods (e.g. daily / weekly) for each participant

45) Additional Briefly explain the concept of collaborative inventory replenishment by referring to Ref. Par. 3.3.1.4

a) The purpose of collaborative inventory replenishment **(2)**: Ref. Par.

Intends to reduce reliance on forecasting when & where inventory needs to be positioned to demand on a just-in-time basis

b) The requirement for collaborative inventory replenishment **(1)**: Ref.

Comprehensive cooperation and information sharing between the participants

c) Four techniques for collaborative inventory replenishment **(4)**: Ref.

- Quick response (QR)
- Continuous Replenishment (CR)
- Vendor managed inventory (VMI)
- Profile replenishment (PR)

46) [SAQ] Compare & contrast quick response (QR), continuous replenishment (CR), vendor-managed inventory (VMI) & profile replenishment (PR) as collaborative inventory planning methods.

Quick response

- Tech driven cooperative effort between retailers & suppliers to improve invent velocity while providing merchandise supply closely matched to consumer buying patterns.
- Implement: share retail sales for specific products for SC participants to facilitate right product assortment availability when and where it is required.
- Can replenish retail inventory in a few days and thus creates an opportunity for max flexibility.
- Fast, dependable order response → commit inventory required → ↑ turnover and improved availability.
- Customer makes the decisions on setting target invent levels

Vendor Managed Inventory

- Modification of quick response that eliminates the need for replenishment orders.
- Goal: Establish SC arrangement so flexible & efficient that retail inventory is continuously replenished.
- Supplier assumes more responsibility and actually manages a category of invent for the customer.

Profile replenishment

- Extends QR & VMI: Gives suppliers the right to anticipate future requirements according to their overall knowledge of a merchandise category.
- Supplier simplifies retailer involvement by eliminating the need to track unit sales & inventory level for fast moving products.
- Integrated planning capabilities facilitate manufacture coordination & management of cust. inventories.

47) [LO] How should inventory be managed when there is more than one product and when inventory is kept in more than one place?

48) [LO] What methods can be used to manage inventory?

49) [LO] What factors should be taken into consideration in the choice of a particular inventory management method?

50) [LO] What is meant by an integrated management strategy?

51) [LO] What process should be followed to develop an inventory management strategy? [Ref. Par. 3.3.2]

The inventory management methods discussed in section 3.3.1 provide a foundation for the development of an inventory strategy. The development process comprises three basic steps:

- Classification of products / market in order to focus a specific inventory strategy on a particular segment
- The definition of a strategy for each segment
- The implementation of the strategy by developing detailed procedures and parameters for each segment

52) [SAQ] Explain in detail how you would go about developing an integrated inventory management strategy. Indicate clearly in your discussion how you would deal with the different characteristics or elements of the inventory management process. [Ref. Par. 3.3.2]

[Unsure] Criteria for classification and the factors that should be considered;

- 1st step: grouping together of similar products makes it easier for management to focus a specific inventory strategy on a particular segment.
- 2nd step: defining the integrated inventory strategy for each product /market group/segment. Formulation of an integrated inventory strategy entails creating specifications for various characteristics of inventory management for each segment.
- 3rd step: formulating detailed purchases and parameters for each strategy so that the integrated inventory strategy can be put into effect. Once these procedures are in place, performance must be monitored to ensure that the inventory management strategy can achieve its objectives.

53) Activity 3.3; 3.6: Five Problem sets in study guide with answers

[2015-S2-Scope: Look at problem set 2]

[PE^{X1}] Complete the DRP Schedule using the given information **(8)**

[Author's Note: Feel this question is unlikely as it was only asked once back in 2010…]

STUDY UNIT 4, PAGE 48

*[2015-S2-EXAM SCOPE: SHORTER QUESTIONS – **STUDY TB, SAQ & ASSIGN.**]*

54) **[PE^{x2}]** Discuss 2 major logistical services as part of transport functionality **(11)**
LO SAQ Briefly discuss the role/chief functions of transport in logistics. Ref. Par. 4.2; Bowersox (2010:193-198) or (2013:187-188)

Product Movement

- Basic value provided by transportation is to move inventory to specified destinations throughout SC supp. chain
- Transportation's performance is vital to procurement, manufacturing & CRM and reverse logistics
- In-transit inventory: inventory generally inaccessible / captive during transportation process
- Use improved information technology to keep in-transit inventory at a minimum
- Driver labour, fuel, vehicle maintenance, capital invested in equipment, administration = Transport cost
- Product loss & damage can represent significant costs
- Impact environmental resources directly e.g. fuel & oil consumption & indirectly e.g. congestions, air & noise pollution

Temporary Product Storage

- Less visible aspect: Product in transportation vehicle = it is being stored
- Also use transport vehicles for temporary product storage at shipment origin/destination as cost of offloading, warehousing & reloading product may exceed temp. cost
- Diversion: occurs when original shipment destination is changed after product has been shipped

55) **[PE^{x1}]** SAQ Act. 4.1 List logistical activities influenced by transport & how transport influence logistical activities? **(6)**
Ref. Par. 4.2

Transport costs: directly influenced by location of enterprise's factories, warehouse, suppliers & customers
Availability, accessibility, suitability & cost of transport play a decisive role in design of a logistics network

Inventory levels & **requirements**: influenced by the transport mode used
E.g. expensive but fast, regular & reliable transport systems require fewer inventory

Mode of transport largely determines type of packaging required

Handling equipment for loading/offloading cargo & design of loading docks depends on carrier type

Method of **order processing** allowing for max freight consolidation → advantage of volume discounts, because larger loads can be transported by carriers

Customer relationship management (CRM) & objectives also influence modal and carrier choice.
↑ Customer service requirements → faster & more reliable transport service needs to be.

56) **[PE^{x2}]** Name 4 enterprise decisions that are directly influenced by transport **(4 or 7)**
SAQ Give 4 examples of how transport can influence other enterprise decisions Ref. Par. 4.2

Product Decisions
Product's transportability (determined by physical characteristics) and cost & availability of suitable transport plays decisive role in product design

Market Decisions
Decisions about where to sell final product depends largely on availability, suitability & cost of transport

Purchasing Decisions
Transport cost, availability & reliability determines what & where to purchase, regardless of enterprise's nature

Price Decisions
Transport constitutes large portion of final product's total cost. Therefore consider price of transport in decision-making. Lower value final product → greater contribution of transport cost element will be total cost → greater the influence of transport tariff changes on the price of the product

57) [PE^{x3}] SAQ Fully discuss 6 parties that influence transportation decisions **(12 or 14)** Ref. Par. 4.2; TB (2010:194-6) or (2013:188-190)

• Shipper / Consignor	• Consignee / Destination Party (Receiver)	• Carriers
• Agents	• Government	• Internet
• Public		

Shipper & Consignee
- Has a common interest in completing a sale or purchase transaction
- Requires moving goods from origin to destination within a specific time at the lowest cost
- Services include pick-up & delivery times, predictable transit time, loss/damage, accurate & timely exchange of info and invoicing

Carriers & agents
- Performs transport services to maximise its revenue for movement while minimising cost.
- Seek to coordinate pickup & delivery times for a group of many different shippers → economy of scale.
- Brokers & freight forwarders are agents that facilitate carrier & customer matching.
- To charge customer, highest freight rate possible while minimizing labour, fuel and vehicle operating costs

Government
- Has interest in transport because of critical importance to economic & social well being
- Desires a stable & efficient transportation environment to support economic growth
- Provide supporting research & right-of-way

Internet
- Advantage: Ability of carriers to share real time information with customers and suppliers
- Wide range of web-based enterprises have been launched.
- These firms provide a market place to facilitate transactions & exchange info relating to the purchase of fuel, equipment, parts and supplies.
- It improves shipment visibility

Public
- Concerned with transportation accessibility, expense & effectiveness as well as environmental protection, security & safety standards.
- Indirectly creates demand by purchasing goods.

58) Act. 4.2 Summarise the main characteristics & relative merits of the five basic transport modes. Paying attention to cost structures & operating characteristics (speed, availability, dependability, capability and frequency) Ref. Par. 4.3.1

Road Transport (a.k.a. truck / motor carrier / highway)
- Fairly quick
- Operate on a variety of roadways → Flexibility of door-to-door operations
- Relatively small fixed investment in terminal facilities
- Operate on publicly financed & maintained roads though cost of license & users fees & tolls are considerable
- Require separate power unit & driver for each trailer → High variable cost per mile
- Driver safety restrictions & need for substantial dock labour → High labour requirements / labour intensive
- Truck operations characterised by low fixed & high variable costs
- Efficiently handles small shipments moving short distances
- High costs in replacing equipment, maintenance, safety, driver shortages, hour-of-service regulations, fuel
- Industry segments include: Truckload (TL), Less-than-truckload (LTL) & Speciality

Rail

- Capable of offering frequent service & economically transport large shipments
- Efficiently transport large tonnage over long distances → reason rail handles significant intercity tonnage
- Expensive equipment, right-of-way & tracks, switching yards and terminals → High fixed costs
- Relatively low variable cost
- Modified labour agreements reduce human resource requirements = further ↓ variable cost
- Fixed variable cost structure offers competitive advantages for long-haul moves
- Deregulation → shift from transporting broad range of commodities to hauling specific freight
- Core railroad tonnage = bulk material & heavy items [e.g. automobiles, farm equip. & machinery]
- Expanded intermodal operations by forming alliances with motor carriers
- Technologies are being applied to reduce weight, increase carrying capacity & facilitate interchange
- Unit train: commit capacity to transport singly product → faster & less expensive
- Articulated cars: concept is to reduce time required to formulate trains at railyards
- Double-stack railcars: transport 2 levels of containers → doubling capacity of each railcar

Pipeline

- Mostly transports petroleum products & natural gas
- Privately owned & operated
- Operates 24/7. Limited only by commodity changeover & maintenance
- No return of empty container or vehicle
- Highest fixed cost and lowest variable cost
- Right-of-way, construction & requirements for control stations & pumping capacity → ↑ fixed cost
- Not labour-intensive → extremely low variable cost
- Disadvantage: not flexible; only gas, liquid, slurry commodities can be transported

Water

- Shift of bulk product transport from rail & highway to lower-cost water movements on rivers/costal canals
- Sizable network; stable in the past and expected to remain so for the foreseeable future
- Advantage: capacity to transport extremely large shipments
- Disadvantage: limited range of operations & slow speed
- Distinction made between deep-water & navigable inland water transport
- Diesel-towed barges, generally operate on rivers & canals have considerably more flexibility than coastal
- Ranks between rail & motor in terms of fixed cost
- Need to develop & operate own terminals, but right-of-way is developed & maintained by government = moderate fixed costs
- Often requires supplemental product movements by rail or truck
- Transport large tonnage at low variable cost → use for low freight rates if transit speed is secondary

Air

- Costly, but speed allows warehousing & inventory logistics aspects to be reduced/eliminated
- Capability is limited by load size, weight lift capacity & aircraft availability
- Combining freight & passengers are economical but limits capacity & flexibility of freight operations
- High cost of jet aircraft & erratic nature of freight demand → limits economic commitment
- Overnight air delivery from centralised warehouses → attracts firms with large number of high-value products & time-sensitive service requirements
- Developed & maintained by government → Comparatively low fixed cost
- Fixed costs consist of aircraft purchase, specialised handling systems & cargo containers required.
- Fuel, user fees, maintenance & labour intensity → extremely high variable cost
- Require significant real-estate → limits integration with other transport modes
- Most freight has high value & priority

~~59) SAQ Briefly discuss how economies of scale & economies of distance may influence the cost of transport Ref. Par. 4.2~~

~~"NB: Please disregard this paragraph, since discussion has been omitted in the 2013 edition"~~ Tut letter 101

60) SAQ Discuss the relative merits of road transport as a possible option in satisfying logistics transport requirements
Ref. Bowersox (2010:203-210) or (2013:191-199)

See question 58 Above

61) Additional Compare & Contrast rail & road transport as options in satisfying logistics transport requirements **(8)** Ref.

Road	Rail
• Small Fixed investment in terminal facilities	• High fixed cost because of expensive equipment
• Variable cost per mile is high	• Relatively low variable operating cost
• Labour requirements high	• Reduced human resources requirements
• Low fixed and high variable cost	• Offers competitive advantage for long haul moves

62) SAQ Briefly discuss the economic and operating characteristics of rail transport. What technological improvements in rail transport give rise to better service through this mode?

[Unsure: Same as Question 58 Above?]

63) [PE^{x3}] SAQ Distinguish briefly between private operators & professions carriers **(4)** Ref. Par. 4.3.2 Par. 6.5

Professional carriers

- synonymous with transport enterprises & transport is enterprise's principal activity
- undertake transport for remuneration
- Subdivided into two groups:
  - Common carriers serve *broad public* and a variety of shippers, and transport almost anything.
  - Contract carriers *specialise* in transporting a particular product for a particular enterprise & endeavour to bargain for a *fixed contract* over a long period
- Tend to also provide other logistical services such as storage and shipment tracing.

Private Carriers (a.k.a. **Auxiliary Carriers**)

- Enterprise main activity is not transport.
- Use their own vehicles to transport goods in normal course of events.
- Hence, this is merely an auxiliary function.
- To better utilise vehicles, sometimes offer transport services for remuneration on the back-haul.

64) SAQ Explain the concept of "intermodal transport" and discuss intermodal services that are at the disposal of logistics management Ref. Par. 4.3.3

Intermodal transportation combines two or more modes to take advantage of their inherent economies of each and thus provide an integrated service at lower total cost. Best known intermodal systems are:

- **TOFC:** trailer on a flatcar
  - Trailer: of similar width & height but length varies and have highway wheels
  - Placement on railcar → wind resistance, damage & weight problems
- **COFC:** container on a flatcar
  - Container: box utilised for intermodal product storage & movement between road, rail & water transport. Typically a standard size and without highway wheels
- Trailer/container placed on flatcar for some portion of intercity line-haul

65) SAQ Briefly discuss the role of the following intermediaries in the logistics transport system:

a) Freight Forwarders: Ref. Bowersox (2013:202-
- For-profit businesses consolidate small shipments from various customers into a bulk shipment
- Then utilise a common surface or air carrier for transport.
- At destination, splits consolidated shipment into original the smaller shipments
- Local delivery may/may not be arranged by forwarder
- Advantage: lower freight rate obtained from consolidation to large shipments

b) Freight Brokers: Ref. Bowersox
- Intermediaries that coordinate transportation arrangements for shippers, consignees & carriers
- Also arrange shipments for exempt carriers & owner operators
- Simultaneously act as sales agents for carrier & traffic managers for shipper
- Typically operate on commission basis
- Provide extensive services e.g. shipment matching, rate negotiation, billing & tracing
- Entire area of brokerage operations is highly adaptable to internet-based transactions
- Increasing in importance as a result of increased globalisation

c) Freight Agents: Ref.

[Unsure]

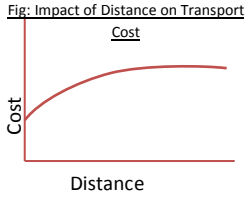
STUDY UNIT 5, PAGE 56

*[2015-S2-EXAM SCOPE: **LONGER**QUESTIONS – **STUDY TB, PE, SAQ & ASSIGN.**]*

66) [PE^{x6}] SAQ Discuss factors that influence the transport cost of products **(3 to 17)** Ref. Par. 5.2; 2015-S2-Assign.01; TB 2013:203-205

Exact question asked varies in length & could ask for sketches to explain economies

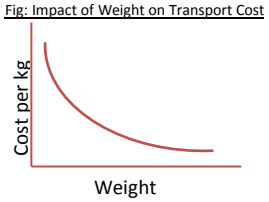
Fig: Impact of Distance on Transport Cost



Distance

- Directly contribute to variable costs e.g. labour, fuel, maintenance: Longer distance, higher costs
- Fixed costs remains the same regardless of distance → curve does not begin at zero
- Cost curve ↑ at a decreasing rate (tapering principle). Fixed costs spread over more km's.

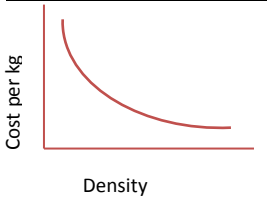
Fig: Impact of Weight on Transport Cost



Load Volume (Weight)

- Economies of scale: Cost per unit of weight decreases as load volume increases
- This occurs because fixed costs are spread over incremental volume
- Relationship is limited by size of transportation vehicle
- Small loads should be consolidated into larger loads to maximize scale economies

Fig: Impact of Density on Transport Cost



Product Density

- Density: the combination of weight & volume (weight to volume ratio)
- Vehicles are constrained more by cubic capacity than by weight
- Fixed costs spread across more weight
- Higher-density products → spread fixed transport cost across more weight
  → products typically assessed lower transport costs per unit of weight
  → declining transport costs per unit of weight as product density increases
- Improve product density so that cubic capacity can be fully utilised
- Cost for any movement is usually quoted in monetary value per unit of weight E.g. R/Kg

Product Stowability

- How product case dimensions fir into vehicles
- Odd sizes and shapes results in wasted cubic capacity
- Silencers and pipes have the same density, but different stowability
- Large numbers of items can be nested in shipments while they may be difficult to stow in small quantities

Product Handling

- Special handling equipment may be required
- The way products are physical grouped together in boxes or on pallets will impact on handling costs

Liability in respect of theft & damages to the product

- Damage and potential claims
- Carriers must have insurance
- Reduce risk by improving packaging

Market factors that cause Backhaul

- Lane volume and balance (return load) influence transport costs
- Either find a back-haul or return (deadhead) empty
- When deadhead occur, costs must be charged against the original front-haul movement
- Balance also influenced by seasonality
- Try to find back loads

67) SAQ Act. 5.1 There are 7 main factors that influence transport costs. Discuss the relative importance of each in price fixing for the transportation of exhaust systems for motor vehicles. Also indicate certain actions that the logistics manager of an exhaust system firm can take to reduce transport costs and thus negotiate more favourable rates

Ref. 5.2; Bowersox (2010:219-221) or (2013:203-205) & example from Act. 5.1

Be able to apply the factors from Question 66 above to a given scenario…?

68) [PE^{x2}] Discuss 4 categories of transport cost **(8 or 10)** Ref. Par. 5.3; 2015-S2-Assign.01; TB 2013:205-206 [Cost Structure]

SAQ Explain the costs that carriers need to take into consideration in fixing rates Ref. Par.5.3 ?

Variable:

- Cost that change in a predictable manner
- In transport it can only be avoided if vehicle is not operating
- Transport cost should at least cover variable cost
- Includes direct carrier cost associated with movement of each load
- labour, fuel and maintenance

Fixed

- Do not change in the short run and must be paid even when the organisations is not operating
- Includes costs not directly influenced by the shipment volume
- Vehicles, terminal, rights-of-way, information systems, and support equipment

Joint

- Created by the decision to provide a particular service
- Example is a back-haul
- Joint cost covered by original shipper or a back-haul shipper must be found
- Carrier quotations must include implied joint costs based on assessment of back-haul recovery

Common

- Includes carrier costs that are incurred on behalf of all or selected shippers
- Terminal or management expenses are characterised as overhead
- Allocated to a shipper according to a level of activity like the number of shipments or delivery appointments handled

~~69) SAQ Indicate two principles that carriers need to consider when fixing rates. Which principle do you think they would apply when transporting the following: Iron Ore, Rolls of Paper, Jewels Ref. Par 5.4~~

~~"NB: Please ignore section 5.4, since it has been omitted in the 2013 edition"~~ Tut letter 101

Pricing Mechanisms / Pricing Freight: General Summary as not all the work is covered by the SAQ's asked Ref. Par. 5.5; Bowersox (2010:223-229) or (2013:206-212)

Class Rates

- Rate: monetary value per hundredweight to move a specific product between two locations
- Tariffs: rate listed on pricing sheets or on computer files
- Class Rate: evolved from the fact that all products transported by common carriers are classified for pricing purposes into groups according to characteristics.
- Class rates simplify the process of quoting prices for a variety of products.
- Determining common carrier class rates is a two-step process:
  - Determine *classification / grouping* of product being transported
  - Determine *rate / price* based on freight classification of the product, weight & origin/destination points
- Determining common carrier class rates is a two-step process:

○ Freight Classification: Grouping all products transported into uniform classifications

- Considers product/commodity characteristics that influence handling/transport costs
- Products with similar density, stowability, handling, liability & value characteristics are grouped together
- Reduces the need to deal with each product on an individual basis
- *Rating*: product's transport characteristics in comparison with other commoduties - determines frieght rate
- Truck & rail have independent classification systems
- Higher class rating = higher the transportation cost
- Ratings based on product characteristics, weight, packaging, transport mode, shipment size

○ Rate Determination:

- Usually based on shipment origin & destination - per hundredweight or per distance charge
- Subject to *minimum charge*: amount a shipper must pay to make a shipment, regardless of weight
- Discounts can be given depending on shippers volume and market competition.
- Surcharges: additional charge designed to cover specific carrier costs

Cube / Density Rates

- Simplified method of transportation pricing
- Shippers complete a cube shipping document (CSD) which replaces traditional bill of lading
- Shippers provide total weight of both stackable & non-stackable freight
- Rates are determined for the weight contained in each category
- Reduces complexity & improve accuracy of traditional transportation pricing

Commodity Rates

- Special/specific rates published without regard to classification
- Common practice when a large quantity of a product moves between two locations on a regular basis.
- Terms & conditions indicated in in a contract between shipper and carrier.
- Published on a point-to-point basis & apply on specified products.
- Whenever a commodity rate exists, it supersedes corresponding class / exception rate

Exception Rates

- Establish special rates lower than class rates rather than publishing a new tariff.
- Provides special rates for a specific area, origin/destination or commodity when justified by either competitive or high-volume movements.
- Changes classification that normally applies to product e.g. assign new class
- *Aggregate tender rate*: shipper provides multiple shipments to carrier in exchange for discount/exception
  Limited service rate: shipper performs selected services typically performed by carrier in exchange for discount e.g. shipper load & count rate where shipper takes responsibility for loading & counting cases; or e.g. Released value rate: limits carrier liability in case of loss or damage

Special Rates & Services: **See Question 73 Below**

70) [PE^{x1}] Describe the term "class rate" **(2)** Ref. Par. 5.5; Act 5.2

The term class rate evolved from the fact that all products transported by common carriers are classified for pricing purposes into groups according to characteristics

71) Act. 5.2 What is the purpose of the freight classification?

To group products with similar characteristics together into a class, thereby reducing the need to deal with each product individually so that freight rates can be determined

72) SAQ Describe a procedure for fixing rates in a transport enterprise that transports a large variety of products Ref. 5.5

In the case of professional carriers that do general cartage and therefore transport a variety of products on a daily basis, it makes sense to place products with the same characteristics into a particular class or group.

73) SAQ Summarise the special rates and services that logistics management can negotiate with a carrier. Clearly show the levies that carriers can impose Ref. Bowersox (2013:210-212)

- **Freight-all-kind (FAK) rates**: mixture of products transported under negotiated rating.
  Line-haul rates replacing class/exception/commodity rates to simplify paperwork of moving mixed products
- **Local rate**: commodity moves under a tariff of a single carrier

- **Joint rate**: moves under a tariff for multiple carriers
- **Transit services**: permits shipment to be stooped at intermediate point between initial origin & destination for unloading/storage/processing then reloaded for delivery to destination.
- **Diversion and reconsignment**: change routing, destination or consignee after shipment is in transit
  Diversion consists of changing shipment's destination prior to arrival to original destination.
  Reconsignment changes consignees prior to delivery
- **Split delivery**: portions of shipment need to be delivered to different destinations
- **Demurrage**: used by railroad for holding a railcar beyond 48 hours before unloading the shipment
- **Detention**: charges assessed for retaining truck trailers beyond a specified loading or unloading time
- **Special / accessorial** services e.g. collect payment on delivery [COD]. Marking/tagging, storage, etc. table 8.9
- **Environmental services**: special control of freight while in transit such as refrigeration, ventilation, heating.
- **Special equipment charges**: use of equipment carrier purchased for shipper's convenience. E.g. sanitation equipment must be purchased to clean trailers for food consignments etc.

STUDY UNIT 6, PAGE 62

*[2015-S2-EXAM: SHORTER QUESTIONS – **STUDY SG & SAQ**]*

74) **[PE^{x3}]** List 4 factors that influence transport decision-making **(4 or 8)** SAQ Pay special attention to the external influences that have to be analysed to ensure effective transport planning Ref. Par. 6.2.1; Fig. 6.1

External Factors/Pressures

Macroeconomic trends & trends in cost of various transport modes	Regulatory Developments	Technological Change	Carrier Strategies
•Analyse the following: •long-term cost trends of various transport modes; •relative price of fuel & other cost components; •trends in production & consumer price index; •interest rates	•Transport decision making is restricted by numerous Acts & Regulations •All decisions should be made within the framework of these restriction	•Logistics management should keep abreast of technological innovations in the transport market •The development of computer tech plays a major role in logistics & are used increasingly for: •routing, •scheduling and •freight documentation, •while satellite technology facilitates: •freight tracing •expediting	•6 strategic decision making areas of carriers: •Nature of service provided •Geographic area wherein services are rendered •Size of the enterprise •Scope of services •Marketing strategy •Use of technology

See figure 6.1: factors that influence transport decision-making:

External Pressures	Carrier Strategies	Internal Strategies
Business Environment	Rail	*Corporate*
Economic	Road	Lines of business – product mix
Competitors	Water	Geographic scope
Customers	Pipeline	Growth Objectives
Vendors	Air	Financial Objectives
Suppliers	Intermediaries	Marketing Strategy: - Produce to order / supply from inventory - Channels - Customer service req. - Terms of trade
Transportation Environment	Intermodal	
Legislative	Multimodal	
Regulatory		Organisation & Staffing
Legal		*Logistics*
Technology		Make or buy product
Modal Economics		Plants: Location & capacity
		Vendors: Location, Num., Capacity
		Finished Goods Inventories: Location & levels
		Warehouse Strategies
		Order Processing system
		Info Management System
		Transportation
		Organisation & Staffing
		Transportation
		Transportation Services: - Modal Choice - Carrier Selection - Proprietary Operations - Equipment Sourcing
		Purchasing Transportation Service - Contracts / Tariffs - Terms of Trade - Use of Intermediaries
		Resources: - Info Managements & Systems - Organisation & Staffing - Facilities & Equipment

75) SAQ Design a framework of transport decisions that can be made from a logistics point of view. Distinguish between tactical and strategic decisions Ref. Par. 6.2.2 [Unsure]

Strategic? **Transport Services Necessary to Achieve the Logistics Mission**: decisions need to be made about the:

- transport modes or combination of modes to be used within the chosen mode
- choice between own and professional transport
- financing of own equipment

How the Necessary Services should be Obtained: Decisions involve

- Extent to which fixed contracts should be concluded instead of using services of common carriers
- When and in what circumstances 3rd parties should be used

Tactical? **Sources Necessary to Implement the Transport Strategies**: Decisions need to be made about

- the information that is necessary to make rational decisions
- the human resources needed and how they should be organised
- how the latest technology is used
- how many financial resources should be spent on transport activity

76) SAQ Briefly discuss the functions of traffic management Ref. Par. 6.3; Bowersox (2010:229-239) or (2013:212-219)

[2015-S2-Scope: "Focus on Study Guide" Study Guide only Lists the functions but doesn't give detail. Discussion was taken from Bowersox TB]

Operations Management

- Oversee day to day transport operations & Implement transport management systems.
- From an operational perspective the following are the most important:
  - Equipment Scheduling & Yard Management: Entails careful load planning, equipment utilisation & maintenance & driver scheduling. Schedule deliveries & pick-ups to allocate slots.
  - Load planning: affects transport efficiency. Trucks are limited in terms of weight & cube. Physical characteristics of the product & size of individual items are important.
  - Routing & Advanced Shipment Notification (ASN): The geographical path a vehicle will take. Send ASN to client to advise shipment arrival date etc. in order for customer to plan offloading, dispatch etc.
  - Movement Administration: Hiring other transporters to carry out work on your behalf. Core carrier strategy is used, only a few carriers are used. Relationships are built and admin work decreases.

Freight Consolidation

- Combining numerous small shipments to a specific destination & sending it as one thus saving costs etc.
  - Reactive consolidation: reacts to shipments as they come. Seeks to combine individual orders. Three ways of effective reactive consolidation :
    - Market area: geographical locations that shipments are destined for
    - Scheduled delivery: limiting of shipments to specific market areas to selected days of the week.
    - Pooled delivery: multiple shippers but destined for same geographical location. Sorting, sequencing and segregation is used.
  - Proactive consolidation: response based logistical systems create a large number of small shipments.

Rate Negotiation

- Obtain lowest possible rate best suited to service levels required.
- Seek win-win agreements. – both share productivity gains
- Matters to negotiate incl. Rates, transit services, diversion & reconsignment, split delivery, scheduled collection and delivery, deferred delivery & internal delivery

Study Guide only Lists the functions but doesn't discuss....?]

Freight Control

- Tracing: procedure to locate lost or late shipments
- Expediting: Shipper notifies carrier that it needs to have a specific shipment move through the carrier's system a.s.a.p.
- Driver hours administration: Because of driver fatigue etc. ensure long enough breaks between trips

Auditing & Claims Administration

- When services are not performed as promised clients can claim for restitution. Classified as:
  - Loss & damage: Shipper demands payments for partial/total financial loss from poor performance.
  - Overcharge/undercharge: result when amount billed differs from that expected
- Agreements define proper procedures for filing claims and parties responsible
- Require detailed attention
- Large volumes of claims means carriers are not performing their service obligations.
- Two types of freight audits :
  - Pre-audit: changes prior to payment or freight
  - Post-audit: changes after payment has been made

Logistical Integration

E.g. change of packaging can result in lower freight costs.

Documentation: Three types of transport documents:

- Bill of lading: utilised in purchasing transport services. Receipt/documents products, quantities, terms etc.
- Freight bill: Carrier's way of charging for transport services performed. Uses info from bill of lading
  Can be either prepaid or collect.
- Shipment manifest: lists individual stops/consignees when multiple shipments are placed on single vehicle.

77) SAQ Explain fully how you would go about selecting a particular carrier Ref. [Unsure]

See Question 79 Below...?

78) SAQ Explain in detail the factors that you would take into consideration when selecting a mode and carrier Ref. 6.3.1

Cost
- overall cost consists of:
  - transit time,
  - ease of system interface,
  - equipment & related activities such as loading and counting

Transit Times
- Carriers offering faster & more reliable transit times also offer service attributes that are important to overall logistics performance

Reliability
- Must provide a high degree of reliability.
- Incosistant → loss of sales
- Measure between actual & expected performance indicates reliability

Capability
- Capacity to provide EDI & specialised equipment such as:
  - temperature control
  - bulk products
  - Online shipment tracking

Accessibility
- Manner in which door-to-door deliveries can be made.
- Generally not a problem for road transport but does present problems to other modes

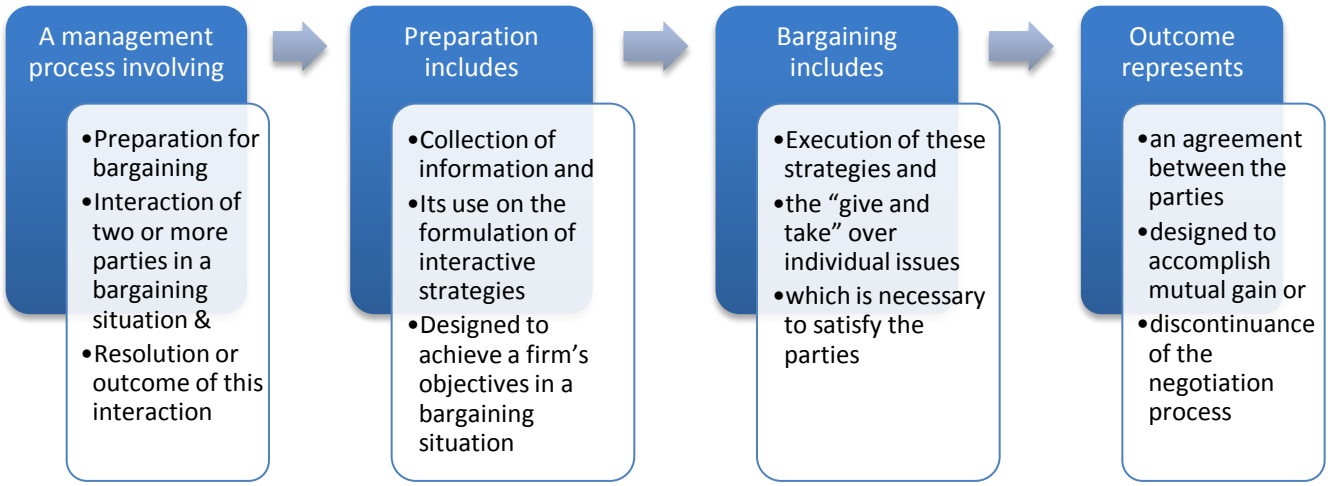
Security
- Carrier's ability to protect a load from and/or resolve claim of:
  - loss,
  - damage
  - theft.

79) [PE^{x1}] Name the two-step approach when evaluating carriers **(2)** Ref. Par. 6.3.2

Step 1: Determines relative importance of service elements to shipper → assign weight factor to each
Step 2: Assess each carrier's performance concerning each consideration according to a scale: 1=high & 3=poor.

Combined performance evaluation = multiply factor's relative importance with each carrier's performance
Carrier with lowest points is the better and should be used.

80) [PE^{x2}] SAQ Explain what negotiation is **(3)** Ref. Par. 6.4.1 [carrier negotiations definition]



Negotiating with Carriers: General Summary as not all the work is covered by the SAQ's asked Ref. Par. 6.4

Need for Negotiation [Why is it necessary to negotiate with Carriers]. Ref. Par. 6.4.2

- Deregulation = market entry of increasing number of carriers.
- Each with a variety of services at different rates.
- Competitive transport market → opportunity for shippers to negotiate with carriers → in effort to bargain for best possible service at lowest possible cost.

Matters that can be Negotiated [What can we negotiate about.] Ref. Par. 6.4.3: Are mainly **Rates & Services**:

- Rate negotiation can assume one of three forms
  - discount on the existing rate for small consignments
  - a commodity rate for truckloads of a particular commodity transported in large volumes on a regular basis
  - a contract rate for regular consignments over a long period
- Main concern when negotiating services: improve carrier's service → in turn raises level of customer service.
- Revolve mainly around quality of service, following special services can also be negotiated:

○ *Transit Services*
- Permit shipment to be stopped at intermediate point between initial origin & destination
- for unloading, storage, and/or processing

○ *Diversion & Consignment*
- Changes to routing, destination or consignee after a shipment is in transit

○ *Scheduled Delivery & Collection Times*
- Congestion at loading docks can be avoided by scheduling collection and delivery times with the carrier
- Results in better utilisation of handling staff & equipment
- Loading & unloading activities are more effective
- Carrier benefits because shorter waiting times and the concomitant better utilisation of vehicles and crews

○ *Deferred Delivery*
- Shipper offers carrier the choice of dispatching consignment later in exchange for a slower service
- Shipper can negotiate a lower rate

○ *Internal Delivery*
- Rates and delivery times can be determined mutually
- Additional service that carriers provide, namely transporting goods internally to offices and warehouses

Determining Relative Power Position Ref. Par. 6.4.4

See Question 81 Below

Preparing for Negotiation Ref. Par. 6.4.5

Info is used to formulate negotiating goals & bargaining strategy. Req.'s collection, analysis & evaluation of info on:

- Enterprise's transport needs & shipping characteristics
- Carrier's operating characteristics & abilities

a. Collecting Information **See Question 83 Below for necessary Info**

b. Definition of Negotiation Objectives - To negotiate meaningfully about rates and services, it is necessary to identify beforehand what the negotiations are supposed to achieve. The formulation of objectives stems from a study of what is expected of the carrier

81) **[PE^{x2}]** Explain relative power positions in negotiations **(4)** Ref. Par. 6.4.4

- Each party's relative power position can be derived from
  - current & previous business conducted with each other
  - competition in the market in which particular organisation does business
- More dependent *carrier* is on organisation's business → greater logistical manager's power position will be
- Smaller the relative share of a specific carrier in org.'s transport work → less reliant the carrier will be on org. & weaker the logistical manager's relative power position will be.
- More dependent *enterprise* is on carrier's services → smaller logistical manager's relative power position

82) SAQ Explain factors that influence the power positions of the logistics manager during negotiation Ref. Par. 6.4.4

[Unsure] Dependence **See Question 81 Above**

83) **[PE^{x4}]** Explain information necessary before negotiations with carriers can begin **(9 or 12 or 18)** Ref. Par. 6.4.5.1

SAQ Discuss in detail the preparatory phase in the carrier negotiation process paying special attention to the information required for negotiation. Ref. 2013-Self-Assign [Preparing for Negotiation]

Transport needs - data used in most decisions about carrier selection must be gathered, such as

- cost & tariff structure of carriers,
- reliability and ability to meet the conditions of the agreement.

- <u>Questions regarding rates</u>
  - Transport costs compared to competition
  - Product price after delivery compared to competition
  - How much discount required to remain competitive
  - How much discount to increase sales
- <u>Questions regarding services</u>
  - What service level do customers require
  - What service level do competition provide
  - What transport improvement will lead to cost reduction
  - What service adjustment necessary to improve logistics system

The enterprises shipping characteristics – Info useful in determining N.B. of enterprise's freight for the carrier & determining the enterprise's power position. The following are also important:

- Annual amount spent on transport
- Annual number of consignments
- Annual tonnage (volumes) shipped
- Regularity of consignments

→ Factors determine the value of the enterprise's business for a carrier

- Density of products
- Direction of consignments
- Handling characteristics of products

→ Influences the carrier's cost

- Number of carriers used

→ Represents the concentration of the shipper's power position

Carrier operation and costs

- N.B. criterion for successful negotiation is knowledge of the other party. N.B. operating & cost factors are:

Competitiveness of the product in a given market

- Owing to the derived nature of transport demand
- High transport rate can ↑ product price to such extent that it can no longer compete against available substitutes
- The logistics manager should emphasise the relationship between
  - the transport rate,
  - the price of the product,
  - the competitive position of the product and the demand for transportation of the product.

Handling characteristics

- It is less expensive for a carrier to handle a product that requires little or no special handling.
- Palletised consignments: cheaper to handle than non-palletised → lower rate can be expected on former

Density

- A shipper who can
  - improve the density of a product and
  - increase the mass that is loaded
- helps the carrier to transport a lower cost per mass unit.
- A lower rate can be negotiated in exchange for these reduced carrier costs.

Back-hauls

- If traffic can be offered in the direction of a carrier's back-haul,
- Negotiate lower rates on strength of the fact that vehicle would have re-turned empty in any event.

- Lower rates can be negotiated in exchange for better utilisation of vehicles.

84) SAQ Discuss in detail the choice between own and professional transport as a strategic transport decision

Ref. Par. 6.5.1 – Nature of own Transport

Ref. Par. 6.5.2 – Basic Reason for own Transport: See Question 85 Below

Ref. Par. 6.5.3 – Cost of own Transport: See Question 86 Below

Ref. Par. 6.5.4 – Advantages & Disadvantages of own Transport: See Question 87 Below

85) SAQ Explain why some enterprises use their own transport instead of professional transport to satisfy their logistical transport needs Ref. 6.5.2

Reason for Choosing Own Transport (8)

- Render better customer service
- To deal with urgent consignments
- Save transport cost
- Enable shipper to improve marketability of own product
- More direct control over transport service such as forwarding, routing and packaging which leads to shorter transit times, more convenient delivery times and reduce risk of damage
- Professional carriers may be unable to provide required service

86) [PE^{x2}] Discuss the cost of own transport (8) Ref. Par. 6.5.3

Fixed Cost e.g. maintenance facilities, cost of accommodating vehicles. Comprises the following 6 points:

- Depreciation & interest on capital in respect of vehicles and other equipment
- Depreciation & interest on capital i.r.o. additional buildings, maintenance facilities and parking facilities
- Other standing vehicle costs such as licenses, insurance and crew costs
- Management costs
- Administrative costs
- Salaries of maintenance staff if the enterprise is going to be responsible for its own maintenance

Variable Cost Concern mainly the operation of vehicles and include the following 3 areas:

- Fuel, oil & lubricants
- Tyres
- Maintenance (parts)

87) **[PE^{x2}]** Name 4 or 3 advantages of own transport **(4 or 3)** Ref. Par. 6.5.4

Advantage

- Terminal cost usually lower
- More direct routes are possible
- Documentation & other administrative activities require less attention
- Ensures speedy and effective delivery of urgent orders
- Creates a good impression of the enterprise among customers because of fast service
- Eliminates congestion at the loading docks
- Ensures safe arrival of goods because of less handling and the correct arrangement of freight
- Integrates incoming raw materials with production and distributes finished products according to orders
- Can possibly eliminate expensive packaging methods
- Can be self-sufficient because it may generate profit (profit professional carrier makes can be saved)
- Highly adaptable and can satisfy special requirements
- Makes transport available immediately or at short notice
- May stimulate freight by advertising on vehicle
- Save costs if vehicles have a high utilization capacity
- provides for reconstruction of vehicles to meet the requirements of the enterprise

Disadvantage

- Equipment has to be purchased
- Involves cost of maintenance
- Often means experiencing problems obtaining suitable staff
- Involves expenses because vehicles may be operated empty and are underutilised
- Involves problems with the management of the transport department and the integration of activities with other functions of the enterprise
- Entails risk associated with purchasing vehicles that are unsuitable for work they are supposed to perform

AUTHOR'S NOTE: Only used the study guide to compile this summary for study unit 6

Study Unit ends with a self-eval "assignment" of developing an effective carrier negotiation plan

STUDY UNIT 7, PAGE 82

*[2015-S2-EXAM: **LONGER**QUESTIONS – N.B **TB SECTION, SG, PE, SAQ & ASSIGN.**]*

88) SAQ What do you understand by the concept "strategic storage"? Ref. Par. 7.2; Bowersox 2013:224 [Unsure]

- Warehouse traditionally viewed as place to hold/store inventory
- that added cost to the distribution process
- However, provided necessary bridge between production & marketing
- As forecasting, production scheduling techniques & production planning improved, need for storage to support stable manufacturing & consumption patterns was reduced.
- Changing consumer demand → establish strategically located warehouses to provide timely & economical inventory replenishment for retailers → from passive storage to strategic inventory assortment

89) SAQ What role does a warehouse play in a logistics system? Ref. Bowersox 2013:223-225 [Unsure]

- Mixing & modifying inventory to create assortments & meet customer requirements.
- Coordinating product supply and consumer demand.
- Saves logistics costs by consolidating inward-/ outward-bound consignments
- Distribution center: dynamic development of shift from passive storage to strategic inventory assortment
- Integral to just-in-time [JIT] (aims to reduce work-in-progress inventory) & stockless production strategies
- Satisfy requirements related to local presence e.g. respond faster to customer needs; increase market share & potential profitability

90) [PE x4 Variations] SAQ Fully discuss the economic and service benefits of warehouses **(25)** **Ref.** par 7.2; Bowersox 2013:225-231

ECONOMIC BENEFITS (14) 2013-Self.Assign; See Bowersox 2013:228 for Figure 9.2

- Occur when overall logistics costs are reduced & total cost reductions are achievable

Consolidation & Break-bulk

- Reduce transportation cost by using warehouse capability to increase shipment size
- Use warehouse capacity to improve transportation efficiency
- Benefit of *consolidation*:
  - realisation of lowest possible freight rate,
  - timely and controlled delivery,
  - reduced congestion at customer receiving dock
- Enables larger shipment consolidation of in- &outbound movement = ↓ transport cost & quicker delivery
- *Break-bulk* receive large shipments and send to multiple locations
- Achieve economies of scales

Sorting: Basic benefit is to reconfigure freight. 3 types of assortment:

- *Cross-docking*: combine inventory from multiple origins into pre-specified assortments. Requires on-time delivery. For fast-moving store inventories. Dependent on technology.
- *Mixing*: perform at intermediate location. Ship truckloads from origin to mixing warehouse. Minimum inbound transportation cost. Sort & combine products according to customer. Products can also be combined with regular stock.
- *Assembly*: support manufacturing operations. Assembled from variety of second-tier (lead or tier one suppliers) suppliers located close to manufacturer. Lately value-added service from lead supplier or ISP

Seasonal storage

- Accommodate seasonal production / demand
- Provides a buffer
- Allows for production efficiencies

Reverse Logistics Processing – includes activities to support
- Returns management: facilitate reverse flow of product that did not sell or to accommodate recalls.
- Remanufacturing & Repair: reverse flow of product following initial use for revitalisation e.g. refurbished
- Remarketing: resell product after original user no longer needs it.
- Recycling e.g. metal, paper, etc.
- Disposal to e.g. landfill/dump if material cannot be effectively reused

SERVICE BENEFITS
- Not direct cost reduction. Results from possible increase in market share because of improved service

Spot Stocking
- Typically used to support customer accommodation.
- Manufacturers of highly seasonal products often spot stock
- Inventory is positioned in a local market in anticipation of customer need during critical sales period

Full Line Stocking
- Manufacturers, wholesalers, & retailers use warehouses to stock product inventory combination in anticipation of customer orders.
- One-stop shopping capability for goods from multiple manufacturers
- Restricted to a few strategic regions and operates year round
- Improve service by reducing number of suppliers that customer must logistically deal with
- Combined assortments make economical larger shipments possible

Value-Added Services [VAS]
- *Value added service*: any work that creates a greater value for customers.
- Changes product's physical features to be presented in a customized manner.
- Postponement is a factor of VAS: meaning producing product but leaving packaging/customisation for last.

91) [PE^{x2}] Discuss type of warehouse using characteristics & advantages: **Private** (6) Ref. par 7.3; 2015-S1-Assign.02; TB 2013:235

Characteristics
- Operated by firm owning products that are handled & stored in facility
- Building may be built/owned or leased (depending on specialised logistical requirements)

Benefits
- *Control*: management has authority to prioritise activities → integrate warehouse with logistics operations
- *Flexibility*: adjust operating policies, hours, procedures to meet specific customer & product req.
- *Cost*: less because not operated for profit
- *Intangibles*: Own name on signage → cust. perception of responsiveness & stability → marketing image

SAQ **Circumstances**
- Firms with very specialised customers / products often own private warehouses
- Use declining because of managerial interest in ↓ capital invested in logistical assets
- Challenged by public warehouse's ability to gain operational economies of scale & scope

92) [PE^{x3}] Discuss type of warehouse using characteristics & advantages: **Public** (12) Ref. par 7.3; 2015-S1-Assign.02; TB 2013:236

Characteristics
- Operated by independent business
- Offers range of relatively standardised for-hire services e.g. Storage, handling & transportation
- SAQ Types/Classification of public warehouses – each using different materials handling & storage technologies related to product & operating environment: **(only 2 marks)**
  - General merchandise: handle package products ,

- Refrigerated: offer frozen/cooler capacity designed to protect products requiring temp control [food, medical]
- Special commodity: designed to handle bulk materials/items requiring special handling [e.g. tires, clothing]
- Bonded: licensed by government. Store goods prior to payment of taxes or import/export duties
- Household goods or furniture: specialise in handling large bulky items [e.g. appliances & furniture]

Benefits

- Provide flexibility & shared service benefits
- Potential to offer operating & management expertise as warehousing is core business
- Lower operating cost than private [resulting from lower wage scales, better productivity & shared overhead among clients]
- Do not require capital investment from customers
- Offers flexibility concerning size and number of warehouses
- Share economic scales [since combined requirements of users can be leveraged]
- Justify investment in state of the art handling equipment
- Leverage transportation by providing consolidation of multiple-client freight
- Charge clients basic fee for in and out handling plus storage
- Special value added services, priced on negotiated basis

SAQ **Circumstances**

- Use for customer accommodation because of variable cost, scalability, range of services & flexibility
- When management performance is judged according to return on investment
- More flexibility as private can't easily change/expand/sell when no longer required

93) [PE^{x3}] Discuss type of warehouse using characteristics & advantages: **Contract** **(7)** [Ref. par 7.3; 2015-S1-Assign.02; TB 2013:236-7]

Characteristics

- Customised extension of public warehousing
- Combines benefits of private & public operations
- Important differences between contract & public:
  - Anticipated length of relationship i.e. Long-term contractual relationship
  - Degree of exclusive/unique/tailored services to a limited number of customers
  - Shared incorporation of benefits & risks

Benefits

- Provide expertise, flexibility, scalability, economies of scale [by sharing resources, equip., etc. across multiple clients]
- Offer range of logistics services [e.g. transportation management , inventory control , order processing , customer service & return merchandise]
- Contract logistics firms/ISP's [Integrated Service Providers] are capable of performing firm's total logistics responsibility

SAQ **Circumstances**

- Long-term contractual relationship will typically result in lower total cost than public

94) [PE^{x1}] SAQ Briefly distinguish between private, public and contract warehouses **(3)** [Ref. par 7.3 Variation on question asked]

See the three questions above

95) SAQ Discuss the value-added services that public and private warehouses can offer [Ref.]

[Unsure] See the three questions above

96) SAQ In what circumstances would you use a combination of public and private warehouses [Ref.]

Network Deployment:

- Full warehouse utilisation throughout a year is rare [fluctuation caused by peak / off-peak / seasonal / trends]
- Firms utilise a combination of private, public & contract facilities to accommodate peak demand

Key Questions: How many warehouses are required & Use which ownership types in specific markets

97) SAQ Explain in detail how you would plan a warehouse Ref. Par. 7.4; Bowersox 2013:237-241

Main considerations in the planning of a warehouse are:						
Selecting a suitable place	Design specifications	Product mix considerations	Provisions for future expansion	Selecting an appropriate material handling system	Layout of the warehouse	Estimating the warehouse space required

Site Selection

- Identify general/broad geographic area, then specific warehouse location then identify building site
- Factors driving site selection:
  - Service availability
  - Cost Land cost; Setup & operating expenses; Essential services;
  - distance from major industrial area
  - Offer adequate room for expansion
  - Necessary utilities must be available
  - Soil must be able to support the structure
  - Site must be high enough to support proper drainage

Design Specifications

- Refer to diagram 9.4
- Must consider product movement characteristics
- Three factors to be determined during design process:
  - No. of floors. Ideally one-floor → Eliminate vertical movement
  - Max Cubic utilisation plan Ceiling height limited by safe lifting capabilities of equip.
  - Facilitate straight product flow through the building Min congestion

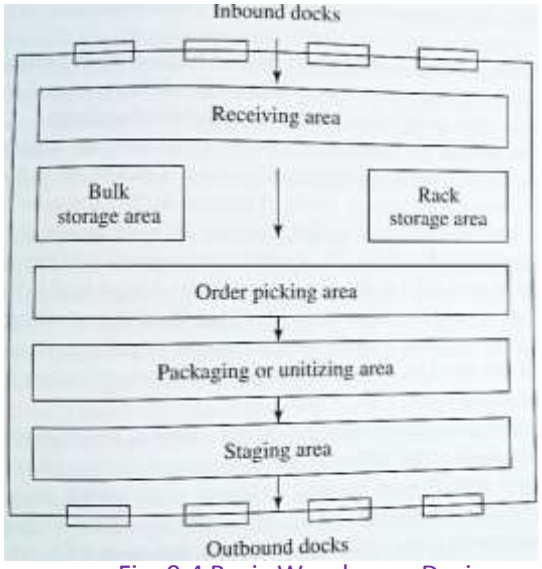


Fig. 9.4 Basic Warehouse Design

Product Mix Analysis: analyse products to be distributed in terms of annual demand, weight, cube, packaging.

Expansion: consider future expansions – influences both site size & building design.

Materials Handling: basic driver of warehouse design ,

Layout / Storage Areas - **See Question 99 Below**

- Warehouse & product layout depends on material handling system
- Planned to facilitate product flow .
- Special attention to location, number & design of receiving and loading docks.
- *E.g.* Difficult to generalize, but if using pallets:
  - Adopt one pallet size throughout →
  - Pallet positioning: 90 degrees/square placement to aisle – widely used because of layout ease →
  - Slotting Plan: placement of specific products in selected pallet locations →
  - Integrate handling equipment to finalise layout.

Sizing

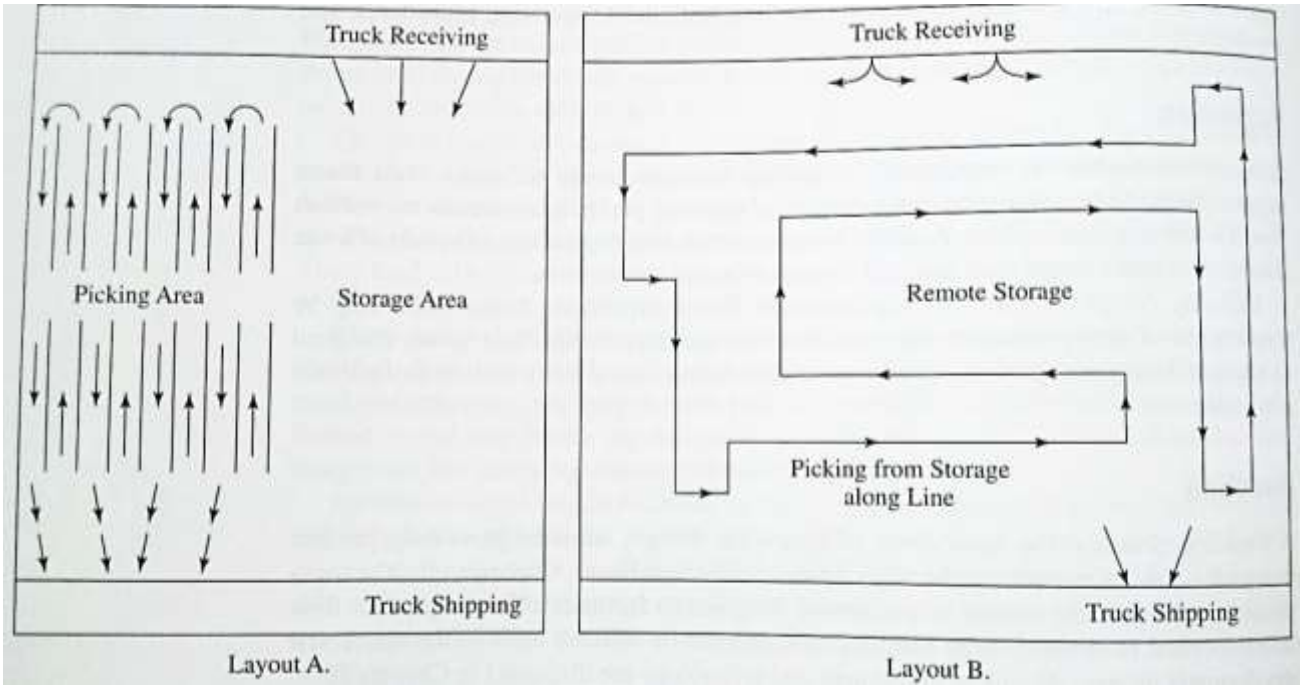
- Estimate using several techniques →
- Begin by projecting total volume expected to move through warehouse during given period →
- Use projection to estimate base & safety stock.
- Failure to consider utilisation rates = overbuilding
- Allow 10% warehouse space to account for increased volume, new products & new business opportunities.

98) SAQ Name the factors that you would take into consideration when selecting a suitable location for a warehouse Ref. Par. 7.4; Bowersox 2013:237-241

See Questions 97 Above

99) SAQ Explain the relationship between material handling and the layout of a warehouse with the aid of a suitable example and sketch Ref. Par. 7.4; Bowersox 2013:237-241

- Assume products can be palletised
- Greatly simplified by omitting offices, special areas & other detail



- **Layout A** illustrates Handling system & layout utilising
  - lift trucks for inbound & inventory transfer movements
  - Tow tractors & inventory collection trailers for order selection
  - Approx. square. Best framework for overall operating strategy
  - *Storage Area*: Supports selection area. Receive products → palletised → move to storage area Replenishes selection area as required
  - *Selection/picking Area*: Positions products in specific warehouse area for order selection Primary purpose = to minimise distance order pickers must travel when assembling order
  - Within Selection Area → position products according to weight, bulk & replenishment velocity to minimise outbound movement
  - Order Selectors assembles customer orders using tow tractor pulling trailers through selection area
  - Arrows indicate selection flow

- **Layout B** illustrates Handling system & layout utilising
  - lift trucks for inbound & inventory transfer movements
  - floor plan is rectangular
  - use continuous towline for order selection, therefore
  - Replace compact selection area by order selection directly from storage
  - Products are moved from receiving areas into storage positions adjacent to towline
  - Then directly select order from storage & place on carts, pulled around warehouse by towline
  - Store / position merchandise to minimise internal movement
  - Weakness of fixed towline: facilitates selection of all products at equal speed & frequency
  - Arrows indicate major product movements
  - Line in centre of layout illustrates path of towline

100) SAQ Discuss warehouse operations with reference to the activities that have to be performed to allow the basic functions of a warehouse to run effectively and efficiently Ref. Par. 7.5; Bowersox (2010:263-267) or (2013:241-246)

- Necessary to develop procedures for warehouse's operational activities
- Numerous managerial decisions in planning & initiating warehouse operations
- Activities ensure facilities start up, run smoothly & are able to accommodate rapid change successfully:

Warehouse Management Systems [WMS]

- Standardises work procedures & facilitates best practice
- Main use is to coordinate order selection. Two basic methods:
  - Discrete Selection: specific customer order is selected & prepared for shipment. Often critical contents
  - Wave/batch selection: coordinated by warehouse area where all products for required customers are selected at one time. Can be planned according to a specific shipment destination/carrier
- Employee has thorough knowledge of specific warehouse selection area/shipping procedure → fewer selection errors typically result using wave picking
- Coordinate work procedures important for receiving & shipping
- Establish procedures for administrations & maintenance e.g. proper replenishment ordering procedures
- Buyers should coordinate with warehouse personnel before large orders are placed
  - Buyers purchase qty.'s that afford best price → little attention to pallet compatible qty.'s / avail. Space
  - Other potential problem = qty. of cases ordered. Aim to purchase in pallet-multiple quantities
- Historical warehouse system functionality → Traditional activities listed under *basic functionality*
- Modern / *advanced functionality* activities include:
  - Value-Added Services [VAS]: coordination of w.house activities to customise product e.g. packaging, labelling
  - Transport Management System [TMS]
  - Yard Management System [YMS]: Managing vehicles & inventory within vehicles while in w.house yard
  - Managing more inventory on Just-in-time [JIT] basis
  - Labour management
  - Warehouse optimisation: select best location within w.house for storage & retrieval to min time etc.
  - Planned Cross-docking & merging
  - Returns management / reverse logistics activities

Accuracy & Audits

- WMS functionality requires verification of inventory accuracy to maintain operational effectiveness
- Inventory accuracy maintained by physical inventory counts / specific portions on a planned basis
- Cycle counting: audit of selected inventory on a cyclic schedule.
- Audits also common to maintain & improve warehouse operating efficiency, safety, work changes etc.

Security: Protection against [Check – Not fully worked through / summarised Bowersox]

- Pilferage / stealing
- Damage / deterioration / incompatibility of products stored/transported together

Safety & Maintenance

- Accident prevention
- Corrective action to eliminate unsafe conditions
- Accidents occur: careless workers, exposure to mechanical / physical hazards

STUDY UNIT 8, PAGE 88

*[2015-S2-EXAM: SHORTER QUESTIONS – **STUDY TB, SAQ & ASSIGN.**]*

101) SAQ Briefly explain the difference between normal and special storage Ref. Bowersox (2010:256) or (2013:234) [Terms Differ?]

Active Storage

- Storage for basic inventory replenishment.
- Typically warehouses that directly serve customers
- Handling processes must focus on quick movement and flexibility.
- Includes flow through- high volume fast moving products and cross dock distribution
- Req. product to be quickly off-loaded, de-unitised, grouped, sequenced & re-loaded into transport equip

Extended Storage

- More than replenishment of stock periods.
- Used for speculative, seasonal or obsolete inventory

102) SAQ Briefly discuss the storage activities that material handling in a warehouse demands Ref. TB (2010:253-277) or (2013:231-3)

Receiving: unloading → performed by equipment. Heisters lift from vehicle and into warehouse

In-storage handling: movement within warehouse. Transfer & selection, preparing orders to be shipped.

Shipping: order verification & transport equipment loading. Orders should be batched in a specific area vehicles should be loaded for shipping. [Check – Not fully worked through / summarised Bowersox]

103) [PE^{x4}] Name 3 principles of and/or discuss basic considerations of material handling **(3 or 6)** Ref. par 8.3; 2015-S2-Assign.02
SAQ Name six important principles in the design of a material handling system Ref. TB 2013:255

- Equipment for handling and storage should be as standardised as possible
- When in motion , the system must provide maximum continuous product flow
- Investment should be in handling rather that stationary equipment
- In handling equipment selection the ratio of dead weight to payload should be minimised
- Handling equipment should be utilised to the maximum extent possible
- Whenever practical, gravity flow should be incorporated in the system design

104) SAQ Compare and contrast order selection and unit load automation Ref. Bowersox (2010:277-285) or (2013:260-262)

See Question 108 Below for technology used in automated handling systems

Ref. Act. 8.1.3 Ability of ASRS's to handle a variety of diversified products is improving. Contemporary systems, however, are able to maximise storage density only when products are packaged in standardised rectangular units. Diversified and non-standardised units create a problem for most systems. When an ASRS meets the specific storage and retrieval requirements of a logistical system, it can handle goods more efficiently with minimum damage.

105) [PE^{x2}] Act. 8.1 What is the role of unit loads in basic material handling **(2 or 3)** Ref. par 8.4; 2013-Self.Assign;

- A unit load is the smallest quantity of a product that can be consigned and are usually combined to form larger loads so that they can be despatched more economically.

- A unit load's shape and size is used as a standard to determine suitable packing material, and the selection and use of handling equipment for a warehouse.

- Important influence on the capital investment for a warehouse and the variable cost related to packaging.

106) [PE[x1]] SAQ Discuss technology used in mechanised & semi-automated handling systems (20) Ref. Bowersox 2013:256-7

See Question 107 Below for technology used in semi-automated handling systems

Author's Note: Knowing two/three bullet points under each equipment type should be sufficient to pass these questions in exam...

MECHANISED HANDLING SYSTEMS – uses great deal of manual labour

Lift Trucks a.k.a. forklifts
- Moves loads of master cartons both horizontally & vertically but are limited to handling unit loads.
- High ratio of labour per unit of transfer → Not economical for long-distance horizontal movement
- Utilised in shipping & receiving ops & to place merchandise in high cube storage
- Skids, boxes, containers may also be transported, depending upon product's nature
- Many types of lift trucks e.g. High-stacking, Palletless/clamp trucks, narrow aisle & side-loading ops.
- Common power sources = propane gas & battery

Rider Trucks Ref. Tutorial Letter 101/3/2015: "Please add the following paragraph taken from Bowersox 2012:277 to Mechanised systems on page 256"
- Provide low-cost, effective method of general materials handling utility.
- Typical applications: un-/loading of transport equip., order selection & accumulation and shuttling loads.
- Widely used in consumer package goods warehouses

Towlines
- Consist of either in-floor or overhead-mounted cable or drag devices.
- Utilised to provide continuous power to four-wheel trailers.
- Advantage = continuous movement.
- Disadvantage = far lees flexibility than lift trucks
- Application: master carton order selection
- In-floor: costly to modify & maintain vs. Overhead: more flexible bur risk of damage & danger

Tractor Trailers
- Consist of driver-guided power unit towing a number of individual four-wheel trailers.
- Advantage = flexibility.
- Used during order selection – not as economical as towline because driver is required

Conveyors
- Used widely in shipping & receiving operations and
- Serve as the basic handling device for a number of order selection systems. Classified according to:
  - Power: Driven by a chain. Sacrifices flexibility
  - Gravity & roller/belt configurations: permit rearrangement with minimum difficulty

Carousels
- Operates on different concept than other mechanised handling equipment.
- Moves inventory to order selector; Rather than require order selector to go to inventory storage location.
- Consists of series of bins mounted on oval track / rack & Reduces storage space requirements
- Multiple track levels = very high-density carousel storage
- Application: selection of items to be packed for shipment
- Rationale is to reduce order selection labour by reducing walking length & time
- Variation = movable racks: move horizontally to eliminate permanent aisles between racks

107) [PE[x3]] Proposal including info on **SEMI-AUTOMATED** material handling systems (12) Ref. 2015-S2-Assign.02; TB 2013:257-9

Automated Guided vehicles (AGV)
- Replaces mechanised tow tractors & trailers
- Is automatically routed , positioned and activated without a driver
- Relies on optical, magnetic or wireless radio guidance system
- Labour reduction

Sortation
- Used in combination with conveyors
- Products must be sorted into specific combinations
- Most can be programmed to permit customised flow
- Reduce labour
- Increase speed & accuracy of order selection

Robotics
- Robot: machine that can be programmed to perform one/series of functions without attendant / driver intervention
- Direct the handling process
- Goal is to accumulate the unique inventory requirements
- Must build & break down unit loads
- Use in environments where it is difficult for humans to function

Live Racks
- Used to reduce manual labour product flows to a selection position
- Contains roller conveyors & constructed for rear loading
- Reduces the need to use lift trucks
- Facilitates FIFO [First-in-first-out]

108) SAQ Discuss in detail the technology that can be used in **AUTOMATED** material handling systems Ref. Bowersox 2013:259-262

Potential to Automate
- Substitute capital equipment for labour
- Advantage: Requires less direct labour; operate faster & more accurately; less product damage
- Storage equip. → integral part of handling capability → represents large investment
- Ratio of dead weight to payload has little relevance
- Information technology is essential e.g. controls automated selection equip.; interface with WMS
- Disadvantage: dependency on proprietary info tech networks

Order Selection
- Initially focused on master carton selection & order assembly in the warehouse
- High labour intensity → aims to integrate mechanised, semi- & automated handling into a system offering high productivity & accuracy while using minimal labour
- Initially limited to merchandise of extremely high value & common master cartons or where working conditions justified investment
- Now substantial advancements made in automated selection of case goods.
  Merchandise automatically routed to live storage position & inventory records updated

Automated Storage/Retrieval [AS/RS] (automated unit-load handling system)
- High-rise storage typically automated from receiving to shipping
- Appropriate for heavy boxes or products in controlled environments
- Better suited to storage than handling devices i.e. not ideal for fast inventory turns
- System reliability & integrity are critical to achieving productivity & max equipment utilisation
- Highly controlled nature = reliable pilferage- & damage-free handling with extremely accurate control
- Min. direct labour & max. storage density per square foot floor space vs. Loss of flexibility
- 4 Primary components:
  - Storage Racks: rows of structured-steel vertical storage separated by aisles
  - Storage & Retrieval Equipment: crane reaching location rapidly; insert/remove merchandise from rack
  - Input/output system: concerned with moving loads to & from rack area
  - Control System: schedules arrivals, location assignment, handles inventory control & rack rotation etc.

109) [PE^{x2}] Proposal including information on **INFORMATION-DIRECTED** handling systems **(3 to 7)** Ref. TB 2013:263-4; 2015-S2-Assign.02

RF wireless (Wi-Fi)

- Use standard mechanised materials handling equipment coordinated by information technology to provide operator directions & control in real time.
- Typically use lift trucks.
- Real-time info interchange is designed to achieve flexibility and better utilisation

Radio-Frequency Identification (RFID)

- Creates opportunity for two-way communication between specific products & lift truck operators.
- Supports information-directed handling
- Potential: achieve selected benefits of automation without substantial capital investment.
- Also increase productivity

Light-directed operations (LDO)

- Commonly pick-to-light: carousel system variation becoming increasingly common.
- Variation = put-to-light: order selectors place product in lighted containers.

110) SAQ Explain fully the operation of a material handling system that you would propose for pharmaceutical products

Incorporate info from questions above into a practical example

111) Act. 8.2 What factors should you bear in mind when considering packaging from a logistical point of view Ref. Par. 8.5

112) SAQ Explain, using an appropriate example, the difference between consumer packaging and industrial packaging Ref. Par. 8.5

Consumer: focused primarily on marketing
Industrial: focused on logistics

113) SAQ Briefly explain the role and advantages of a standardised master carton Ref. Par. 8.5; Bowersox (2010:269) o (2013:248)

Containers used to group individual products → Facilitates materials handling and transportation
Containers are called master cartons → should be used to maximise cube utilisation
Master carton standardisation facilitates handling by an individual without mechanical assistance .

114) SAQ Discuss unitisation by referring to the methods, benefits and protection of unitisations, the size of the platform and stacking methods. Ref. Par. 8.6; Bowersox (2010:272-276) or (2013:251-255)

115) [PE^{x2}] Name 3 logistical functions of packaging **(3)** Ref. par 8.6

- Protection against damage and theft/pilferage
- Increasing handling efficiency
- Communication (e.g. to identify contents of master carton)

116) SAQ Explain the functions of packaging from a logistical perspective, under the following headers **(12)**: 2013-Self.Assign

a) Protection against Damage and theft/pilferage: Ref. Bowersox (2010:269-276) or (2013:248-255)

- Package design and material must be combined to achieve desired level of protection without incurring expense of overprotection.

- The degree of allowable damage in terms of expected overall conditions should be defined and then a combination of design and material capable of meeting those specifications should be isolated.

b) Increasing Handling Efficiency: Ref. Bowersox (2010:269-276) or (2013:248-255)

- Master cartons should be standardised and reasonably large to minimise the number of units handled at a warehouse.
- For ease of material handling is it desirable to have retailers purchase in master carton quantities.
- Unitisation is the process of grouping master cartons into one physical unit.
- With unitisation the loading time and congestion are minimised.

c) Communication: Ref. Bowersox (2010:269-276) or (2013:248-255)
[PE^{x3}] Discuss communication as the final logistical packaging functionality **(5 or 7)** Ref. par 8.6

- This function is critical to provide content identification, tracking and handling instructions.
- The most obvious role is to identify packaging contents for all channel members.
- Used to identify information for product receiving, order selection and shipment verification.
- Ease of package tracking is important. Also provides handling and damage instruction to material handlers

- Becoming increasingly critical to provide content identification , tracking information, handling instructions and information essential for security
- The most obvious communication role is identifying package content for all channel members
- Visibility is the major content identification consideration as material handlers should be able to observe or electronically read the label of reasonable distance from all directions
- Effective internal operation and increasing customer require that the product be tracked as it moves through the supply chain
- Positive control of all movement reduces product loss and pilferage
- Provide handling and damage instructions to material handlers

117) [PE^{x2}] SAQ Name advantages of rigid containerisation **(4)** Ref. Par. 8.6; Bowersox 2013:252 Table 10.1 [Benefits of Rigid Devices]

"NB: Please note that rigid containers & flexible containers are now referred to as Rigid devices & flexible devices " Tut letter 101

- Improves overall material movement efficiency
- Reduces damage in handling and transit
- Reduces pilferage
- Reduces protective packaging requirements
- Provide greater protection from element environment
- Shipment unit can be reused a substantial no. of times → reducing waste & need to dispose of container

ANNEXURE: Additional Info along with Formula page taken from Past Papers

FORMULAS / FORMULES

$$F_t = (B_t \times S_t \times T \times C_t \times P_t) + I$$

: Forecast Model

SU1

$$F_t = \alpha D_{t-1} + (1 - \alpha) F_{t-1}$$

$$ROP = D \times T + SS,$$

: Reorder Point condition of uncertainty

SU3

$$EOQ = \sqrt{\frac{2C_o D}{C_i U}}$$

: Economic Order Quantity

SU3

$$\sigma = \sqrt{\frac{\Sigma F_i D_i^2}{n}}$$

: Standard Deviation

SU3

$$\sigma_c = \sqrt{TS_s^2 + D^2 S_t^2}$$

: Combined Standard Deviation

SU3

$$SL = 1 - \frac{f(k)\sigma_c}{Q}$$

: Fill Rate

SU3

$$f(k) = (1 - SL) \times (Q/\sigma_c)$$

: 2 Formulae used to calculate Safety Stock

SU3

$$SS = k \times \sigma_c$$