Chapter 12 : Reorder Inventory

Order Notation (Interval and Quantity)

d - average demand (daily, weekly or monthly)	s – variable ordering costs (per SKU)	S – fixed order processing costs
z – safety stock factor – number of std deviations above expected demand	n – number of SKUs purchased from the supplier	D(j) – annual demand of SKU(j)
LT – lead time (daily, weekly or monthly)	n – number of SKUs purchased from the supplier	OI – order interval (time between orders) (daily, weekly or monthly)
σ(d) – standard deviation of daily, weekly or monthly demand	i – annual holding cost rate	R(j) – unit cost per SKU(j)

Chapter 12 Notes

Reorder Point:

- The inventory level that triggers a replacement order
- Assumes that both demand & lead times are constant

If demand is not constant; extra inventory to act as insurance against a shortage (Safety Stock)

Factors affecting SS requirements:

-Variability of demand & lead times
- Desired service level

Leads Time Service Levels

- probability that demand will not be greater than supply during LT
- equal to LT fill rate = (1-(number short/lead time demand))

Annual Service Level = 1-(number short/-order cycle demand)

Both assume that demand is normally distributed during a lead time

- safety stocks can be calculated as the area under the curve measure by the number of sd from the expected demand (look up this probability on the Z-score Table Sheet

Fixed Order Interval/Order Up To Level Model

- used when orders are placed at fixed intervals with the amount of the order changed adjusted to bring inventory up to a pre-determined level

-common method with wholesalers who hold many SKUs in stock to meet retailer demand

- characterized by the grouping of orders to minimize shipping costs
- some cases, it may be useful to simply retain a pre-scheduled fixed order interval

Order Up To Level

The amount of good that should be sufficient to last until the next order arrives. The order quantity is the difference between the *order up level (IMAX)* and the quantity of the good still on hand at the time of order placement.

fixed order interval method needs safety stocks (protection against outages) during the order interval which is greater than the safety stocks required for the *fixed quantity order* method (EOQ/ROP) which only needs shortage protection during the order lead time.

assumes demand variability but will assume that lead time is constant and not subject to variability.

Chapter 13: Aggregate Operations Planning

Long term

- Deal with product matrix (what you are going to make)
- Location
- Size of facilities
- Size and scale of machinery or production systems
- Product flow (layout)

Medium term

- Long term decisions determine the limits within which

medium term decisions must be made

- Employment levels
- Output capacity
- Inventory levels and capacities

Short term

- Medium term decisions determine the confines within which short term decisions can be made
- Scheduling of production shifts and labour needs
- Manufacturing schedules which include run sizes, product sequencing

Definition: links sales forecasts to production (capacity) planning

Goals Satisfy anticipated consumer demand at lowest possible cost (use efficiency)

- inventory appropriate amount of inputs
- Allocate an adequate amount of labour
- Maintain sufficient level of finished goods stocks

CH 13: AOP Demand Influencing Options

1. **Price**

- Re-issuance of price lists can have a direct effect on how much product is demanded
- Differential pricing to shift demand from peak periods to periods of lower demand

2. **Promotion**

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CH 13: AOP Demand Influencing Options (cont)

- Temporary price discounts to encourage demand (product introductions)
- Advertising incentives
- Bonus product offerings (inclusion of sample pkg of another good)
- BOGO programs

3. **Early orders**

4. **Backorders**

- Advance orders placed in one period for delivery in the next period

-->Allows producer to even out production by filling up production in periods of lower demand

5. **Exporting**

6. **Development of Complementary Products**

- Complementary products fill out production schedules and expand product lines
- Design plant to meet peak season demand and then use complementary products to fill in the gaps during the off-season

CH 13: Capacity Options

1.Determining permanent workforce level (hiring and firing of workers)

Implications of laying off workers

- Demoralized workforce – workers hate uncertainty

and workers are just like the rest of us – they need

to buy groceries, pay rent and live

- Can create animosity between direct labour and management
- Increased costs - severance pay
- Could negatively impact product quality

Hurdles with hiring new workers

- Recruitment costs
- Costs of training and orientation
- May be difficult to find skilled workers during

labour shortages

CH 13: Capacity Options (cont)

Callback Issues

- Assumes workers are waiting for your call
- Firms do have the option to keep workers during slowdowns to avoid some of these risks

2. Use of Overtime and Idle Time Strategies

Implications of overtime

- Can be implemented quickly
- Incentive for some workers
- Increased payroll costs
- Can induce worker fatigue

Advantages and disadvantages of utilizing idle time

- Inefficient use of labour (i.e. they are not producing)
- Can help long-term goals with enhanced worker skills training
- Provides opportunity for scheduled maintenance

3. Use of Temporary Workers

- Flexibility
- Suited to lower skilled jobs such as packaging as opposed to machine operation
- Costs less – lower wages and no benefits
- Very useful approach in seasonal industries such as tourism and restaurant businesses – can also be used in manufacturing plants as fill-in for summer vacations

4. Stockpiling Inventories of Finished Goods

- Stock build-up during periods that precede periods of high demand (limited productive capacity)
- Costs include the financing costs of additional inventory and the costs of occupying and managing additional warehouse space
- Runs the risk of increased product spoilage

5. Subcontracting

CH 13: Basic AOP Strategies

Option 1 – Level Output – Workforce Strategy

- Maintain steady workforce and hopefully a constant flow of output
- Uses inventory buildup

--> To ensure employment during periods of slow demand

--> Provide stocks of product to meet demand during periods of higher demand

--> In some cases, assumes that demand can be satisfied by the use of backordering system

- Assumes that product has a shelf life suitable for storage

Option 2 – Chase Demand Strategy

- Change output to match demand for period at hand
- Planned output = forecast demand
- Permanent workforce numbers dictated by low period demand
- Reduced inventory levels

Option 3 – Mixed Strategy

Factors Affecting Strategy Choice

Company Policies (or union agreement restrictions) on the number of part-time employees

Costs

- Keeping too many permanent employees on payroll (with benefits) will increase costs during off-peak demand periods

Company Philosophy

- Many small companies that are privately owned will keep employees on payroll during periods of reduced production as matter of conscience, loyalty to their employees and out of a genuine belief in community responsibility

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CH 14: Key Requirements

BOM that identifies the dependent parts needs for one unit of finished good. A listing of all raw materials, sub assemblies and parts.

Master Production Schedule (MPS) to determine how much will be made and when it will be made.

A list of any **existing inventory** of each good on the BOM.

Estimated **lead time requirements** for individual components (from suppliers).

A list of any **existing open orders** for any of the components needed to avoid duplic-ation.

CH 14: Special Types of BOM

Planning bill (aka pseudo bill or kit) a combination of several BOMs
- Used in the planning for the production of goods that have minor different options.

Modular bill a BOM for a module; ie. Space Station Habitation Unit
- Used when a product is comprised of several modules. Objective is to reduce the number of BOM that would be required for a finished good containing modules that have optional subcomponents

Phantom bill (aka transient bill) for items not usually kept in inventory
- Used for a part of sub-assembly that is not often ordered. Makes ordering easier when the part is needed. Lead time is not a consideration

CH 14: MRP Processing

Gross Requirement Quantity of an input required without regard to inventory on hand or parts in transit

Scheduled Receipt An order that has been placed but not yet received

CH 14: MRP Processing (cont)

Projected On-hand (Inventory) Amount of a part that is expected to be on hand at the beginning of production. It includes any scheduled receipts plus any inventory leftover from the last production run of finished good

Net Requirement The actual amount required in a time period

CH 14: Other Terms

Lot-for-lot ordering: Determine orders based on requirements

Lot-size ordering: planned receipts may exceed net requirements

Planned-Order Receipt: Quantity of an order to be received at the beginning of a period

Planned-Order Release: Quantity planned to be released (purchased) at the beginning of a period. Planned-order release = planned-order receipt adjusted for lead time

Pegging: prcoess of identitifying the end product(s) manufactured from a specific part or input. Important in firms with many parts.

CH 14: Maintaining an Updated MRP

Regenerative MRPs are synonymous with periodic revision where accumulated changes to materials requirements are updated in a batch-type format
- Runs the risk of being out of synch with current activity on the shop floor
- Best suited to environments where there typically are not a lot of crucial changes
- One way around this is to use a day as the time bucket
- Processing costs are typically less using regenerative MRP

Net-Change MRPs are constantly being revised to address ongoing changes
- Provide more up-to-date information

CH 14: Maintaining an Updated MRP (cont)

- The entire plan would not be regenerated
- Typically seen in firms where there are steady streams of changes to in process schedules

System Nervousness – Even small changes to an item at the top of the BOM Tree can have large effects on the parts down the tree
Problematic if it results in changes in purchase or shop orders
Similar to “bullwhip effect”
A solution could be to freeze the MPS for near future

Backflushing – this is nothing more than a method to check usage and to compare what has been estimated to have been used against what is left on hand

CH 14: Lot Sizing Method

Fixed-Interval Ordering
- FIO sets an arbitrary order period that matches cumulative demand
- Sometimes the span is arbitrary
--> Ie. In the food industry, someone who has worked there for a while, they can make a guess as to how much they will need.
- Sometimes a review of historical demand patterns may lead to a more rational designation
--> If they have steady demand, they can expect the same order each week (even though the demand will actually change)

Part-Period Method
- PPM attempts to balance holding and ordering costs
- Refers to holding a part or parts over a number of periods
e.g. 10 parts held for two periods comprise 20 part periods
- EPP (Economic Part Period) is calculated as:
- EPP = Ordering(or setup) costs

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CH 14: Lot Sizing Method (cont)

Holding cost per period
Solution Method – various order sizes corresponding to various cumulative demands are examined and each one's number of part periods is determined. The one that comes closest to the EPP is the one chosen

CH 14: Primary & Secondary MRP Reports

Primary (Active) Reports
Immediate Order Releases
Authorization for the execution of week one planned-order releases
Planned order releases indicate the amount and timing of future orders
The amount of items that you will be ordering/producing
Reports that detail changes (revisions to due dates and quantities) to ongoing material resource plans
Any changes that are made will be reflected in this report
Secondary (Analysis) Reports
Performance Control Reports that evaluate how well the MRP is working in terms of missed orders, stock-outs etc.
Demand History Reports that are useful in forecasting future dependent demand requirements

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