Inventory Control

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Disadvantages of HIGH Stock Levels

Storage Cost e.g. space, utility, insurance,manpower
Capital tied up(***financial cost***)
Obsolete Stock,Deterioration,Theft,Damage
Change in market condition
Change in ***fashion***,price
Production capacity tied up

Disadvantages of LOW Stock Levels

Stock out--failure to satisfy customer demand, Impact on production (***bottleneck***)
Costly remedy to meet customer demand, eg: work overtime, buy-in, special production run
Possible higher ***replenishment*** costs
Loss of volume discount
Cost of multiple handling, eg: transport, crossloading
Inflexibility to respond to market opportunities

Stages of Inventory

- ***Raw materials***
- ***Work-in-process***
- ***Finished goods***

$$EOQ = \sqrt{\frac{2DCo}{Ch}}$$

D ~ Annual Demand Rate
Co ~ Variable Ordering Cost
Ch ~ Variable Holding Cost

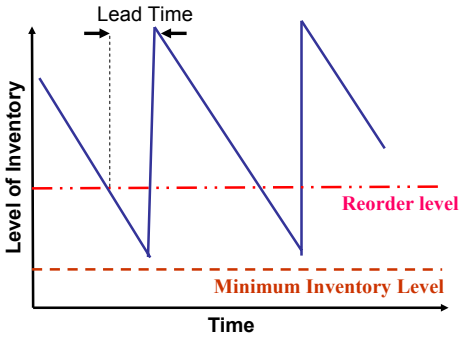
Economic Order Quantity

EOQ

Too Much Too Little
Δ

- cannot ***predict*** demand rate (***reactive***)
- cannot predict storage cost
- may not be able to supply right amount
- order based on ***'average'*** demand

→ **reduce EOQ by reducing Co**

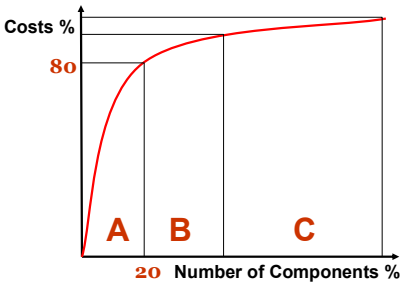


The problems with Order Quantity systems led to MRP

ABC Analysis / Pareto

20% of components account for 80% of cost ∴concentrate on these & form ***strategic partnerships***

Class A ~ Critical
Class B ~ Important
Class C ~ Trivial



MRP – Materials Requirement Planning (1st Generation)

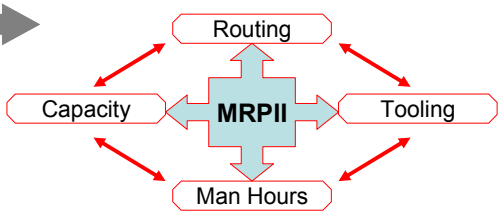
- The MRP system ***explodes*** the entire manufacturing process into ***discrete parts*** which make up the whole. It then projects demand, the time needed to meet it, and the materials required.
- The ***key*** to MRP is that you have to define the ***lead time*** to manufacture a part, component or assembly. Instead of building to a fixed inventory, MRP builds to the ***scheduled delivery*** of the ***end product.***

Parts Explosion
↓
Bill of Materials (Quantities)
↓
Master Production Schedule

Level 1 → Level 2 → Level 3 etc

MRPII – Materials Resource Planning (2nd Generation)

MRPII = MRP + additional resource ingredients



Advantages : (1) reduced stock levels and higher turnover, (2) reduced shortages ***(Improved utilisation of facilities; Increased customer service; Speedy delivery and reliability)*** and (3) less rush jobs and less time on emergency orders

Problems with MRP

- Cost of hardware / software
- Complex & Centralised
- Cost of Training
- Cost of Implementation

→ **Assumes fixed lead times**
- assumptions often incorrect (garbage in garbage out)
- applied to all situations (they can vary due to loading / congestion)
- removes responsibility for lead times from shop floor (no ***incentives***)

MPR often seen as a 'Push System' : ie the inventory can be pushed through and overwhelm

Pull vs. Push

The basic difference between ***pull*** and ***push*** is that a pull system initiates production as a reaction to ***present demand***, while push initiates production in anticipation of ***future demand***.

JIT ~ add value not cost

JIT is the Western embodiment of a ***philosophy*** and series of ***manufacturing techniques*** developed by the Japanese. The philosophy is founded on doing the simple things well, on gradually doing them better and on squeezing out waste (MUDA) every step of the way. Toyota Motors are largely accredited with development of the techniques in response to the world oil crisis of the 1970's.

Just In Time is as it states; the manufacture of a product in response to an order placed by a customer for delivery just in time (only when they order it). JIT is predominantly a ***pull*** system of manufacturing whereby the process is driven by customer demand. Products are only manufactured in response to a customer order and raw materials are only ordered in response to customer demand. The product is pulled through the process rather than pushed with large buffer stocks in between processes.

Philosophy:

- ➜ **Eliminate Waste** (over-production, waiting time, transport, process, inventory, motion, defective goods).
- ➜ **Involve Everyone** (aims to provide guidelines that embrace everyone and every process in an organisation).
- ➜ **Continuous Improvement** (A perpetual desire to identify and implement small incremental changes throughout all aspects of an organisation).

Techniques:

- ➜ **Basic Working Practices**
- ➜ **Design For Manufacture**
- ➜ **Operations Focus**
- ➜ **Small Simple Machines**
- ➜ **Layout And Flow**
- ➜ **Total Productive Maint.**
- ➜ **Set-Up Reduction**
- ➜ **Total People Involvement**
- ➜ **Visibility of JIT Supply**

KANBAN
Japanese for 'card'

A card system for delivery of a small tray of component parts to individual cells within the processing environment. Delivery is not possible until the operator requests further parts by displaying a card or other such signal.

Why is JIT Misunderstood ?

Two schools of thought on implementation of JIT; ***pragmatic*** view & ***romantic*** view. But common is understanding that there are ***no correct formulae*** of step-wise instructions for success. ***Application*** & ***Implementation*** must be ***tailored*** to manufacturing process using combination of philosophies & tools
If you simply cut inventories without considering philosophy & techniques ~ **problems with customers & suppliers.**

Pragmatist: ~ ***focuses on the concrete details*** of the production process. Every plant suffers from many problems that hinder the smooth flow of materials –these problems are the main causes of delays and inventories must be held to compensate for them. Thus JIT means using a variety of practical measures to reduce these obstacles (Continuous Improvement) & need slow, careful implementation following thorough preparation. The view is one of ***long-term realism***, there is ***no overnight revolution***.

Romanticist ~ In contrast the romantic view calls for an ***overnight revolution*** and a call to action to prevent the demise of manufacturing. There are many writings in this area, however they are often the work of those people ***divorced*** from processing itself.

Internal Factors

- ➜ ***APPLY* TECHNIQUES**
- ➜ ***Heavy on internal resources***
- ➜ ***Training / Culture / Comms / HR / Reality***
- ➜ ***JIT reduces Buffer ~ exposes problems***

- poor layout ; rework ; training

- ➜ ***Need flexibility***
- ➜ ***Need Investment***

External Factors

➜ ***Relies heavily on*** **demand forecast** ***. . .***

- governs the 'pull' manufacturing methodology of JIT. Smooth production and low inventories require an ***even flow of work***, but JIT also requires production to respond closely to demand, which can fluctuates wildly. To consolidate the product line, make fewer models with fewer options. With a smaller number of variables demand fluctuations will be less marked. Prices can be manipulated to smooth demands to a certain extent.
- relies heavily on ***marketing and sales functions*** (promotions actually exacerbate demand fluctuations). However, important to realise that demand and thus markets must be ***accommodated***. Before embarking on a JIT programme an organisation must understand clearly exactly what business it is in.

➜ ***Need to build*** **Relationships** ***with suppliers . . LEARNING CURVE***

- **TRUST ~ contractual / competence / goodwill**

What Are The Problems:

Supplier Shock – Inventory/ demand fluctuations absorbed by suppliers ~ can lead to poor relationships. ***Worker Stress*** – Reduction in buffer inventory between cells can lead to regimented workflows & high levels of stress. A stringent version of JIT can work against employee involvement. ***Time*** – It will take a number of years. ***Costs*** – Can be high. ***Implementation*** – Many organisations develop ***inappropriate*** models and implementation plans for JIT, they start in the ***wrong place*** leading to ***dissatisfaction*** and ***staff dissent***.

MRP vs. JIT

MRP systems seen as a ***push*** system & ***JIT*** a ***pull*** system - intuitively they are seemingly incompatible. However, organisations have used ***MRP for overall operations control and scheduling*** & ***JIT for internal control of manufacturing***. JIT is used to control movement of materials within the manufacturing process in response to demand as indicated by MRP. JIT is insensitive to long-term future demands and so can lead to widely fluctuating periodic production levels – widely recognised as being poor for JIT philosophies. Therefore, possible to use MRP as ***high level planner*** to look at ***future demands*** & consider production and supply ***requirements*** in order to 'level' production quantities throughout the year. **Combining JIT and MRP works to improve adherence to customer demand and to reduce production variability.**