

Production

&

Operations Management



Operations Management

- Product Design
- Product Process Design
- Production Planning and Control
- Operations Competency

Product Design

- **Product design** can be defined as the **idea** generation, **concept** development, **testing** and **manufacturing** or implementation of a **product** (physical object or **service**).

Two Basic Steps in Designing a Product

- Functional Design
 - Product is designed to be functional.
 - Include the following concerns; functional considerations, customer appeal, cost, ease of operations and maintenance.
- Production Design
 - Designer consider the introduction of modification and new concept into the product to make it more suitable for production.

Concepts Employed

- Standardization
- Modular Design
- Simplification

Design Phases

1. Basic research and development
2. Define market needs in various situations
 1. is it market demand that is pushing change or is emergent new technology (lower costs, better products) that is pushing change
 2. internal development and up-grading
3. create the "design"
4. evaluate alternative designs and agree which to prototype
5. do the prototyping, evaluate (design and process of implementation)
6. Finalize and hand-over to operations to get on and produce?

Product Process Design

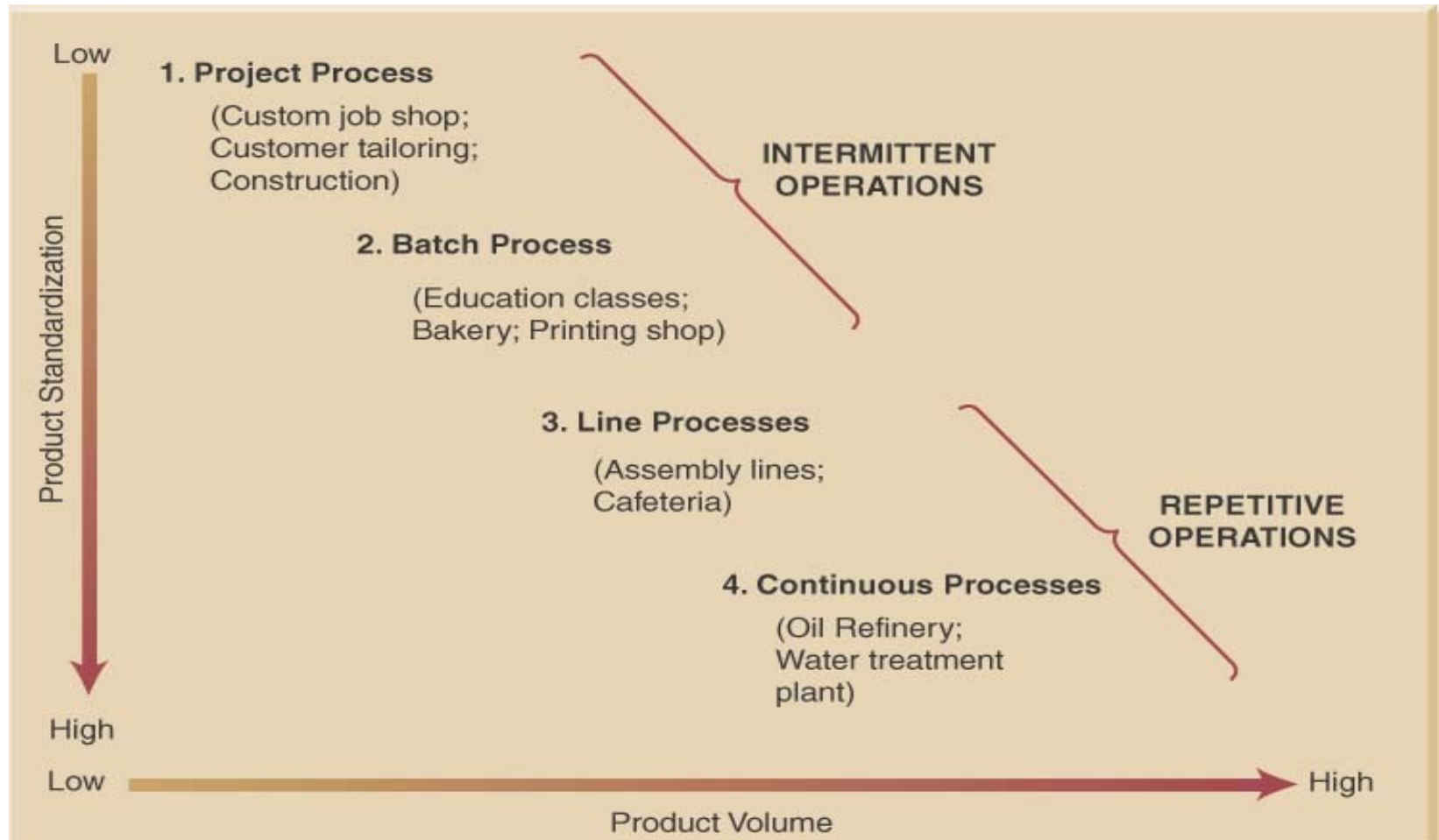
- "Process design" (in contrast to "design process") refers to the planning of routine steps of a process aside from the expected result.
- Processes (in general) are treated as a product of design, not the method of design. The term originated with the industrial **designing of chemical processes**. With the increasing complexities of the **information age**, consultants and executives have found the term useful to describe the **design of business processes** as well as **manufacturing processes**.

Product Process Design

Decisions regarding the selection of a process design for producing a product or a service are influenced by the following factors

- such as the nature of demand for the product.
- the degree of vertical integration.
- product and volume flexibility.
- the degree of automation.
- the quality level required.
- degree of customer contact involved.

Underlying Process Relationship Between Volume and Standardization



Process Performance Metrics

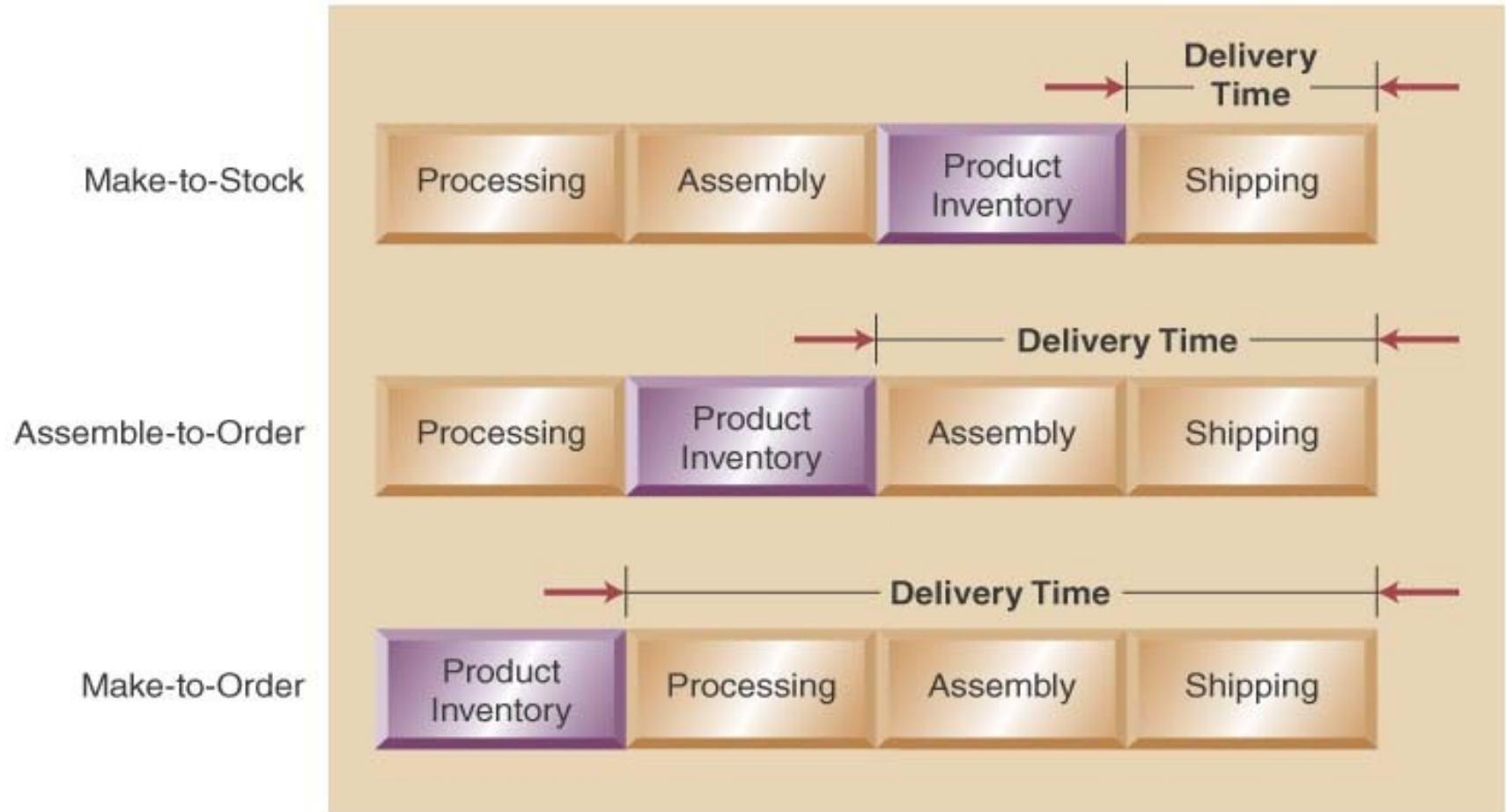
Measure	Definition
1. Throughput time	Average amount of time product takes to move through the system.
2. Process velocity = $\frac{\text{Throughput time}}{\text{Value-added time}}$	A measure of wasted time in the system.
3. Productivity = $\frac{\text{Output}}{\text{Input}}$	A measure of how well a company uses its resources.
4. Utilization = $\frac{\text{Time a resource used}}{\text{Time a resource available}}$	The proportion of time a resource is actually used.
5. Efficiency = $\frac{\text{Actual output}}{\text{Standard output}}$	Measures performance relative to a standard.

Linking Design & Process Selection

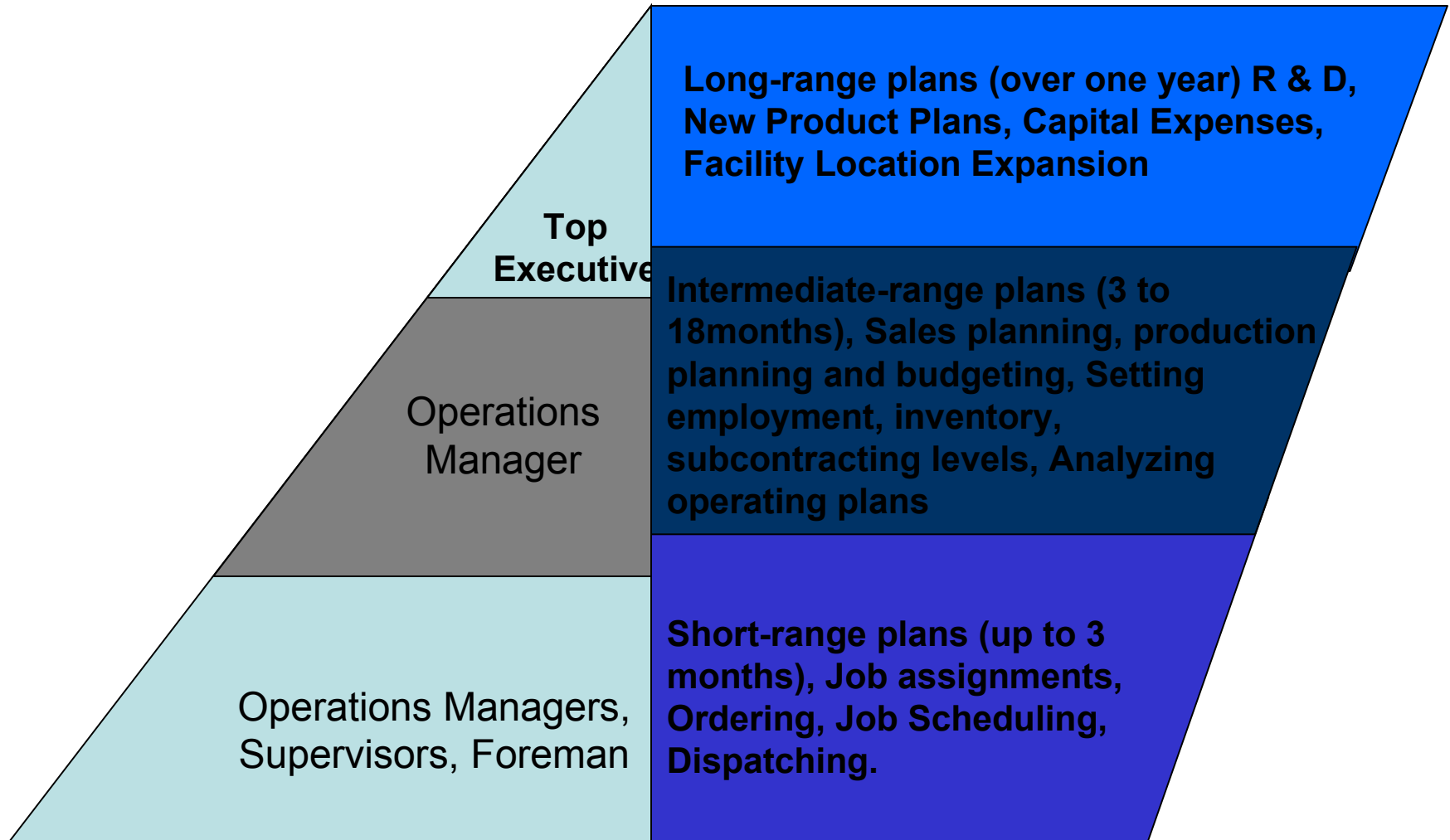
- Organizational Decisions appropriate for different types of operations

Decision	Intermittent Operations	Repetitive Operations
Product design	Early stage of product life cycle	Later stage of product life cycle
Competitive priorities	Delivery, flexibility, and quality	Cost and quality
Facility layout	Resources grouped by function	Resources arranged in a line
Product strategy	Make-to-order/assemble-to-order	Make-to-stock
Vertical integration	Low	High

Product and Service Strategy Options

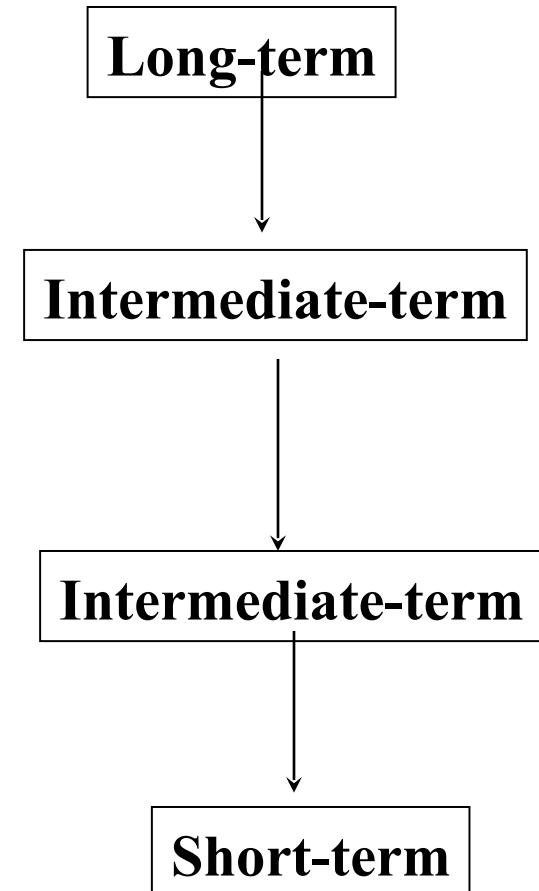
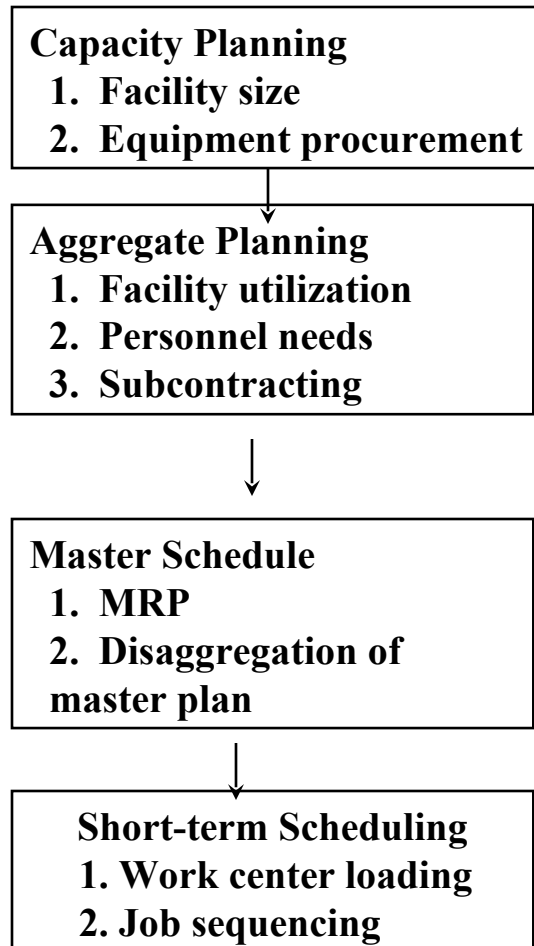


The Planning Process

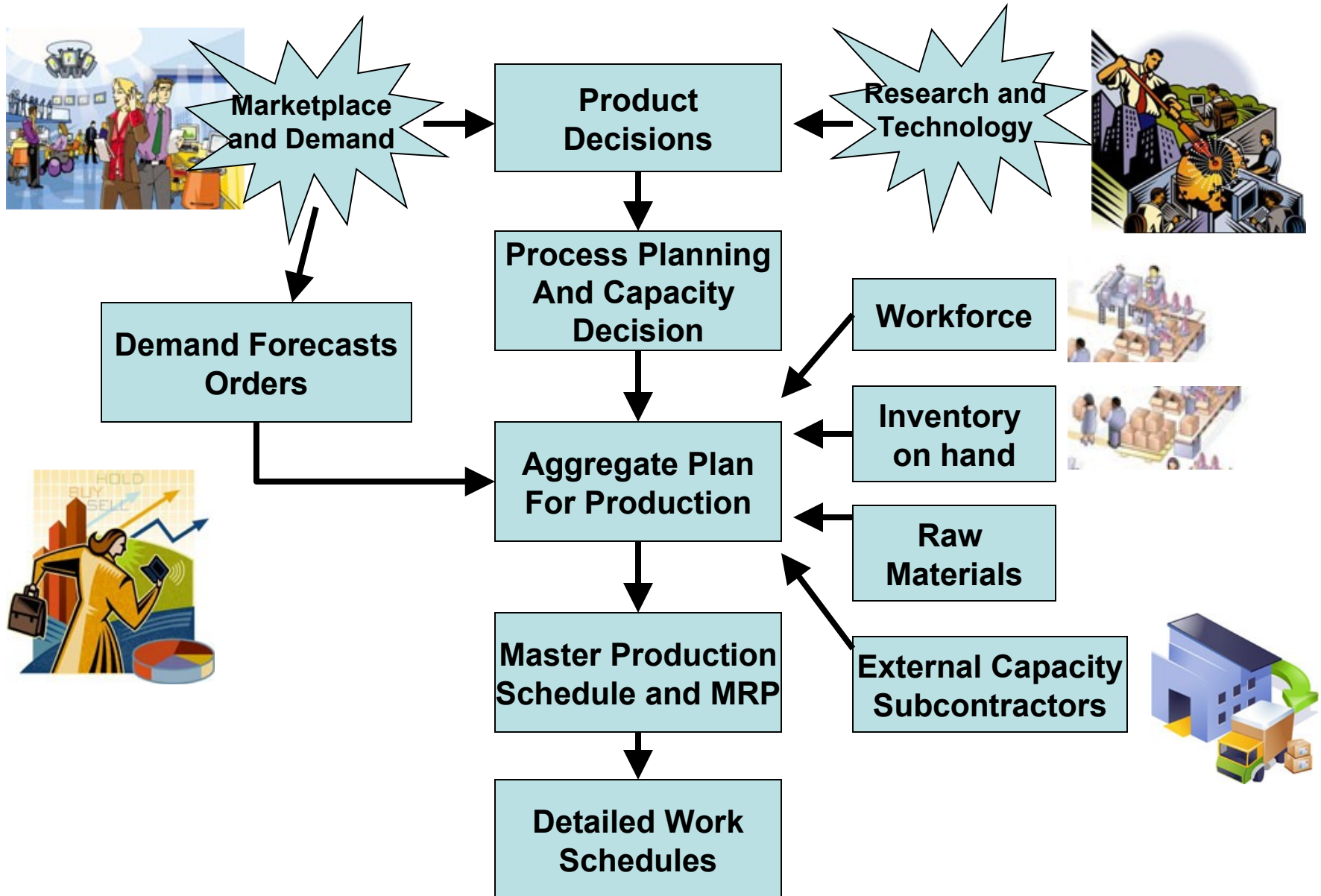


If top management does a poor or inconsistent job of long-term planning, problems will develop that makes the aggregate planner's job very tough.

Capacity Planning, Aggregate Planning, Master Schedule, and Short-Term Scheduling



Relationships of the Aggregate Plan



Aggregate Planning Options

Capacity Options

- Changing inventory levels. 
- Varying workforce size by hiring or layoff.
- Varying production rates through overtime or idle time.
- Subcontracting.
- Using part time workers.

Demand Options

- Influencing Demand.
- Back ordering during high-demand periods.
- Counter seasonal product and service mixing.

Aggregate Planning Strategies

Three basic production strategies :

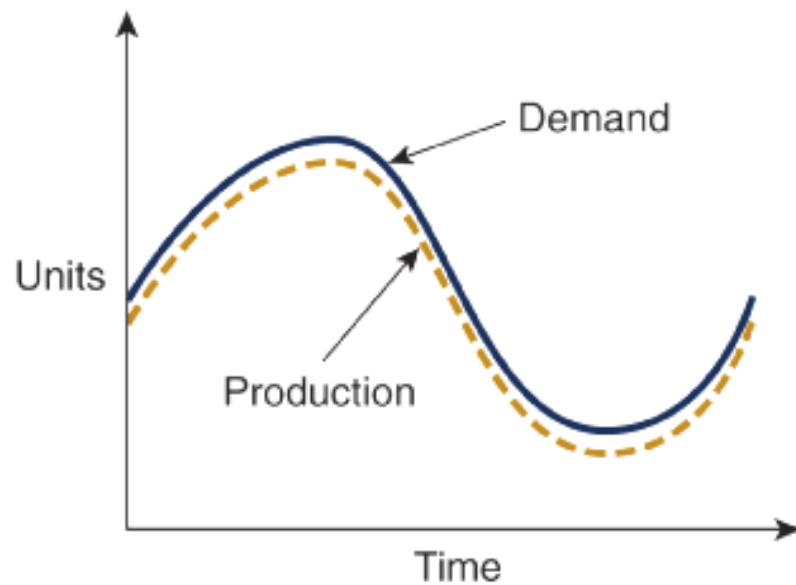
Chase Strategy- Adjusts capacity to match the demand pattern. Firm **hires & lays off** workers to match production to demand.

Level Strategy- Relies on a **constant output rate & capacity** while **varying inventory & backlog** levels according to fluctuating demand pattern.

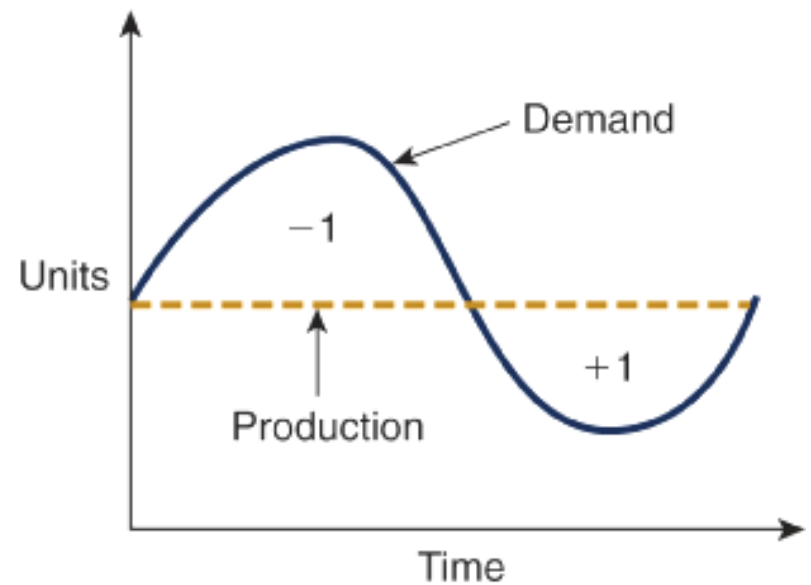
Mixed Production Strategy- To maintain stable workforce core while using other short-term means, such as overtime, & additional subcontracting or part time helpers to manage short-term demand.

Aggregate Planning Strategies

A. Pure Chase Strategy



B. Pure Level Strategy



Master Production Scheduling

Master Production Schedule- A detailed disaggregation of the aggregate production plan, listing the exact end items to be produced by a specific period.

More detailed than APP & easier to plan under stable demand.

Planning horizon is shorter than APP, but longer than the lead time to produce the item.

Note: For the service industry, the master production schedule may just be the ***appointment log*** or book, which ensures that capacity (e.g., skilled labor or professional service) is balance with demand.



Master Production Scheduling

Tentative segment (AKA **planning time fence**),
from end of the firmed segment to several weeks
farther into the future.

Available-to-Promise (ATP) Quantities-

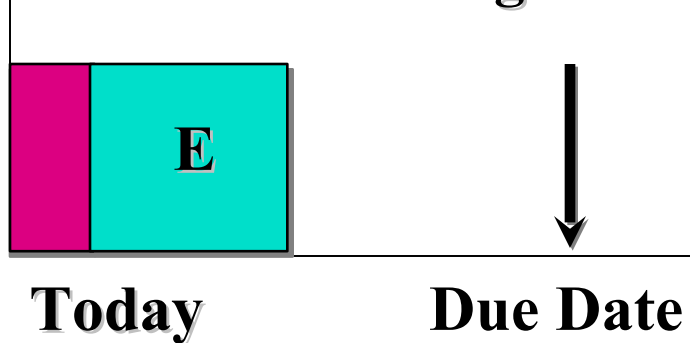
The MPS decides whether additional orders can be
accepted for difference between confirmed
customer orders & the quantity the firm planned to
produce.



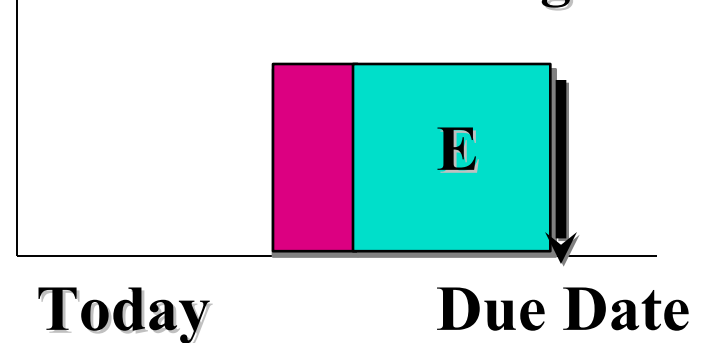
Short-Term Scheduling

- ◆ Deals with timing of operations
- ◆ Short run focus: Hourly, daily, weekly
- ◆ Types

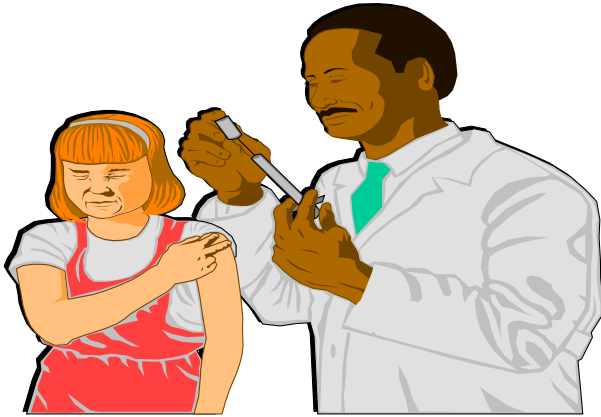
Forward Scheduling



Backward Scheduling



Short-Term Scheduling Examples



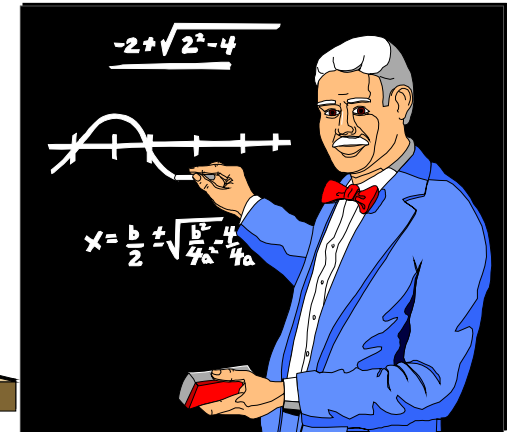
Hospital

Outpatient treatments
Operating rooms



Factory

Production
Purchases



University

Instructors
Classrooms

Forward and Backward Scheduling

Forward scheduling: begins the schedule as soon as the requirements are known

- jobs performed to customer order
- schedule can be accomplished even if due date is missed
- often causes build-up of WIP

Backward scheduling: begins with the due date of the final operation; schedules jobs in reverse order

- used in many manufacturing environments, catering, scheduling surgery

Choosing a Scheduling Method

Qualitative factors

- Number and variety of jobs
- Complexity of jobs
- Nature of operations

Quantitative criteria

- Average completion time
- Utilization (% of time facility is used)
- WIP inventory (average # jobs in system)
- Customer waiting time (average lateness)

A Production Planning and Control System Should

- Schedule incoming orders without violating capacity constraints of individual work centers
- Check availability of tools and materials before releasing an order to a department
- Establish due dates for each job and check progress against need dates and order lead times
- Check work in progress as jobs move through the shop
- Provide feedback on plant and production activities
- Provide work efficiency statistics and monitor operator times for payroll and labor distribution analyses

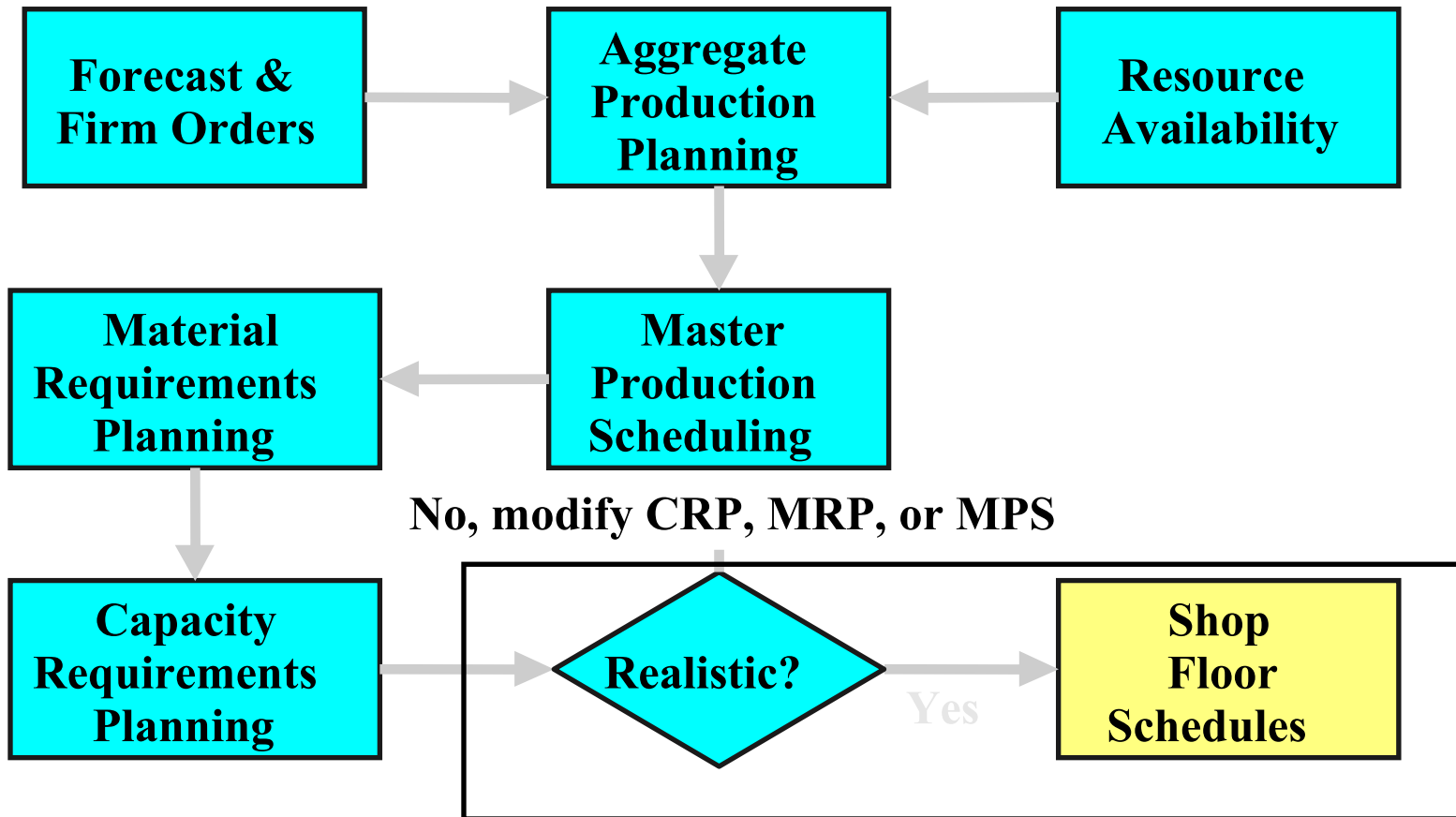
Types of Planning Files

- **Item master file** - containing information about each component the firm produces or purchases
- **Routing file** - indicates each component's flow through the shop
- **Work center master file** - containing information about the work center such as capacity and efficiency

Process-Focused Work Centers

- High variety, low volume systems
- Products made to order
- Products need different materials and processing
- Complex production planning and control
- Production planning aspects
 - Shop loading
 - Job sequencing

Process-Focused Planning System



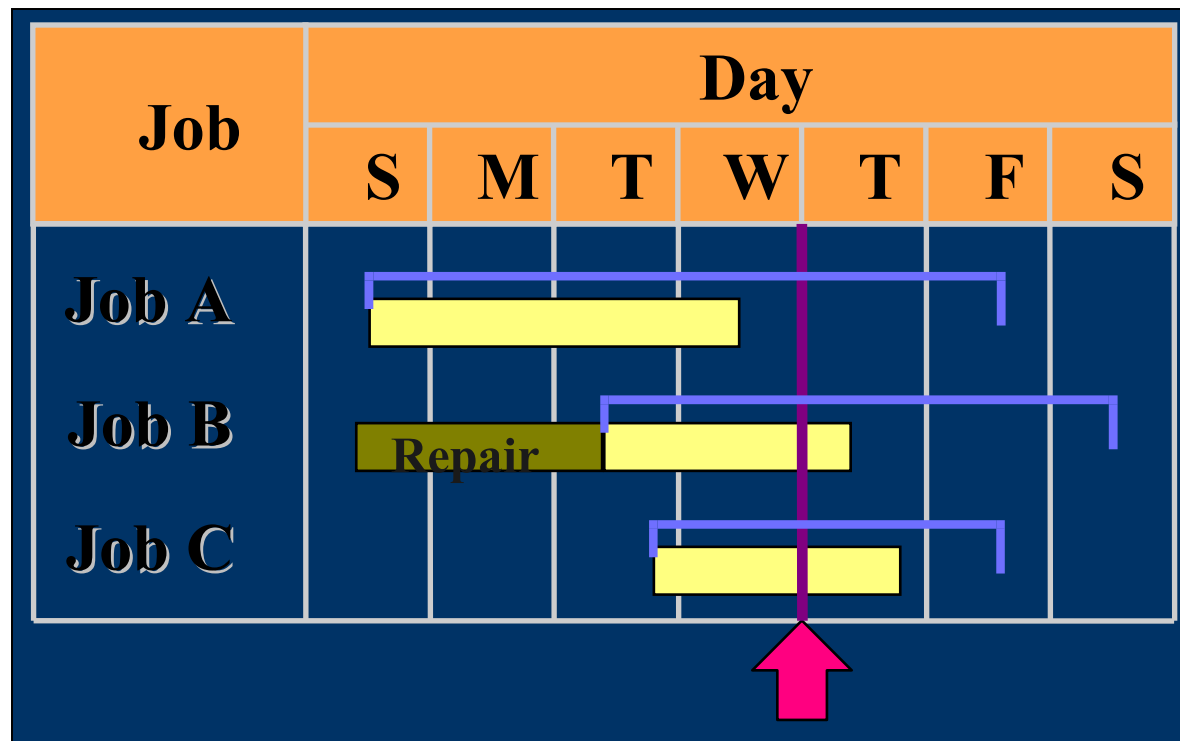
Gantt Load Chart

- Shows relative workload in facility
- **Disadvantages**
 - Does not account for unexpected events
 - Must be updated regularly

Work Center	M	T	W	Th	F
Sht. Metal	Job A			Job F	
Mechanical		Job D		Job G	
Electrical	Job B			Job H	
Painting	Job C		Job E		Job I

Gantt Scheduling Chart

- Used to monitor job progress



Assignment Method

- Assigns tasks or jobs to resources
- Type of linear programming model
 - Objective
 - Minimize total cost, time etc.
 - Constraints
 - 1 job per resource (e.g., machine)
 - 1 resource (e.g., machine) per job

Sequencing Challenge

Order
release

Job Packet
Job XYZ

Which job
do I run
next?



Production Control

Dispatch List			
<u>Order</u>	<u>Part</u>	<u>Due</u>	<u>Qty</u>
XYZ	6014	123	100
ABC	6020	124	50



Production

Sequencing

- Specifies order jobs will be worked
- Sequencing rules
 - First come, first served (FCFS)
 - Shortest processing time (SPT)
 - Earliest due date (EDD)
 - Longest processing time (LPT)
 - Critical ratio (CR)
 - Johnson's rule

Priority Rules for Dispatching Jobs

- **First come, first served**

The first job to arrive at a work center is processed first

- **Earliest due date**

The job with the earliest due date is processed first

- **Shortest processing time**

The job with the shortest processing time is processed first

- **Longest processing time**

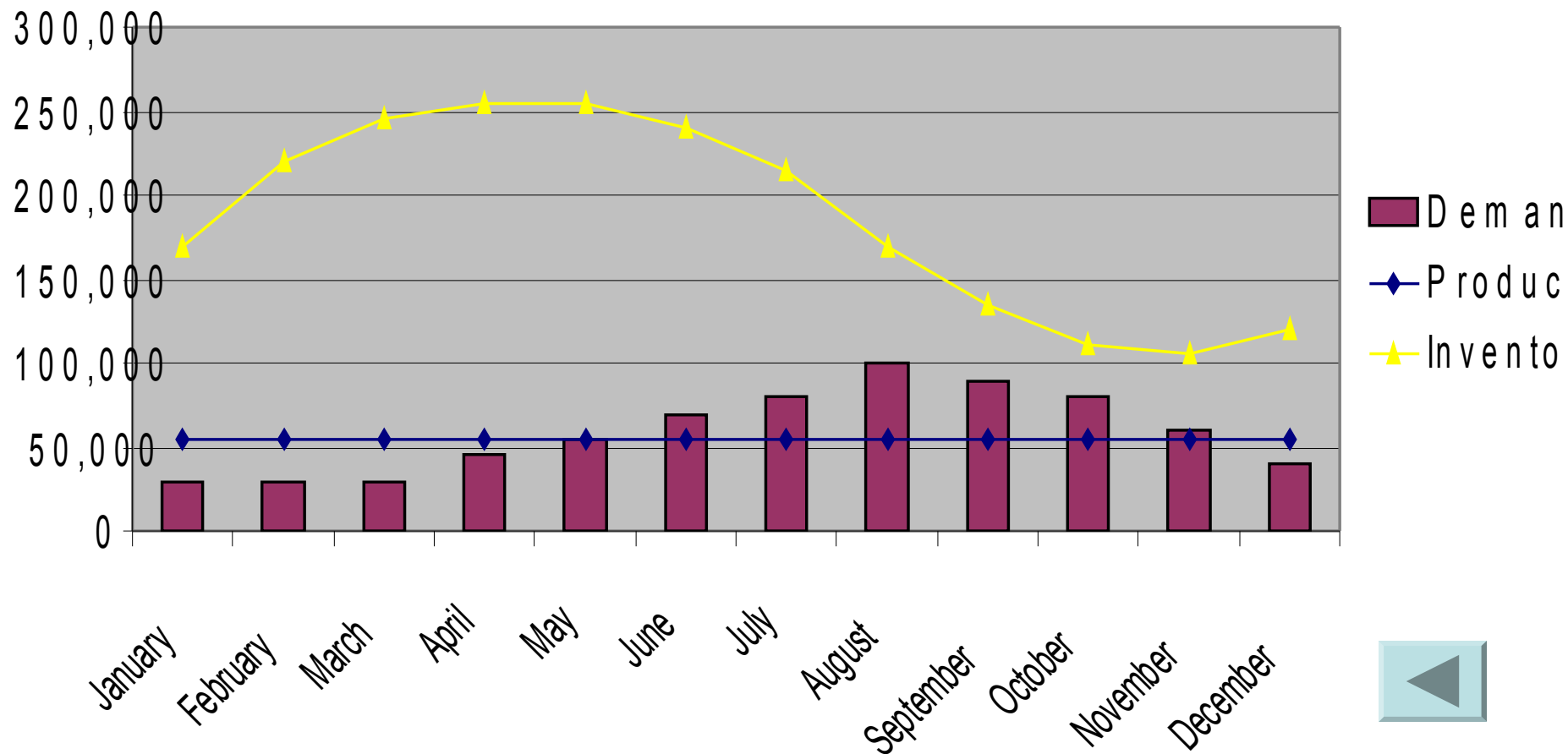
The job with the longest processing time is processed first

- **Critical ratio**

The ratio of time remaining to required work time remaining is calculated, and jobs are scheduled in order of increasing ratio.

Thank You.

	January	February	March	April	May	June	July	August	September	October	November	December
Produced Qty	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000
Demand	30,000	30,000	30,000	45,000	55,000	70,000	80,000	100,000	90,000	80,000	60,000	40,000
Inventory	170,000	220,000	245,000	255,000	255,000	240,000	215,000	170,000	135,000	110,000	105,000	120,000



Please use the link below to view our next week schedule:

<\\btfile001\data\Planning\Production Schedule\Nano\08.07.2008 NanoSchedule.xls>

Product Group	Weekly	Buffer	WW32	WW33	WW34	WW35	WW36	WW37	WW38
	Capacity	Stock Qty.	Current week	Next Week	2nd Week Out	3rd Week Out	4th Week Out	5th Week Out	6th Week Out
Multimag Total	200,000	-	79,000	80,000	29,000	202,000	21,000	44,000	21,000
FA Total	5,400,000	3,000,000	2,264,000	6,234,000	5,974,000	6,302,000	2,707,000	4,846,000	1,775,000
Slo-Blo Total	1,760,000	750,000	721,000	1,369,000	1,425,000	1,037,000	1,266,000	1,363,000	437,000
Telecom Total	1,518,750	400,000	322,500	1,042,500	540,000	320,000	397,500	40,000	20,000
250V Total	15,000	-	7,500	-	21,000	3,000	3,000	6,000	-
Pb Free Total	-	-	2,000	223,000	2,000	1,000	4,000	55,000	50,000
Omni Total	300,000	106,500	115,500	250,500	142,500	178,500	127,500	120,000	72,000
250V Wickman Total	-	-	-	-	18,000	21,000	18,000	-	-
Grand Total	9,193,750	4,256,500	3,511,500	9,199,000	8,151,500	8,064,500	4,544,000	6,474,000	2,375,000

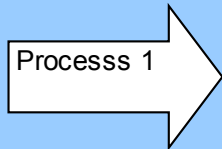
Notables:

- Figures above is as of 2:50 PM yesterday, 8/07/2008.
- Capacity defined for each product group was based on 5 days @ 24 hours per day working hours.
- Overall average demand in the next 4 weeks is 7.5M combination of all product lines.



Bottleneck Work Centers

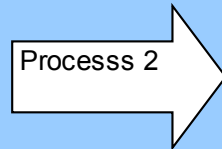
Rate 4000 units / hour



Lot Size 10,000

2.5Hrs

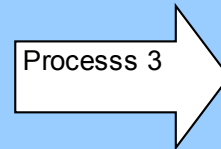
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Lot Size 10,000

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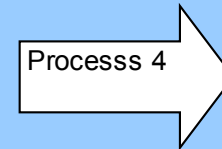
Rate 2000 units / hour



Lot Size 10,000

5Hrs

Rate 4000 units / hour



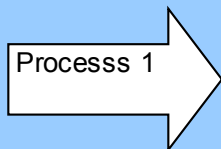
Lot Size 10,000

2.5Hrs

Total 12.5Hrs

Improved 1

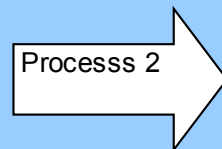
Rate 4000 units / hour



Lot Size 10,000

2.5Hrs

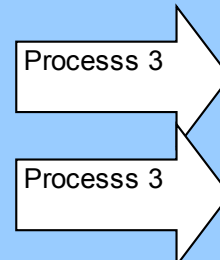
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Lot Size 10,000

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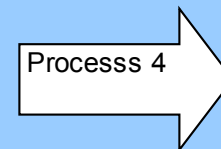
Rate 4000 units / hour



Lot Size 10,000

2.5Hrs

Rate 4000 units / hour



Lot Size 10,000

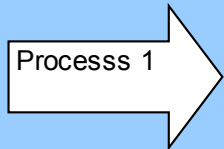
2.5Hrs



To

Level Material Use

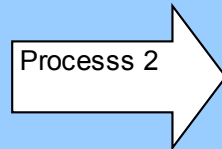
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Lot Size 10,000

2.5Hrs

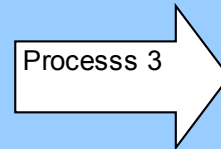
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Lot Size 10,000

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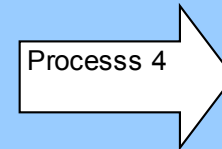
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Lot Size 10,000

5Hrs

Rate 4000 units / hour

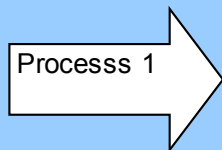


Lot Size 10,000

2.5Hrs

Total 12.5Hrs

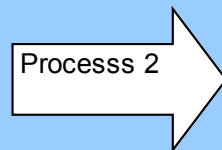
Rate 4000 units / hour



Lot Size 2,000

0.5Hr

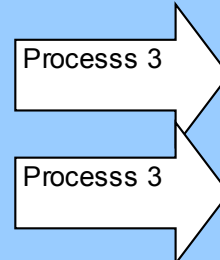
Rate 4000 units / hour



Lot Size 2,000

0.5Hr

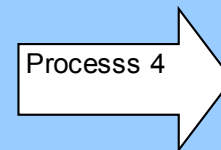
Rate 4000 units / hour



Lot Size 2,000

0.5Hr

Rate 4000 units / hour



Lot Size 2,000

0.5Hr

Total

