Produksi dan Penjadualan Proyek

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Project Organization Works Best When

- Pekerjaan dapat digambarkan dengan suatu batas waktu dan tujuan spesifik
- Pekerjaan adalah unik atau sedikit banyaknya tidak familier pada organisasi
- Pekerjaan berisi tugas saling berhubungan kompleks yang menuntut ketrampilan khusus
- Proyek adalah temporer tetapi kritis kepada organisasi

Project Planning, Scheduling, and Controlling

Project Planning
1. Setting goals
2. Defining the project
3. Tying needs into timed project activities
4. Organizing the team

→

Time/cost estimates
Budgets
Engineering diagrams
Cash flow charts
Material availability details

Project Scheduling
1. Tying resources to specific activities
2. Relating activities to each other
3. Updating and revising on a regular basis

→

CPM/PERT
Gantt charts
Milestone charts
Cash flow schedules

Project Controlling
1. Monitoring resources, costs, quality, and budgets
2. Revising and changing plans
3. Shifting resources to meet demands

→

Reports
- budgets
- delayed activities

Before project ↑ During project ↑

Project Planning

- Penetapan sasaran hasil
- Penjelasan proyek
- Menciptakan struktur uraian pekerjaan
- Menentukan sumber daya
- Pembentukan organisasi

Work Breakdown Structure

1. Project
2. Major tasks in the project
3. Subtasks in the major tasks
4. Activities (or work packages) tobe completed

Project Scheduling

- Mengidentifikasi hubungan yang lebih tinggi
- Aktivitas yang berkaitan
- Menentukan aktivitas waktu& biaya-biaya
- Penaksiran kebutuhan material dan pekerja
- Menentukan aktivitas kritis

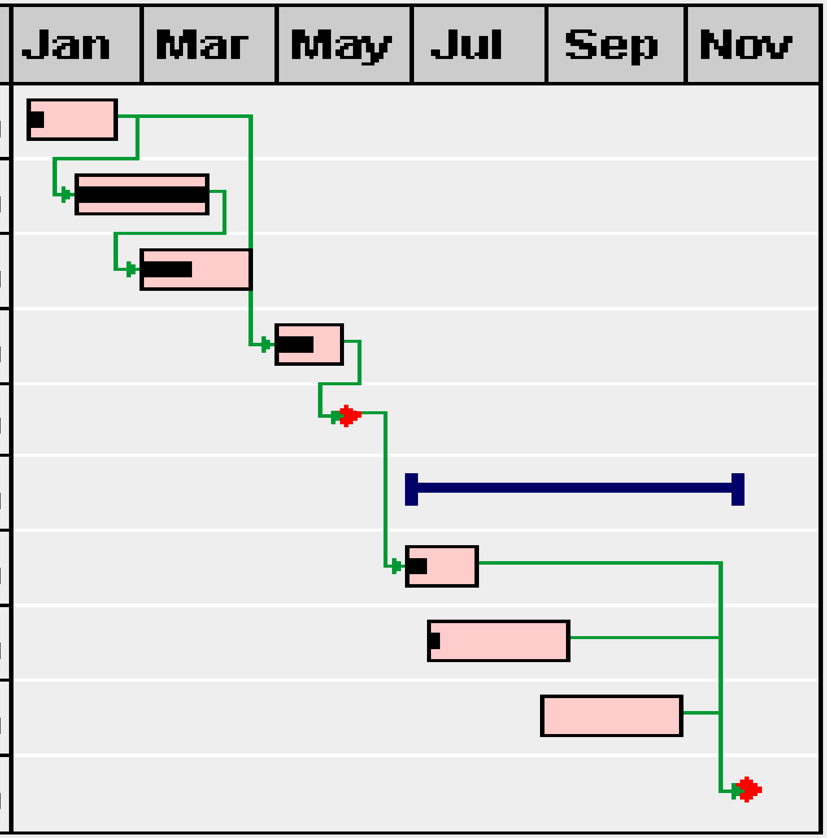
Project Management Techniques

- Gantt chart
- Critical Path Method (CPM)
- Program Evaluation & Review Technique (PERT)

Gantt Chart

GANTT chart with task links

Task	Start	End	Link	%
Task 1	10-01	20-02		20
Task 2	01-02	01-04	1	100
Task 3	01-03	20-04	2	50
Task 4	01-05	01-06	1	60
Milestone 1	02-06	02-06	4	0
Summary	01-07	01-12		80
Task 5	01-07	03-08	5	30
Task 6	10-07	12-09		10
Task 7	30-08	02-11		0
Milestone 2	01-12	01-12	7:8:9	0



PERT and CPM

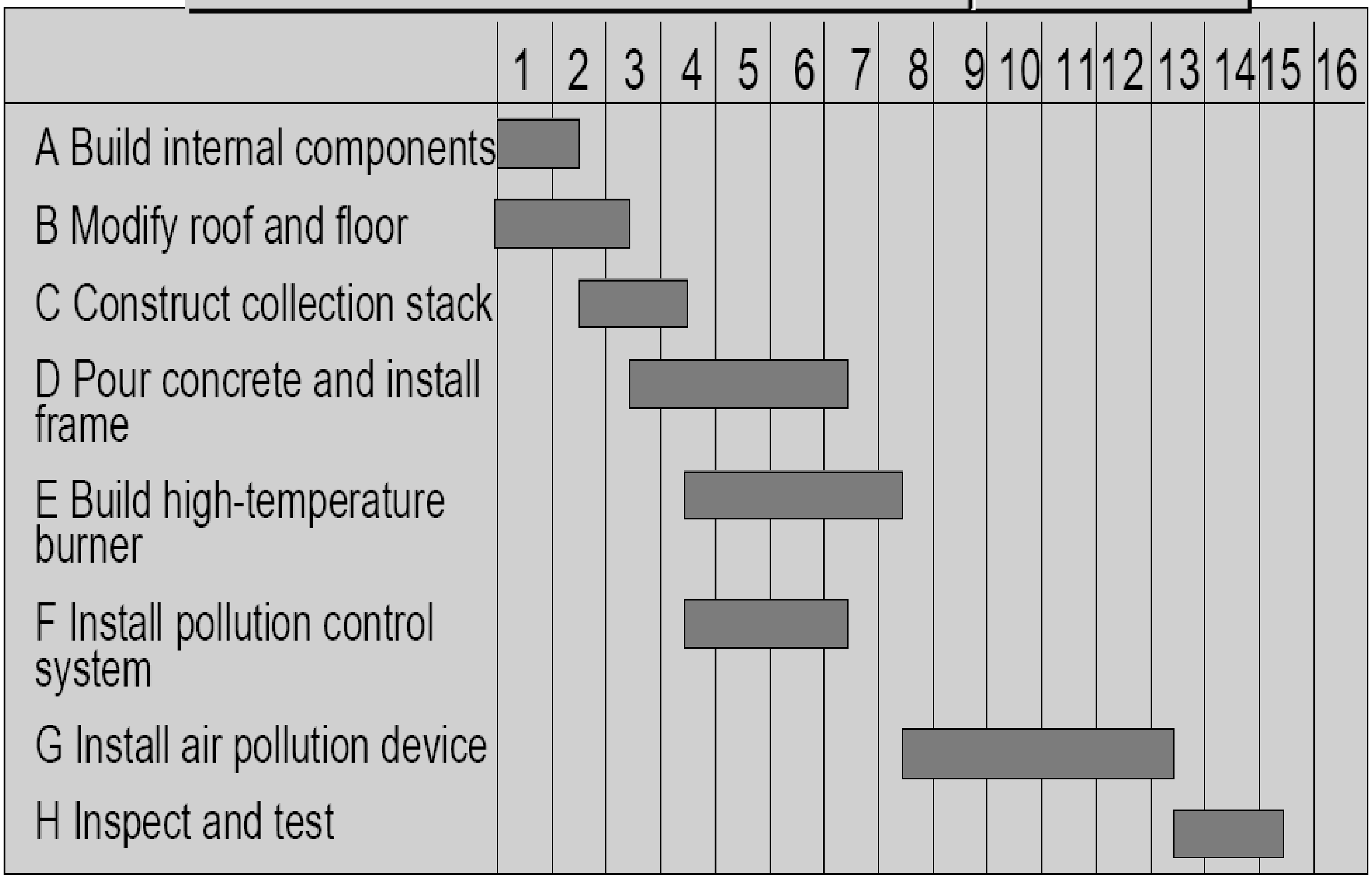
- Teknik jaringan
- Dikembangkan tahun 1950
- CPM dengan Dupont untuk bahan kimia (1957)
- PERT oleh Booz, Allen& Hamilton dengan angkatan laut, U.S. untuk Polaris proyektil (1958)
- Mempertimbangkan hubungan yang lebih tinggi dan interdependencies
- .. Masing-Masing penggunaan [adalah] suatu perkiraan waktu aktivitas [yang] berbeda

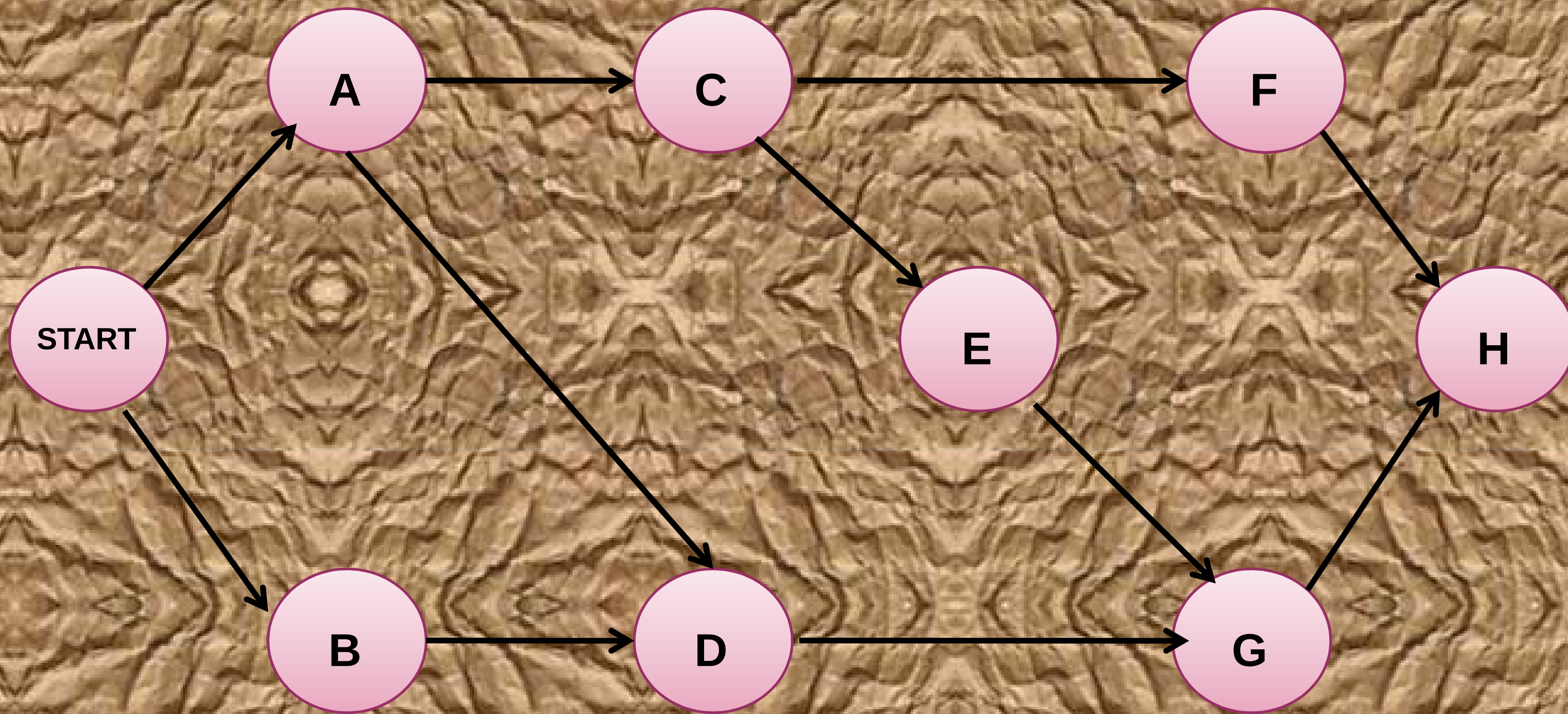
Milwaukee General Hospital’s Activities and Predecessors

Activity	Description	Immediate Predecessors
A	Build internal components	
B	Modify roof and floor	
C	Construct collection stack	A
D	Pour concrete and install frame	A,B
E	Build high-temperature burner	C
F	Install pollution control system	C
G	Install air pollution device	D, E
H	Inspect and test	F. G

A

Milwaukee General Hospital




START
A
B
C
D
E
F
G
H

Critical Path Analysis

- Provides activity information
  - Earliest (ES) & latest (LS) start
  - Earliest (EF) & latest (LF) finish
  - Slack (S): Allowable delay

- Identifies critical path
  - *Longest path in network*
  - *Shortest time project can be completed*
  - Any delay on critical path activities delays project
  - Critical path activities have 0 slack

Latest Start and Finish Steps

- Begin at ending event and work backward
- LF = Maximum EF for ending activities
  - LF is latest finish; EF is earliest finish
- LS = LF - Activity time
  - LS is latest start
- LF = Minimum LS of all successors for non-ending activities

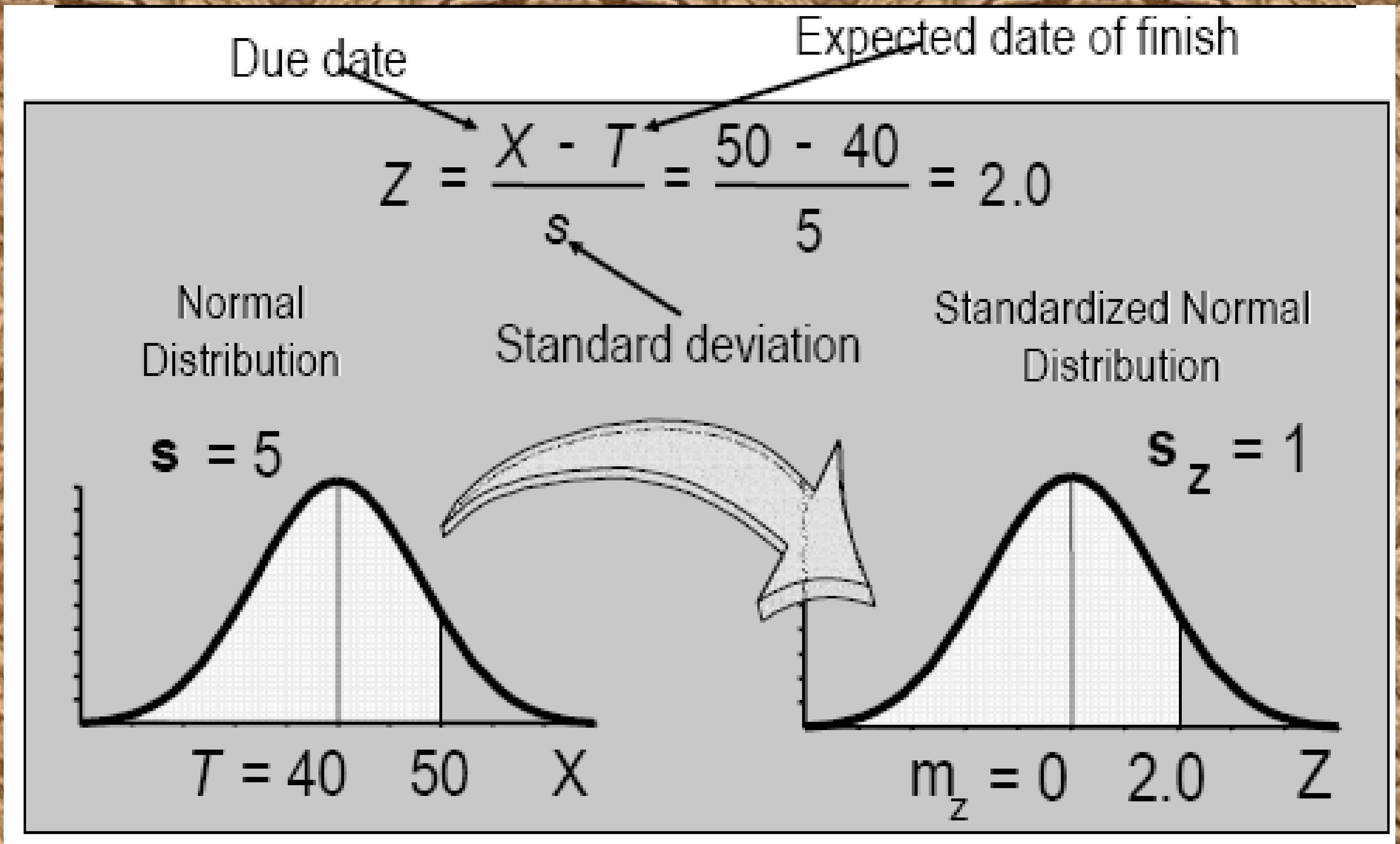
PERT Activity Times

- 3 time estimates
  - Optimistic times (*a*)
  - Most-likely time (*m*)
  - Pessimistic time (*b*)
- Follow beta distribution
- Expected time: $t = (a + 4m + b)/6$
- Variance of times: $v = (b - a)2/6$

PERT Probability Example

- suatu perencana proyek umum
- Dinamika. Suatu proyek kapal selam mempunyai waktu penyelesaian yang diharapkan 40 minggu, dengan suatu simpangan baku 5 minggu.
- Apa mungkin dapat menyelesaikan dalam waktu 50 minggu atau lebih sedikit?

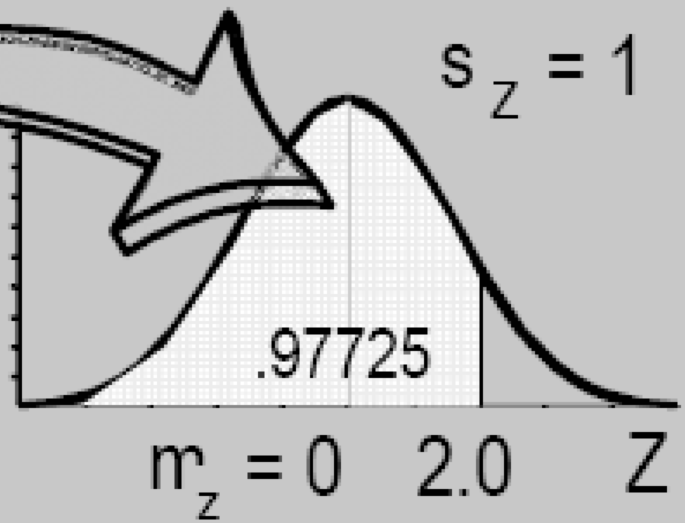
Converting to Standardized Variable



Obtaining the Probability

Standardized Normal Probability Table (Portion)

Z	.00	.01	.02
0.0	.50000	.50399	.50798
:	:	:	:
2.0	.97725	.97784	.97831
2.1	.98214	.98257	.98300



Probabilities in body

Variability of Completion Time for Noncritical Paths

- Variabilitas aktivitas pada noncritical alur harus dipertimbangkan manakala menemukan kemungkinan penyelesaian di dalam suatu waktu yang ditetapkan.
- Variasi dalam noncritical aktivitas bisa menyebabkan perubahan dalam alur kritis

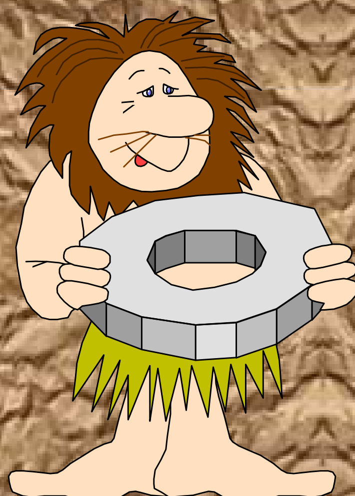
Steps in Project Crashing

- Menghitung biaya crash setiap periode waktu. Karena biaya-biaya crash diasumsikan liniear dari waktu ke waktu:

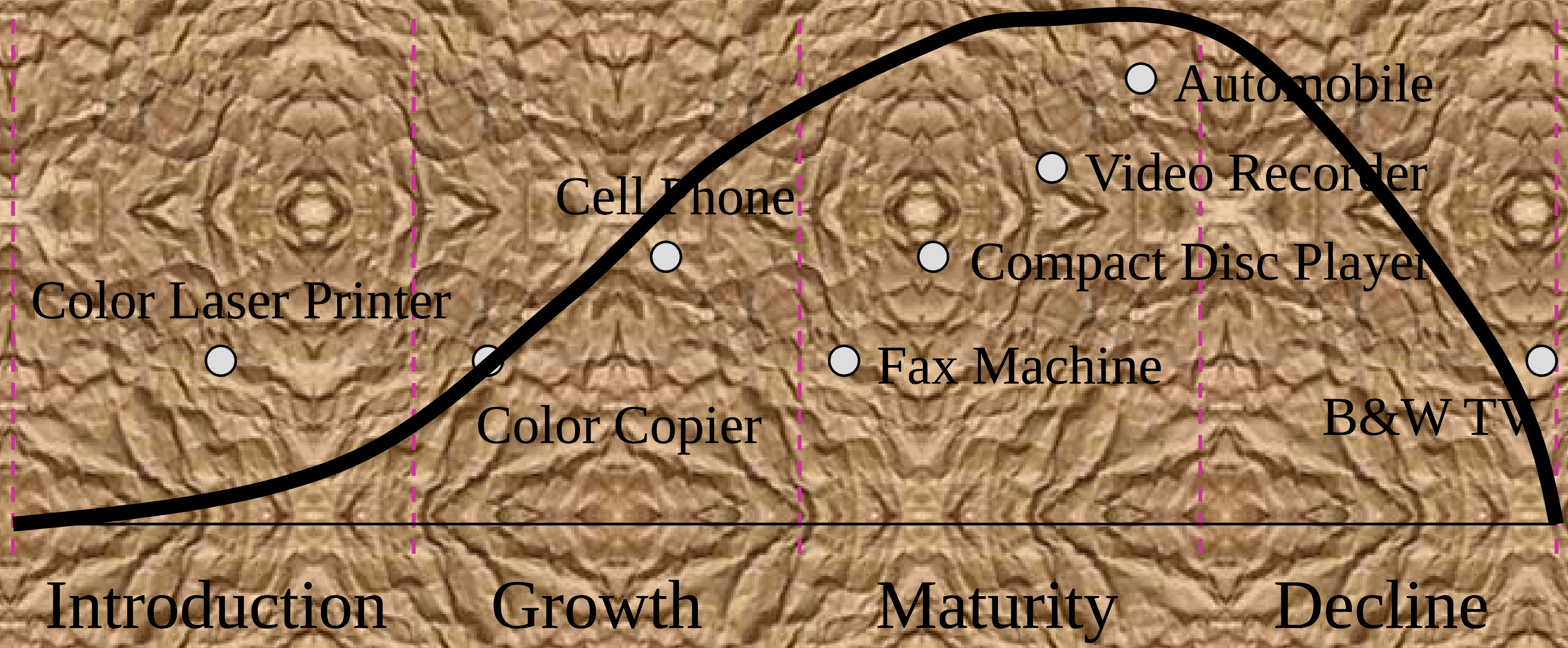
$$\text{Crash cost per period} = \frac{(\text{Crash cost} - \text{Normal cost})}{(\text{Normal time} - \text{Crash time})}$$

- Penggunaan aktivitas waktu sekarang, temukan jalur kritis
- Jika ada hanya satu jalur kritis, kemudian memilih aktivitas pada
- jalur kritis yang dipotong, dan mempunyai paling biaya crash setiap periode. Catatlah bahwa aktivitas tunggal boleh secara umum lebih dari satu jalur kritis
- Membaharui semua aktivitas waktu.

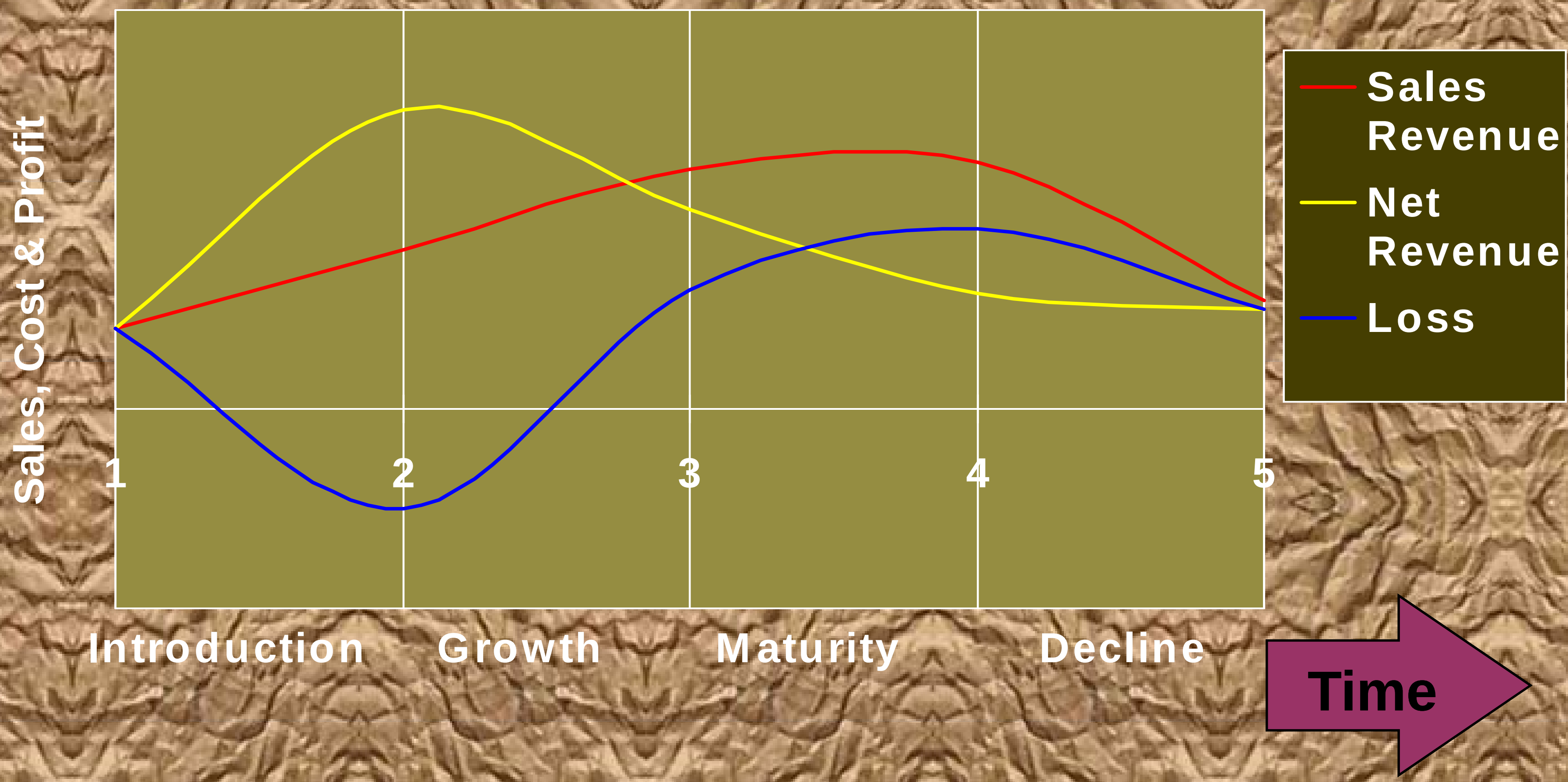
Product/Service Development and Design



Stages of a Product's Life Cycle



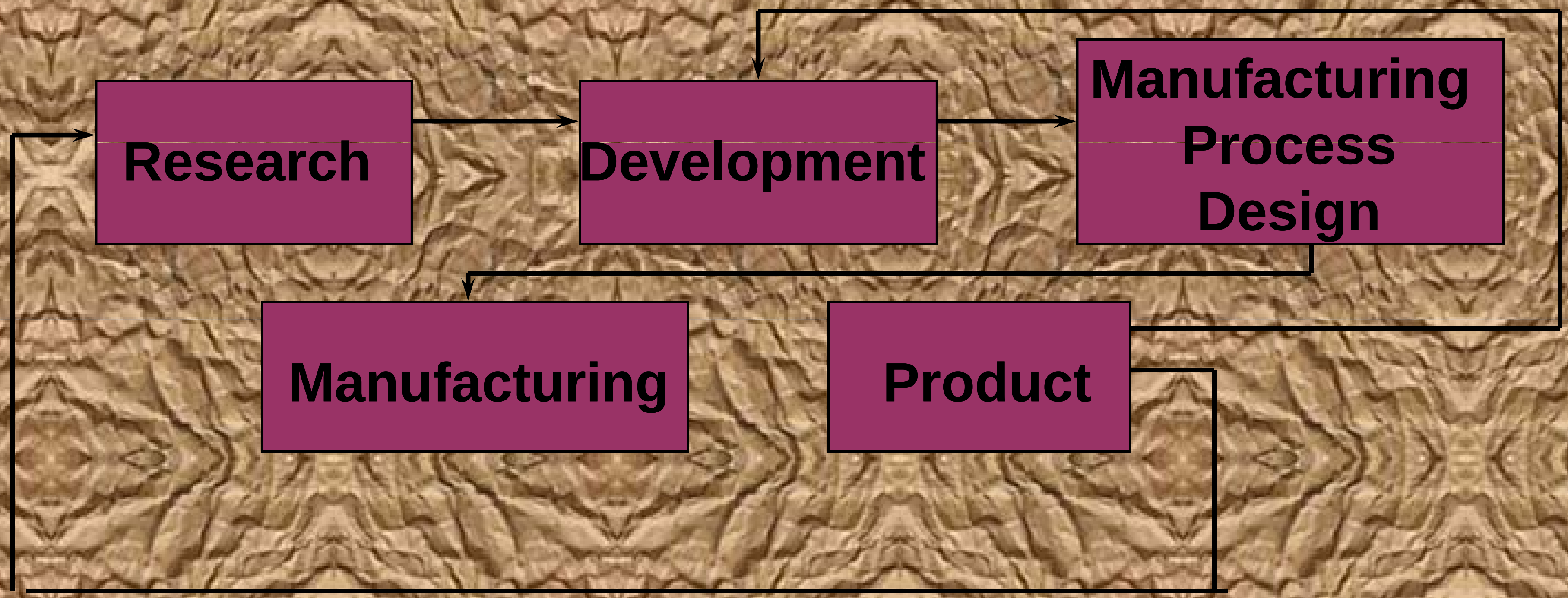
Product Life Cycle & Sales, Cost, and Net Revenues



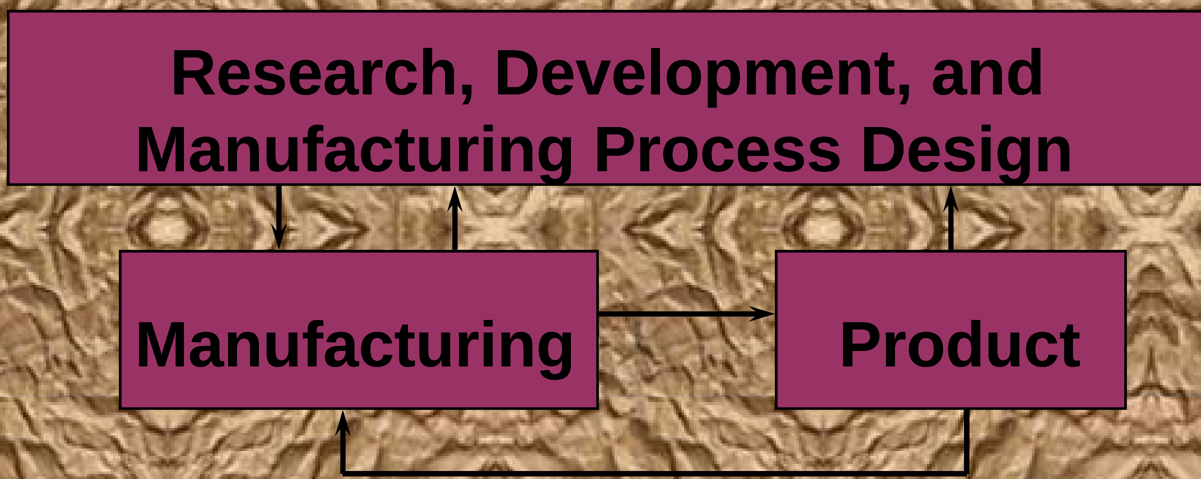
Operations Emphasis in Product Life Cycle

Stage	Operations Emphasis
Introductory	Research Product development Process modification & enhancement Supplier development
Growth	Capacity determination/enhancement
Maturity	High volume production with innovation Cost control Reduction in options Paring down of product line
Decline	Termination of production if necessary

American Approach to Product Design



Japanese Approach to Product Design



Product/Service Design

- Manakala suatu produk dirancang:
- Karakteristik terperinci produk yang dibentuk.
- Karakteristik produk secara langsung mempengaruhi bagaimana produk dapat diproduksi atau dikirimkan.
- Bagaimana produk diproduksi atau disalurkan akan menentukan disain dari produksi atau sistem saluran.

Product/Service Design

Desai produk atau jasa secara langsung mempengaruhi:

- Mutu produk atau jasa
- Biaya produksi atau penyaluran
- Kepuasan pelanggan

Product/Service Design and Development

- Sumber daya produksi
- Mengembangkan produk atau jasa baru
- Menjadikan menjualnya lebih cepat
- Menginprofe produk atau jasa sekarang
- Perancangan untuk mempermudah produksi
- Perancangan mutu
- Merancang dan mengembangkan jasa baru

Sources of Product/Service Innovation

- Pelanggan
- Para manajer
- Pemasaran
- Operasional
- Rancang-Bangun
- Riset dan pengembangan (R&D)
  - Riset dasar
  - Riset terapan

Steps in Designing and Developing New Products

1. studi kelayakan ekonomi dan teknis
2. Disain prototipe
3. Test kemampuan prototipe
4. Mengevaluasi pasar dan evaluasi ekonomi prototipe
5. Perancangan model produksi
6. Menguji pasar, pencapaian dan dan proses serta evaluasi produksi model ekonomi
7. Melanjutkan modifikasi model produksi

Getting New Products to Market Faster

- Kecepatan menciptakan manfaat kompetisi
- Kecepatan menyelamatkan uang
- Meningkatkan kecepatan alat:
  - Otonomi pengembangan dan disain team
  - Computer-aided design/computer-aided manufacturing (CAD/CAM)
  - Rancang-bangun bersama

Improving the Design of Existing Products/Services

- Fokus dalam meningkatkan pencapaian, mutu, dan biaya
- Tujuan adalah memelihara atau meningkatkan penguasaan pasar kedewasaan produk atau jasa
- Perubahan sedikit dapat menjadi penting
- Kecil, peningkatan yang berlanjutan dapat menambah sampai pada peningkatan jangka panjang yang besar
- Analisis nilai yang diharapkan, corak disain berarti menguji keterkaitan dengan cost / benefit mereka

Designing for Ease of Production

Mempermudah Produksi

- Spesifikasi informasi tepat tentang karakteristik dari produk
- Toleransi Minimum dan batas maksimum atas suatu dimensi yang mengijinkan item untuk merancang fungsi
- Standardisasi mengurangi variasi antar suatu kelompok komponen atau produk
- Penyederhanaan mengurangi atau menghapuskan kompleksitas dari suatu produk atau bagian

Designing for Quality

- Unsur kerumitan disain produk dampaknya pada mutu
- Mutu ditentukan oleh persepsi konsumen dari derajat tingkat keunggulan karakteristik produk atau jasa
- Prinsip perancangan mutu produk atau jasa

Tiga dimensi disain umum adalah:

- Derajat tingkat standardisasi menyangkut layanan
- Derajat kontak pelanggan di dalam mengirimkan jasa
- Campuran barang-barang phisik dan jasa tak terukur

Process Planning and Design

Process Planning and Design

<u>Inputs:</u>

- Product/Service Information
- Production System Information
- Operations Strategy

↓

<u>Process Planning & Design:</u>

- Select process type
- Vertical integration studies
- Process/Product studies
- Equipment studies
- Production procedures studies
- Facilities studies

→

<u>Outputs:</u>

- Process Technology
- Facilities
- Personnel Estimates

Major Factors Affecting Process Designs

- Nature of product/service demand
- Degree of vertical integration
- Production flexibility
- Degree of automation
- Product/Service quality

Degree of Vertical Integration

- Vertical integration is the amount of the production and distribution chain that is brought under the ownership of a company.
- This determines how many production processes need to be planned and designed.
- Decision of integration is based on cost, availability of capital, quality, technological capability, and more.
- Strategic outsourcing (lower degree of integration) is the outsourcing of processes in order to react quicker to changes in customer needs, competitor actions, and technology.

Production Flexibility

- Product flexibility -- ability of the production (or delivery) system to quickly change from producing (delivering) one product (or service) to another.
- Volume flexibility -- ability to quickly increase or reduce the volume of product(or service) produced (or delivered).

Degree of Automation

- Advantages of automation
  - Improves product quality
  - Improves product flexibility
  - Reduces labor and related costs
- Disadvantages of automation
  - Equipment can be very expensive
  - Integration into existing operations can be difficult

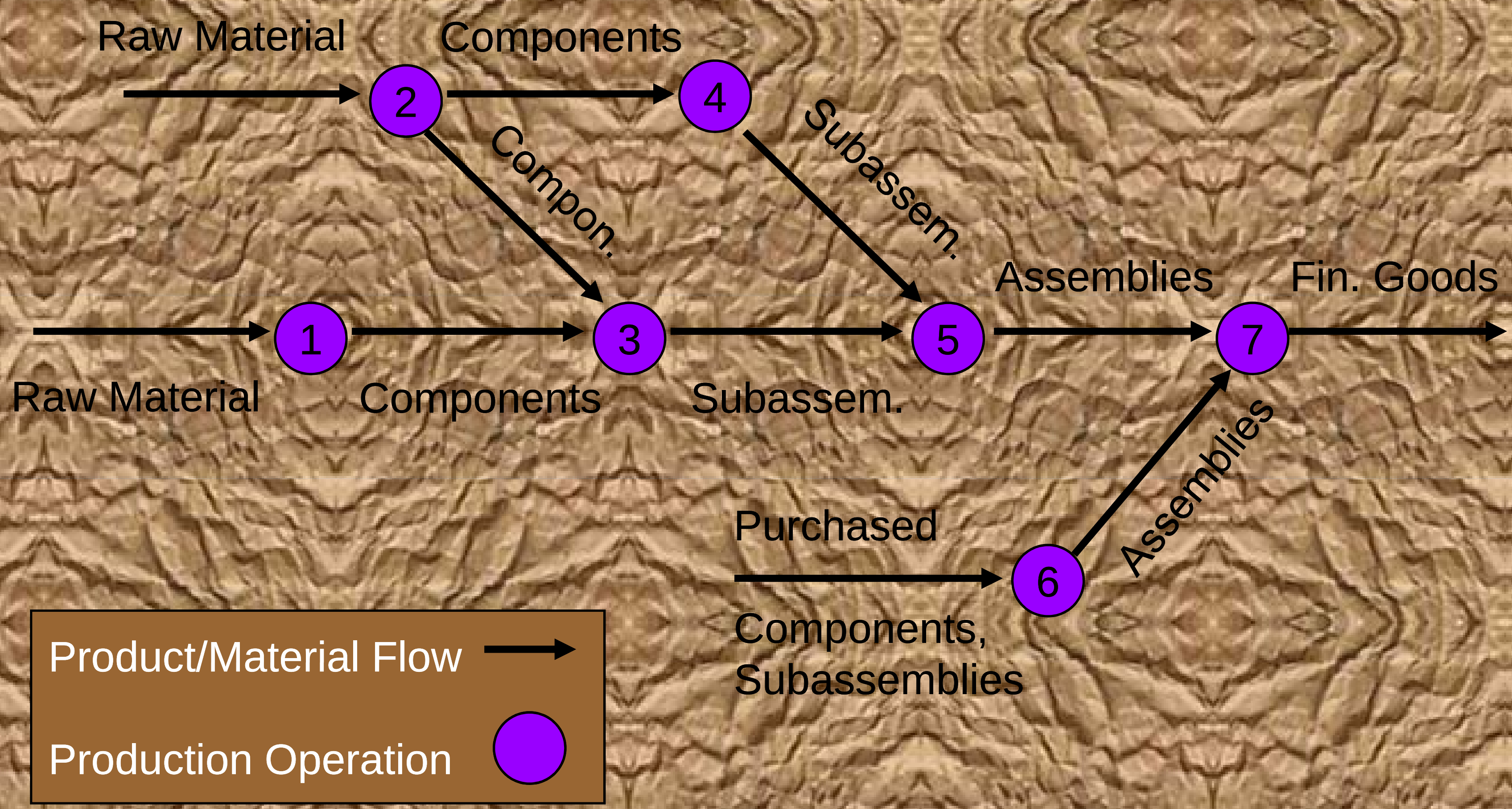
Types of Process Designs

- Product-Focused
- Process-Focused
- Group Technology/Cellular Manufacturing

Product-Focused (Production Line)

- Processes (conversions) are arranged based on the sequence of operations required to produce a product or provide a service
- Two general forms
  - Discrete unit
  - Process (Continuous)
- Examples
  - Automobiles
  - Vacuum cleaners

Product-Focused Production

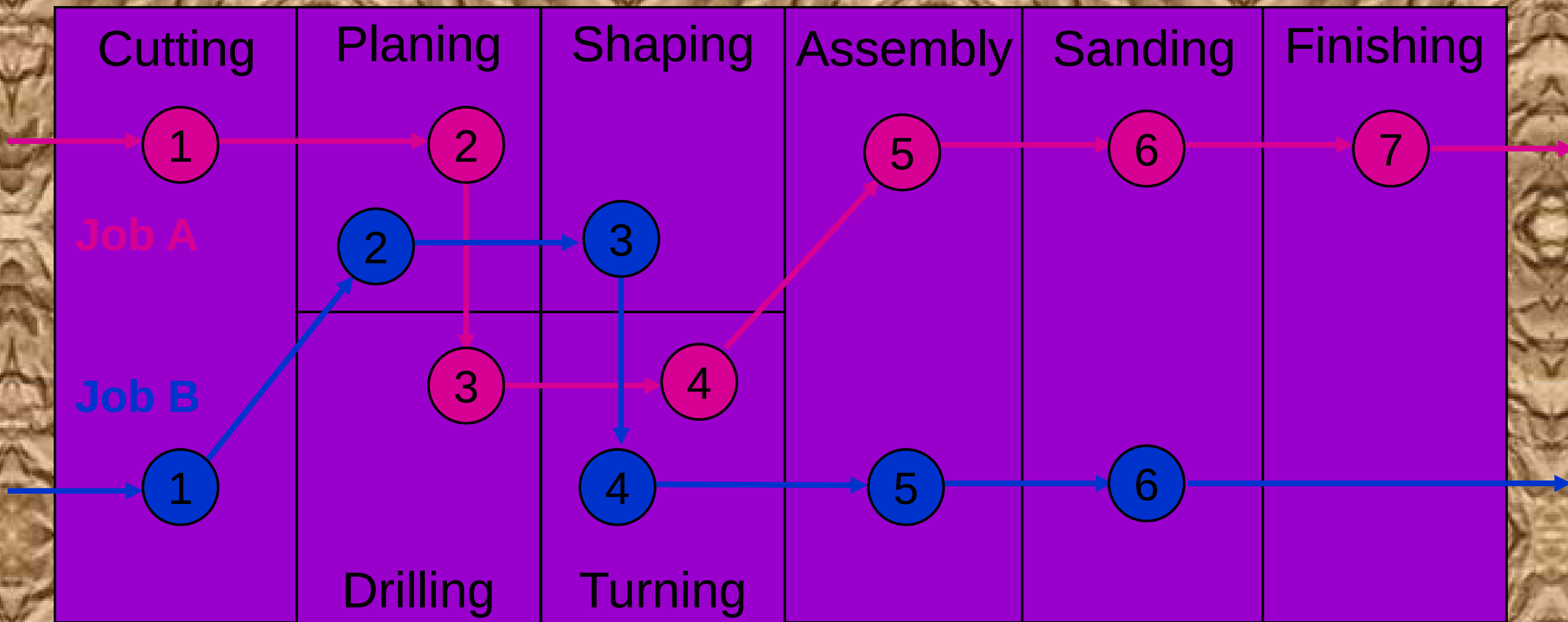


Process-Focused (Job Shop)

- Processes (conversions) are arranged based on the type of process, i.e., like processes are grouped together
- Products/services (jobs) move from department (process group) to department based on that particular job's processing requirements
- Examples
  - Auto body repair
  - Custom woodworking shop

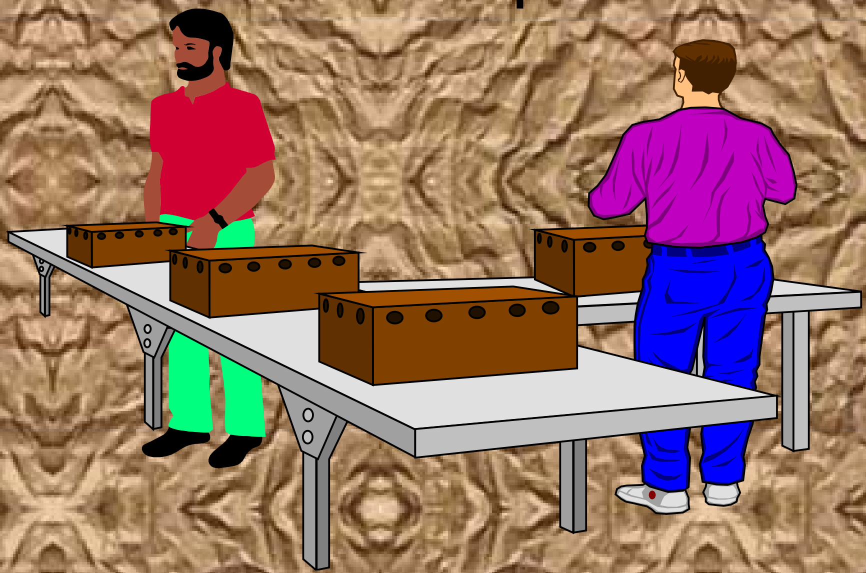
Process-Focused Production

Custom Woodworking Shop



Group Technology/Cellular Manufacturing

- Group technology forms parts with similar processing requirements into part families or groups.
- A manufacturing cell is an arrangement of the processes required to make the parts that make up the group.



Group Technology/Cells

- Advantages (relative to a job shop)
  - Process changeovers simplified
  - Variability of tasks reduced
  - More direct routes through the system
  - Quality control is improved
  - Production planning and control simpler
  - Automation simpler

Group Technology/Cells

- Disadvantages
  - Duplication of equipment
  - Under-utilization of facilities
  - Processing of items that do not fit into a family may be inefficient

Product/Process Design & Inventory Policy

- Standard Products and Produce to Stock
  - Forecast/orders drive production schedule
  - Maintain pre-determined finished-goods levels
  - MRP forecast drives material ordering
- Custom Products and Produce to Order
  - Orders set production schedule and drive material deliveries
  - Design time may be required before production can be scheduled

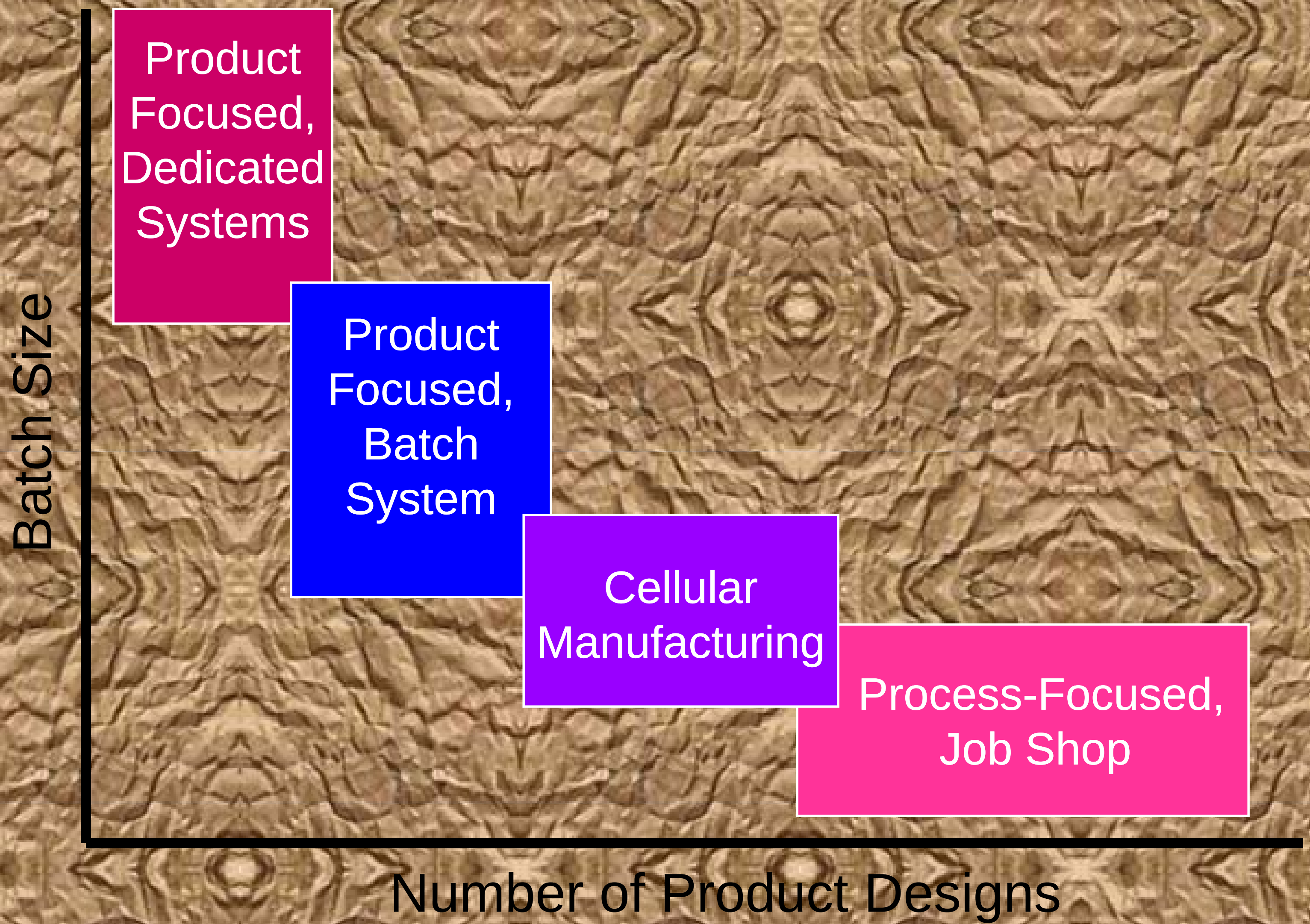
Process Design in Services

- Quasi manufacturing -- production of goods takes place along a production line with almost no customer interaction
- Customer-as-participant -- high degree of customer involvement in the process of generating the service
- Customer-as-product -- service is provided through personal attention to the customer

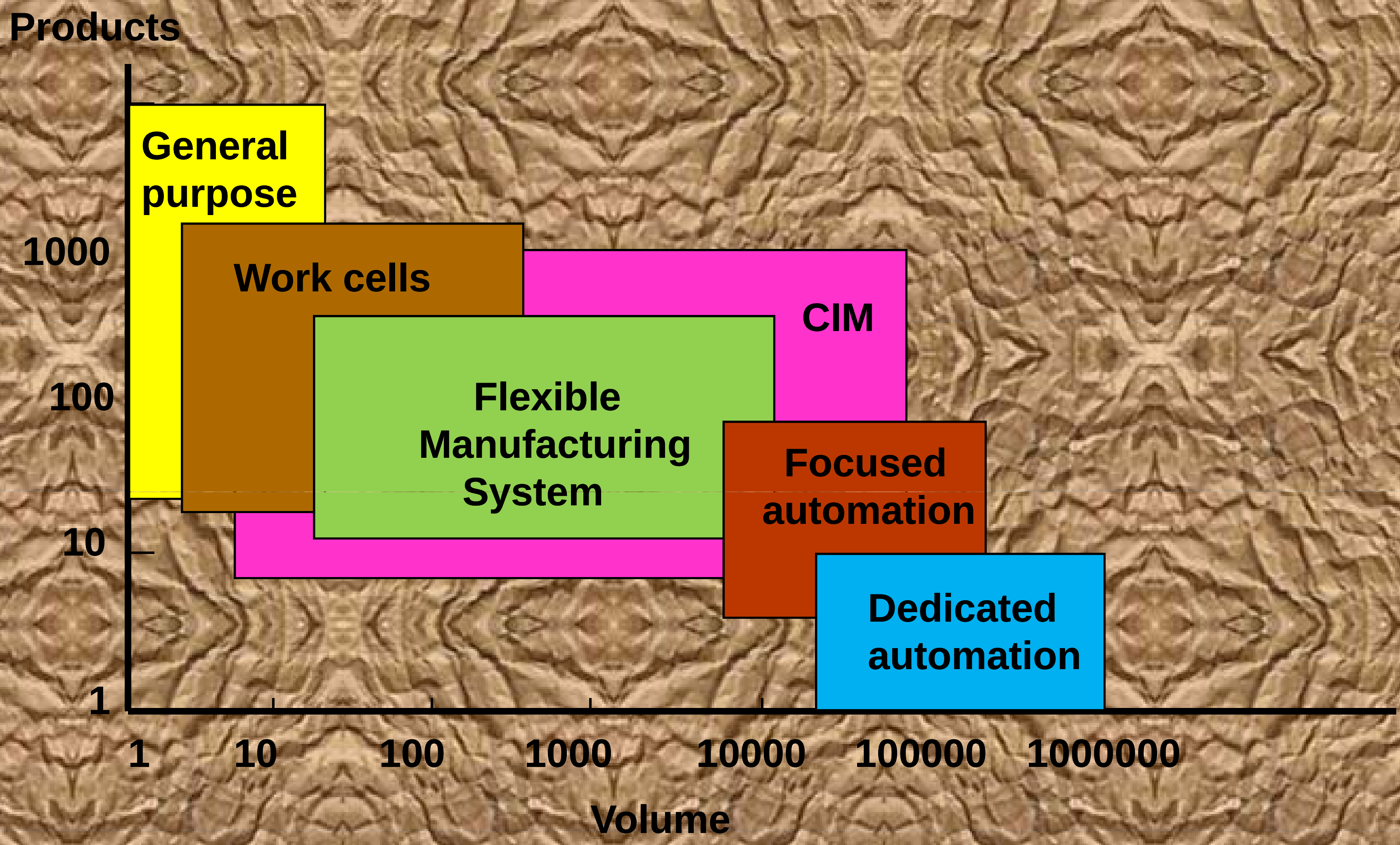
Deciding Among Processing Alternatives

- Batch Size and Product/Service Variety
- Capital Requirements
- Economic Analysis
  - Cost functions of alternatives
  - Operating leverage - relationship between a firm's annual costs and its annual sales
  - Break-even analysis
  - Financial analysis

Process Design Depends on Product Diversity and Batch Size



Flexible Manufacturing System



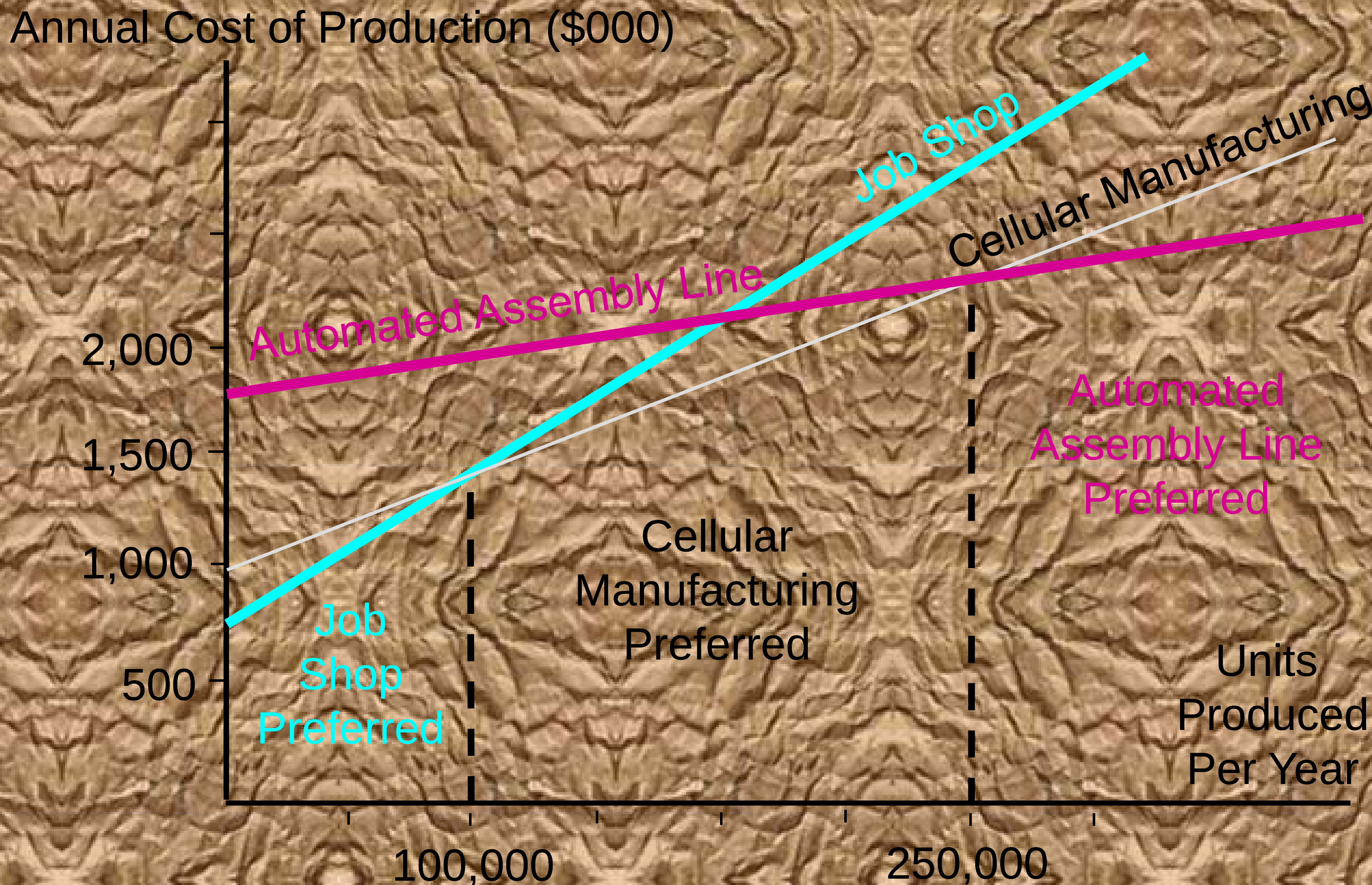
Economic Analysis

- Cost Function of Processing Alternatives
  - If capital is not a factor, the process design preferred depends upon product volume
- Operating Leverage
  - Relationship between firm's annual costs and annual sales
  - If high % firm's costs fixed, then high degree of operating leverage
  - Small % change in sales drives large % change in operating income
- . . . more

Economic Analysis

- Break Even Analysis
  - Formulas for comparing processes
  - Cannot incorporate uncertainty, costs assumed over entire range of values, and does not take into account time value of money
- Financial Analysis
  - Incorporate time value of money .... net present value, internal rate of return, etc.

Cost Functions of Processing Alternatives



Example: Cost Functions of Processing Alternatives

Three production processes - A, B, and C - have the following cost structure:

Process	Fixed Cost Per Year	Variable Cost Per Unit
A	$120,000	$3.00
B	90,000	4.00
C	80,000	4.50

What is the most economical process for a volume of 8,000 units per year?

Example: Cost Functions of Processing Alternatives

- **Most Economical Process at 8,000 Units**

$$TC = FC + v(Q)$$

A: TC = 120,000 + 3.00(8,000) = $144,000 per year

B: TC = 90,000 + 4.00(8,000) = $122,000 per year

C: TC = 80,000 + 4.50(8,000) = $116,000 per year

Process C has the lowest annual cost.

Example: Cost Functions of Processing Alternatives

- **Break-Even Points of Processes**

$$Q = FC / (p-v)$$

Assuming a $6.95 selling price per unit:

A: Q = 120,000 / (6.95 - 3.00) = 30,380 units

B: Q = 90,000 / (6.95 - 4.00) = 30,509 units

C: Q = 80,000 / (6.95 - 4.50) = 32,654 units

Deciding Among Processing Alternatives

- Assembly Charts (Gozinto Charts)
  - Macro-view of how materials are united
  - Starting point to understand factory layout needs, equipment needs, training needs
- Process Charts
  - Details of how to build product at each process
  - Includes materials needed, types of processes product flows through, time it takes to process product through each step of flow

Wrap-Up: World Class Practice

- Fast new product introduction
- Design products for ease of production
- Refine forecasting
- Focus on core competencies ... less vertical integration
- Lean production
- Flexible automation
- Job shops move toward cellular manufacturing
- Manage information flow ..... automate and simplify!