

Design of Processes and Products

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What is a Product?

Need-satisfying offering of an organization
 P&G does not sell laundry detergent...

- P&G sells the benefit of clean clothes

 Customers buy satisfaction, not parts
 May be a good or a service
 Tangible or intangible

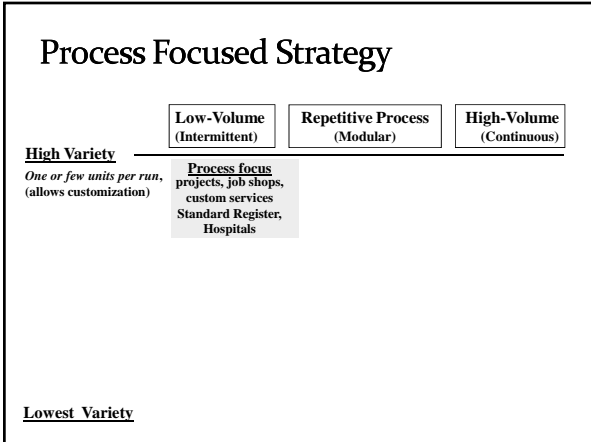
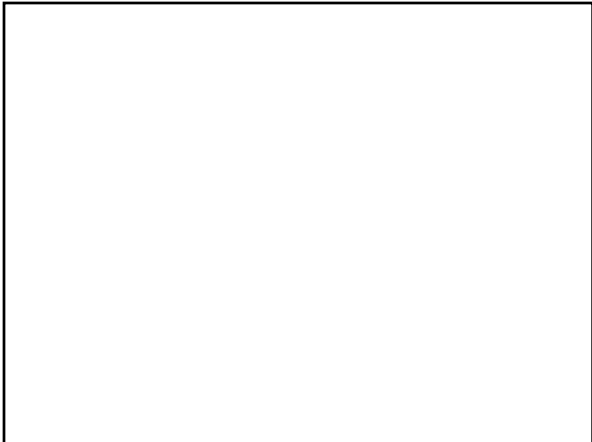
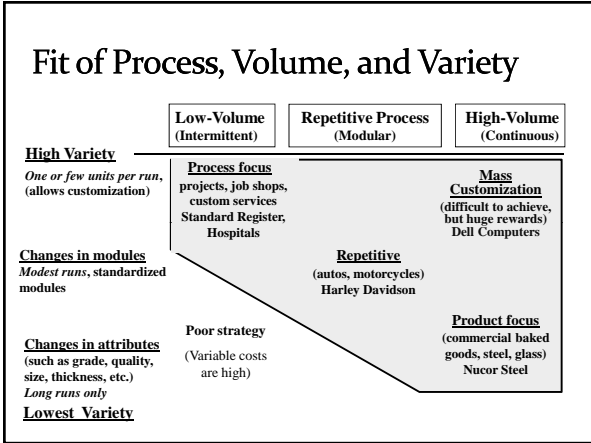
Product Strategy Options

Product differentiation
 How can this be accomplished?

Low cost
 What must we focus on to succeed?

Rapid response
 How does product design fit into this?

Note: Products are rarely if ever strictly physical. Entire product/service bundle is of concern to customers



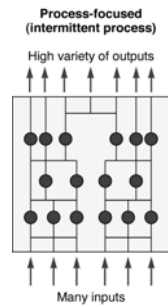
Process Focused Strategy

Advantages

- Greater product flexibility
- More general purpose equipment
- Lower initial capital investment

Disadvantages

- More highly trained personnel
- More difficult production planning & control
- Low equipment utilization (5% to 25%)



Product-Focused Strategy

High Variety



Changes in attributes
(such as grade, quality, size, thickness, etc.)
Long runs only
Lowest Variety

Product focus
(commercial baked goods, steel, glass)
Nucoor Steel

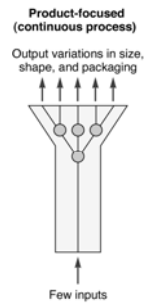
Product-Focused Strategy

Advantages

- Lower variable cost per unit
- Lower skilled labor but more specialized
- Easier production planning and control
- Higher equipment utilization (70% to 90%)

Disadvantages

- Lower product flexibility
- More specialized equipment
- Usually higher capital investment



Repetitive Focused Strategy

High Variety



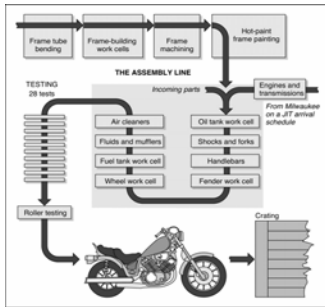
Changes in modules
Modest runs, standardized modules

Repetitive
(autos, motorcycles)
Harley Davidson

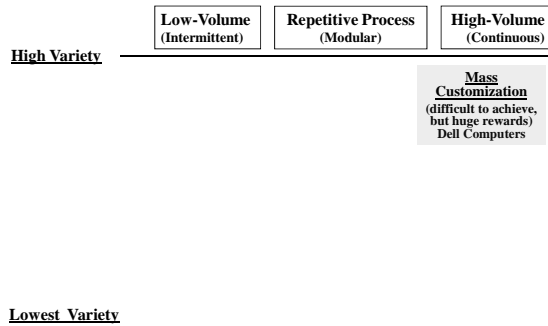
Lowest Variety

Repetitive Focused Strategy

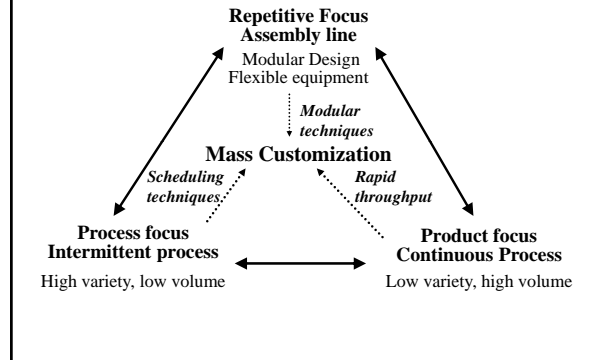
Facilities often organized by *assembly lines*
 Characterized by *modules*
 Parts & assemblies made previously
 Modules combined for many output options



Achieving Mass Customization



Achieving Mass Customization



Product Development Stages

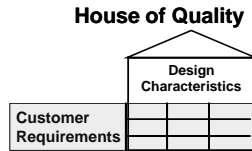
1. Idea generation
 2. Assessment of firm's ability to carry out
 3. Customer Requirements
 4. Functional Specification
 5. Product Specifications
 6. Design Review
 7. Test Market
 8. Introduction to Market
 9. Evaluation
- Scope of design for manufacturability and value engineering teams
- Scope of product development team

Customer Requirements Stage

Identifies & positions *key* product benefits (“what”)

Identifies attributes desired by customer
Focus groups, surveys, etc

Example: Digital Camera...
Lightweight, easy to use, reliable, good pictures



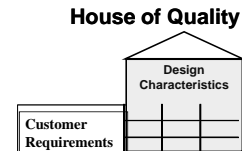
Functional Specification Stage

How the product would meet customer requirements

Design characteristics

Example: Digital Camera...

- Strong body, CCD sensor, autofocus, auto-exposure, “scene modes”, long-life battery



Product Specification Stage

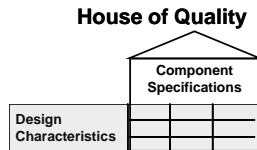
How product will be made

Gives product’s specifications

Example: Aluminum body, specific size, 10mp sensor, 3-point AF, 10 popular “scene modes”, 7200mah battery, etc.

Defined by engineering drawing

Computer-Aided Design (CAD)



Concurrent Engineering

Traditional product development

Sequential

Little to no interaction among relevant groups

Concurrent engineering

Team-based approach

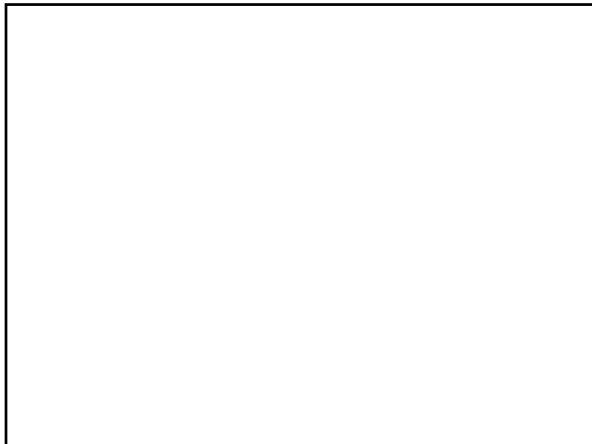
Overlapping development steps

Design for Manufacturability & Value Engineering

Takes place before production begins

Benefits:

- reduced complexity
- additional standardization
- improved functional aspects of product
- improved job design and job safety
- improved maintainability of the product
- robust design



Issues for Product Development (1 of 3)

Robust design
Small variations in manufacturing do not affect product performance

Time-based competition
Capable of faster product development than competitors

Modular design
Use of standard modules to simplify production while providing flexibility in product offerings

Issues for Product Development (2 of 3)

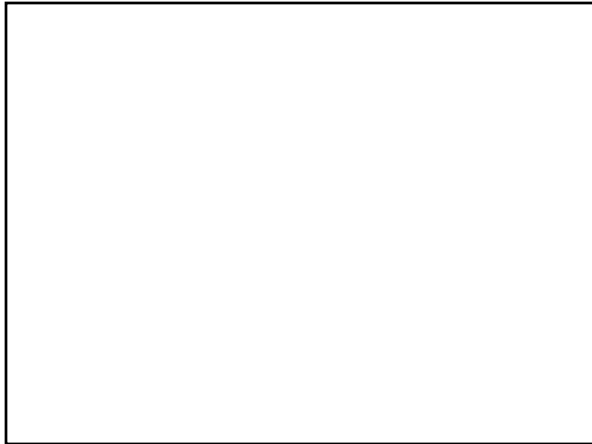
Computer-aided design (CAD)
Using computers to design products
Used often w/ computer aided mfg. (CAM) & computer aided engineering (CAE)

Benefits of CAD/CAM
Shorter design time
Database availability
New capabilities
• Example: Focus more on product ideas
Improved product quality
Reduced production costs

Issues for Product Development (3 of 3)

Value analysis
Focuses on design improvements during production
• Improved performance at same cost
• Same performance at less cost (Ford: "de-contenting")

Product-by-value analysis
Lists products in decreasing order of \$\$ contribution to firm
Helps to evaluate strategic alternatives
• What to sell or not sell; prices; where to invest in R&D




Product Documents

Engineering drawings
Shows dimensions, tolerances, & materials
Shows codes for *Group Technology*

Bill of Material
Lists components, quantities & where used
Shows product structure

Bill of Material				
P/N:	1000	Name:	Bicycle	
P/N	Desc	Qty	Units	Level
1001	Handle Bars	1	Each	1
1002	Frame Assy	1	Each	1
1003	Wheels	2	Each	2
1004	Frame	1	Each	2



Production Documents

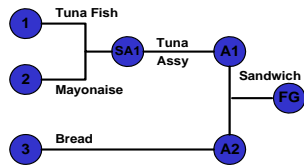
(1 of 2)

Assembly Drawings

A 3-dimensional "exploded" view of the product

Assembly chart

Graphical view of product components and assembly order



Production Documents

(2 of 2)

Route sheet

Listing and ordering of operations needed to make product

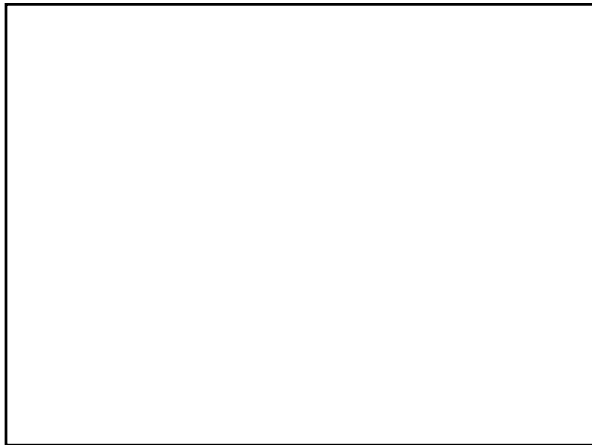
Route Sheet for Bracket				
Sequence	Machine	Operation	Setup Time	Operation Time/Unit
1	Shear # 3	Shear to length	5	.030
2	Shear # 3	Shear 45° Corners	8	.050
3	Drill press	Drill both holes	15	3.000
4	Brake press	Bend 90°	10	.025

Work order

Tells what and how much to make

Engineering change notice (ECN)

A modification or correction to a product or production document



Transition to Production

First issue:

knowing when to move to production!

Second:

must view product development as evolutionary and a team/organizational responsibility

Third:

expect to need a trial period to work the bugs out

Fourth:

recognize that responsibility must also transition

