Coordinated Product SC Design

Lecture 3

Evolution: Product life cycle is getting shorter and shorter, product variety increases

About 40% revenue came from new products introduced a year before (Handfield & Nichols, 2002)

Selama tahun 80-an dan 90-an Sony mengeluarkan 572 produk inovatif (Jiang, 2003)

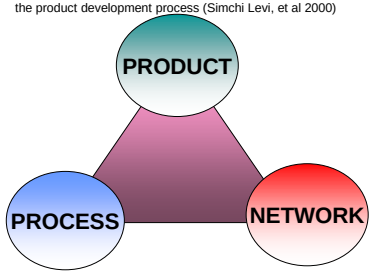
Zara produces 10,000 New Items/Year

Product Development – Supply Chain Connection

- Production – Inventory – New Product Introductions. *Production and inventory policies for new existing products need information on when the new product will be released!*
- The effect of component commonality on inventory reductions
- Postponement
- Design for logistics
- Supplier roles in NPD

Three Elements of Design

For many years manufacturing engineering was the last stop in the product development process (Simchi Levi, et al 2000)



DFM – key to efficient manufacturing process

Time to Market as A Competitive Advantage

Waktu mulai adanya rencana perancangan sampai suatu produk baru diluncurkan.

Meliputi kegiatan:

- Idea generation
- Business / technical assessment
- Concept development
- Engineering & Design
- Prototype / ramp-up

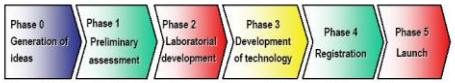
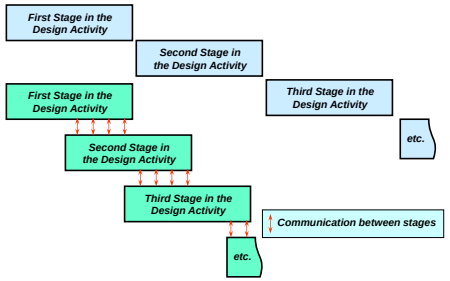


Figure 1. New product development process for generic pharmaceutical companies

Memperpendek Time to Market

- Keterlibatan banyak pihak mulai dari wakil-wakil bagian (fungsional) di dalam perusahaan maupun pihak luar seperti supplier dan pelanggan (concurrent engineering)
- Manajemen proyek yang bagus
- Tim perancangan produk yang solid, dinamis, dan enerjik, serta
- Teknologi yang mendukung.

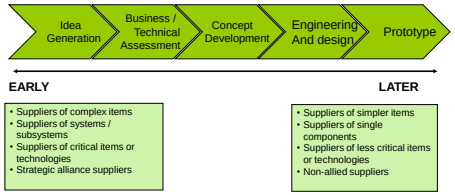
Concurrent & Parallel Processing



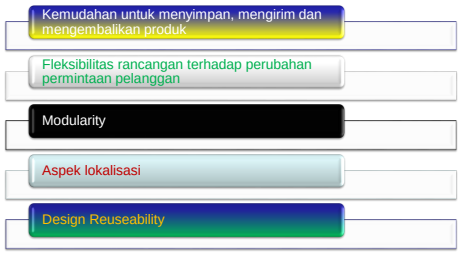
Supplier Integration

- Secara tradisional, supplier sering dipilih setelah rancangan produk selesai dibuat dan siap diproduksi.
- Saat ini, supplier dipilih lebih awal dan dilibatkan dalam perancangan produk baru.
- Contoh: General Motors (GM). Keterlibatan supplier-supplier kunci mereka merupakan salah satu kontributor bagi suksesnya GM mereduksi waktu pengembangan produk dari 60 bulan pada tahun 1996 menjadi hanya 18 bulan pada tahun 2003.

Timing of Supplier Integration



Design for SCM



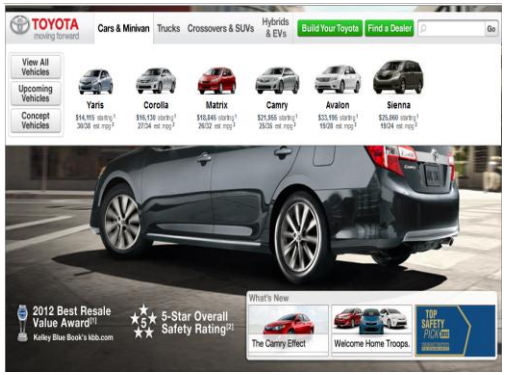
Economic Packaging & Transportation

IKEA

Co-production:
Final assembly is done by the Customers

Economic Packaging
Products are easy and efficient to ship.

Economic Transportation



Manufacturing Postponement

Postponement

- Manufacturing Postponement → manufacturing postponement is to retain the product in a neutral and non-committed status as long as possible in the manufacturing process. This means to postpone **differentiation of form and identity** to the latest possible point

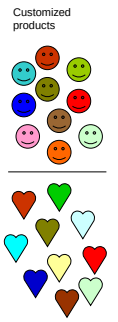
Why Manufacturing Postponement?

- Large product variety with uncertain mix
- Many common components / sub-assemblies
- Relatively short lead time for final configuration (compared to waiting time tolerated by customers)
- Stages often postponed: final assembly, packing, labeling, color mixing, etc.

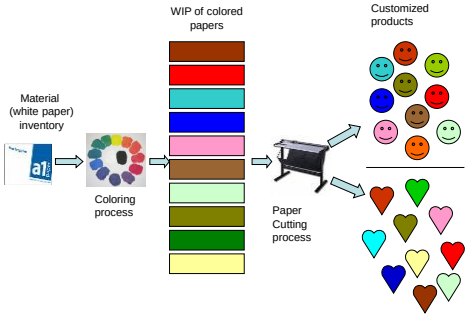
An Illustrative Case

- You manage a company producing toys. Assume you have 2 basic forms and 10 different colors. The current process of producing the toys are:
  - Buy standard A1 paper
  - Color the paper
  - Cut it into two different forms
- Draw the production process
- Do you see any problem in your production system? How would you improve it?

The concept of Manufacturing Postponement



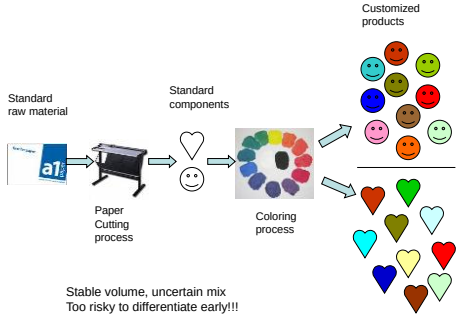
The concept of Manufacturing Postponement



The Concept of manufacturing Postponement

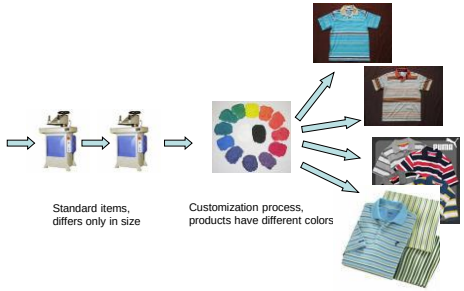
- How if the mix of colors becoming more uncertain?
- How if the number of color options grows to 20?
- How if the production process is arranged differently?

The concept of Manufacturing Postponement



Stable volume, uncertain mix
Too risky to differentiate early!!!

An Illustration of Manufacturing Postponement

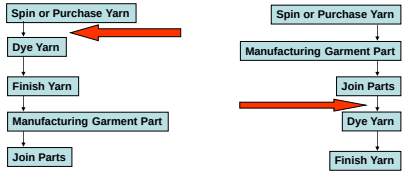


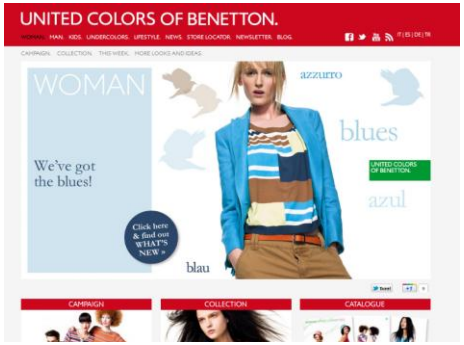
UNITED COLORS OF BENETTON

A Change in Decoupling Point

Postponement

Benetton





Postponement and Mass Customization

- Postponement unable the company to produce a very large product variety so each customer may obtain a custom designed product
- Customer may be given an opportunity to partially involve in the design process

Component Commonality

Component Commonality

- Similarity in the components needed to produce products.
- It can reduce the complexity of the manufacturing system
- It can reduce the need for safety stock because of the pooling effect (reduced uncertainty)

Demonstrate how component commonality could reduce uncertainty in the demand of components!

Simple Analytical Model to Quantify The Impact of Commonality on Inventory

Assume there are n components (X1, X2, ..Xn) to be standardized into Xs. Currently the demand for each of those components are normally distributed with mean M and standard deviation of demand during lead time of s.

To achieve a service level of (1-α)%, each component needs a safety stock of $s_{dl} \times Z_\alpha$ and for all n components, the total is $n \times s_{dl} \times Z_\alpha$.

If those components are standardized, the safety stock for the standardized component is **SQRT** (n) x $s_{dl} \times Z_\alpha$.

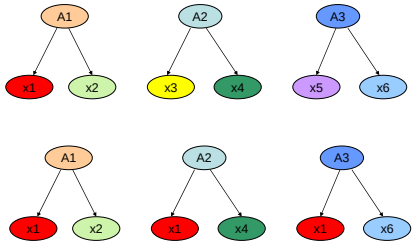
Example

- Currently you have 4 components each with a weekly demand normally distributed N(800, 100). Assume that production lead time is 1 week. The target service level is 95% for each component. Calculate the safety stock needed for each component and for all four component.
- If all those components are standardized into one, what would be the safety stock level needed?

Solution

- SS = $Z_{(95)}$ * s_{dl} = 1.645 * 100 = 164.5 units
- Thus, the total of safety stock for 4 items would be 4 * 164.5 = 658 units.
- If all four components are standardized then the safety stock requirement is 1.645 * 100 * SQRT (4) = 329 units

Increasing Commonality



Demand and Lead Time

Weekly demand distribution.

D(A1) → N (100, 20)

D(A2) → N (200, 30)

D(A3) → N (100, 10)

Lead Time for obtaining X1 … Xn is 1 week.

Calculate the safety stock of components for both situations, assuming that there is no correlation in the demand finished products.

What if the standard Deviation Differs?

- Component 1 ~ **N** (1000, 200)
- Component 2 ~ **N** (1000, 250)
- Component 3 ~ **N** (800, 150)
- Component 4 ~ **N** (700, 200)

Safety stock for item 1 = 1.645 * 200 = 329 units
2 = 1.645 * 250 = 411 units
3 = 1.645 * 150 = 247 units
4 = 1.645 * 200 = 329 units

Thus, total safety stock required is 1316 units

If standardized, the safety stock level needed is 1.645 * s_{dl}

Where s_{dl} = **SQRT**(200^2+250^2+150^2+200^2) = **SQRT**(165000) = 406.

Thus, the safety stock needed is 668 units which is about 49% reduction.