Teams

Best Practices

• Use an appropriate stage/gate process
• Simultaneous/concurrent engineering
  – Clear tasks
  – Tasks ordered correctly
• Cross functional teams
Concurrent engineering vs. Cross-function engineering

• Concurrent engineering = design task sequencing
• Cross-functional engineering = who is involved in the design tasks

Cross-functional engineering

• Shortcomings
  – time intensive
  – meeting intensive
• Benefits
  – reduce rework later
  – improve the quality
  – increase the impact of design for manufacturing
    • earlier in design it is easier to change
Functional groups

- Systems engineering
  - in charge of ensuring that the system works together
  - interface design and management
- Marketing
  - Define and explore the market
- Supplier liaisons / Materials
  - Work with and negotiate with suppliers
- Research and Technology
  - bring the new technology up to speed
- Quality
  - in charge of testing and validation of the product

Engineering functions
- Aircraft: structures, electronics, hydraulics, etc.
- Automotive: suspension, body, interior, controls
- Copiers: toner, paper feeds, image processing, etc.
- Manufacturing
  - Tooling designers
  - Assemblers/hourly labor
  - Advanced manufacturing
  - Process designers
- Legal
- Finance

Concurrent and cross-functional categories

<table>
<thead>
<tr>
<th>Concurrent engineering</th>
<th>Sequential</th>
<th>Overlapping</th>
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<td>Functionally oriented</td>
<td>Traditional hand it over the wall</td>
<td>Hand partial information over the wall</td>
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<td>High risk of expensive late design fixes</td>
<td>- Risk of late design fixes</td>
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<td>- Long design cycle</td>
<td>- Risk of design changes affecting downstream tasks</td>
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| Cross-functionally oriented | Long design cycle | Short design cycle |
|                            | Lower risk of expensive design fixes | Lower risk of expensive design fixes |
|                            | - Higher risk of design changes impacting downstream tasks | - Higher risk of design changes impacting downstream tasks |
### Cross-functional product development

IPPD 3/28/00 Teams

- Making decisions with input from multiple inputs
- Different levels of interactions
  - **Highly coupled** - manufacturing has input during the design process
  - **Coupled** - manufacturing and design evaluate designs together (DFM, FMEA)
  - **De-coupled** - functional teams come in to approve or reject current design

### Types of cross-functional work

IPPD 3/28/00 Teams

- sub-system to sub-system
  - Understanding interfaces between sub-systems and functional systems
- sub-system to process
  - Understanding how the product relates to other non-product disciplines
    - manufacturing
    - marketing
    - delivery
Sub-system to sub-system  

- Cross-stream interaction (vs. upstream/downstream interactions)
- Example: Hardware and electronics communication
- Focus on system integration
- Focus on the interfaces between sub-systems

**Work breakdown structure**  

- Product is broken down into sub-systems
- Each sub-system is a “work package” and is assigned to a given group
Design the interfaces to

• Allow for
  – redesign/replacement of functional elements
  – within a set of “rules” that are set by the interfaces between parts
• Enables
  – standard assembly processes
  – rapid redesign and debug

Coupled

• Chunk A must be adjusted if Chunk B is.
• Requires iteration between sub-assembly groups

Uncoupled

• Chunk A and B can be changed independently as long as interfaces are kept the same
• Requires interface standardization agreement between sub-assembly groups
Pimmler and Eppinger - Chunk design

IPPD 3/28/00 Teams

- Sub-systems are highly coupled
  - automotive climate control
- Break the product down into subsystems that reduce the number of cross-chunk interactions

Interactions

- Spatial - do the parts have geometric interactions
- Energy - do the parts share energy or not want to share energy (i.e., thermal etc)
- Information - signals (i.e., EMF)
- Materials - fluid flows etc.
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### Controls

- **Air Contr.**

### Front end

- **Refrigerant**

### Interior Air

- **Sub-system to sub-system**
Sub-system to process interactions

• Upstream/downstream interactions
• I.e., Manufacturing/DFM analyses
• Ensure that the global optimum is achieved
• Difficult because
  – incentives are different
  – time scales are different
  – language/methods are different
• Subject of DFM lecture later in class

Three types of communication

• Coordination
  – technical information transfer
  – task coordination
• Knowledge
  – consultation
  – instruction
• Inspiration
  – motivation
  – managerial affirmation

Morelli, et al. “Predicting technical communication in product dev. Organizations”
Team dilemma

- No clear evidence that cross-functional teams actually improve productivity
  - hard to measure differences
  - no control case
- People know/think it is the “right” thing to do.

Diversity in cross-functional teams

- Diversity
  - increases internal conflict
  - reduces innovation, performance, etc
  - *but*, increases the teams ability to communicate with the outside world
- Companies need to have diversity in their teams to enable higher quality
- To overcome conflict
  - Training and facilitation
  - Rotation of people through groups
  - Management and evaluation - incentives to perform together
  - Large organizational change
Group vs. Team

- **Group**
  - Individual projects with input from other members
  - Incentive structures are external to the group (i.e., functionally oriented)

- **Team**
  - Team has the deliverables and is responsible for the package
  - Incentive structures are internal to the group

Generalists vs. Integrators

- Jack of all trades
- Team members have expertise in many areas
- Allows flexibility in team membership
- Dilutes functional strengths

- Specialists with an understanding of how to integrate their areas with others
- Team members are still experts
Matrix organizations

• Each person is a member of a functional and product team
• Functional heads and product heads

Problems with matrix organizations

• Unclear incentives
  – not sure who your boss is
  – who do you eventually have to satisfy
• Power struggle
  – dual command
• Paralysis of analysis
  – matrix org. ≠ group decision making
  – need a clear leader who makes decisions
Organization types

- functional teams
- lightweight
- heavyweight
- autonomous

Functional teams

- Process
  - Sequential flow
  - Intermediate meetings to hand off work
- Strengths
  - Strong functional capabilities
  - Clear career path
- Weaknesses
  - System integration is difficult
  - System optimization is difficult
Lightweight teams

- **Process**
  - each functional group has a liaison who coordinates the project
  - lead by a lightweight coordinator -- very little status to coordinate

- **Strengths**
  - same as function plus
  - there is some coordination

- **Weaknesses**
  - leader has no power

---

Heavyweight teams

**Process**

- power in project lead

**Strengths**

- cross-coordination

**Weaknesses**

- functional expertise
## Autonomous teams

- **Process**
  - dedicated project team that is outside the regular organizational structure
- **Strengths**
  - autonomous
- **Weaknesses**
  - out of touch with the rest of the organization

## Organizational structures for redesign: Scheme

- Individual projects developed
- Project information given to Lead and assistants
Individual projects in conjunction with production IPT
Project information given to production IPT
IPPD 3/28/00 Teams

- Production IPT Lead and Senior Managers
- QA Liaison
- MFG Liaison
- Individual ENG Project
- Individual MFG Project
- Individual QA Project

Core Team Daily Meetings
Weekly Meetings
Functional Division Communication

Core IPT ENG MFG QA
Japanese vs. US leadership

• Team leader (shusa) controls all aspects of the car
• has ultimate say

• Team leader is a coordinator who coordinates
• Can be overridden

Leadership responsibilities and characteristics in Japan

• coordination for many functional areas
• entire life cycle of the product
• concept creation
• specifications, costs, layout and major components
• design
• customer interaction
• negotiate and decide on conflicts
• understand the whole product and process
Thursday

1) Present the strategy and plan
2) Presentation should focus on the risks and what is your plan to mitigate them

Tues
- The Legal Protection of Intellectual Property (HBS #9-898-230)
- Case: CVD vs. A.S. Markham Corporation (HBS # 9-388-042)