Wrap up lecture

Purpose of the class

- We want to jointly teach you the process of
  - Developing a good product
  - Developing a good business
- Assignments and lectures are coordinated
Enterpreneurship and IPPD

- **Entrepreneurship**
  - seeks to understand how opportunities to bring into existence “future” goods and services are discovered, created, and exploited by whom and with what consequences
  
  *Venkataraman “The distinctive domain of entrepreneurship research”*

- **IPPD**
  - seeks to discover, and create future goods and services

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Our challenge

- All of the material is tightly coupled
- We want to teach you everything twice
- You will see things before you learn them.
Course introduction

Motivation for up-front design

80% of the final cost of the product is set in the first 20% of the design process
To do up-front analysis

- Must understand the downstream impact of decisions
- Must understand the constraints, cost models and requirements of other functional groups
- Need to design for
  - Product customers
  - The customers for your work (manufacturing, sales, marketing, field service)
  - The business you are developing

Definitions of IPPD

- Definitions
  - *Integrated Product and Process*: The tradeoffs and coupling between functional needs (i.e., product and process)
  - *Development*: The tools and methods used throughout the development cycle to enable to identify IPP tradeoffs and make the “best” decisions.
What does IPPD gain you

• Reduced cycle time
  – Move from a sequential process to a simultaneous process
  – Reduced time to integrate the product
• Improved quality
  – Fewer adjustments
  – More manufacturable
  – Less inspection

• Reduced costs
  – Reduced rework, scrap and repair
  – Appropriate selection of manufacturing processes
  – Optimization of the entire product, not individual functions

Understand IPPD and TE

• In product development
  – who to go to talk with
  – what are the key issues
  – what tools to use to make tradeoffs and decisions
  – what are the implications and effects of your decision
  – what are the risks

• Enterpreneurship - what makes a good business
  – appropriability
  – legal issues
  – technology trends
  – issues about new firms
  – customer requirements
Assumptions

• Product development is a process of tradeoffs
  – Every decision made will effect the ability of another member of the PD team to achieve their goals
  – There are tools that can highlight tradeoffs

• Cost is the ultimate metric
• Decisions are made in an environment of uncertainty, the uncertainty results in risk
• Decisions are impacted by
  – technical issues
  – cost impact
  – organizational structure

Products and platforms not parts

• Multiple product
• New technologies
• Pushing the edge of process capability
• Systems integration is hard
  – Many intended interactions
  – Many unintended interactions
• Many people and significant time to develop
**IPPD as risk management**

- Risk is the probability that the outcome you want won’t happen
- Risk mitigation strategies
  - Risk avoidance
  - Risk reduction through
    - information gathering
    - better practice
  - Risk dispersion through
    - avoiding "all of the eggs in one basket"
    - transfer risks to other players

**PD is a resource intensive process**

![Diagram of product realization process](chart.png)

- R&D/New Technology
- Prototyping
- Process Design
- Ramp
- Production
- Delivery
- Use

- Human resources
- Time
- Interest costs
- Opportunity costs

- Profit
- Reusable elements
- Expertise
- Market Share
Tradeoffs

- Equipment costs
- Ergonomics
- Design for repair
- Part costs
- Performance
- Supplier costs
- Prototypes
- Assembly
- Risk
- Reuse
- Platform design
- Design Time
- Safety
- Manufacturing
- Cycle time
- Robustness
- Ramp time
- Logistics
- Yield

Key tradeoffs

Goal is to find creative ways to create *synergies* instead of *tradeoffs*.
Conundrum

• Production
  – “It is just as easy to build a bad product as it is to build a good product” *Deming*
  – Most press on product improvement in production
    • TQM, 6Sigma
  – Benefits immediately seen

• Design
  – It is *much* harder to design a good product than a bad product
  – Don’t see the results for years
  – Never know if it was worth the effort

Lectures and what you should have learned

• Product architecture and variety
  – What is the architecture, how do you select between architectures

• Existence and identification of opportunities (3DP)
  – Asymmetries: Why opportunities arise and why certain people can take advantage of these opportunities
  – What are the issues around taking advantage of opportunities

• Understanding Customer Needs (sweet water)
  – Understand how to elicit and quantify customer needs
  – Understand how to quantify Market Size

• Methods For Managing Customer Needs
  – FMEA and HoQ
  – Benefits and limitations of these methods
Lectures continued

- Target Costing, Pricing And Techniques For Managing Cost (Toyota)
  - What is target costing - why is it important - what skills are involved
- The Evolution of Markets and Patterns of Technology Changes (EMI case)
  - S curves
  - Diffusion
  - Adopter categories
- The Impact Of New Technology On Product Development (Cannon and EMI)
  - Driven by uncertainty
  - Methods to mitigate risks (multiple applications,
- Incumbent Failure And New Firms (continuous casting)
  - Innovator’s dilemma
  - Why large firms can not innovate

- Prototyping (BMW and Team New Zealand)
  - Prototyping categories from conceptual to manufacturing
  - Strategy paralleling development strategy
- Scheduling and concurrent engineering
  - Problems with “Murphy” and overlapping tasks
  - Critical chain scheduling being dependant on resources and time
  - Types of tasks that can be overlapped
- Teams
  - Types of teams
  - Interaction with architecture, product development process
  - Problems and benefits of Teams
- Protecting Intellectual Property (CVD vs. Markam)
  - Patent, Trademark and Copyright - what are the benefits and problems of each
Lectures continued

• Manufacturing Strategy And The Impact Of Design Decisions (ITT automotive)
  – Interaction between manufacturing, delivery, product architecture, quality
  – Copy exactly vs. local optimization

• Appropriability: Profiting From Innovation (Beta golf)
  – License, joint venture, solo venture
  – Complimentary assets and their role in the maturity of the technology
  – Innovator vs. follower

• Make Buy Decisions
  – Supplier Relations
    – Close vs. arm’s length relationships
    – The role of the product feature in the supplier model

Lectures cont.

• Dfx
  – Design for X models and types of tools

• Variation Risk Management, The Role Of Quality
  – What is variation and how should it be managed in the design and production processes

• Conclusion
Thanks!