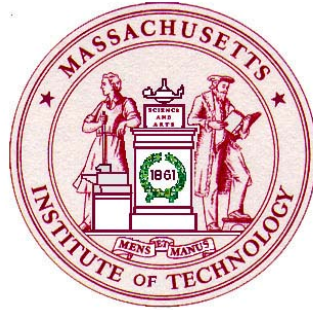


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Systems Ideas in Product Development

Assignment for ESD.83:
Research Seminar in Engineering Systems

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Outline

- Review several models of PD process in literature
- Examine system aspects of PD
- Non-systems ways of doing PD

Product Development (PD) Definition

- PD defined by Ulrich and Eppinger (1995) as “the set of activities beginning with the perception of a market opportunity and ending in the production, sale and delivery of a product”

PD Process as described by Anderson

- Reference: Anderson, D.M. (1997) Agile Product Development for Mass Customization. Chicago, Irwin Professional Publishing
- There are a minimum of 5 phases required of PD, as shown in the table below.

Table 1. Phases of Product Development by Anderson

Phase	Definition
1. Product Definition	Product specifications and resource prioritization
2. Architecture	Simplified concept and optimized architecture including modularity and customization strategies
3. Design	Product/Process design so thorough that the need for prototype testing and pilot production is minimized or eliminated
4. Ramp-up	Smooth introduction into production with rapid volume ramp-up
5. Follow-up	Postmortem to capture lessons learned that can be applied to future projects.

PD Process as described by Wheelwright & Clark

- Reference: Wheelwright, S. and K. Clark (1992) Revolutionizing Product Development. New York, The Free Press.
- Diagram below shows a four phase product development cycle mapped to a 36 month calendar, indicating sequential overlaps between the phases and what activities occur in each phase.

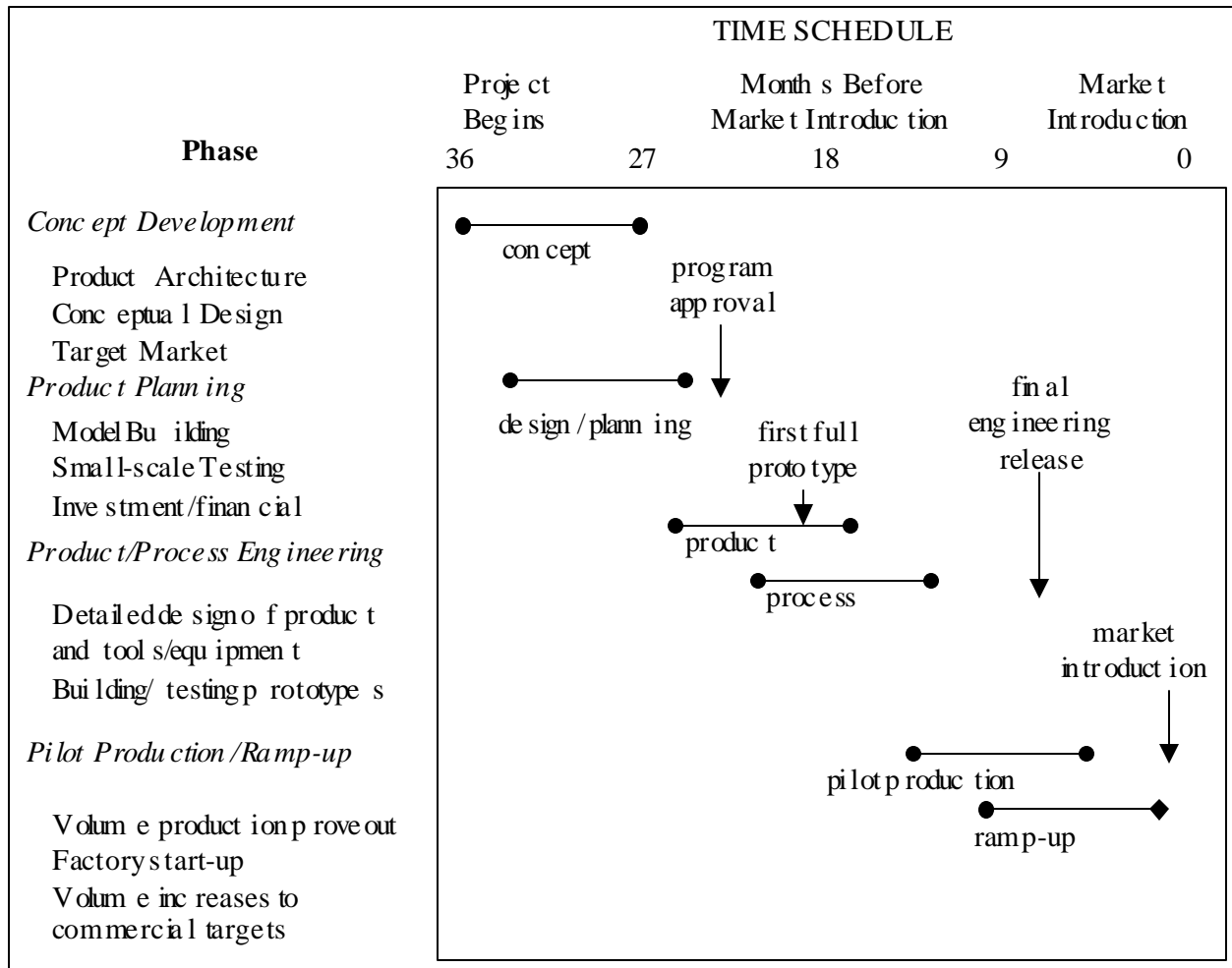


Figure 1. Product Development Process by Wheelwright and Clark.

PD Process as described by Ulrich & Eppinger

- Reference: Ulrich, K. and S. Eppinger (1995) Product Design and Development. New York, McGraw-Hill, Inc.
- Ulrich and Eppinger's generic model of PD contains 5 phases as shown in the diagram below:
 1. Concept Development
 2. System-Level Design
 3. Detail Design
 4. Testing and Refinement
 5. Production Ramp-up
- Marketing, Design and Manufacturing activities are detailed in each phase

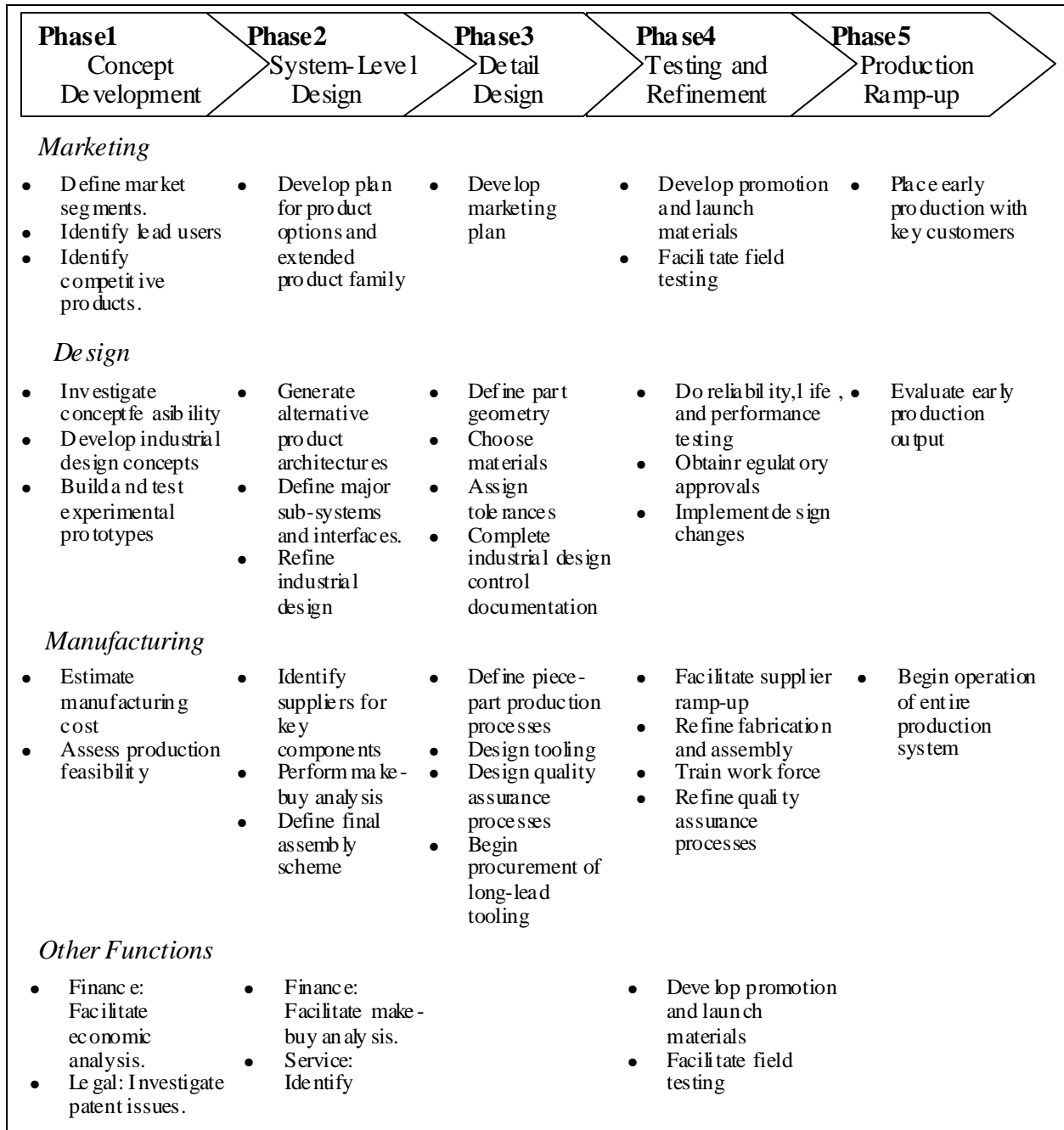


Figure 2. Product Development Process by Ulrich and Eppinger.

PD Process as described by Clark & Fujimoto

- Reference: Clark, K. and T. Fujimoto (1991) Product Development Performance. Boston, MA, Harvard Business School Press.
- Clark and Fujimoto model of PD process contains four major developmental stages as shown in the diagram below:

1. Concept Generation
 2. Product Planning
 3. Product Engineering
 4. Process Engineering
- Process has loops and other non-linear features

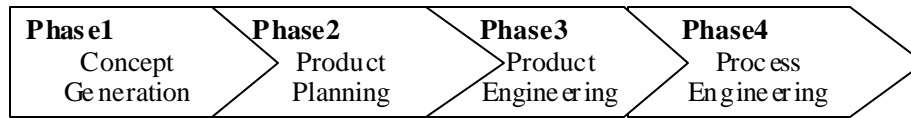


Figure 3. Product Development Process by Clark and Fujimoto.

Systems Aspects of PD

Several systems knowledge domains contribute various concepts to PD:

- Systems Engineering
 1. Requirements flowdown
 2. Concept generation and evaluation
 3. Trades process
- Systems Architecture
 1. Top-level systems perspective
 2. Interactions with “environment”
- Systems Analysis
 1. Market analysis
 2. Cost analysis

Non-Systems Ways to do PD

- Have less or no concern for:
 1. Interactions
 2. Upgrades
 3. Changes
 4. Maintenance
 5. Customer needs
- Don't integrate various parts of PD (marketing, design, manufacturing)
- Take narrow view of the product

Future Research for PD Area

- Reduce PD cycle time
- Effectively integrate PD team organization
- Applying lean principles to PD