The Role of Axiomatic Design in Business Innovation
And Lean Product Development

Dr. Kai Yang
Professor
Industrial and Manufacturing Engineering
Wayne State University, Detroit, Michigan

Two other books on the works:


2. «Cost Based Tolerance Design »
CONTENTS

- DFSS-Innovation and Value Creation
- TRIZ, AD and Innovation
- Product Development Process and AD
- Lean Product Development-Toyota
- The Future of Axiomatic Design
Innovation and Value Creation

Success Factors for every company:

\[ \text{Profit} = \text{Revenue} - \text{Cost} \]
Value Creation Map

Innovation Map

- Type of Product Development
  - Technology/Innovation Push
  - Customer/Market Pull
- Creativity/Ideas generation: driver for technology push
- Customer centric innovation:
  - Identify hidden unmet needs
  - Identify customer value
  - Make creative ideas to commercial success
  - Deliver better business processes
- Make creative ideas/customer centric innovation into quality products
  - Lean Product Development
  - Robust design
  - Product development Kaizan cycles
TRIZ, Axiomatic Design and Creativity

- TRIZ, Axiomatic Design are close relatives
- TRIZ makes Samsung to be more R&D Competitive and to surpass Sony (Fortune)
- There is increasing usage of AD to bring Breakthrough designs

Axiomatic Design and Voice of Customer

Customer Attributes  Functional Requirements  Design Parameters  Process Variables

Physical Mapping  Process Mapping

Y=f(x)  Y=f(x)
Product Development Process and Axiomatic Design

PD Performance Metrics

• Product Design Quality

• Product Development Lead Time (Concept to launch)

• Product Productivity (Engineering hours, concept to launch)

(Clark and Fujimoto 1991)

Axiomatic Design Practices

• Independence Axiom: Maintain independent Functional Requirements and Design Parameters

Implications
• Encourages modular design practices
• Maintain parametric independence within modules

Benefits
Parallel developments and testing
Much easier for engineering change
Information Axiom

---Minimize the information content in designs

Implication – Lean Product

Reducing Design complexity by:

• Reducing unnecessary product functions and parts
• Loosening up unreasonable tolerances
• Using standard/out of shelf parts
• Controlling technical immaturity
• Avoiding complicated user/operator requirements
• Avoiding complicated interface requirements

---Minimize the information content in designs

Nature of Product Development

Information (knowledge) creation (Reinertsen 1997)

\[ I = \ln \left( \frac{1}{p} \right) \]

I: Information contents

\[ I_{Test} = P_{Failure} (I_{Failure}) + P_{Pass} \sin g (I_{Pass} \sin g) \]

Keys for Success in PD Process

• Maximize Information Creation Speed
• Increase Information Flow
• Minimize information contents in each product
Information also has time value

The earlier we get the information, the more valuable

- In general, we want to get information as early as possible (Small scale early tests, robust technology development)

- We want to get the more critical information earlier than Non-critical information

(Task sequencing)
One shot, unilateral transfer of complete blueprints

High bandwidth transmission of design information

Fragmented release of preliminary information

Design for manufacturing

Information exchange prior to problem solving cycles
13 Principles of Lean Product Development (Toyota)

Principle 2: Front-load the product development process

Set-based Concurrent Engineering

Evaluate against threats and each other
Eliminate weak
Add knowledge
Combine in different ways

AD Implication: Generate information earlier
Principle 3: Create Leveled Product Development Process Flow

• Synchronize activities across function
• Level the work load, no idle, no overload
• Create steady speed job flow for design engineers
• Stagger the release of data from one function to the next

AD Implication

Minimize the Product Development Process Complexity
By minimizing variation in job flow, workload, and Information flow

Principle 4: Utilizing Rigorous Standardization to Reduce Variation Variation and Create Flexibility and Predictable Outcomes

• Design standardization:
  engineering checklist, standard architecture, share common Components

• Process standardization
  Standardizing common tasks, sequence of tasks and task duration

• Skill Set standardization
  Standardized skill inventories

AD Implication

Minimize the Product design complexity, process complexity, and Engineers communication complexity by standardization
**Principle 11: Adapt Technology to fit People and Process**

- Integrate new technology seamlessly into existing technologies And lean product development system before using it
- Use the technology to support the lean product development Process. Not to drive it
- Technology should enhance people, not replace them
- Right size, not king sized

**AD Implication**
Streamline and simplify the overall people/technology/process

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**Principle 12: Align your organization through simple, visual Communications**

**Principle 13: Use powerful tools for standardization and organizational learning**

And many others

**AD: Information Axioms**
The Future of Axiomatic Design

Axiomatic Design

TRIZ