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

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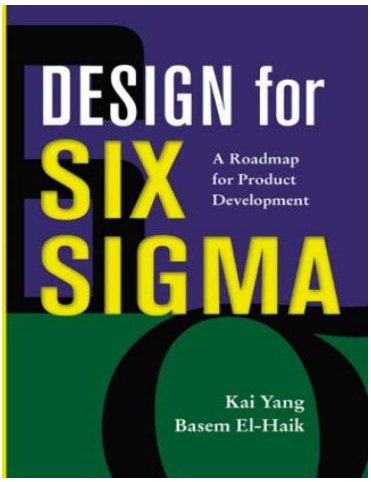
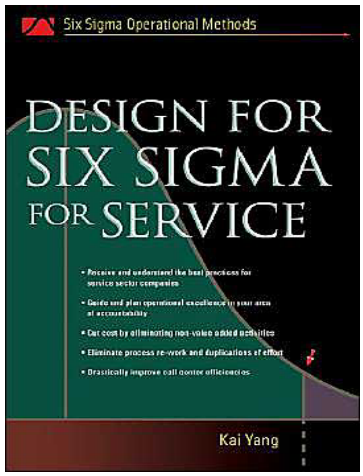
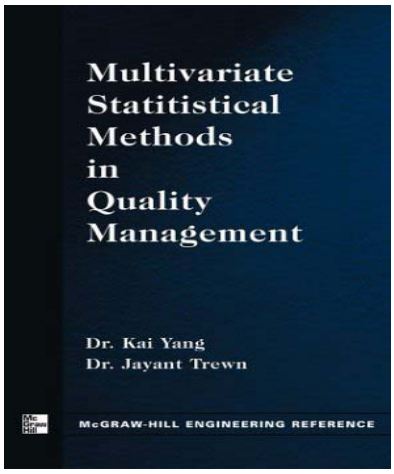


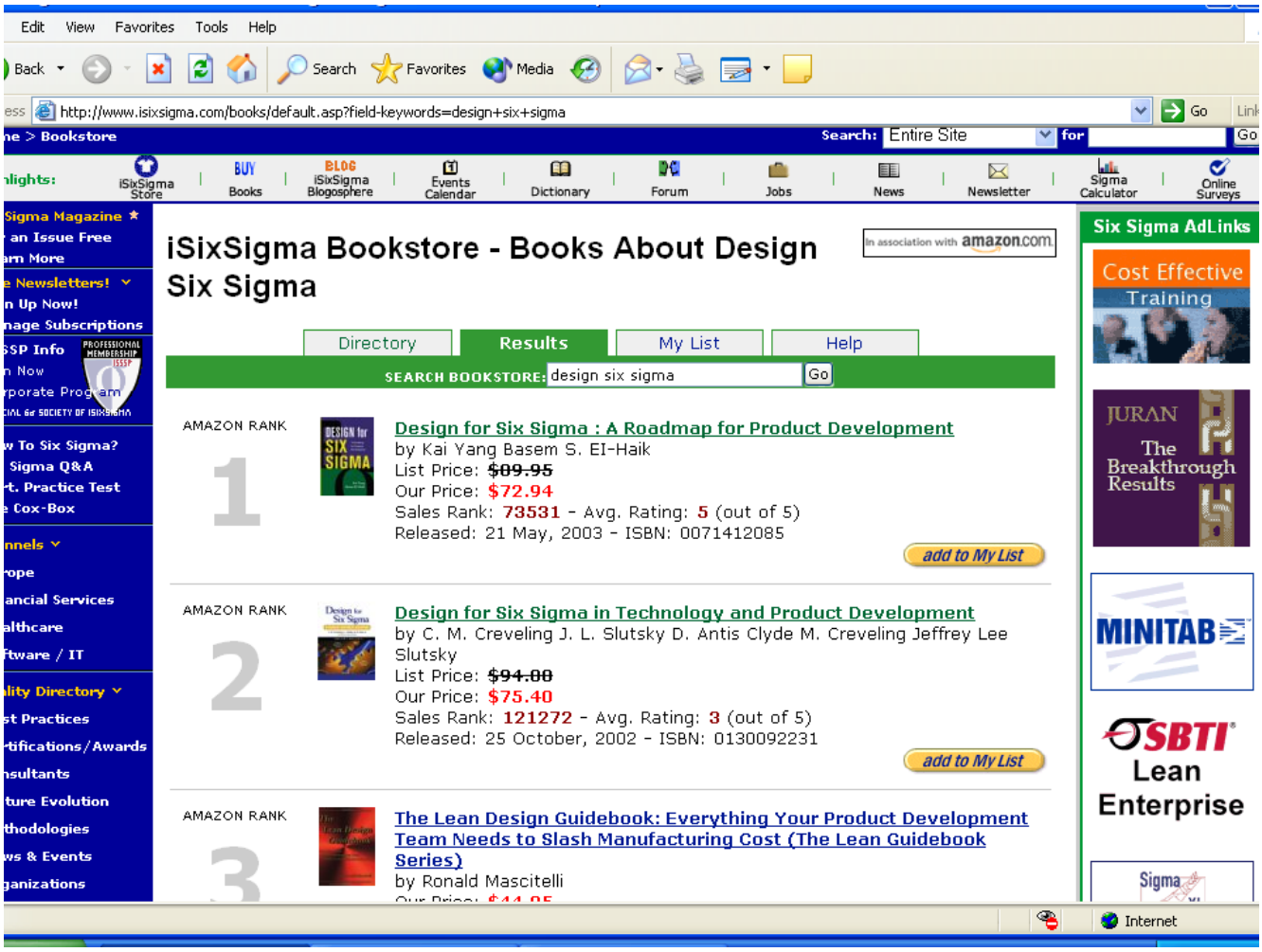




## Two other books on the works:

1. « Voice of Customer: A Roadmap for Value Creation in product Development Process »

2. 《Cost Based Tolerance Design 》




# CONTENTS

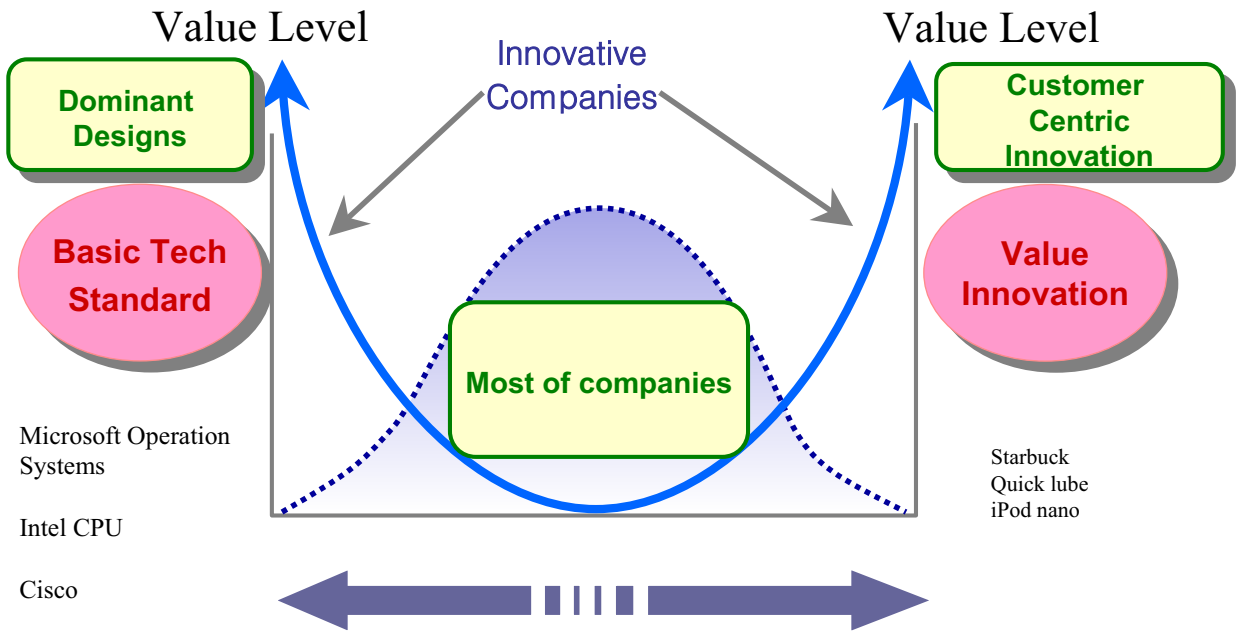
- **DFSS-Innovation and Value Creation**
- **TRIZ, AD and Innovation**
- **Product Development Process and AD**
- **Lean Product Development-Toyota**
- **The Future of Axiomatic Design**

# Innovation and Value Creation

**Success Factors for every company:**

**Profit = Revenue - Cost**

# Value Creation Map






# Innovation Map

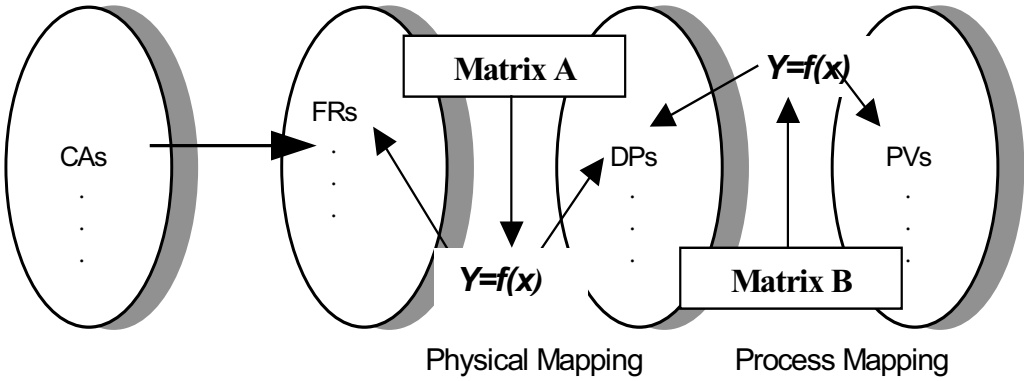
- **Type of Product Development**
  - **Technology/Innovation Push**
  - **Customer/Market Pull**
- **Creativity/Ideas generation: driver for technology push**
- **Customer centric innovation:**
  - **Identify hidden unmet needs**
  - **Identify customer value**
  - **Make creative ideas to commercial 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 |
|---|---|---|---|

# 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**



# Nature of Product Development

**Information (knowledge) creation (Reinertsen 1997)**

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

**I: Information contents**

$$I_{Test} = P_{Failure}\,(I_{Failure}) + P_{Pas\,sin\,g}\,(I_{Pas\,sin\,g})$$

## 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**

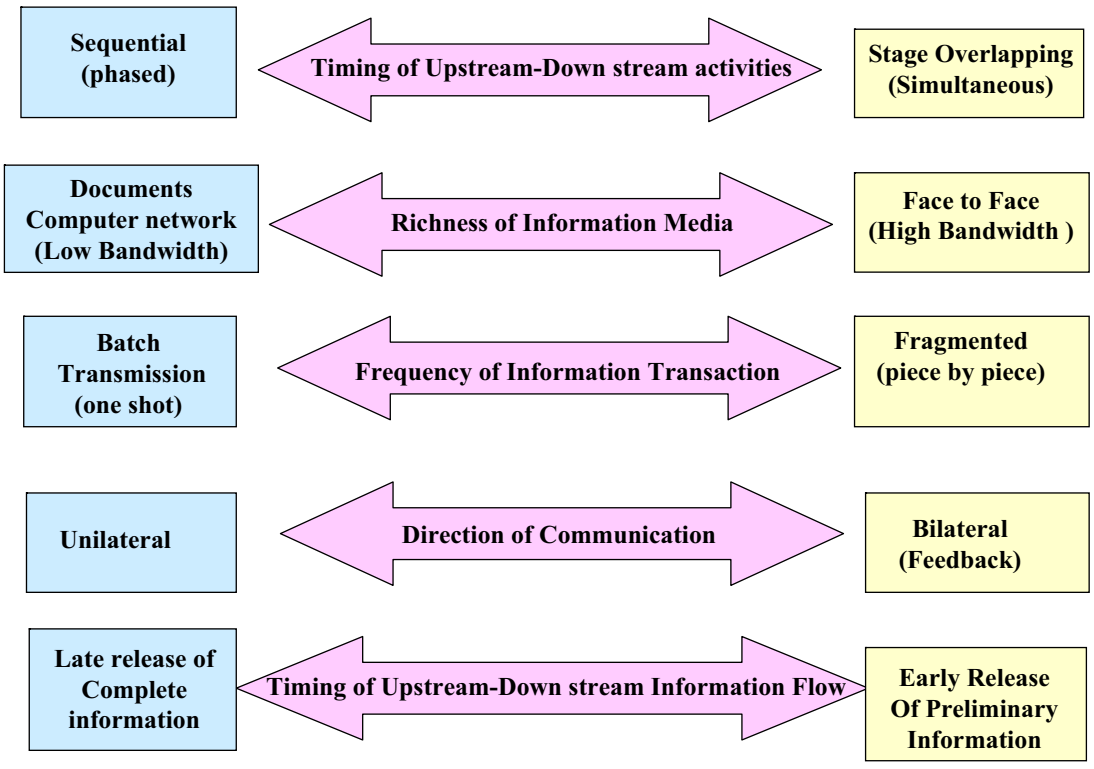
**• In general, we want to get information as early as possible (Small scale early tests, robust technology development)**

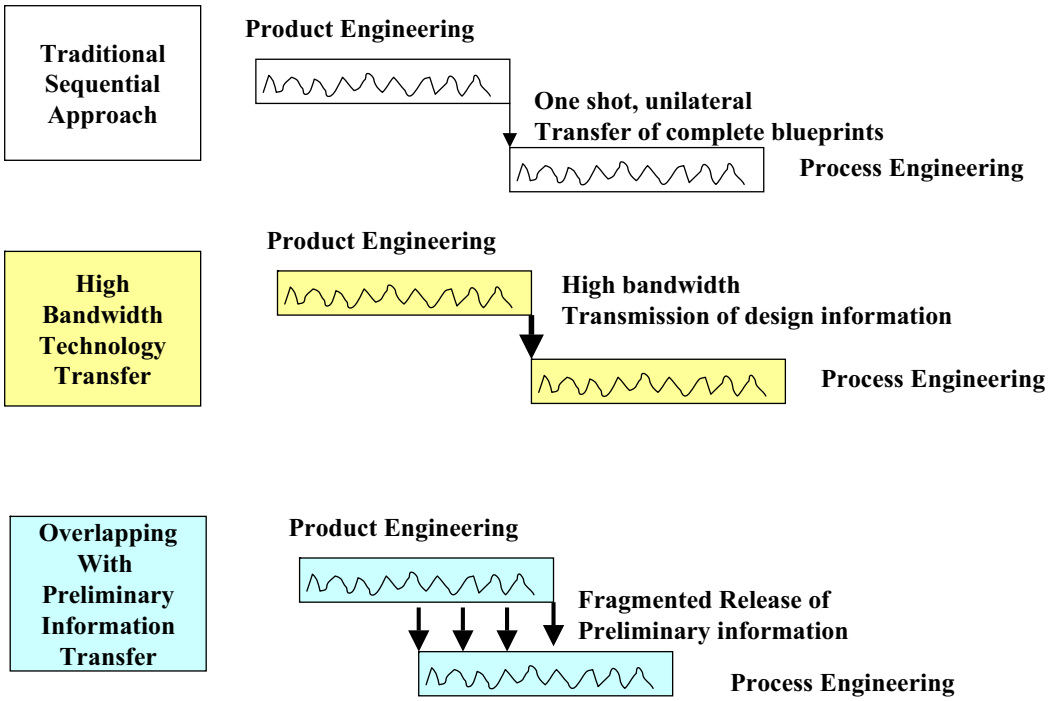
**• We want to get the more critical information earlier than Non-critical information**

**(Task sequencing)**

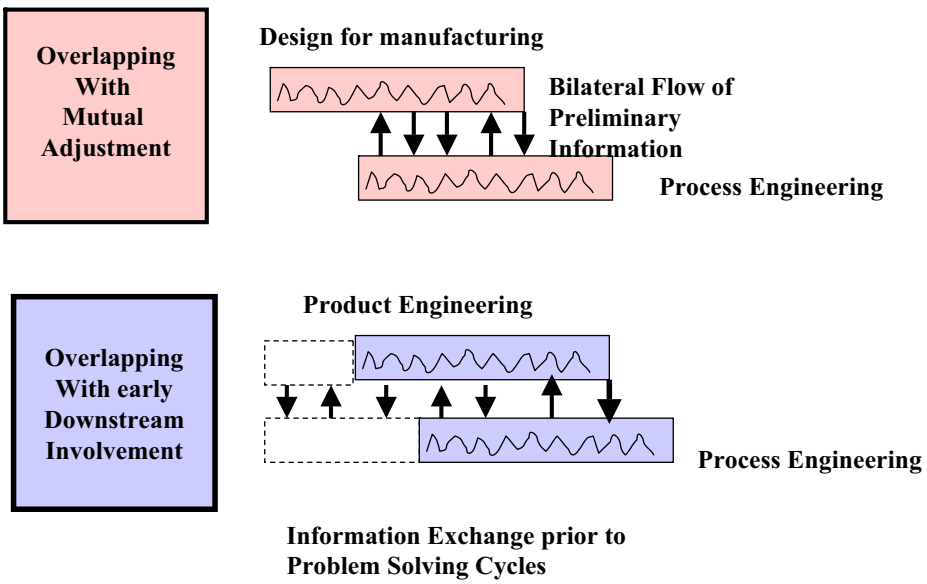


# Information Flow Quality




Traditional Sequential Approach
Product Engineering
One shot, unilateral
Transfer of complete blueprints
Process Engineering
High Bandwidth Technology Transfer
Product Engineering
High bandwidth
Transmission of design information
Process Engineering
Overlapping With Preliminary Information Transfer
Product Engineering
Fragmented Release of
Preliminary information
Process Engineering




Overlapping With Mutual Adjustment
Design for manufacturing
Bilateral Flow of
Preliminary
Information
Process Engineering
Overlapping With early Downstream Involvement
Product Engineering
Process Engineering
Information Exchange prior to
Problem Solving Cycles

# 13 Principles ofLean Product Development (Toyota)

5. Develop a Chief Engineer System to Integrate Development from Start to Finish.
6. Organize to Balance Functional Expertise and Cross-functional Integration.
7. Develop Towering Technical Competence in all Engineers.
8. Fully Integrate Suppliers into the Product Development System.
9. Build in Learning and Continuous Improvement.
10. Build a Culture to Support Excellence and Relentless Improvement.

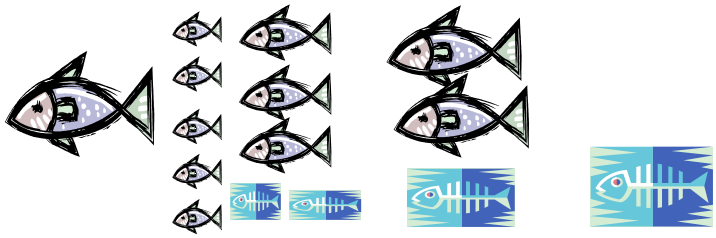

11. Adapt Technology to Fit your People and Process.
12. Align your Organization through Simple, Visual Communication.
13. Use Powerful Tools for Standardization and Organizational Learning.

1. Establish Customer-Defined Value to Separate Value-Added from Waste.
2. Front-Load the Product Development Process to Explore Thoroughly Alternative Solutions while there is Maximum Design Space.
3. Create a Leveled Product Development Process Flow.
4. Utilize Rigorous Standardization to Reduce Variation, and Create Flexibility and Predictable Outcomes.

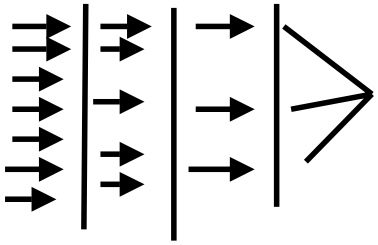
**(Jeff Liker)**



## 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 stead 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**



## 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