Value Chain Dynamics: Business and Supply Chain Strategy in a Fast-Clockspeed World

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## Supply Chains and Value Chains

### Supply Chain Management

- **Order fulfillment**
  - Inventory
  - Quality, cost & service
  - Flexibility
  - Response times
  - Logistics
  - Distribution
  - Procurement
  - Forecasting
  - Transportation

"The Physics of Flow"

### Value Chain Design

#### System Design

**Static**

- Core competences
- Make/Buy
- Relationship Design
- Strategic Intent

**Dynamic**

- Fast Clockspeed
- External Forces
- Disintegration
- Dependence
- Capability development
- Disintermediation

"The Biology of Evolution"
The Three Chains of Enterprise Design:
Fulfillment, Development, & Capability Chains

- **Fulfillment Supply Chain**
  - Supply
  - Produce
  - Distribute
  - Sell
  - Customer

- **Development Chain**
  - 3-D Concurrent Engineering
  - Design
  - Develop
  - Launch

- **Capability Supply Chain**
  - Supply
3-D Concurrent Engineering & the imperative of concurrency

**Product** (or Service)
- Detailed Design
- Product/ System Architecture
- Modular/ Integral Life Cycles

**Process** (for production & delivery)
- Unit Processes
- Technology Equipment
- Production System
- Objectives
- Systems
- People
- Capacity

**Value Chain** (Partners/Suppliers)
- Value Chain Architecture
- Sourcing
- Selection
- Relationship

**Fulfillment Architecture Technology**
- Logistics & Coord System
- Information Inventory Integration
- Development & Capab. Chains
- Fulfillment Supply Chain
“Gear Model” to support Roadmapping of Value Chain Dynamics (VCD)

Corporate Strategy Dynamics
Customer Preference Dynamics
Technology & Innovation Dynamics
Regulatory Policy Dynamics
Industry Structure Dynamics
Capital Market Dynamics
Business Cycle Dynamics

Gears differ by size/speed
Each has an engine & clutch
MANUFACTURING STRATEGY FORMULATION

1. DRAFT MISSION STATEMENT (ADVISED BY BENCHMARKS)

2. SET OPERATING OBJECTIVES

   --QUALITY
   --COST
   --LEAD TIMES
   --FLEXIBILITY
   --CUSTOMER SATISFACTION
   --INNOVATIVENESS

3. DEVELOP POLICIES & INVESTMENTS

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<th>INFRASTRUCTURAL</th>
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# Major Manufacturing Decision Categories

1. **FACILITIES**
   - size
   - location
   - focus

2. **CAPACITY**
   - amount
   - timing
   - type

3. **VERTICAL INTEGRATION AND SUPPLIER MANAGEMENT**
   - direction
   - extent
   - interfaces
   - collaboration

4. **PRODUCTION TECHNOLOGIES AND PROCESSES**
   - equipment
   - automation
   - interconnectedness
   - scale
   - flexibility

5. **WORK FORCE AND MANAGEMENT**
   - wage policies
   - security
   - skill levels

6. **INFORMATION TECHNOLOGIES**
   - use and level of investment
   - parity or differentiation

7. **SUPPLY CHAIN AND MATERIALS**
   - logistics facilities and methods
   - inventory policies
   - vendor relations
   - production planning

8. **ORGANIZATION AND INCENTIVES**
   - structure
   - reporting levels
   - degree of centralization
   - role of staff
   - control/reward systems
   - costing systems

9. **BUSINESS PROCESSES**
   - product generation
     - interfaces
     - responsibilities
     - vendor development
   - order fulfillment
   - service and support
   - quality management, flexibility, and other cross-cutting capabilities
SAMPLE MANUFACTURING STRATEGY TEXT

MANUFACTURING VISION

MANUFACTURE WORLD-CLASS QUALITY AUTO COMPONENTS IN THE PRESCRIBED VOLUMES, ON SCHEDULE, AT THE LOWEST COST

MANUFACTURING MISSION

ACHIEVE WORLD-CLASS STATUS (BY THE YEAR 20xx) IN QUALITY COST, TIME, AND FLEXIBILITY WITH PEOPLE WHO HAVE A SHARED VISION AND OBJECTIVES THAT ARE BASED ON A CULTURE OF CONTINUOUS PROCESS IMPROVEMENT

PERFORMANCE METRICS

1. QUALITY: PRODUCT & PROCESS
2. COST/PRODUCTIVITY
3. TIME
4. FLEXIBILITY
### Processes

- Technology
- Capability
- Control
- Flexibility
- STD. OPER. PROCS.

### People

- Skills, Training, Hiring Practices
- Knowledge, Expertise, Empowerment
- Partnership w/ Accountability
- Flexibility
- Environment

### Value Chain

#### Internal

- Procurement/Supply
- Engineering
- Marketing/Sales
- Design Office
- Finance
- Labor Relations

#### External

- World-Class Benchmarks
- Customers & Dealers
- Suppliers
- Government
- Universities
Value Chain Dynamics as an Operations Strategy Lens

Outsourcing Traps (motivating strategic value chain design)

Value Chain Architectures (refining strategic value chain design)

Value Chain Roadmapping (implementing strategic value chain design)

Corporate Personal

National

Integral vs. Modular (Commercial Aircraft)

Open vs. Closed (Communications)

Technology Dynamics

Policy Dynamics

Business Dynamics
“Gear Model” to support Roadmapping of Value Chain Dynamics (VCD)

Corporate Strategy Dynamics
Customer Preference Dynamics
Technology & Innovation Dynamics
Regulatory Policy Dynamics
Industry Structure Dynamics
Business Cycle Dynamics

Interdependent sectors represented as intermeshed gears
The Strategic Impact of Value Chain Design:

(Who let Intel Inside?)

1980: IBM designs a product, a process, & a value chain

Consumers/ Users  Distribution Channel(s)  OEM  Subsystem Suppliers

IBM

Intel

Microsoft

The Outcome:

A phenomenally successful product design
A disastrous value chain design (for IBM)
LESSONS FROM A FRUIT FLY: 
THE PERSONAL COMPUTER

1. BEWARE OF *INTEL INSIDE*. 
(Regardless of your industry)

2. TACTICAL MAKE/BUY: 
IT MAY BE A LITTLE BIT *CHEAPER* OR *FASTER* 
TO OUTSOURCE VERSUS INSOURCE.

3. STRATEGIC SOURCING: 
*VALUE CHAIN DESIGN* CAN DETERMINE 
THE FATE OF COMPANIES AND INDUSTRIES, 
AND OF PROFIT AND POWER.

4. THE LOCUS OF *VALUE CHAIN CONTROL* 
CAN SHIFT IN UNPREDICTABLE WAYS.
Vertical Industry Structure with *Integral* Product/System Architecture

Computer Industry Structure, 1975-85

- **IBM**
  - Microprocessors
  - Operating Systems
  - Peripherals
  - Applications Software
  - Network Services
  - Assembled Hardware
  - All Products

- **DEC**
  - All Products

- **BUNCH**
  - All Products

(A. Grove, Intel; and Farrell, Hunter & Saloner, Stanford)
Horizontal Industry Structure with *Modular* Product/System Architecture

Computer Industry Structure, 1985-95

<table>
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<th>Moto</th>
<th>AMD</th>
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<td>Mac</td>
<td>Unix</td>
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<tr>
<td>Peripherals</td>
<td>HP</td>
<td>Epson</td>
<td>Seagate</td>
<td>etc</td>
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<tr>
<td>Applications Software</td>
<td>Microsoft</td>
<td>Lotus</td>
<td>Novell</td>
<td>etc</td>
</tr>
<tr>
<td>Network Services</td>
<td>AOL/Netscape</td>
<td>Microsoft</td>
<td>EDS</td>
<td>etc</td>
</tr>
<tr>
<td>Assembled Hardware</td>
<td>HP</td>
<td>Compaq</td>
<td>IBM</td>
<td>Dell</td>
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</table>

(A. Grove, Intel; and Farrell, Hunter & Saloner, Stanford)
THE DYNAMICS OF PRODUCT ARCHITECTURE, STANDARDS, AND VALUE CHAIN STRUCTURE: “THE DOUBLE HELIX”

Examples: IBM, Autos, Embraer/Boeing, Nokia, Small Firms

Fine & Whitney, “Is the Make/Buy Decision Process a Core Competence?”
What Drives Clockspeeds?

- technology/innovation push, customer pull, system complexity, and regulation

- Consumer
- Handset or PC Applications
- Handset or PC Platforms
- Communications Equipment and Networks
- Semiconductor Components
- Semiconductor Manufacturing Equipment
ALL COMPETITIVE Advantage IS TEMPORARY

**Autos:**

**Computing:**

**World Dominion:**
*Greece* in 500 BC, *Rome* in 100AD, *G.B.* in 1800

**Sports:**

*The faster the clockspeed, the shorter the reign*
Value Chain Evolution in a Fast-Clockspeed World: Study the Industry Fruitflies

**Evolution in the natural world:**
- **FRUITFLIES** evolve faster than **MAMMALS**
- **MAMMALS** evolve faster than **REPTILES**

**THE KEY TOOL:**
- Cross-SPECIES Benchmarking of Dynamic Forces

**Evolution in the industrial world:**
- INFOTAINMENT is faster than **MICROCHIPS**
- **MICROCHIPS** evolve faster than **AUTOS**
- **AUTOS** evolve faster than **AIRCRAFT**
- **AIRCRAFT** evolve faster than **MINERAL EXTRACTION**

**THE KEY TOOL:**
- Cross-INDUSTRY Benchmarking of Dynamic Forces
“Gear Model” to support Roadmapping of Value Chain Dynamics (VCD)

Interdependent sectors represented as intermeshed gears
Innovation along the Value Chain: How (& why) do Autos & Electronics Differ?

AUTOS

Add-ons: Minivan, SUV, Crossover
Internet: iPod, X-Box, Palm, Office, Digital Photog.

ELECTRONICS

Napster, Apple I
Amazon, Dell

Sales/Marketing /Distribution

Consumers/ Users

Product Concept

Production

Subsystem Suppliers

Core Technology Suppliers

Lean Production

Hybrid Engine, Active Suspension

Aluminum Bonding, Carbon Fiber, CAD tools

Contract Manufacturing

Html C++

Microprocessor, Hard disk drive, Photolithography
Innovation Dynamics can be **RADICAL** *(disruptive)* or **INCREMENTAL** *(sustaining)*

**Maturity**

- How to measure performance?
- How to know where you are on the "S"?
- Where in the value chain?
- Worse before better?
Disruptive Process Innovation in Autos vs. Disruptive Product Innovation in Electronics

In Electronics:
- Vacuum tubes to IC’s
- Mainframes to PC’s
- Chemical to Digital Photography
- Wire-line to Wireless Telephony

Process Innovators:
- Ford
- Dell
- Wal-mart
- Southwest Air
- Toyota
THE CASE OF APPLE iPod/iPhone

Creative Artists

Content Publishers

Content Marketing

Content Sales

Content Distrib.

Content & HW Consumption

Applications

Closed to non-Apple apps; then explosive App Store Growth

Content

Closed to all but one carrier per region; slowly opening

Networks

Closed to non-MP3, non-Apple formats

iTunes Retail Stores

Listening accessories

Open, then license

App Stores

iTunes homepage

iTunes

iTunes
What makes an innovation disruptive?

**Performance Push**
an overwhelmingly superior technology/process
(pancillin, mass production)

**Customer Pull**
new customers care about different measures of performance
(wireless phones, personal computers)

**Organizational Competencies**
incumbents cannot do what the innovators can
(Dell supply chain, Southwest Air)
"Gear Model" to support Roadmapping of Value Chain Dynamics (VCD)

Interdependent sectors represented as intermeshed gears
CUSTOMER PREFERENCE DYNAMICS:
P&G Value Proposition:
Premium Products at Premium Prices

Controlling the Channel Through Closeness to Customers: consumer research, pricing, promotion, product development

Customers

Retailer

Retailer

Retailer

P&G

What is the role of brand names vs. product features?
Laundry Detergent; Mobile Phones; Motorcycles
CUSTOMER PREFERENCE DYNAMICS:
Walmart Value Proposition:
Large Selection of Products at Very Low Prices

Controlling the Channel Through Closeness to Customers: Chain Proximity

Vertical Growth on the Double Helix
Brand vs. Brand vs. Channel vs Channel: Competing on fast-clockspeed retail

Consumers

Walmart

Best Buy

Sony

Samsung
“Gear Model” to support Roadmapping of Value Chain Dynamics (VCD)

Interdependent sectors represented as intermeshed gears
Cisco’s End-to-End Integration for its Fulfillment Supply Chain

Customers
Cisco
Contract Manufacturers
Component Suppliers & Distributors

Early investment in logistics supplier partnerships for speed and accuracy of product flow

Early investment in Internet based communication for speed and accuracy of order information
Cisco’s Strategy for Technology Supply Chain Design (I.e., Capabilities)

1. Integrate technology around the router to be a communications network provider.
2. Leverage acquired technology with - sales muscle and reach - end-to-end IT - outsourced manufacturing - market growth
3. Leverage venture capital to supply R&D

Basic Design Principle: Acquisition Relationship with Technology Chain Partners
Volatility Amplification in the Supply Chain: "The Bullwhip Effect"

Information lags
Delivery lags
Over- and underordering
Misperceptions of feedback
Lumpiness in ordering
Chain accumulations

SOLUTIONS:
Countercyclical Markets
Countercyclical Technologies
Collaborative channel mgmt.
(Cincinnati Milacron & Boeing)
Supply Chain Volatility Amplification: Machine Tools at the tip of the Bullwhip

“We are experiencing a 100-year flood.” J. Chambers, 4/16/01

Volatility in the Electronics & Semiconductors Supply Chain

Yearly data showing trends in worldwide semiconductor manufacturing equipment sales, worldwide semiconductor shipments, and GDP over various years from 1961 to 2011.
LESSONS FROM A FRUIT FLY: 
**CISCO SYSTEMS**

1. KNOW YOUR LOCATION IN THE VALUE CHAIN
2. UNDERSTAND THE DYNAMICS OF VALUE CHAIN FLUCTUATIONS
3. THINK CAREFULLY ABOUT THE ROLE OF VERTICAL COLLABORATIVE RELATIONSHIPS
4. INFORMATION AND LOGISTICS SPEED DO NOT REPEAL BUSINESS CYCLES OR THE BULLWHIP.

**Bonus Question:**
How does clockspeed impact volatility?
INDUSTRY CLOCKSPREAD IS A COMPOSITE: OF PRODUCT, PROCESS, AND ORGANIZATIONAL CLOCKSPREADS

Mobile Phone INDUSTRY CLOCKSPREAD

THE Mobile Phone product technology

THE Mobile Phone PRODUCTION PROCESS process technology

THE Mobile Phone MANUFACTURING COMPANY organization
Mobile Phone System CLOCKSPEED is a mix of Transmission Standards, Software and Handsets

ISSUE: THE FIRMS THAT ARE FORCED TO RUN AT THE FASTEST CLOCKSPEED ARE THE MOST LIKELY TO STAY AHEAD OF THE GAME.
**Automobile** CLOCKSPED IS A MIX OF ENGINE, BODY & ELECTRONICS

**ISSUE:** MOST AUTO FIRMS OPERATE AT ENGINE OR BODY CLOCKSPEDS; IN THE FUTURE THEY WILL NEED TO RUN AT ELECTRONICS CLOCKSPED.
“Gear Model” to support Roadmapping of Value Chain Dynamics (VCD)

Interdependent sectors represented as intermeshed gears

- Corporate Strategy Dynamics
- Regulatory Policy Dynamics
- Industry Structure Dynamics
- Technology & Innovation Dynamics
- Customer Preference Dynamics
- Capital Market Dynamics
- Business Cycle Dynamics
Projects, Strategy, and Value Chains
Clockspeed drives
Business Strategy Cadence

CAPABILITIES enable & constrain PROJECTS;
PROJECTS build CAPABILITIES

CORE CAPABILITIES

PROJECT DESIGN
(New projects, new processes, new suppliers)

Leonard-Barton, Wellsprings of Knowledge
Projects Serve Three Masters: Capabilities, Customers, & Corporate Profit

- Core Capabilities
- Project Design (New products, new processes, new suppliers)
- Customer Value Proposition
- Corporate Value Proposition
VALUE CHAIN DESIGN:
Three Components

1. Insourcing/OutSourcing
(The Make/Buy or Vertical Integration Decision)

2. Partner Selection
(Choice of suppliers and partners for the chain)

3. The Contractual Relationship
(Arm’s length, joint venture, long-term contract, strategic alliance, equity participation, etc.)
3-D Concurrent Engineering & the imperative of concurrency

**Product**
(or Service)

- Detailed Design
- Specs
- Materials Functions

**Process**
(for production & delivery)

- Product/ System Architecture
- Modular/ Integral Life Cycles
- Unit Processes
- Technology Equipment
- Production System Objectives
- Systems People Capacity

**Value Chain**
(Partners/Suppliers)

- Value Chain Architecture
- Sourcing Selection Relationship

**Fulfillment Architecture Technology**

- Logistics & Coord System
- Information Inventory Integration
- Development & Capab. Chains
- Fulfillment Supply Chain
IMPLEMENTATION OF PROJECT DESIGN: FRAME IT AS 3-D CONCURRENT ENGINEERING
Do you have to think strategically about every project?

- CORE CAPABILITIES
- PROJECT DESIGN (New products, new processes, new suppliers)
- CUSTOMER VALUE PROPOSITION
- CORPORATE VALUE PROPOSITION
ARCHITECTURES IN 3-D

INTEGRALITY VS. MODULARITY

**Integral product architectures** feature close coupling among the elements
- Elements perform many functions
- Elements are in close spatial proximity
- Elements are tightly synchronized
  - Ex: jet engine, airplane wing, microprocessor

**Modular product architectures** feature separation among the elements
- Elements are interchangeable
- Elements are individually upgradeable
- Element interfaces are standardized
- System failures can be localized
  - Ex: stereo system, desktop PC, bicycle
Integral value-chain architecture features close proximity among its elements
- Proximity metrics: Geographic, Organizational Cultural, Electronic
- Example: Toyota city
- Example: Ma Bell (AT&T in New Jersey)
- Example: IBM mainframes & Hudson River Valley

Modular value-chain architecture features multiple, interchangeable supplier and standard interfaces
- Example: Garment industry
- Example: PC industry
- Example: General Motors’ global sourcing
- Example: Telephones and telephone service
ALIGN ARCHITECTURES ACROSS SYSTEMS AND VALUE CHAINS

SUPPLY CHAIN / VALUE CHAIN ARCHITECTURE
(Geographic, Organizational, Cultural, Electronic proximity)

INTEGRAL ─── MODULAR

<table>
<thead>
<tr>
<th>INTEGRAL</th>
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<td>Chrysler (90’s) Nokia</td>
<td>Polaroid</td>
</tr>
<tr>
<td>Digital Rights/ Music Distribution</td>
<td>Cisco</td>
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<td>Dell PC’s Bicycles</td>
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TPS Dynamics between Continuous Improvement & Respect for People (Stakeholders)

Motivated People Drive faster Improvement

Continuous Improvement

Respect For People

Profits get shared to reward and incentivize alignment
The Evolution of Business Ecosystems

Operations (or “quantity”) Loop

Ted Piepenbrock, MIT

Modular Enterprises

Integral Enterprises

which drive...

Competitive Dynamics

Maximization of Shareholder Value

Maximization of Stakeholder Surplus

Enterprise Architectural Forms

which generates...

Firm Long-Term Performance

which shapes...

Enterprise Dynamic

which creates...

Growing Markets (Economies of Scale)

Stable Markets (Economies of Scope)

Carrying Capacity (e.g. Global GDP)

1900 1925 1950 1975 2000


Firm Output

Short-term Speed & Flexibility

Long-term Speed & Stability

Market Capitalization
Dell Supply Chain

Materials ordering cycle
10-180+ days

Customer fulfillment
2-5 days

Modular Product Architecture enables Modular Supply Chain
HP/Flextronics vs. Dell Supply Chain

Materials ordering cycle
10-180+ days

Retailer fulfillment
2-5 days

Retailer inventory
30+ days

Customer fulfillment
30 min

Modular Product Architecture enables Modular Supply Chain
Demand-Supply Chain Management @ Dell

- **Demand Management:**
- **Forecast = Buy = Sell**
- **Buy to Plan, but Build to Order**

- **Inventory Velocity is a wonderful thing ...**
  - Customers have immediate access to the latest technology.
  - Suppliers get their products to market quickly
  - Quality is improved with fewer touches.
  - Cash is generated through negative cash cycle.
  - Model efficiencies drive Market Share gain.
Can “Dell Direct” Work for Autos?

• Appealing to OEM’s on Many Dimensions
  – Satisfy customer need for Speed
  – Reduce Supply Line Inventories
  – Reduce mismatches and discounting
  – Direct OEM-Customer Relationships (& Data!)
  – Information Transparency

Adapted from Prof. J.P. MacDuffie, IMVP & The Wharton School
BUT,
A Car is not a Computer!!

- **Personal Computer**
  - ~50 components
  - 8-10 key parts
  - 40 key suppliers
  - 24 hour burn-in
  - 100 design
  - variations
  - Modular
  - Architecture

- **Car**
  - ~4000 components
  - 100 key subsystems
  - 300 key suppliers
  - 12 month validation
  - 1,000,000
  - variations
  - Integral
  - Architecture

Adapted from Prof. J.P. MacDuffie, IMVP & The Wharton School
In/Outsourcing: Sowing the Seeds of Competence Development to develop dependence for knowledge or dependence for capacity

**Dependence**
- Amount of Work Outsourced
- Knowledge +/or supply
- Supplier Capability ➔ Amount of Supplier Learning ➔ Independence

**Independence**
- Amount of Work Done In-house
- Knowledge +/or supply
- Internal Capability ➔ Amount of Internal Learning ➔ Dependence
Technology Dynamics in the Aircraft Industry:
LEARNING FROM THE DINOSAURS

Japanese appeal as subcontractors

Boeing outsources to Japan 
(Mitsubishi Inside?)

Japanese Industry Autonomy

Japanese industry size & capability

U.S. firms’ appeal as subcontractors

industry size & capability
SOURCEABLE ELEMENTS

PROCESS ELEMENTS

ENGINEERING

ASSY

TEST

CONTROLLER

I4

V6

V8

PRODUCTS

SUBSYSTEMS

VALVETRAIN

BLOCK
Strategic Make/Buy Decisions: Assess Critical Knowledge & Product Architecture

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<td>BEST OUTSOURCING OPPORTUNITY</td>
<td>OVERKILL IN VERTICAL INTEGRATION</td>
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<td>WORST OUTSOURCING SITUATION</td>
<td>CAN LIVE WITH OUTSOURCING</td>
<td>BEST INSOURCING SITUATION</td>
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Adapted from Fine & Whitney, “Is the Make/Buy Decision Process a Core Competence?”
Strategic Make/Buy Decisions: Also consider Clockspeed & Supply Base Capability

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<td>Fast</td>
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<td>Few Many</td>
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<td>Slow</td>
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<tr>
<td>DEPENDENT FOR KNOWLEDGE &amp; CAPACITY</td>
<td>DEPENDENT FOR CAPACITY ONLY</td>
<td>INDEPENDENT FOR KNOWLEDGE &amp; CAPACITY</td>
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<tr>
<td>Trap</td>
<td>OK</td>
<td>Best Out</td>
<td>Clockspeed</td>
<td>Over- kill</td>
<td>Clockspeed</td>
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<tr>
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<td>Watch it!</td>
<td>Clockspeed</td>
<td>Fast</td>
<td></td>
<td>Slow</td>
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</tbody>
</table>

Adapted from C. Fine, *Clockspeed*, Chap. 9
Qualitative analysis of strategic importance uses five key criteria

- Value chain elements with high customer importance and fast clockspeed are generally strategic (unless there are many capable suppliers)

- Competitive position is seldom the primary consideration for strategic importance, rather it serves as a “tie-breaker” when other criteria are in conflict

- When many capable suppliers exist, knowledge may be considered commodity and development should be outsourced

- Architecture is considered a constraint for the sourcing decision model, controls the level of engineering that must be kept in house for integration purposes

Model developed by GM Powertrain, PRTM, & Clockspeed, Inc.
Every decision requires qualitative and quantitative analysis to reach a conclusion.

Model developed by GM Powertrain, PRTM, & Clockspeed, Inc.
Value Chain Mapping

**Organizational Supply Chain**
- Chrysler
- Eaton
- Casting supplier
- Clay supplier

**Technology Supply Chain**
- Engines
- Valve lifters
- Casting manufacturing process
- Clay chemistry

**Capability Chain**
- Supply Chain Management
- Quality assurance
- NVH engineering
- R&D

**Underlying Assumption:** You have to draw the maps before you can assess their dynamics.
VALUE CHAIN DESIGN IS THE ULTIMATE CORE COMPETENCY

Since all advantages are temporary, the only lasting competency is to continuously build and assemble capabilities chains.

KEY SUB-COMPETENCIES:

1. Forecasting the dynamic evolution of market power and market opportunities
2. Anticipating Windows of Opportunity
3. 3-D Concurrent Engineering: Product, Process, Value Chain

Fortune Favors the Prepared Firm
1. Benchmark the Fruit Flies
2. Map your Value Chain
   - Organizational Value Chain
   - Technology Value Chain
   - Competence Chain
3. Dynamic Chain Analysis at each node of each chain map
4. Identify Windows of Opportunity
5. Exploit Competency Development Dynamics with 3-D Concurrent Engineering
In-depth Exercise 2: Value Chain Analysis

Consider these five industries or an industry of your choice:
- Food
- Defense aircraft
- Automobiles
- Handheld electronic organizers/communicators
- Music

At each table, pick ONE industry:
What are the key dependency relationships in the value chain?
What are the opportunities for outsourcing?
What are the windows of opportunity in the chain?
“Takeaways” from the day

1. Value Chains are dynamic
   - industry structure dynamics
   - technology & innovation dynamics
   - customer and channel dynamics

2. Innovation happens along the value chain
   and in the value chain model itself.

3. All advantage is Temporary

4. Strategic Sourcing is a key leverage point for supply chain design.

5. Supply Chain organizations have multiple strategic roles to play.
All Conclusions are *Temporary*

Clockspeeds are increasing almost everywhere
Value Chains are changing rapidly

Assessment of value chain dynamics

Roadmap Construction
BACKUP SLIDES
“Gear Model” to support Roadmapping of Value Chain Dynamics (VCD)

Interdependent sectors represented as intermeshed gears
A long, long time a go in an industry far away . . .
Freight Railroads vs. Trucks

The Dynamics of Industry Economics and the Optimal Timing of Deregulation

“In the Zone”

Too early

Too late


Railroads

Trucks

Regulation reins in “monopoly”

Shocks happen; Environment changes; Substitutes mayarise

Regulation constrains response; deregulation timing is critical

If deregulation is SLOW, LATE, & PIECEMEAL; then Economic Dislocation; Incumbent Collapse
## Histories: Dynamics of Regulation

<table>
<thead>
<tr>
<th>Industry</th>
<th>Regulation Reins in “Monopoly”</th>
<th>Shocks Happen</th>
<th>Environment Changes; Substitutes arise</th>
<th>Regulation Constrains response</th>
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<th>Mistakes harm incumbents, consumers &amp; taxpayers</th>
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<tbody>
<tr>
<td>RailRoads</td>
<td>Rockefeller &amp; Morgan ”Robber Barons”</td>
<td>Autos &amp; Highways</td>
<td>Trucking arises</td>
<td>Prices, Exit, Innovation</td>
<td>1958 vs. 1980</td>
<td>Weak rail capabilities; Trucking dominant</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>”Natural” Monopoly</td>
<td>Oil Embargo; Fall of Iran</td>
<td>Gas Demand Explodes</td>
<td>Low prices inhibit new supply</td>
<td>Long lag for new sources (1978 v 1989)</td>
<td>Shortages; price swings; LT consumer costs of take or pay contracts</td>
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<td>Banking</td>
<td>Bank size limited to limit power</td>
<td>Inflation in the 1970’s</td>
<td>Money Market Funds</td>
<td>Deposits Shrink; Riskier investments</td>
<td>1978 vs. 1989</td>
<td>S&amp;L’s died; $160B+ Bailout</td>
</tr>
<tr>
<td>Telecom</td>
<td>AT&amp;T ”natural” monopoly</td>
<td>Internet &amp; Moore’s Law</td>
<td>Wireless Broadband VOIP</td>
<td>TELRIC pricing; entry &amp; exit; access fees</td>
<td></td>
<td>Wireless success; wireline TBD</td>
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</table>
Conceptual Model: *The Dynamics of Regulation and Deregulation Processes*

- **Perception of Monopoly**
- **Regulation Reins in “Monopoly”**
  - Regulation constrains incumbent response
  - **Shocks Happen**
  - **Environment changes; Substitutes may arise**

  - Deregulation is **TOO EARLY** and not well thought out; Electricity (Calif), CATV (1984)
  - **Costly mistakes; re-regulation; Try, try, again.**

  - Deregulation is **RAPID, TIMELY, & COMPREHENSIVE**; Airlines (1978), Wireless (1993)
  - Robust competition; Large jump in consumer welfare
  - **Economic Dislocation; Incumbent Collapse**
  - Full, but Late, Deregulation

  - Deregulation is **SLOW, LATE, & PIECEMEAL**; Railroads (1958-80), Gas (1973-93), Banking (1978-99)
Collapse of the railroads

- number of Class I railroads dropped from 230 → 7 between 1907-1999
- railroad mileage declined from 254,000 → 99,000 between 1916-1999
- by the 1970s, every major Northeast railroad filed for bankruptcy
- By the 1970s, 21% of track-miles were operated by bankrupt railroads
- deferred maintenance and delayed capital expenditures amounted to billions of dollars
- rate of accidents due to track or structure defects quadrupled from 1966 to 1976
- BY 1976, 15% of track (50,000 miles) was operated at reduced speeds (as slow as 10 miles per hour)
- standing derailments (when a train falls over when not moving) became prevalent
- terminal facilities deteriorated
Deregulation improved performance

- Inflation-adjusted rail rates have plunged 60% from 1981-2001

- By 1999, railroads were generating 58% more ton miles than in 1979

- In the 1990s, railroads stopped the erosion of market share. From 1996 through 1998, the railroad’s market share actually exceeded 40%

Image by MIT OpenCourseWare.
“Gear Model” to support Roadmapping of Value Chain Dynamics (VCD)

Corporate Strategy Dynamics
Customer Preference Dynamics
Technology & Innovation Dynamics
Regulatory Policy Dynamics
Industry Structure Dynamics
Capital Market Dynamics
Business Cycle Dynamics

Gears differ by size/speed
Each has an engine & clutch
<table>
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<tr>
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<th>Business Cycles</th>
<th>Industry/ Organization Structure</th>
<th>Regulatory Policy</th>
<th>Technology</th>
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<th>Clockspeed</th>
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<td>Technology</td>
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<td>Integration/Disintegration</td>
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<td>Downturn triggers outsourcing; Search for smoothness</td>
<td>Integrality slows clockspeed</td>
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<td>Innovation can obsolete regulations</td>
<td>Regulation slows incumbent innovation</td>
<td>Deregulation speeds innovation</td>
<td>Technology innovates drives clockspeed</td>
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<td>Integration/Disintegration</td>
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<td>Capability life drives project frequency</td>
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<td>Customer power drives clockspeed</td>
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**Explanation**

- **Business Cycles**: Downturns trigger dis-integration.
- **Industry/Organization Structure**: Integration buffers downturns.
- **Regulatory Policy**: Integration/Disintegration.
- **Technology**: Downturns stifle R&D investment.
- **Consumer Preferences**: Downturn triggers outsourcing; Search for smoothness.
- **Corporate Strategy**: Integrality slows clockspeed.
- **Clockspeed**: Deregulation speeds innovation.

**Additional Notes**

- Innovation can obsolete regulations.
- Regulation slows incumbent innovation.
- Innovation slowdowns drive brand investment.
- Capability life drives project frequency.
- Customer power drives clockspeed.
- Faster innovation moderates downturns.
Mother Nature strikes
The Cell Phone Supply Chain

8:00 pm, Friday 17 March 2000: Lightning Strikes an ASIC semiconductor plant of Philips in Albuquerque, New Mexico, USA
8:10 pm: Fire is extinguished. Plant will be down for months.

LESSON: RESPONSE SPEED
Mother Nature strikes
The Cell Phone Supply Chain

NOKIA
Shipment discrepancies noticed within 3 days.
Philips is pushed hard.
New supply sources.
New chip design.
Global capacity grab.

ERICSSON
Problem undiscovered for weeks.
Slow chain of command.
Slow response.
Capacity already taken.
$400M revenue loss.
Exits phone manufacture.

LESSON: RESPONSE SPEED
RFID tags push the boundaries of the Edge
(Research Assistant: Natalie Klym)

1. DoD wartime needs will *prime the pump* for RFID technology and applications.
2. Walmart will add to this effect: box & pallet.
3. Pharmacies will do the same for item tagging.

What *disruptions* will be driven by the explosion of the edge?
# VALUE CHAIN MAPPING Exercise

For each business:

- Key elements in the chain?
- Who has power in the chain?
- Who makes the profits in the chain?
- Sources of power & profits (technology, brand, etc.)?
- Key dynamic processes influencing chain power?
- Locus of innovations?
- Clockspeed Drivers?

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<tr>
<td>Financial Services</td>
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<tr>
<td>Construction</td>
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<tr>
<td>Health Care</td>
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<tr>
<td>Food</td>
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<tr>
<td>Chemicals</td>
</tr>
</tbody>
</table>
Moore’s Law

Transistors per chip

Year

Source: Joel Birnbaum, HP, Lecture at APS Centennial, Atlanta, 1999
Roadmap for Electronic Devices

Number of chip components

Classical Age

Quantum Age

295°K

77°K

4°K

SIA Roadmap

Historical Trend

CMOS

Quantum State Switch

Feature size (microns)

10^1

10^0

10^{-1}

10^{-2}

10^{-3}

1970

1980

1990

2000

2005

2010

10^2

10^4

10^6

10^8

10^{10}

10^{12}

10^{14}

10^{16}

10^{18}

Horst D. Simon
**The Outsourcing Trap: A Novel of Four Families**

<table>
<thead>
<tr>
<th>Family Type</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Navy Pilot</strong></td>
<td>Crash, Investigation, SC education, “Columbo”</td>
</tr>
<tr>
<td></td>
<td>- Visits, Toyota, Dell, Zara &amp; aircraft supply chain</td>
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<tr>
<td><strong>Pilot’s sister</strong></td>
<td>MIT grad; laid off; discovers entrepreneurship</td>
</tr>
<tr>
<td><strong>Pilot’s wife</strong></td>
<td>Policy analyst for Senator;</td>
</tr>
<tr>
<td><strong>Pilot’s son</strong></td>
<td>outsources homework; outsource capacity, not knowledge</td>
</tr>
<tr>
<td><strong>Pilot’s daughter</strong></td>
<td>business student; Zara shopper</td>
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<tr>
<td><strong>Chinese Entrepreneur</strong></td>
<td>(e.g., Morris Chang/Terry Gou)</td>
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<td></td>
<td>- “Benevolent Father:” Chinese coexistence; Henry Ford; HongSing</td>
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<tr>
<td></td>
<td>- Ultimately brokers cooperation</td>
</tr>
<tr>
<td><strong>Warrior Daughter</strong></td>
<td>Chinese domination; aggressive growth</td>
</tr>
<tr>
<td><strong>Defense contractor</strong></td>
<td>Three Generations</td>
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<tr>
<td></td>
<td>- Grandfather (England), Father (USA), Grandson (affair w/Chinese daughter)</td>
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<tr>
<td></td>
<td>- Makes avionics systems; lobbies senator; Outsource to HongSing</td>
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<td></td>
<td>- losing commercial business to Chinese</td>
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<tr>
<td><strong>U.S. Senator</strong></td>
<td>Loses son in crash, orders investigation</td>
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<td>- Pork to military contractors; but cost pressures as well</td>
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<td></td>
<td>- How to keep good jobs in USA?</td>
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<td></td>
<td>- Campaign contributions from Americans &amp; Chinese</td>
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<td>- “Caused” the death of his son</td>
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<td></td>
<td>- Ultimately works on collaboration with Chinese CEO &amp; Gov’t</td>
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<tr>
<td><strong>3rd tier supplier</strong></td>
<td>illegal outsourcing of circuit board</td>
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<tr>
<td></td>
<td>- Tells senators: “you made me do this”</td>
</tr>
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</table>
All Conclusions are *Temporary*

Clockspeeds are increasing almost everywhere
Value Chains are changing rapidly

Assessment of value chain dynamics

Supply Chain Strategy Development