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

Excerpts from: Clockspeed

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http://web.mit.edu/ctpid/www/people/Fine.html
Supply Chains and Value Chains

**Supply Chain Management**

Order fulfillment

*Reaction & Anticipation*
- 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"
Operations Strategy & Business Model Alignment

- Product
- Process
- Supply Chain/Value Chain
- Marketing Strategy

Operations Strategy

Business Strategy
# Operations Strategy & Business Model Alignment

## Product

<table>
<thead>
<tr>
<th>Benihana</th>
<th>Ritz</th>
<th>Zipcar</th>
<th>Starbucks/McD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractive Food</td>
<td>Luxury</td>
<td>Convenience</td>
<td>Premium</td>
</tr>
<tr>
<td>Entertainment Value</td>
<td>Personalized</td>
<td>Social Network</td>
<td>Environemntal</td>
</tr>
<tr>
<td>Value</td>
<td></td>
<td>Value</td>
<td>Third Place</td>
</tr>
</tbody>
</table>

## Process

| Ass'y Line                        | Std proc                    | e-centric                   | Invest in people            |
| Chef pdtn control                 | Selection                   | customer dep't              | heavily std                 |
| labor/cap efficient               | Training                    |                             | some proc stds              |
|                                   | Ladies & Gents              |                             | foolproof                   |

## Supply/Value Chain

| Japanese mat'ls                   | investors                   | Cars                        | environmental               |
| Japanese labor                    | labor                       | IT                          | partners                    |
| Basic ingredients                 |                             |                             | fair trade                  |
|                                   |                             |                             | innov source                |

## Marketing

| Exotic and Safe                   | Luxury                      | Convenience                 | Premium                     |
| Fun                                | Personalized                | Social Network              | Environemntal              |
|                                    |                             | Value                       | Third Place                |
|                                    |                             |                             | Value                       |
“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
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

National

Personal

Integral vs. Modular
(Commercial Aircraft)

Open vs. Closed
(Communications)

Technology Dynamics

Business Dynamics

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

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

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

- **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>
<thead>
<tr>
<th>Microprocessors</th>
<th>Intel</th>
<th>Moto</th>
<th>AMD</th>
<th>etc</th>
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<tbody>
<tr>
<td>Operating Systems</td>
<td>Microsoft</td>
<td>Mac</td>
<td>Unix</td>
<td></td>
</tr>
<tr>
<td>Peripherals</td>
<td>HP</td>
<td>Epson</td>
<td>Seagate</td>
<td>etc</td>
</tr>
<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>
</tr>
</tbody>
</table>
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:
Ford in 1920, GM in 1955, Toyota in 2000

Computing:
IBM in 1970, Wintel in 1990, Apple in 2010

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 evolve faster than REPTILES

THE KEY TOOL:
Cross-SPECIES Benchmarking of Dynamic Forces

Evolution in the industrial world:
INFOTAINMENT is faster than MICROCHIPS is faster than AUTOS evolve faster than 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

- Corporate Strategy Dynamics
- Customer Preference Dynamics
- Technology & Innovation Dynamics
- Regulatory Policy Dynamics
- Industry Structure Dynamics
- Capital Market Dynamics
- Business Cycle Dynamics
Innovation along the Value Chain: How (& why) do Autos & Electronics Differ?
Innovation Dynamics can be RADICAL *(disruptive)* or INCREDENTAL *(sustaining)*

**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
- Li & Fung
THE CASE OF APPLE iPod/iPhone

Creative Artists

Content Publishers

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

Networks
Closed to all but one carrier per region; slowly opening

Content
Closed to non-MP3, non-Apple formats

Content Marketing
iTunes homepage

Content Sales

iTunes

Content Distrib.

iTunes

App Stores

Retail Stores

Content & HW Consumption

iPod/iPhone

Listening accessories

Open, then license
What makes an innovation disruptive?

Performance Push
an overwhelmingly superior technology/process
(penicillin, 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

Corporate Strategy Dynamics

Customer Preference Dynamics

Technology & Innovation Dynamics

Regulatory Policy Dynamics

Industry Structure Dynamics

Business Cycle Dynamics

Capital Market Dynamics
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

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

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

Customers

Cisco

Contract Manufacturers

Component Suppliers & Distributors
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

% Change, Year-to-Year

Year

Worldwide Semiconductor Manufacturing Equipment Sales
Worldwide Semiconductor Shipments
Electronics, Computing and Communications Equipment Output
GDP World
GDP USA
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 CLOCKSPEED IS A COMPOSITE: OF PRODUCT, PROCESS, AND ORGANIZATIONAL CLOCKSPEEDS

Mobile Phone INDUSTRY CLOCKSPEED

THE Mobile Phone product technology

THE Mobile Phone PROCESS production 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** CLOCKSPPEED IS A MIX OF ENGINE, BODY & ELECTRONICS

### ISSUE:
MOST AUTO FIRMS OPERATE AT ENGINE OR BODY CLOCKSPEEDS; 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
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
  - Specifications
  - Materials
  - Functions
- Product/System Architecture
  - Modular/Integral Life Cycles

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

Value Chain (Partners/Suppliers)
- Value Chain Architecture
- Sourcing
- Selection
- Relationship
- Logistics & Coord System
- Information
- Inventory
- Integration
- Development & Capab. Chains
- Supply Chain
- Fulfillment

Fulfillment Architecture Technology
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 spacial 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
VALUE CHAIN ARCHITECTURE

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>
<th>MODULAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microprocessors &amp; BMW vehicles</td>
<td>Lucent Nortel</td>
</tr>
<tr>
<td>Polaroid</td>
<td></td>
</tr>
<tr>
<td>Chrysler (90’s) Nokia</td>
<td>Cisco</td>
</tr>
<tr>
<td>Digital Rights/ Music Distribution</td>
<td>Dell PC’s Bicycles</td>
</tr>
</tbody>
</table>
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...
Enterprise Competitive Dynamics

which generates...
Long-Term Performance

Enterprise Architectural Forms

Maximization of Shareholder Value
Maximization of Stakeholder Surplus

which shapes...
Industrial Dynamic Evolution

Growing Markets (Economies of Scale)
Stable Markets (Economies of Scope)

Carrying Capacity (e.g. Global GDP)

Long-Term Performance

1900 1925 1950 1975 2000

Growing Markets (Economies of Scale)
Stable Markets (Economies of Scope)

Firm Output

Short-term Speed & Flexibility
Long-term Speed & Stability


Modular Enterprise
Modular 1
Modular 2
Modular 3

Market Capitalization
Dell Supply Chain

Demand Management

Build to customer specifications

Sales

Global \ Regional Procurement
Demand/ Supply Management

Continuity of Supply

Supplier

SLC

Supplier

Continuity of Supply

Dell

Customer

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
Technology Dynamics in the Aircraft Industry:
LEARNING FROM THE DINOSAURS

Japanese industry size & capability

Japanese Industry Autonomy

Boeing outsources to Japan *(Mitsubishi Inside?)*

Japanese appeal as subcontractors

U.S. firms’ appeal as subcontractors

U.S. industry size & capability

Japanese Industry Autonomy
SOURCEABLE ELEMENTS

PROCESS ELEMENTS

ASSY

TEST

ENGINEERING

PRODUCTS

I4 V6 V8

SUBSYSTEMS

VALVETRAIN

BLOCK

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

<table>
<thead>
<tr>
<th>ITEM IS INTEGRAL</th>
<th>ITEM IS MODULAR</th>
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<tbody>
<tr>
<td>DEPENDENT FOR KNOWLEDGE &amp; CAPACITY</td>
<td>INDEPENDENT FOR KNOWLEDGE &amp; DEPENDENT FOR CAPACITY</td>
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<tr>
<td><strong>A POTENTIAL OUTSOURCING TRAP</strong></td>
<td><strong>BEST OUTSOURCING OPPORTUNITY</strong></td>
</tr>
<tr>
<td><strong>WORST OUTSOURCING SITUATION</strong></td>
<td><strong>CAN LIVE WITH OUTSOURCING</strong></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

<table>
<thead>
<tr>
<th>Suppliers</th>
<th>Clockspeed</th>
<th>INDEPENDENT FOR KNOWLEDGE &amp; CAPACITY</th>
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<tbody>
<tr>
<td>Few</td>
<td>Fast</td>
<td>Best</td>
</tr>
<tr>
<td>Many</td>
<td>Slow</td>
<td>In</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Suppliers</th>
<th>Clockspeed</th>
<th>DEPENDENT FOR CAPACITY ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Few</td>
<td>Fast</td>
<td>OK</td>
</tr>
<tr>
<td>Many</td>
<td>Slow</td>
<td>Watch it!</td>
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</tbody>
</table>

<table>
<thead>
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<th>Suppliers</th>
<th>Clockspeed</th>
<th>DEPENDENT FOR KNOWLEDGE &amp; CAPACITY</th>
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<tr>
<td>Many</td>
<td>Slow</td>
<td>OK</td>
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</tbody>
</table>

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

- **Customer Importance:**
  - High
  - Medium
  - Low

- **Technology Clockspeed:**
  - Fast
  - Medium
  - Slow

- **Competitive Position:**
  - Advantage
  - Parity
  - Disadvantage

- **Capable Suppliers:**
  - None
  - Few
  - Many

- **Architecture:**
  - Integral
  - Modular

- **Possible Decisions (Knowledge & Supply):**
  - Insource
  - Outsource
  - Partner/Acquire
  - Partial Insourse
  - Partial Outsource
  - Invest
  - Spin Off
  - Develop Suppliers

- 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
“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

Corporate Strategy Dynamics
Customer Preference Dynamics
Technology & Innovation Dynamics
Regulatory Policy Dynamics
Industry Structure Dynamics
Capital Market Dynamics
Business Cycle Dynamics
A long, long time ago in an industry far away . . .
Freight Railroads vs. Trucks
The Dynamics of Industry Economics and the Optimal Timing of Deregulation

Too early
Too late


Railroads
Trucks

Share of Revenue

“In the Zone”

Regulation reins in “monopoly”
Shocks happen; Environment changes; Substitutes may arise
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>Reins in “Monopoly”</th>
<th>Shocks Happen</th>
<th>Environment Changes; Substitutes arise</th>
<th>Regulation Constrains response</th>
<th>Deregulation timing is Critical</th>
<th>Mistakes harm incumbents, consumers &amp; taxpayers</th>
</tr>
</thead>
<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>
</tr>
<tr>
<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>Wireless, BB, &amp; VOIP less constrained than ILECs</td>
<td>Wireless success; wireline TBD</td>
</tr>
</tbody>
</table>

[Banking:  
- **Telecom:** AT&T "natural” monopoly  
- **Internet & Moore’s Law:**  
  - Wireless Broadband VOIP  
  - TELRIC pricing; entry & exit; access fees  
  - Wireless, BB, & VOIP less constrained than ILECs  
- **Wireless success; wireline TBD**]
Conceptual Model: The Dynamics of Regulation and Deregulation Processes

- Perception of Monopoly
  - Regulation Reins in "Monopoly"
    - Regulation constrains incumbent response
      - Deregulation is RAPID, TIMELY, & COMPREHENSIVE;
      - Deregulation is SLOW, LATE, & PIECEMEAL;
        Railroads (1958-80), Gas (1973-93), Banking (1978-99)
      - Economic Dislocation; Incumbent Collapse
        Full, but Late, Deregulation
    - Costly mistakes; re-regulation; Try, try, again.
  - Deregulation is TOO EARLY and not well thought out;
    Electricity (Calif), CATV (1984)

- Shocks Happen
  - Environment changes; Substitutes may arise

- Processes
  - Happen
  - Reins in
    - "Monopoly"

- Environment
  - Changes;
    - Substitutes
      - May arise
What caused the collapse of the freight railroads?

“A good way to understand what has happened [to railroads] is to imagine a business that is prevented from adjusting its prices to changing market conditions and from negotiating with its customers. Furthermore, imagine that the business is not permitted to decide how much of its principal inputs to purchase, how much it will pay for them or even how to use them, and it may not decide where it will operate. Worse yet, imagine that it faces strong competitors who are not encumbered by similar constraints. It would be surprising if such a business survived at all. This is only a slight exaggeration of the railroads’ position before 1980.”

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%
“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>
<thead>
<tr>
<th>Business Cycles</th>
<th>Industry/Organization Structure</th>
<th>Regulatory Policy</th>
<th>Technology</th>
<th>Consumer Preferences</th>
<th>Corporate Strategy</th>
<th>Clockspeed</th>
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## Gear Teeth Dynamics

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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Downturns trigger dis-integration</td>
<td></td>
<td>downturns stifle R&amp;D investment</td>
<td></td>
<td>Downturn triggers outsourcing; Search for smoothness</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry/Organization Structure</th>
<th>Integration buffers downturns</th>
<th>Integration/Disintegration</th>
<th>Wrap services around commodities</th>
<th>integrality slows clockspeed</th>
<th>deregulation speeds innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory Policy</td>
<td>innovation attacks incumbents &amp; supports integration</td>
<td>innovation can obsolete regulations</td>
<td>regulation slows incumbent innovation</td>
<td>technology innov drives clockspeed</td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>branding slows disintegration</td>
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<tr>
<td>Consumer Preferences</td>
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<td>project frequency drives Capab. life</td>
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</table>

- Business Cycles: Downturns trigger dis-integration
- Industry/Organization Structure: Integration buffers downturns
- Regulatory Policy: Integration/Disintegration
- Technology: Innovation attacks incumbents & supports integration
- Consumer Preferences: Wrap services around commodities
- Corporate Strategy: Innovation slowdowns drive brand investment
- Clockspeed: Branding slows disintegration project frequency drives Capab. life
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.

Ericsson Cell Phones

Philips
Chip Factory

Image by MIT OpenCourseWare.

LESSON: RESPONSE SPEED

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

Nokia Cell Phones

Image by MIT OpenCourseWare.
# The Outsourcing Trap: A Novel of Four Families

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Navy Pilot</strong></td>
<td>Crash, Investigation, SC education, “Columbo”</td>
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<tr>
<td></td>
<td>- Visits, Toyota, Dell, Zara &amp; aircraft supply chain</td>
</tr>
<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>
</tr>
<tr>
<td><strong>Chinese Entrepreneur</strong></td>
<td>(e.g., Morris Chang/Terry Gou)</td>
</tr>
<tr>
<td></td>
<td>- “Benevolent Father:” Chinese coexistence; Henry Ford; HongSing</td>
</tr>
<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>
</tr>
<tr>
<td></td>
<td>- Grandfather (England), Father (USA), Grandson (affair w/Chinese daughter)</td>
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<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></td>
<td>- Pork to military contractors; but cost pressures as well</td>
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<tr>
<td></td>
<td>- How to keep good jobs in USA?</td>
</tr>
<tr>
<td></td>
<td>- Campaign contributions from Americans &amp; Chinese</td>
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<tr>
<td></td>
<td>- “Caused” the death of his son</td>
</tr>
<tr>
<td></td>
<td>- Ultimately works on collaboration with Chinese CEO &amp; Gov’t</td>
</tr>
</tbody>
</table>

**3rd tier supplier:** illegal outsourcing of circuit board
- Tells senators: “you made me do this”
All Conclusions are *Temporary*

Clockspeeds are increasing almost everywhere. Value Chains are changing rapidly.

Assessment of value chain dynamics

Supply Chain Strategy Development
15.768 Management of Services: Concepts, Design, and Delivery
Fall 2010

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