# 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

*Reaction & Anticipation*

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

*"The Physics of Flow"*

## *Value Chain Design*

### System Design

*Static*

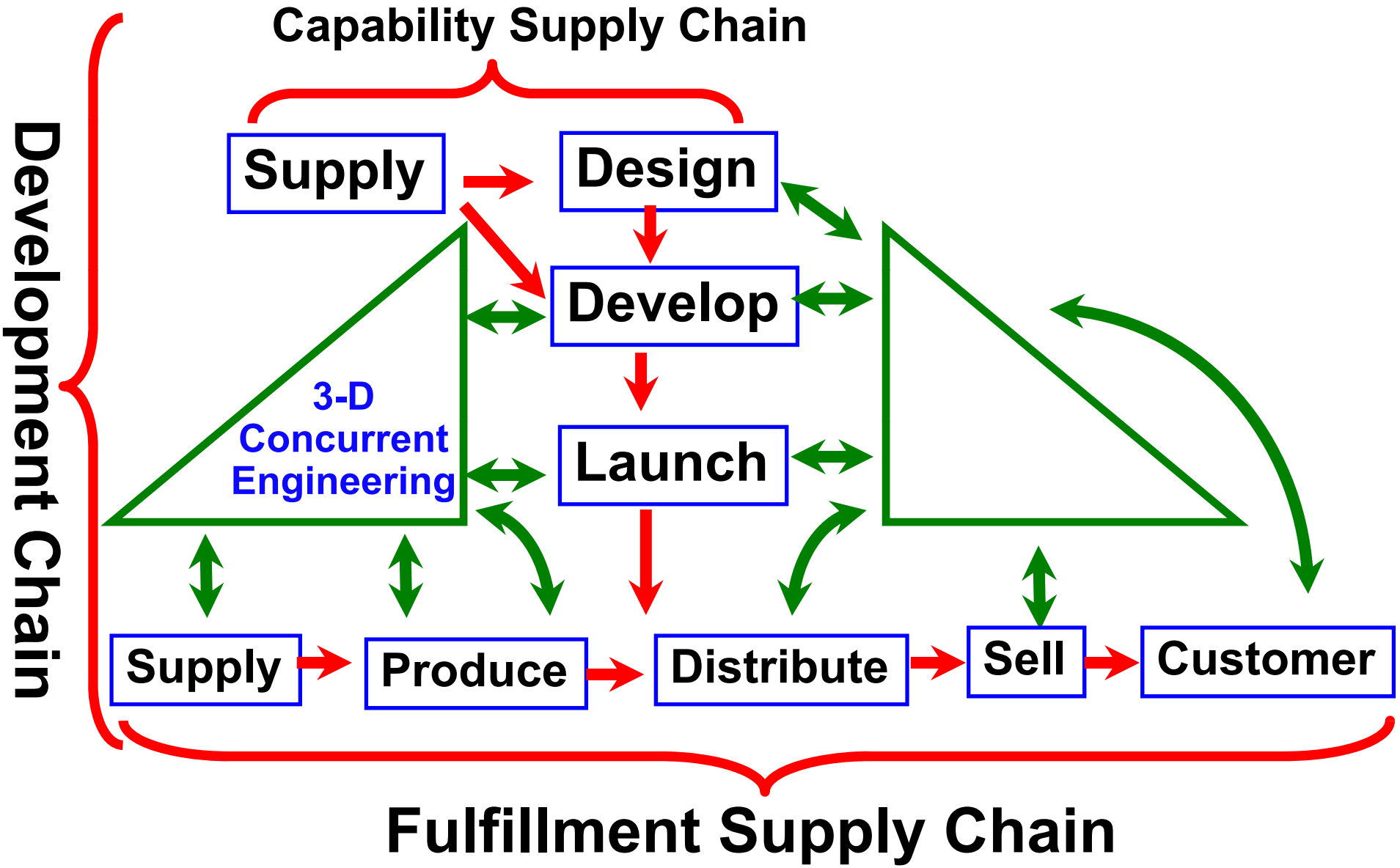
- Core competences
- Make/Buy
- Relationship Design
- Strategic Intent

*Dynamic*

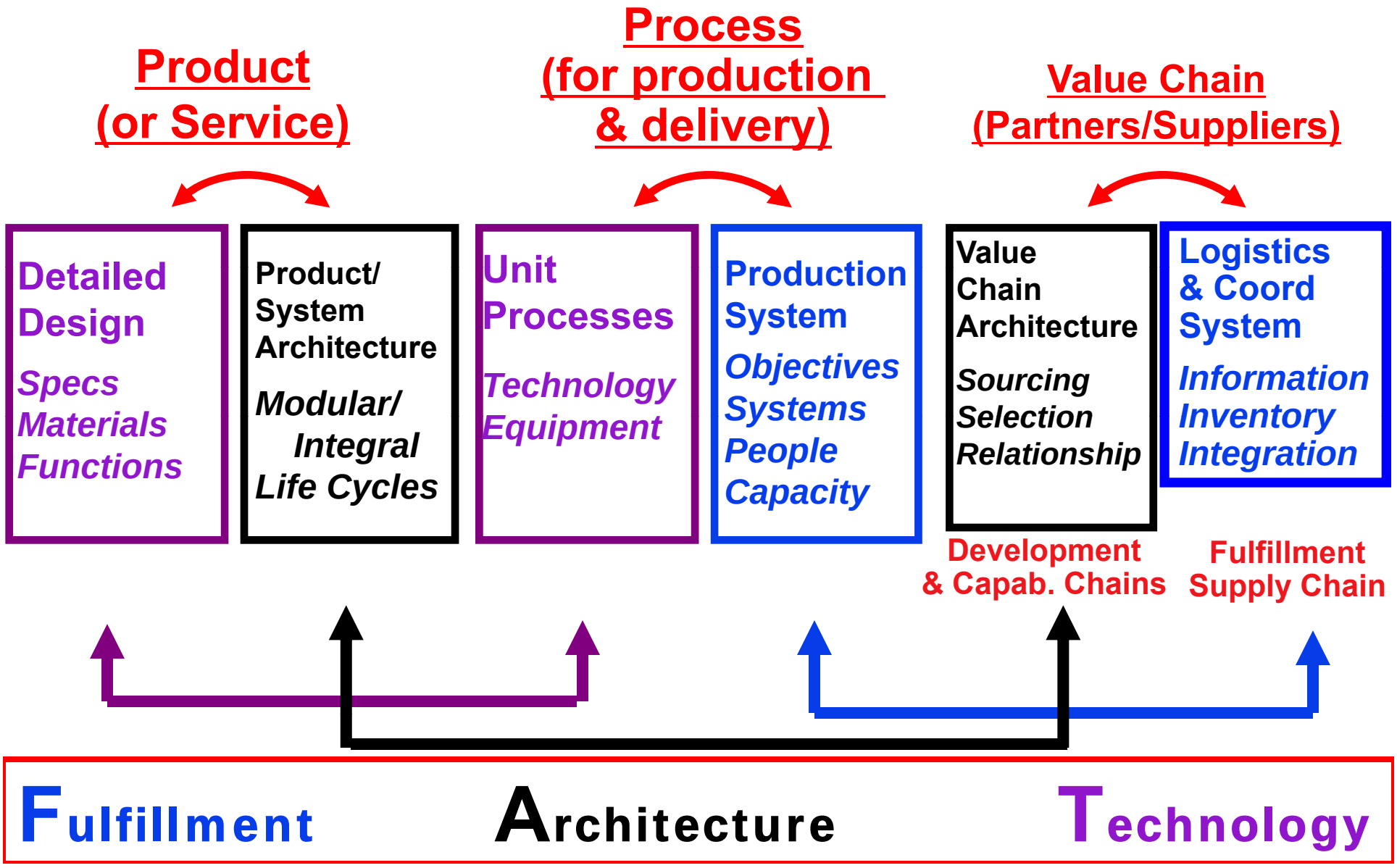
- Fast Clockspeed
- External Forces
- Disintegration
- Dependence
- Capability development
- Disintermediation

*"The Biology of Evolution"*

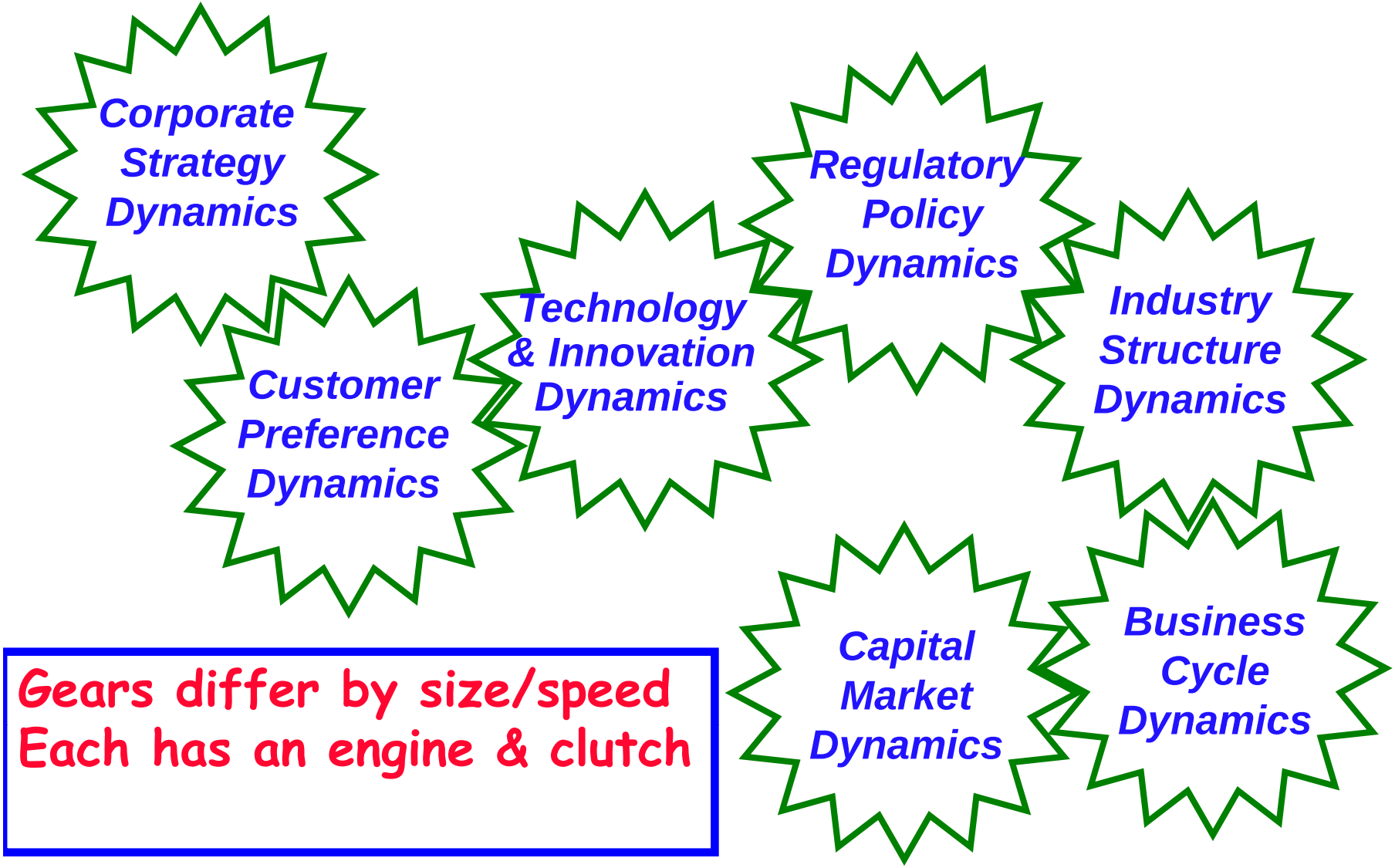
# The Three Chains of Enterprise Design:
## *Fulfillment, Development, & Capability Chains*



# 3-D Concurrent Engineering & *the imperative of concurrency*



# "Gear Model" to support Roadmapping of Value Chain Dynamics (VCD)




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

| STRUCTURAL | INFRASTRUCTURAL |
|---|---|
| CAPACITY ACQUIS. | HUMAN RESOURCES |
| FACILITIES | QUALITY ASSUR. |
| EQUIPMENT/TECH. | PDTN. PLAN/CONT. |
| VERTICAL INTEG. | PRODUCT DEVELOP. |
| | PERF. MEAS/EVAL |
| | CAPITAL ALLOC. |
| | ORG. STRUCTURES. |

# 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

# SAMPLE MANUFACTURING STRATEGY FRAMEWORK (CONTINUED)

## PROCESSES

-TECHNOLOGY
-CAPABILITY
-CONTROL
-FLEXIBILITY
-STD. OPER. PROCS.

## PEOPLE

-SKILLS, TRAINING, HIRING PRACTICES
-KNOWLEDGE, EXPERTISE, EMPOWERMENT
-PARTNERSHIP W/ ACCOUNTABILITY
-FLEXIBILITY
-ENVIRONMENT

## VALUE CHAIN

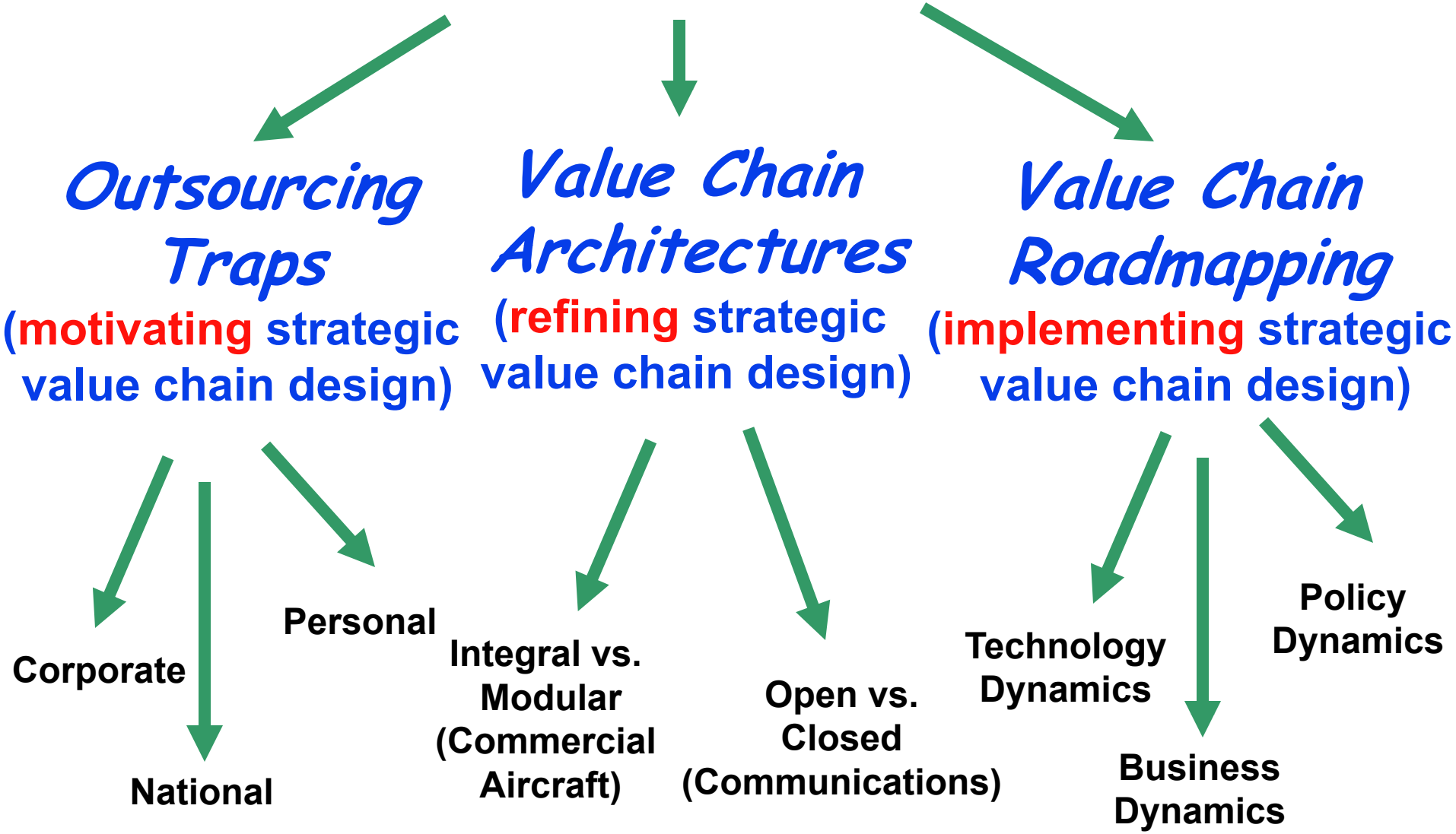
### INTERNAL

-PROCUREMENT/SUPPLY
-ENGINEERING
-MARKETING/SALES
-DESIGN OFFICE
-FINANCE
-LABOR RELATIONS

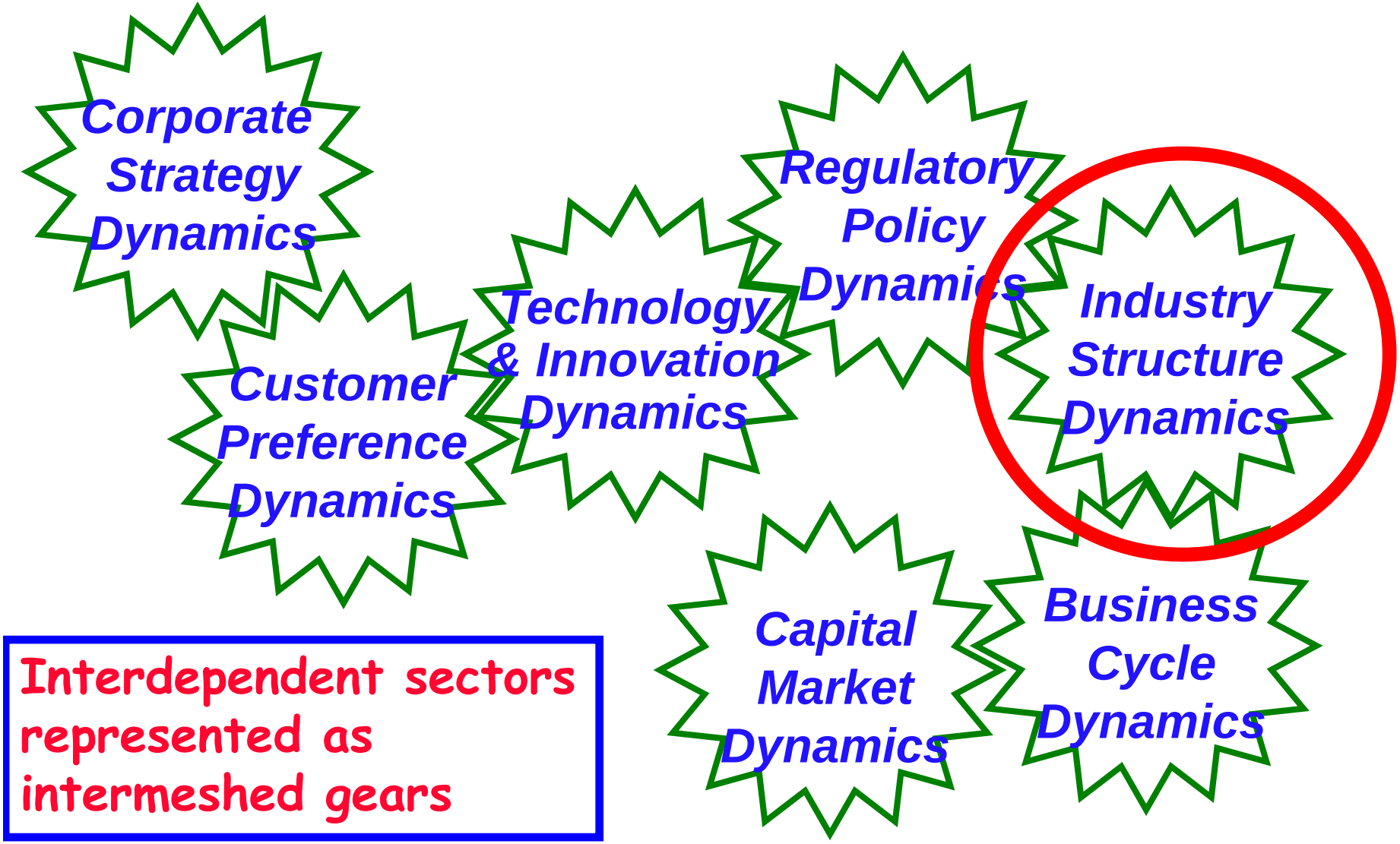
### EXTERNAL

-WORLD-CLASS BENCHMARKS
-CUSTOMERS & DEALERS
-SUPPLIERS
-GOVERNMENT
-UNIVERSITIES

# Value Chain Dynamics as an Operations Strategy Lens



# "Gear Model" to support Roadmapping of Value Chain Dynamics (VCD)

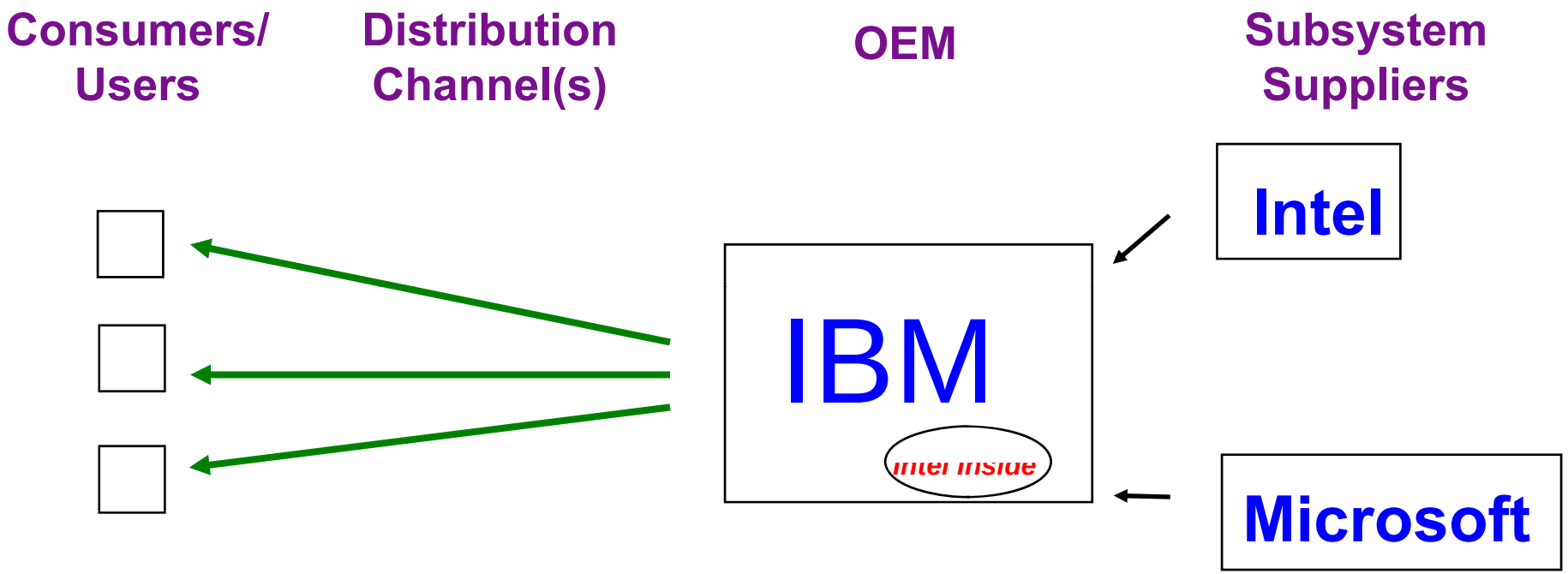



Interdependent sectors represented as intermeshed gears

# 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**

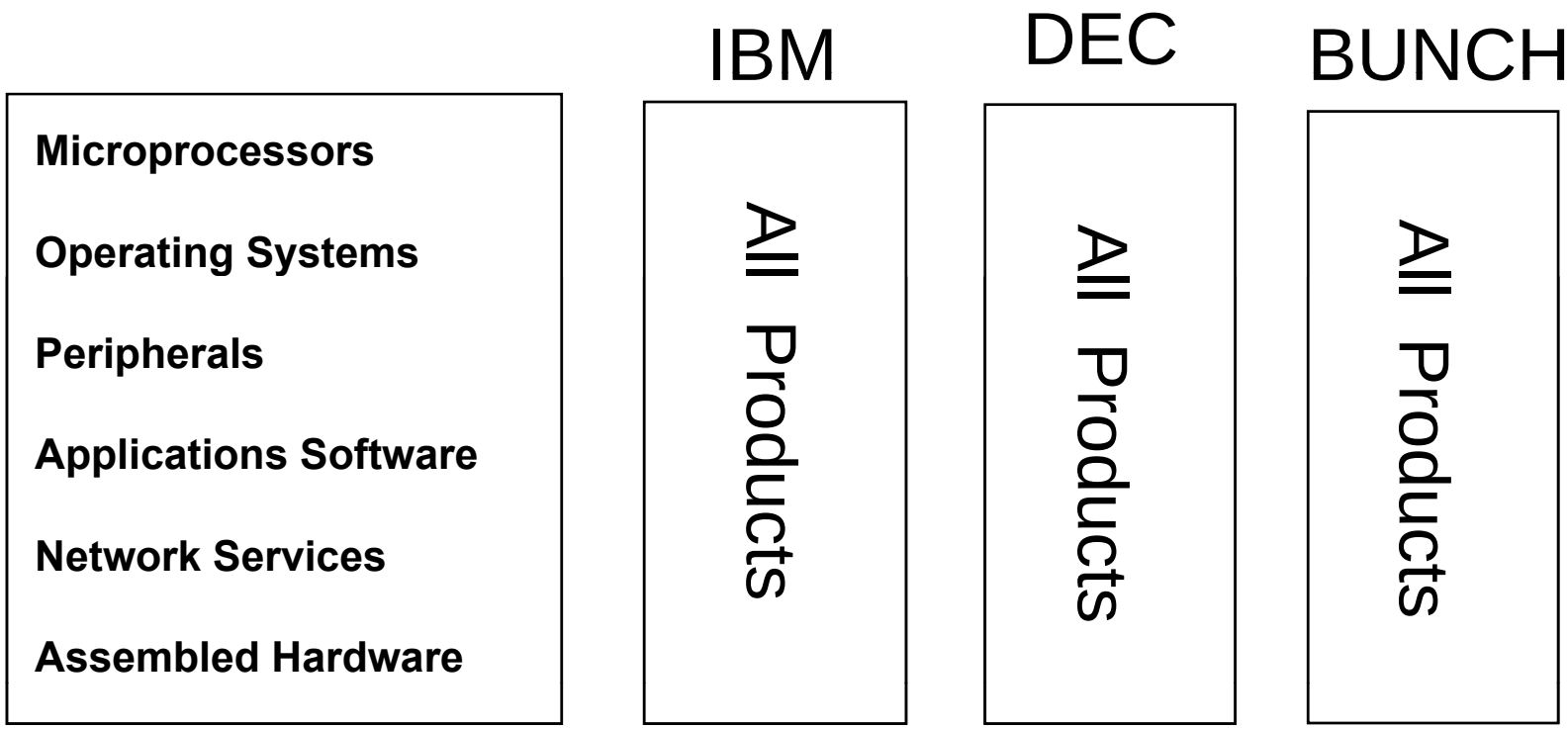
**A disastrous value chain design (for IBM)**

# 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

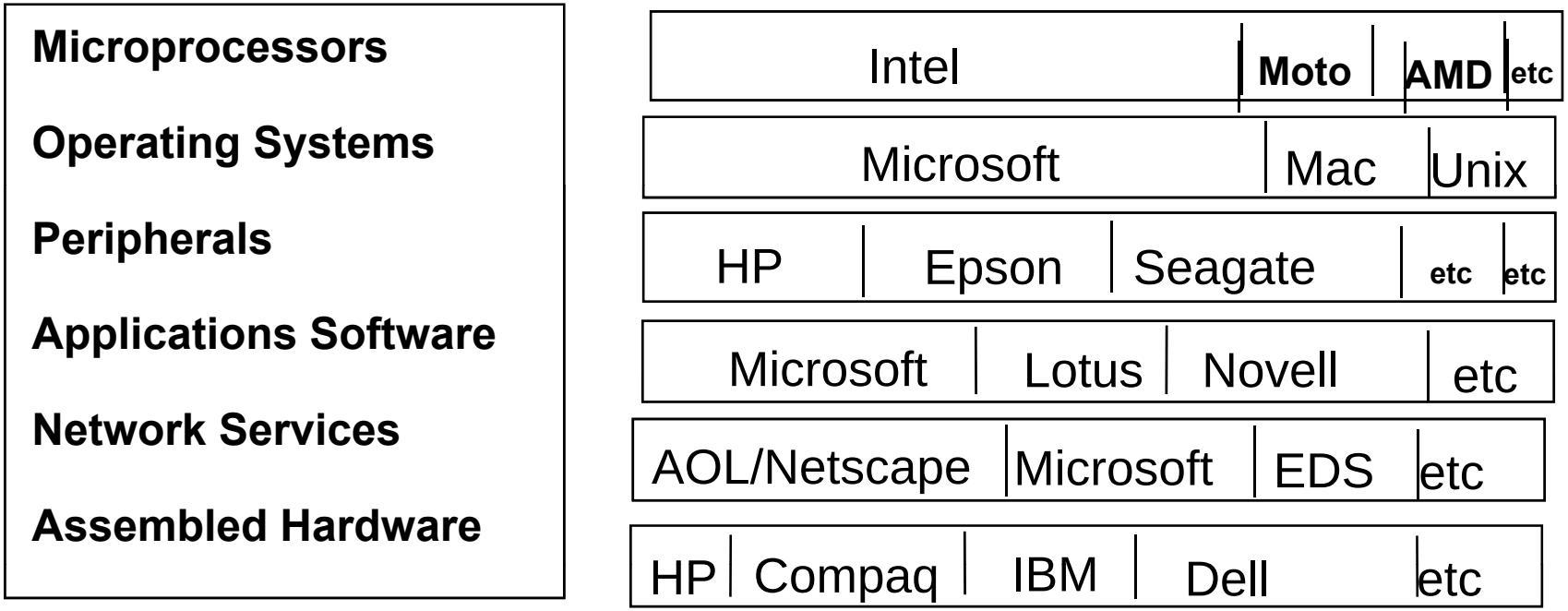
Computer Industry Structure, 1975-85




**(A. Grove, Intel; and Farrell, Hunter & Saloner, Stanford)**

# Horizontal Industry Structure with *Modular* Product/System Architecture

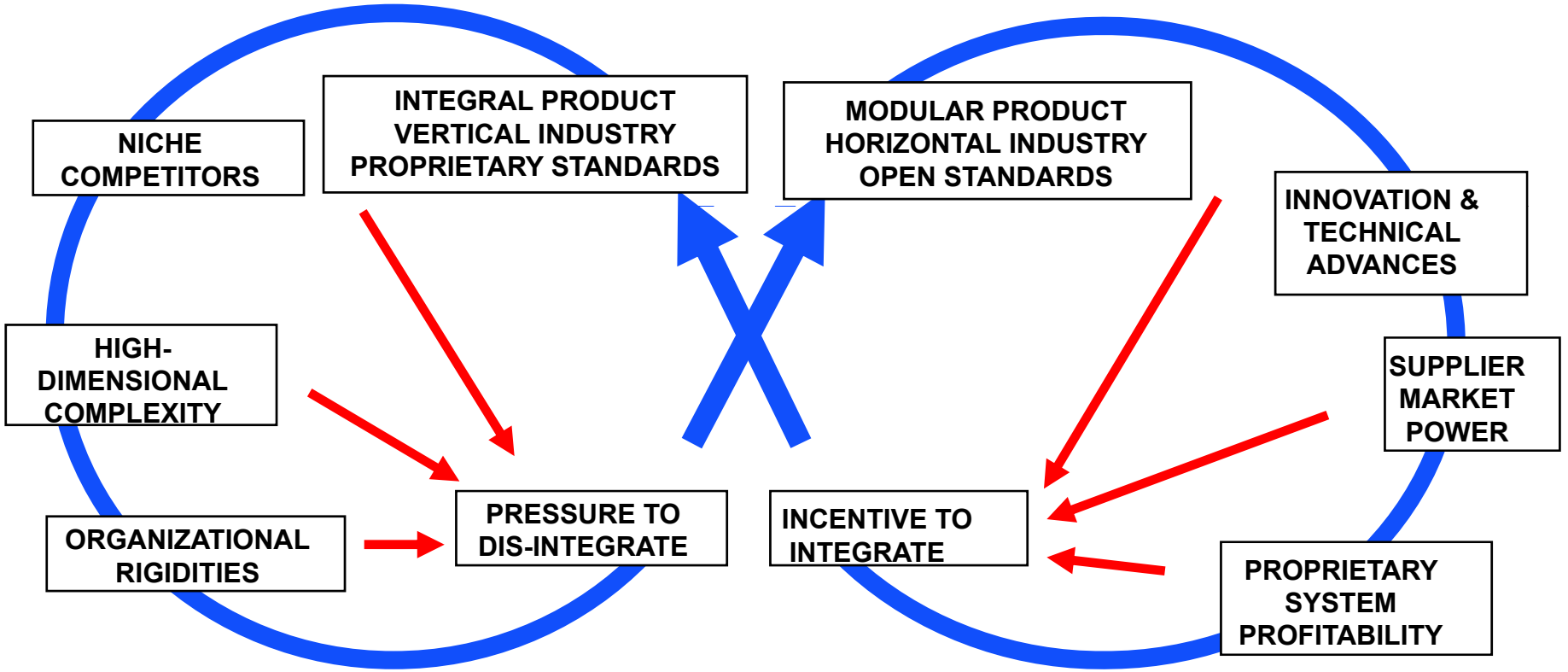
## Computer Industry Structure, 1985-95




**(A. Grove, Intel; and Farrell, Hunter & Saloner, Stanford)**

# THE DYNAMICS OF PRODUCT ARCHITECTURE, STANDARDS, AND VALUE CHAIN STRUCTURE:

## "THE DOUBLE HELIX"

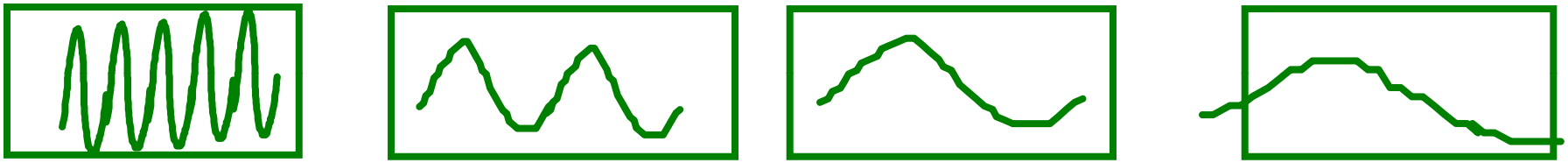



**Examples: IBM, Autos, Embraer/Boeing, Nokia, Small Firms**

**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:***

***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:***

***Red Sox* in 2007, *Celtics* in 2008, *Yankees* in 2009**

***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***

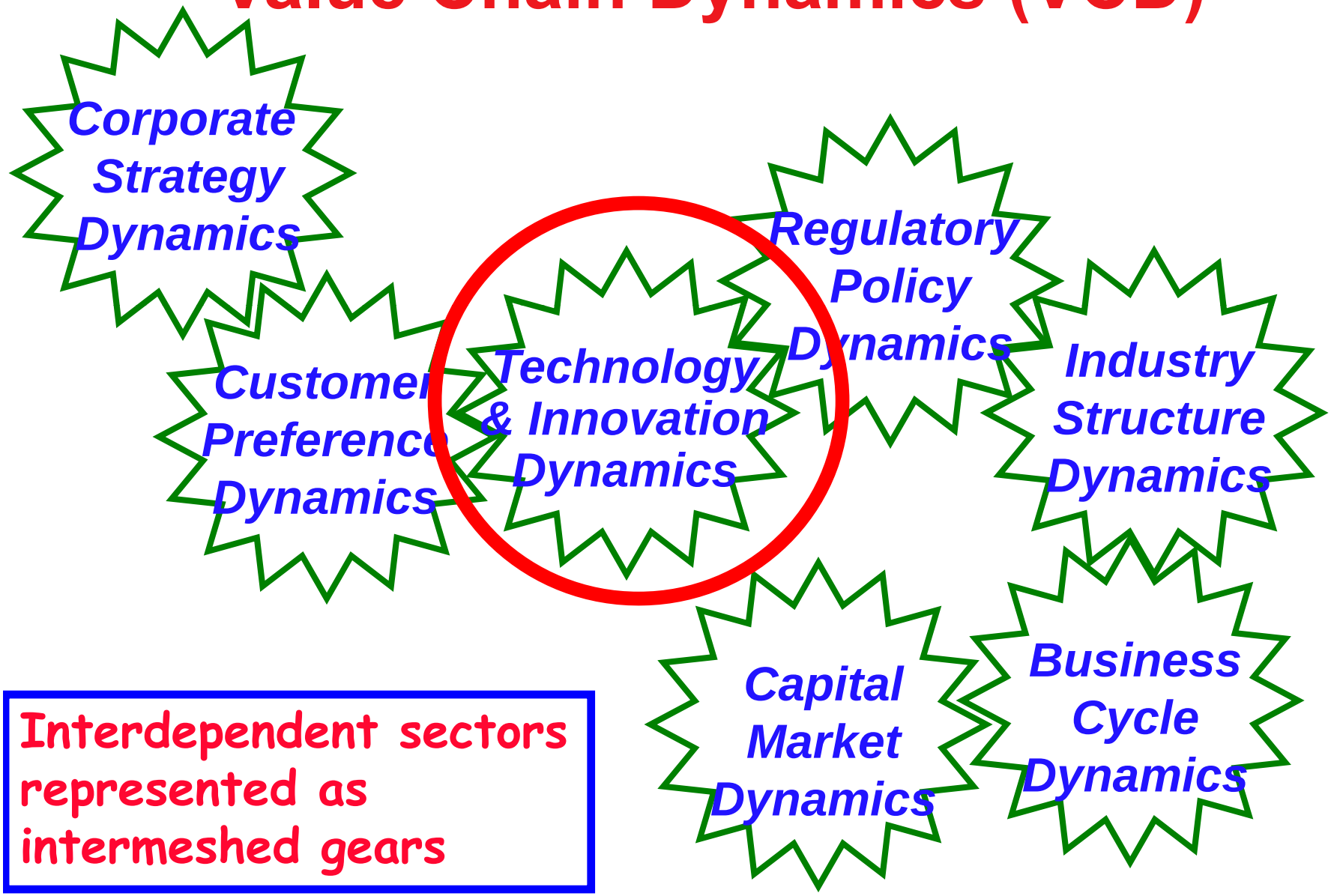
***Evolution in the industrial world:***

**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***

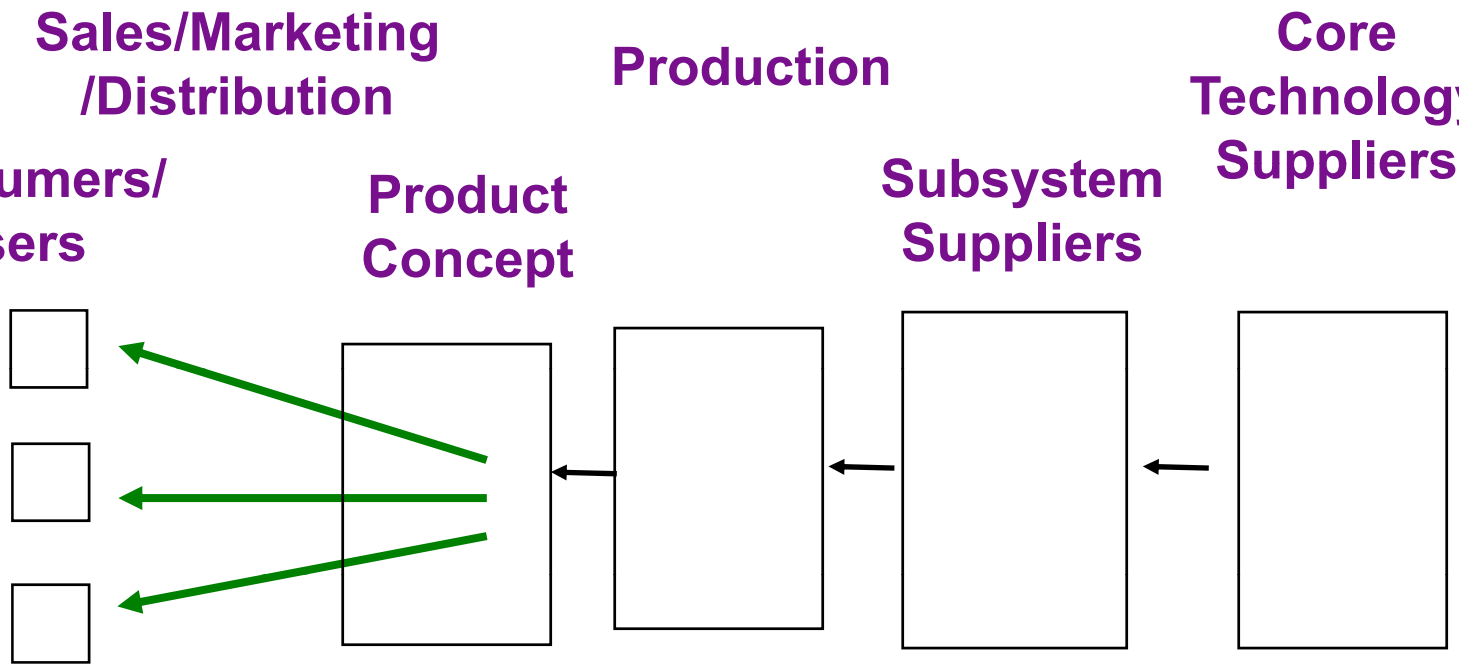
# "Gear Model" to support Roadmapping of Value Chain Dynamics (VCD)




Interdependent sectors represented as intermeshed gears

# Innovation along the Value Chain:

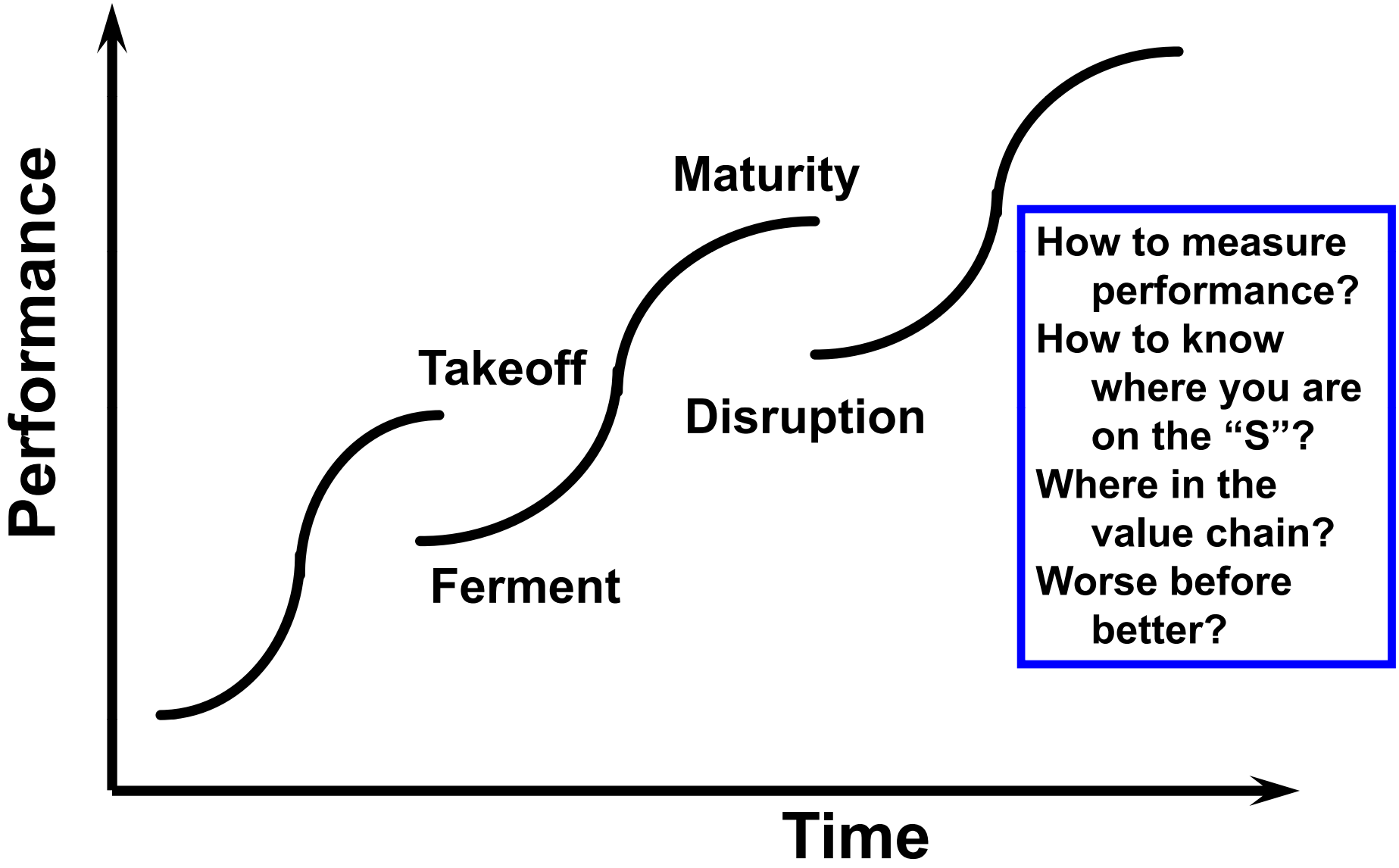
## *How (& why) do Autos & Electronics Differ?*



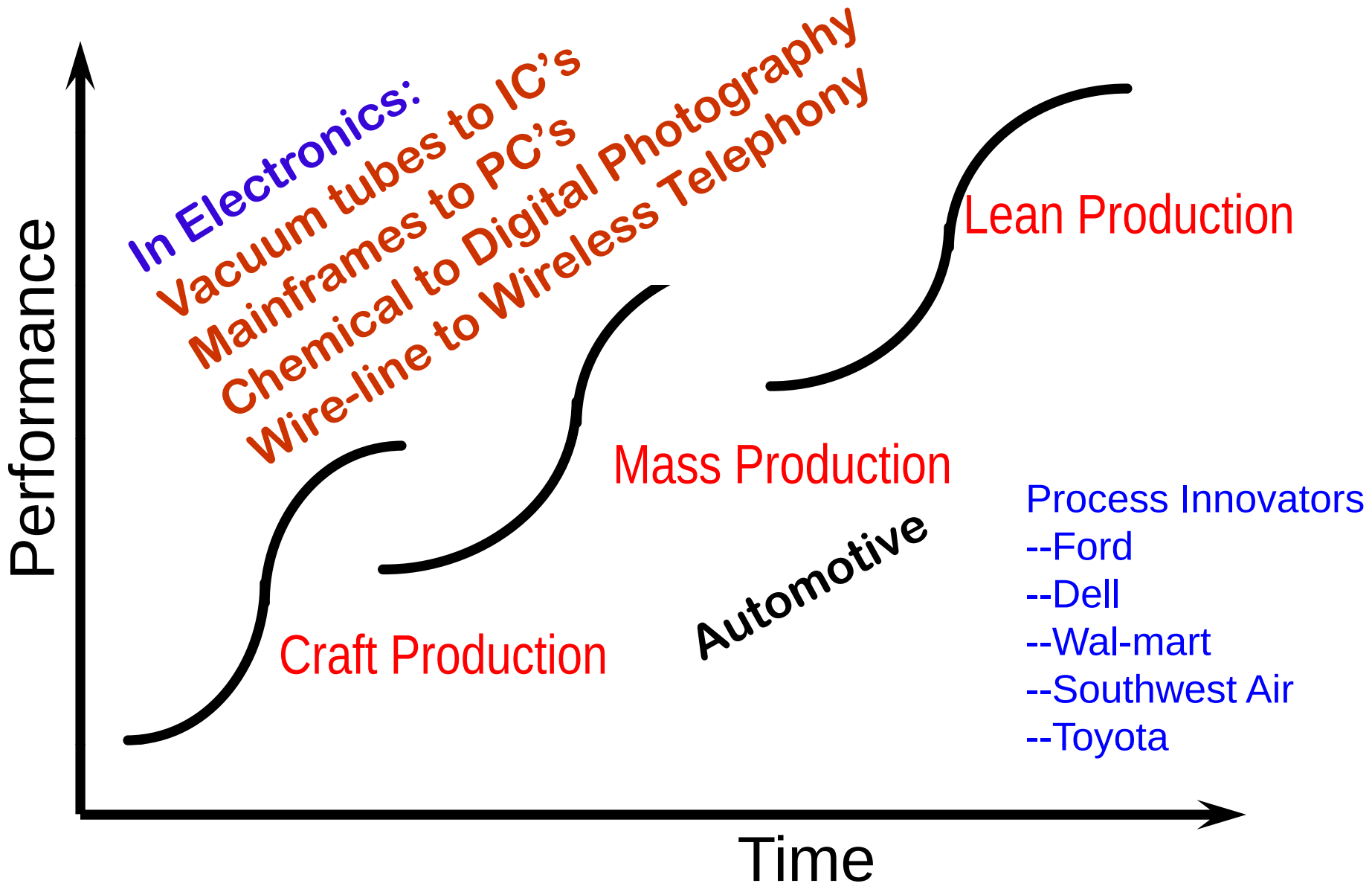

| | | | | | | |
|---|---|---|---|---|---|---|
| AUTOS | Add-ons | Internet | Minivan, SUV, Crossover | Lean Production | Hybrid Engine, Active Suspension | Aluminum Bonding, Carbon Fiber, CAD tools |
| ELEC-TRONICS | Napster, Apple I | Amazon, Dell | iPod, X-Box, Palm, Office, Digital Photog. Mobile Phone | Contract Manufacturing | Html C++ | Microprocessor, Hard disk drive, Photolithography |

# Innovation Dynamics can be

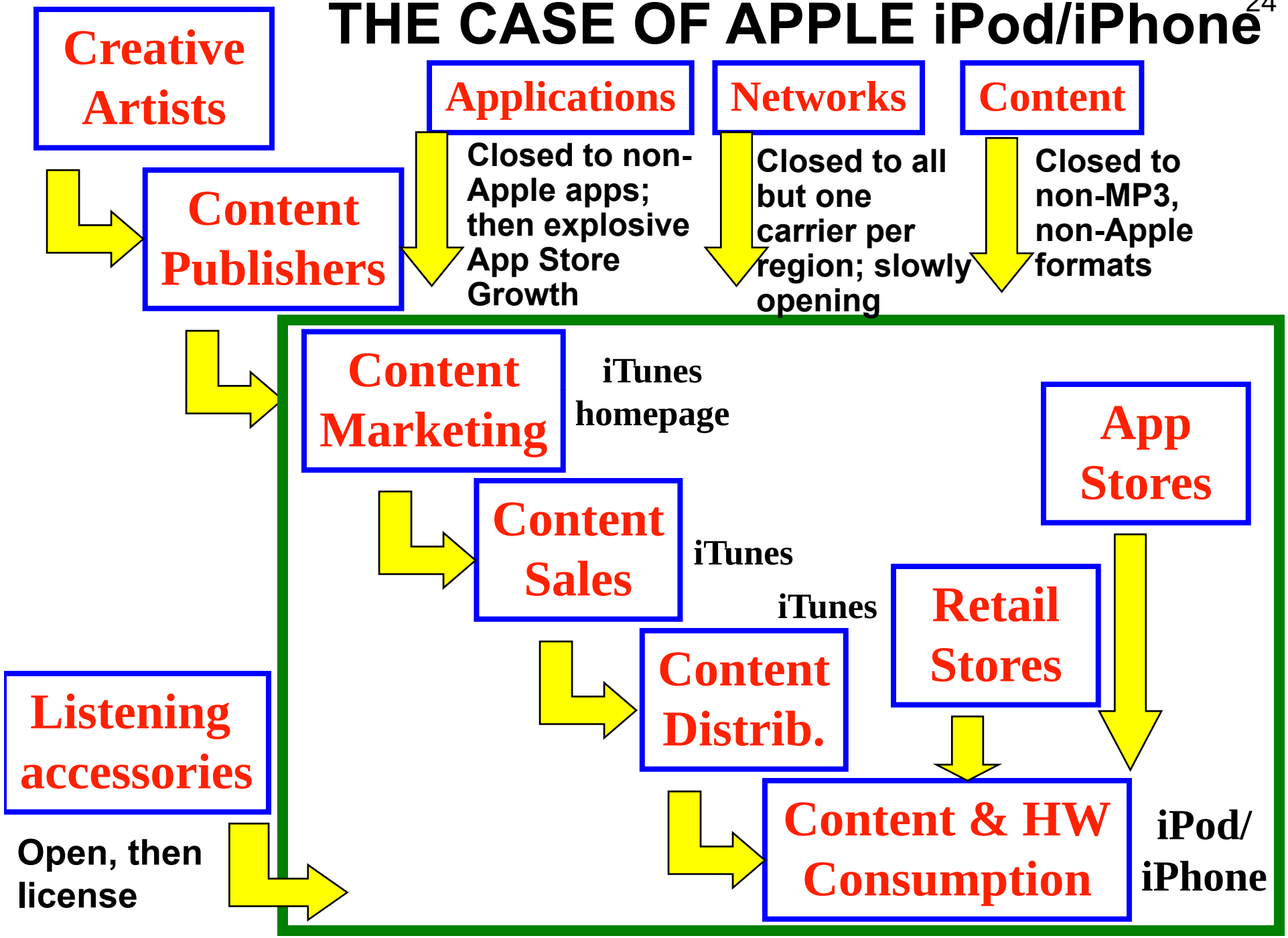
## RADICAL *(disruptive)* or INCREMENTAL *(sustaining)*



# Disruptive *Process* Innovation in Autos vs. Disruptive *Product* Innovation in Electronics



# THE CASE OF APPLE iPod/iPhone



# 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)**

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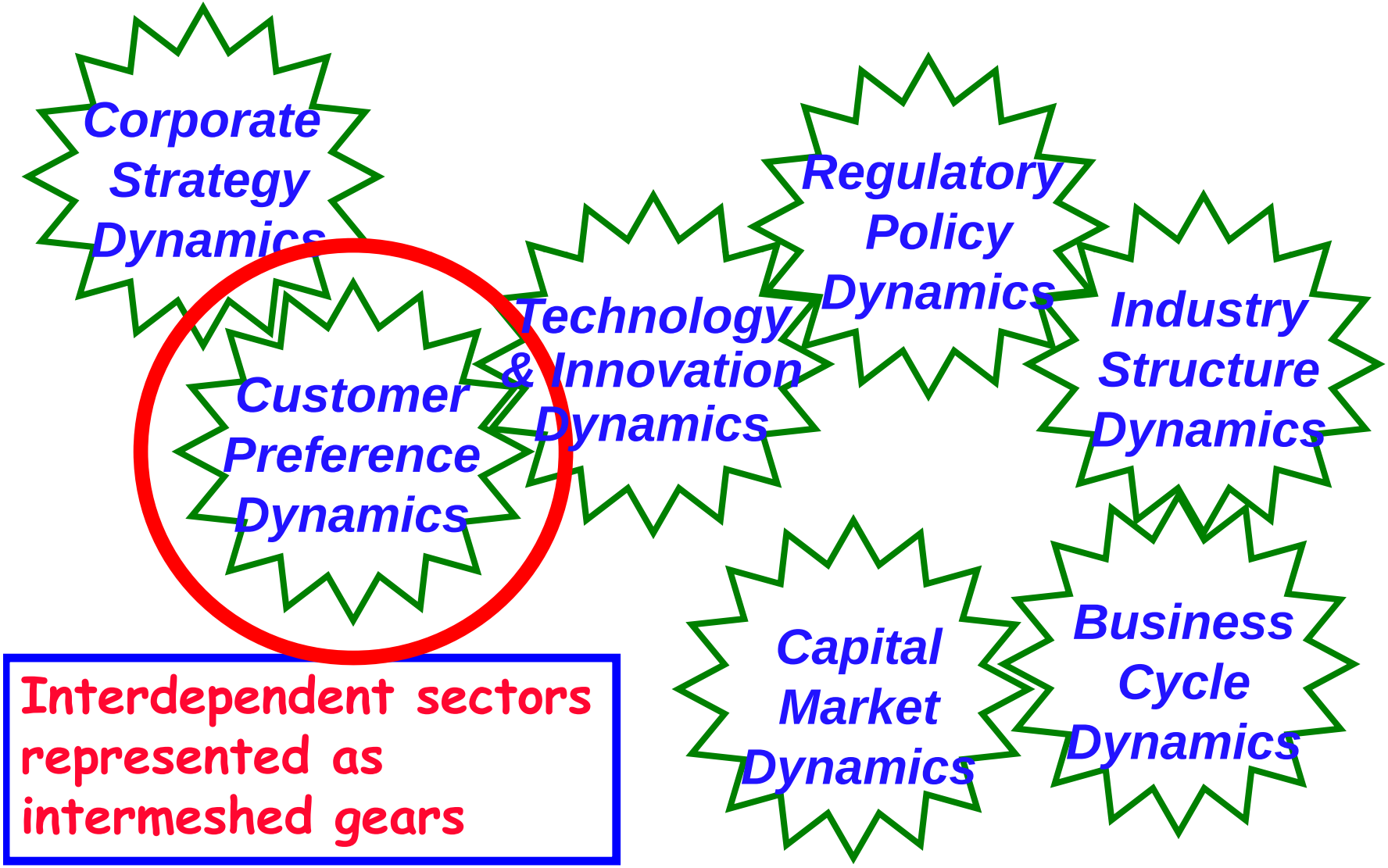
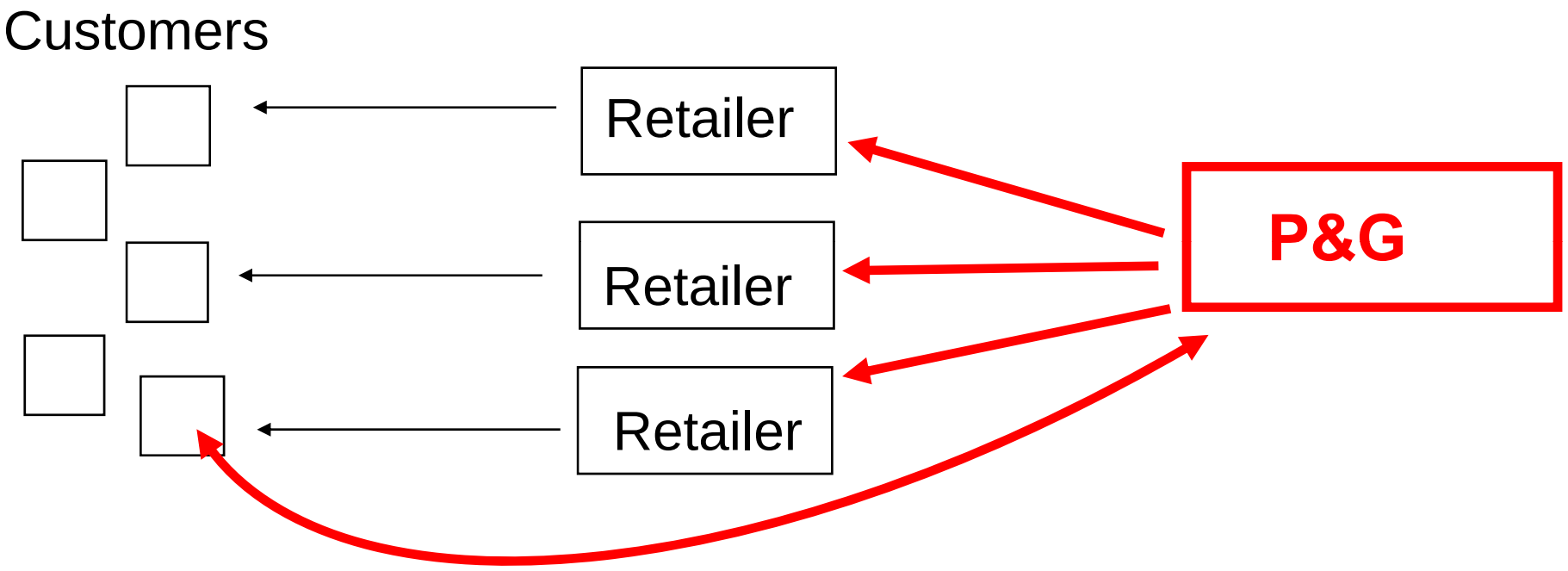


# CUSTOMER PREFERENCE DYNAMICS:
## P&G Value Proposition:
## Premium Products at Premium Prices

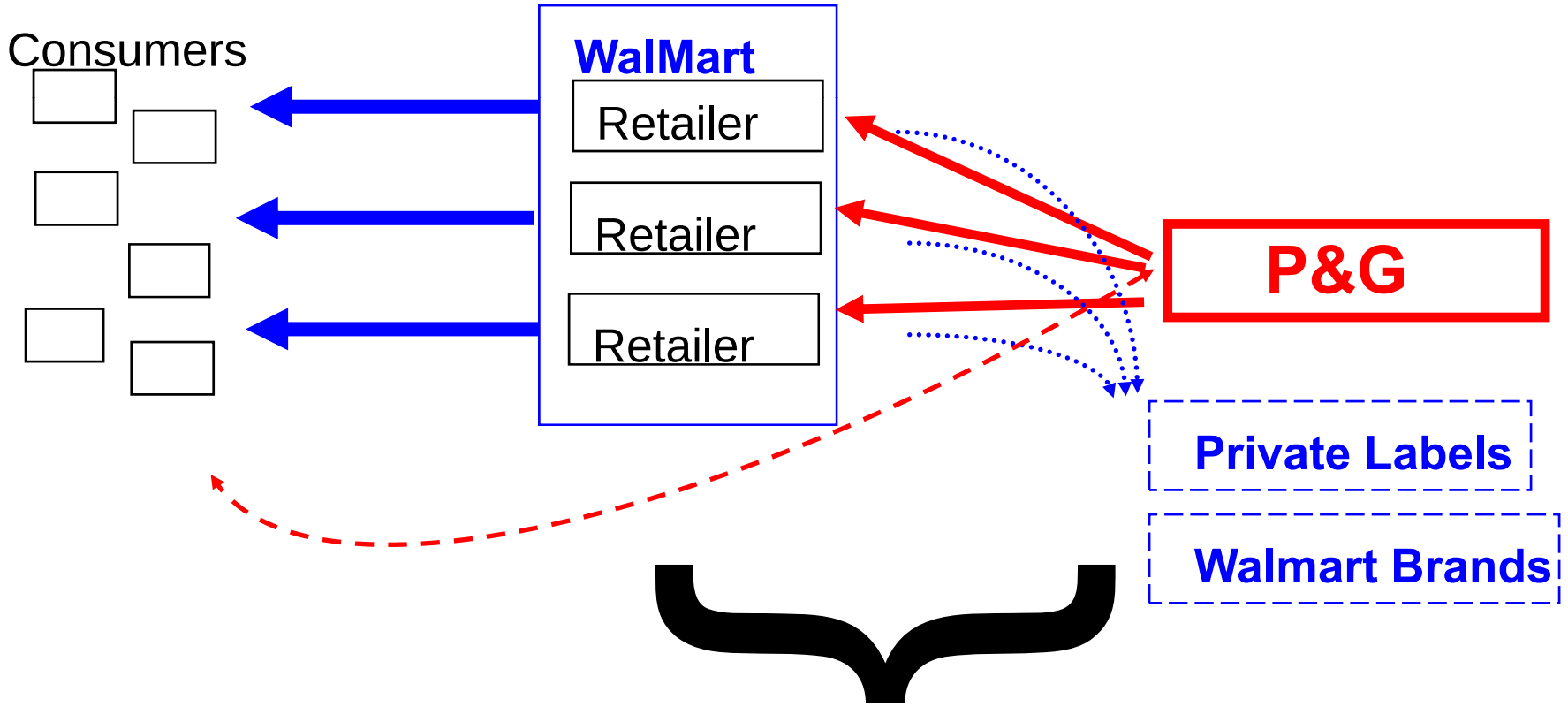
***Controlling the Channel Through Closeness to Customers:***
***consumer research, pricing, promotion, product development***




**What is the role of brand names vs. product features?**
**Laundry Detergent; Mobile Phones; Motorcycles**

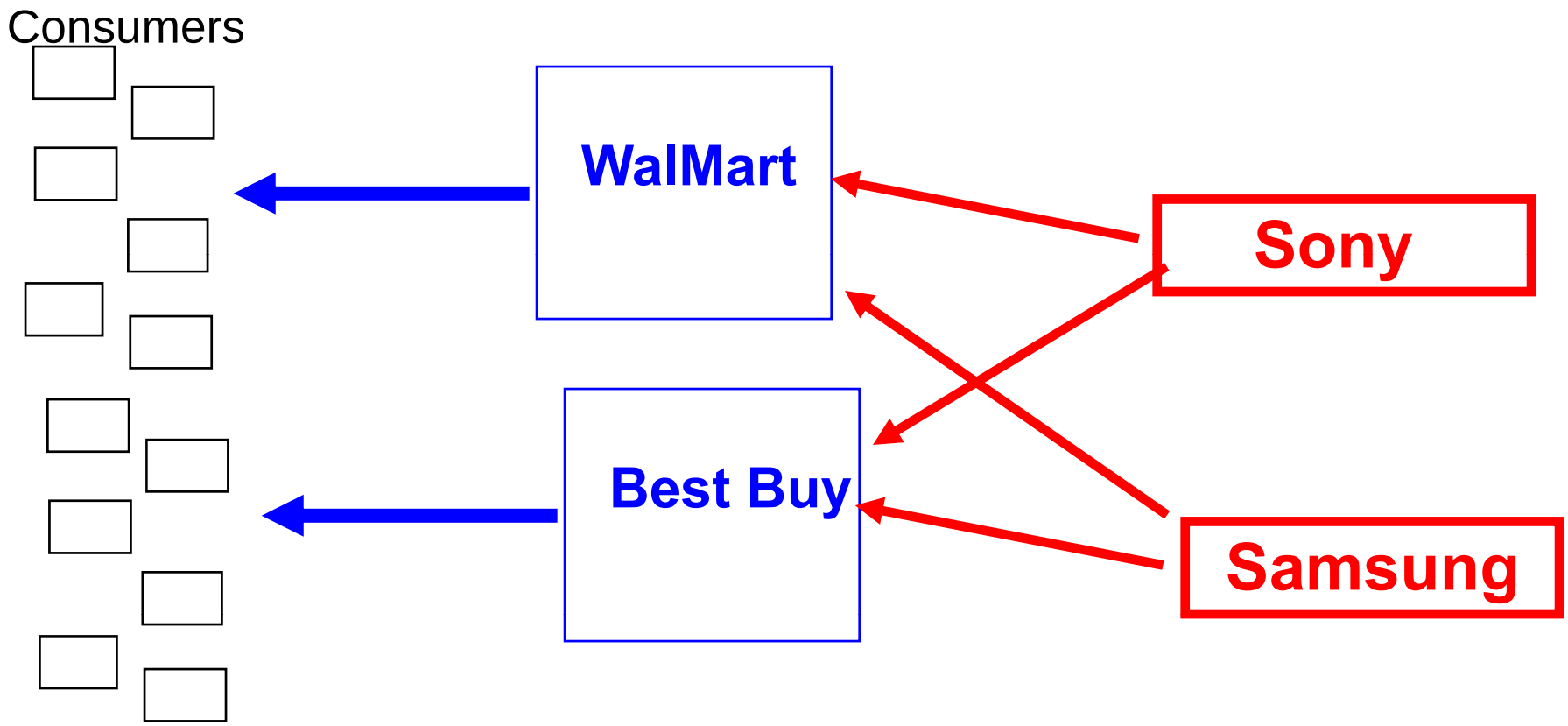
# CUSTOMER PREFERENCE DYNAMICS:
## Walmart Value Proposition:
## Large Selection of Products at Very Low Prices

*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



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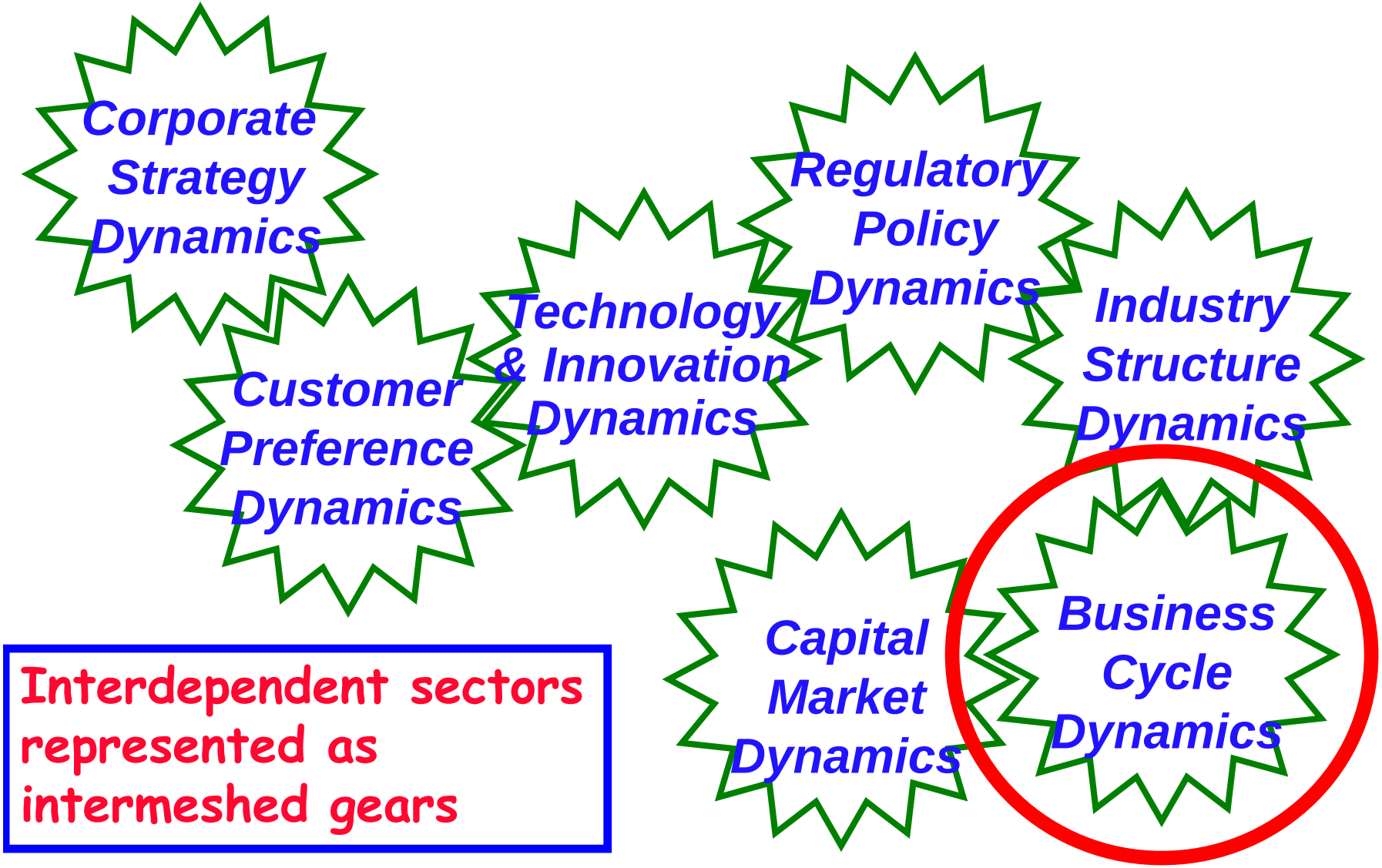
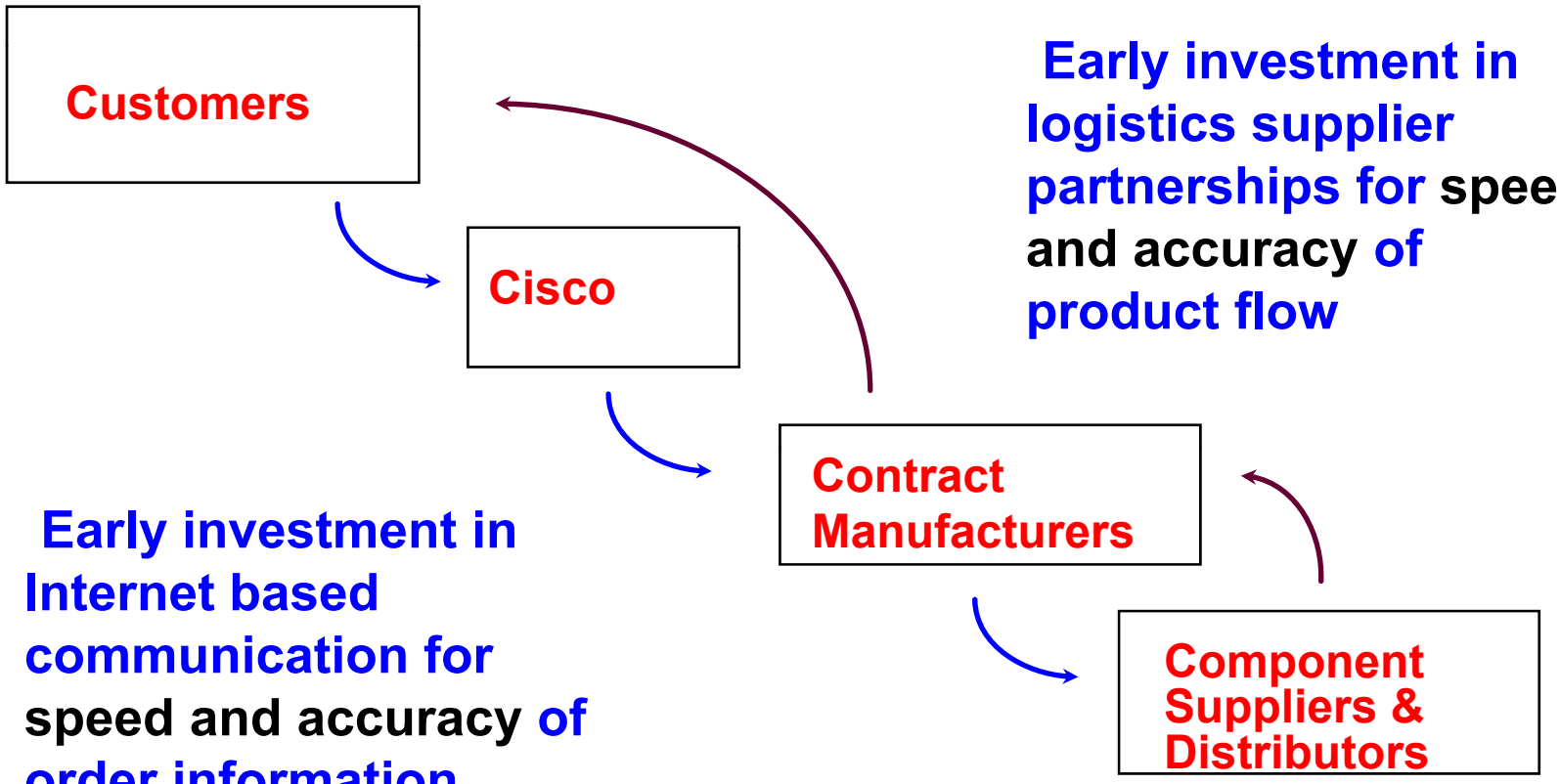


# Cisco's End-to-End Integration for its Fulfillment Supply Chain

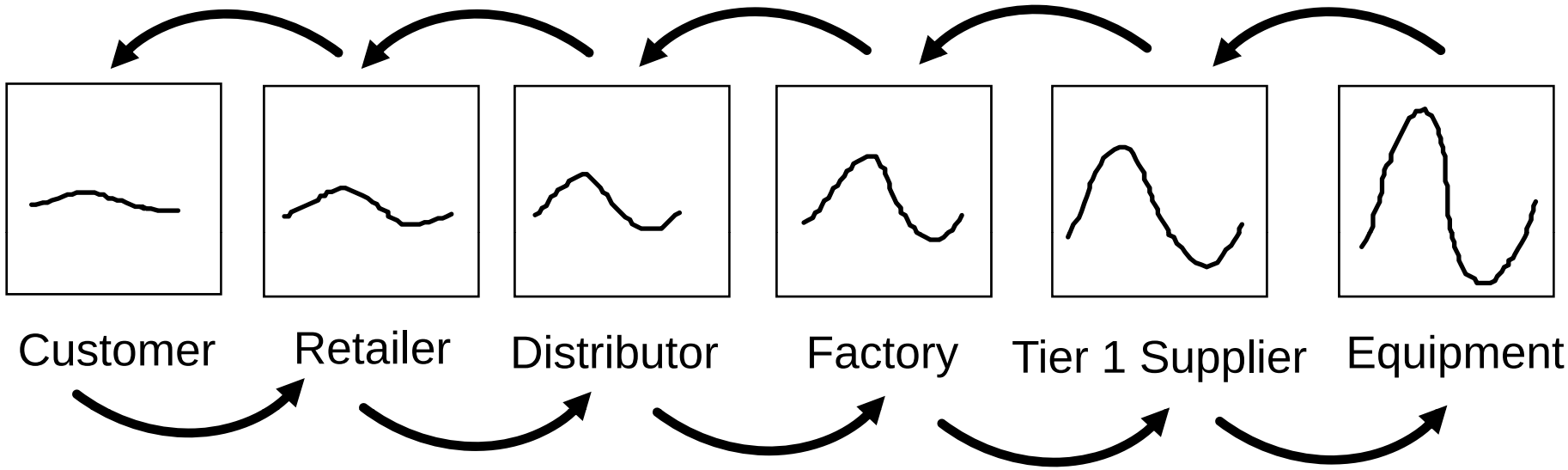


# Cisco's Strategy for Technology Supply Chain Design (I.e., Capabilities)

1. Integrate, echnology 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**

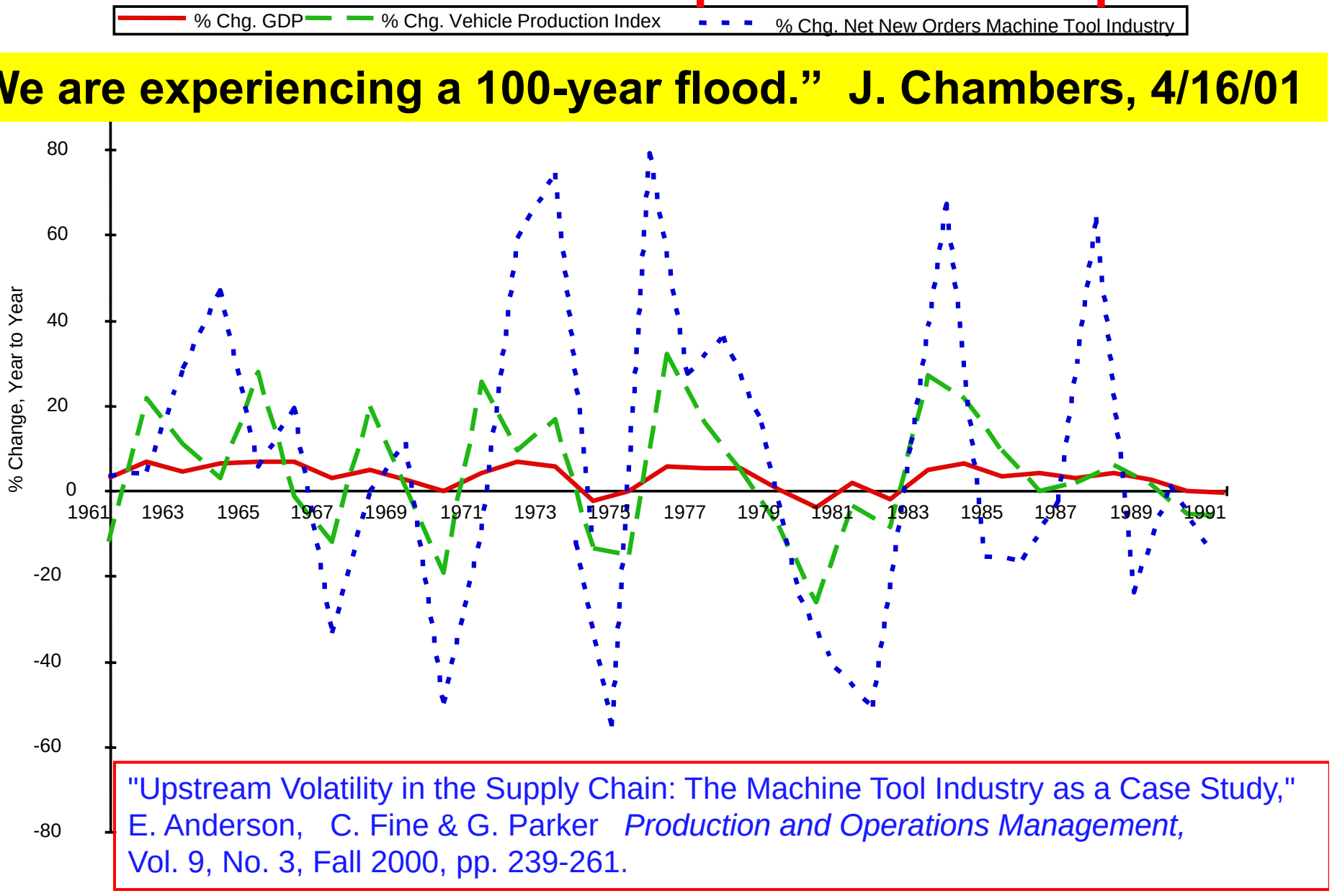
# Volatility Amplification in the Supply Chain: *"The Bullwhip Effect"*




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

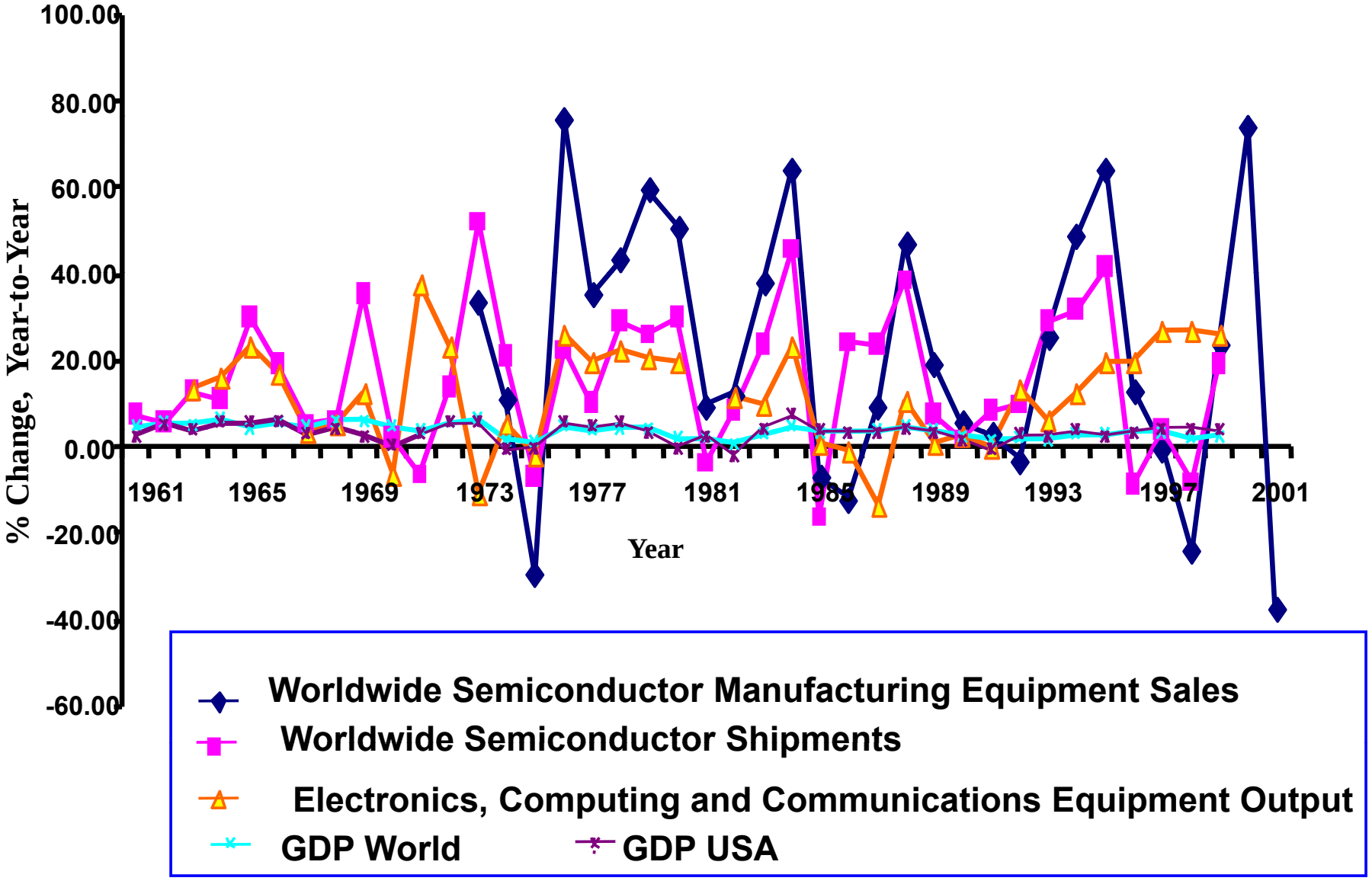
SOLUTIONS:
Countercyclical Markets
Countercyclical Technologies
Collaborative channel mgmt.
(Cincinnati Milacron & Boeing)

# Supply Chain Volatility Amplification: Machine Tools at the tip of the Bullwhip




"Upstream Volatility in the Supply Chain: The Machine Tool Industry as a Case Study," E. Anderson, C. Fine & G. Parker *Production and Operations Management,* Vol. 9, No. 3, Fall 2000, pp. 239-261.

# Volatility in the Electronics & Semiconductors Supply Chain



# 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

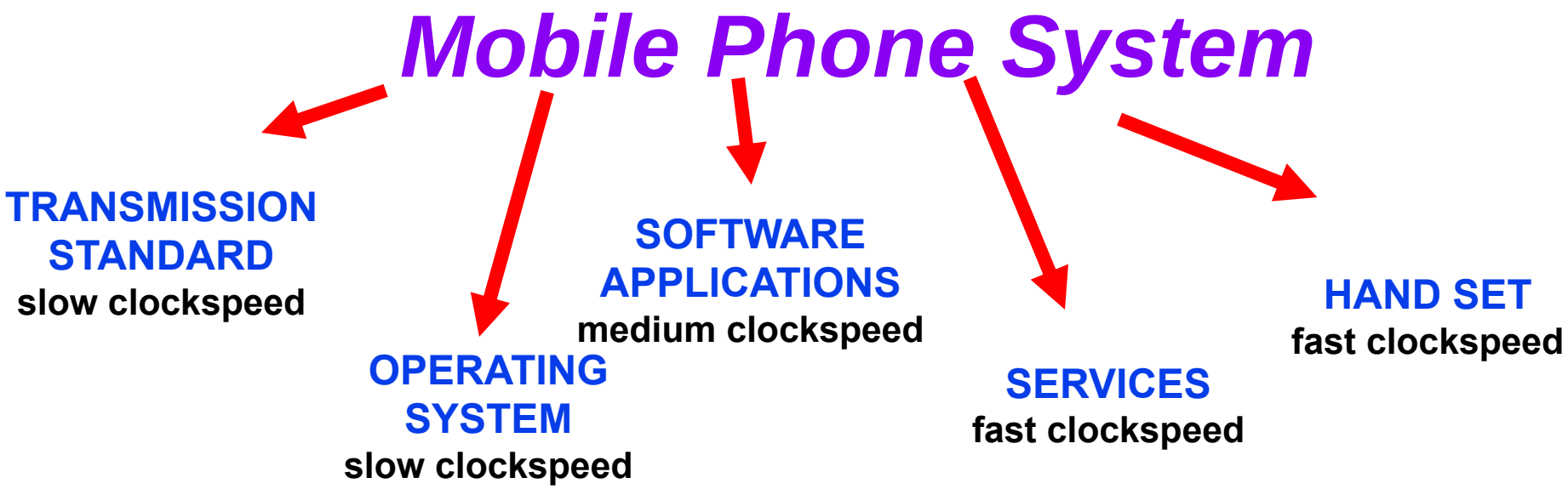
***Mobile Phone*** **INDUSTRY CLOCKSPEED**

**THE**
***Mobile Phone***
**product technology**

**THE**
***Mobile Phone***
**PRODUCTION PROCESS**
**process technology**

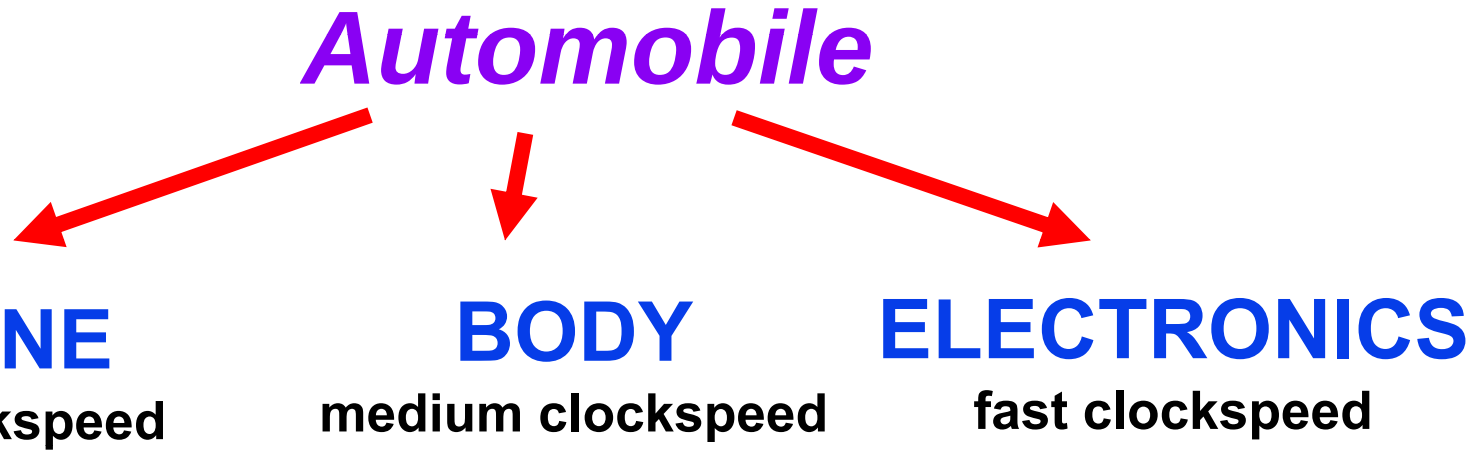
**THE**
***Mobile Phone***
**MANUFACTURING COMPANY**
**organization**

# *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* CLOCKSPEED 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 CLOCKSPEED.***

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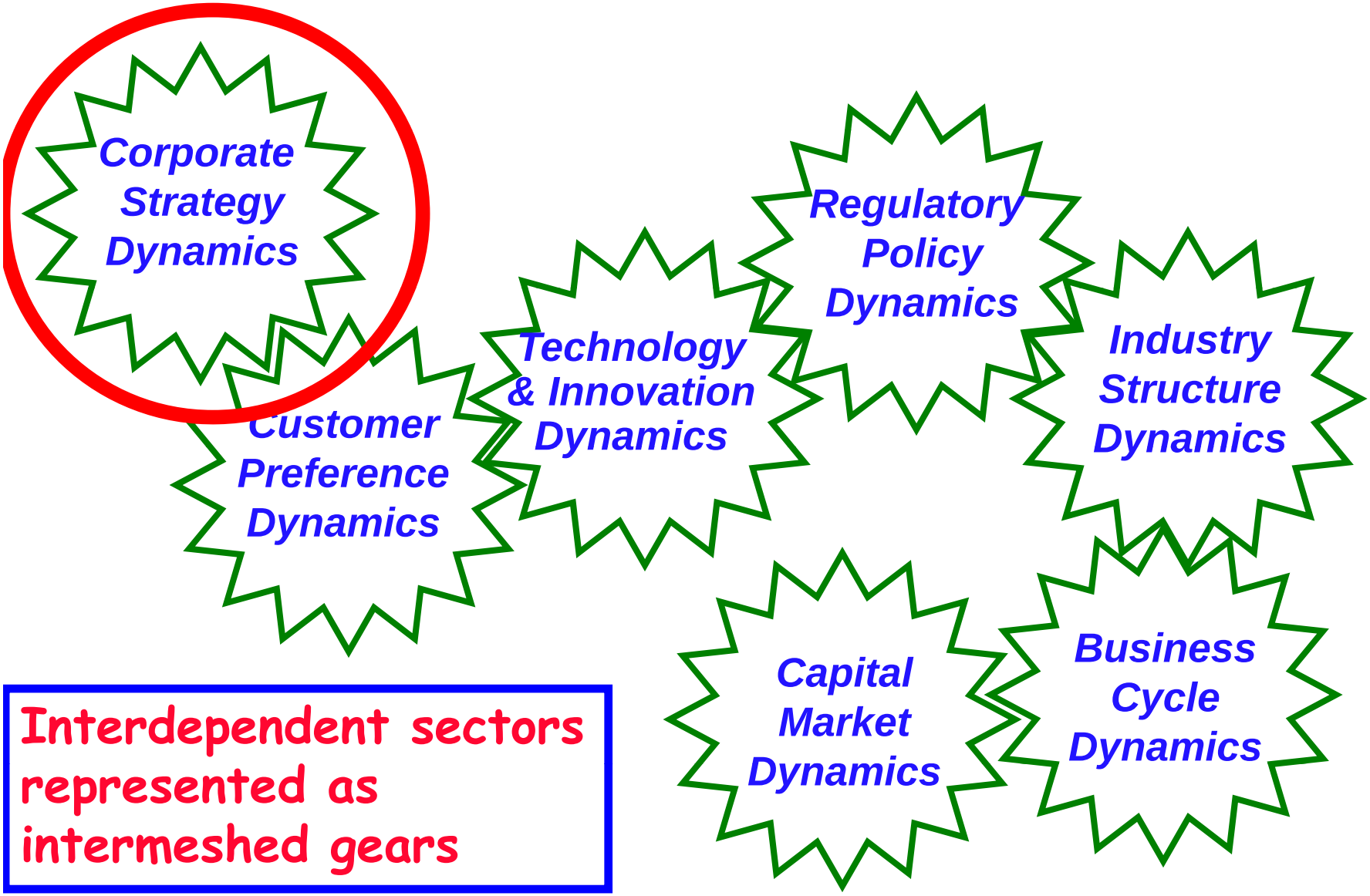
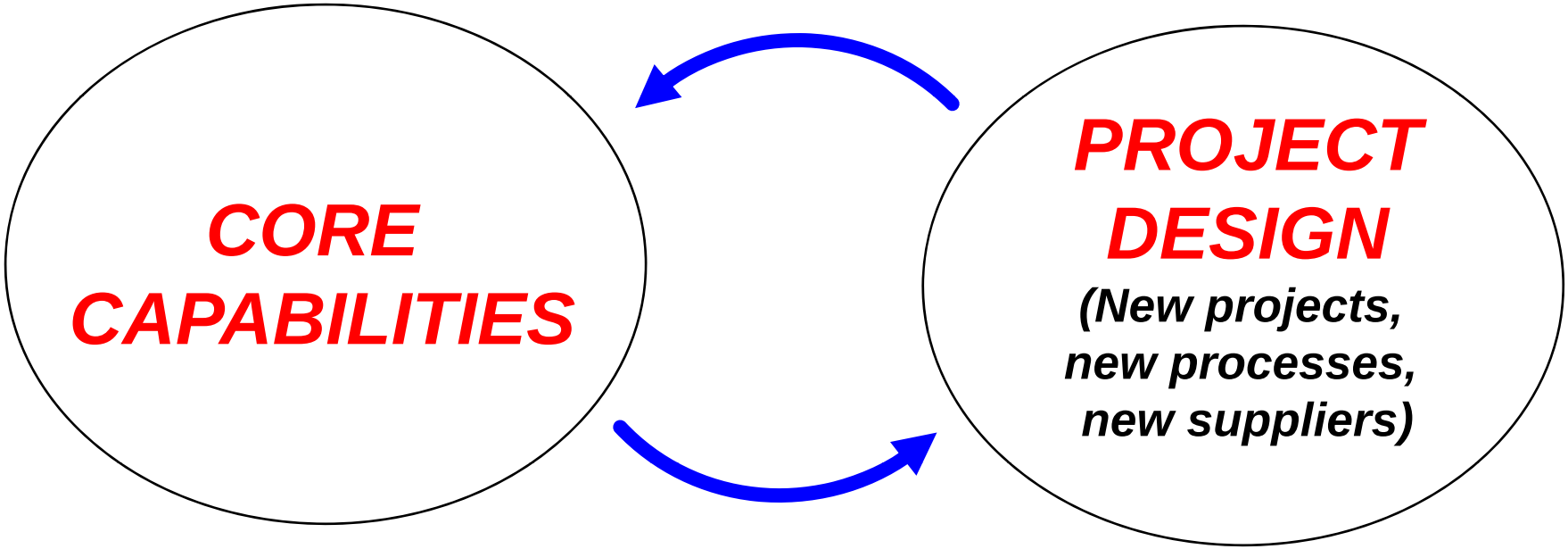



Interdependent sectors represented as intermeshed gears

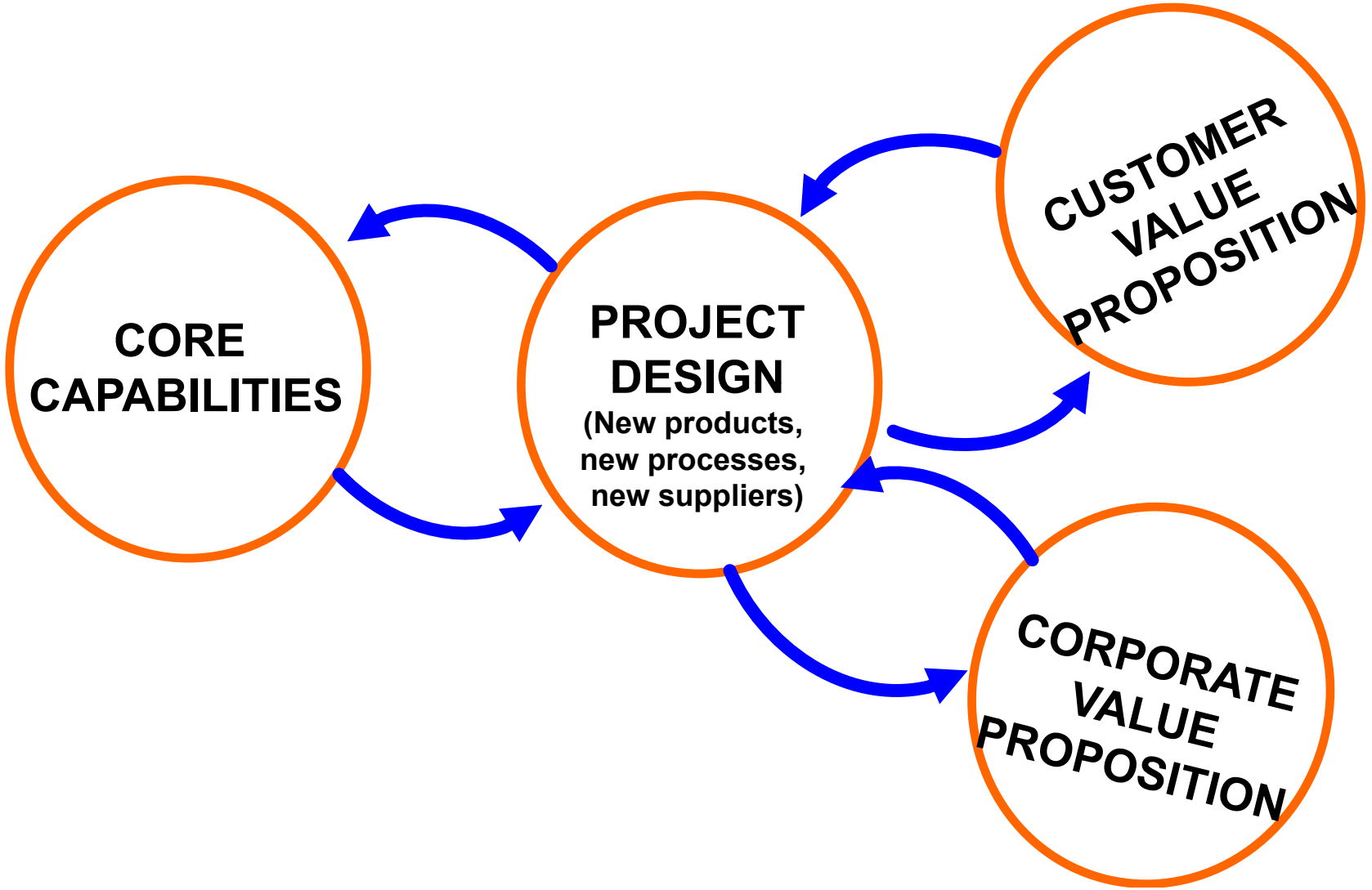
# *Projects, Strategy, and Value Chains*
## Clockspeed drives
## *Business Strategy Cadence*

**CAPABILITIES enable & constrain PROJECTS;**
**PROJECTS build CAPABILITIES**




Leonard-Barton, *Wellsprings of Knowledge*

# Projects Serve Three Masters: Capabilities, Customers, & Corporate Profit



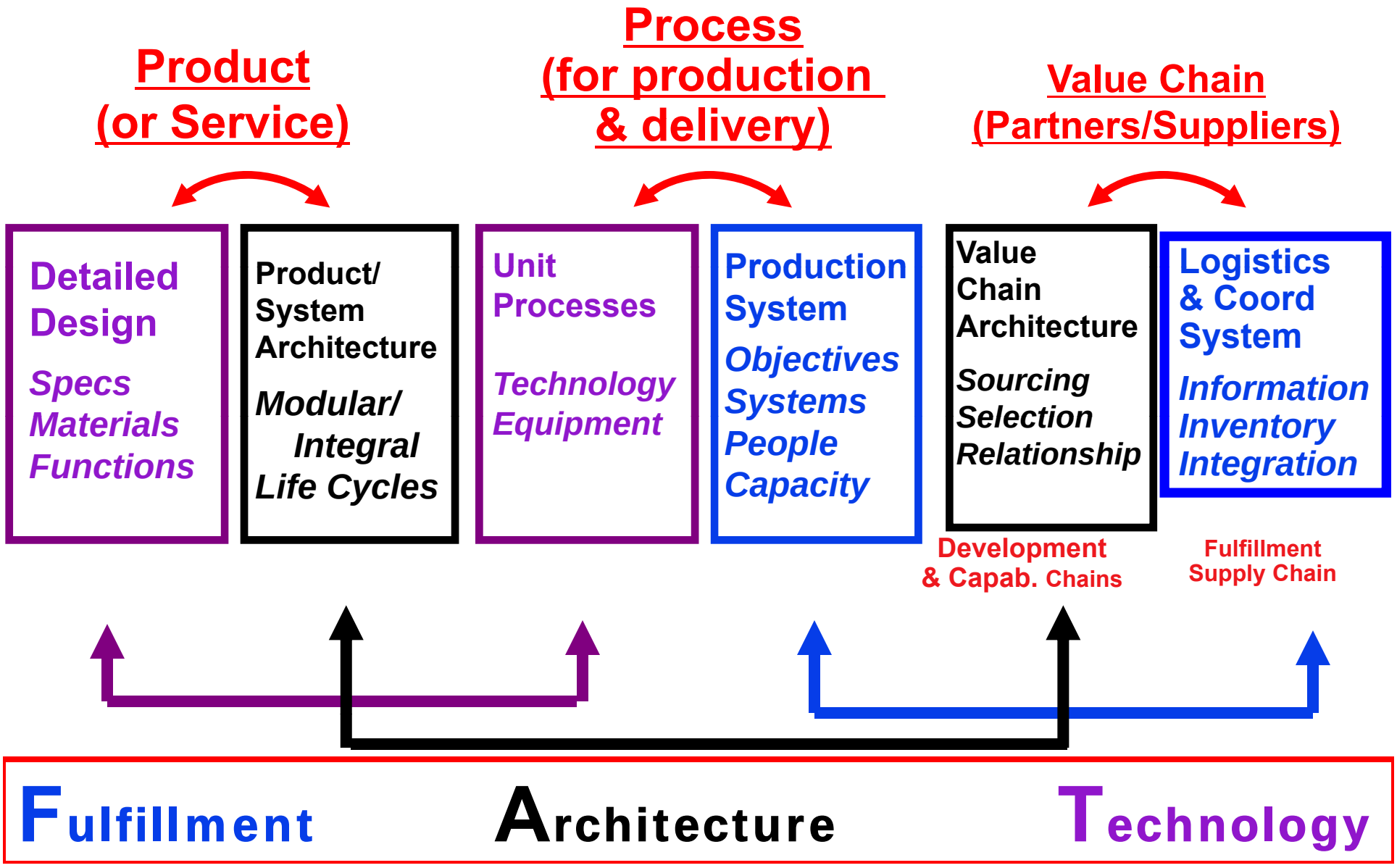
# VALUE CHAIN DESIGN:
# Three Components

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

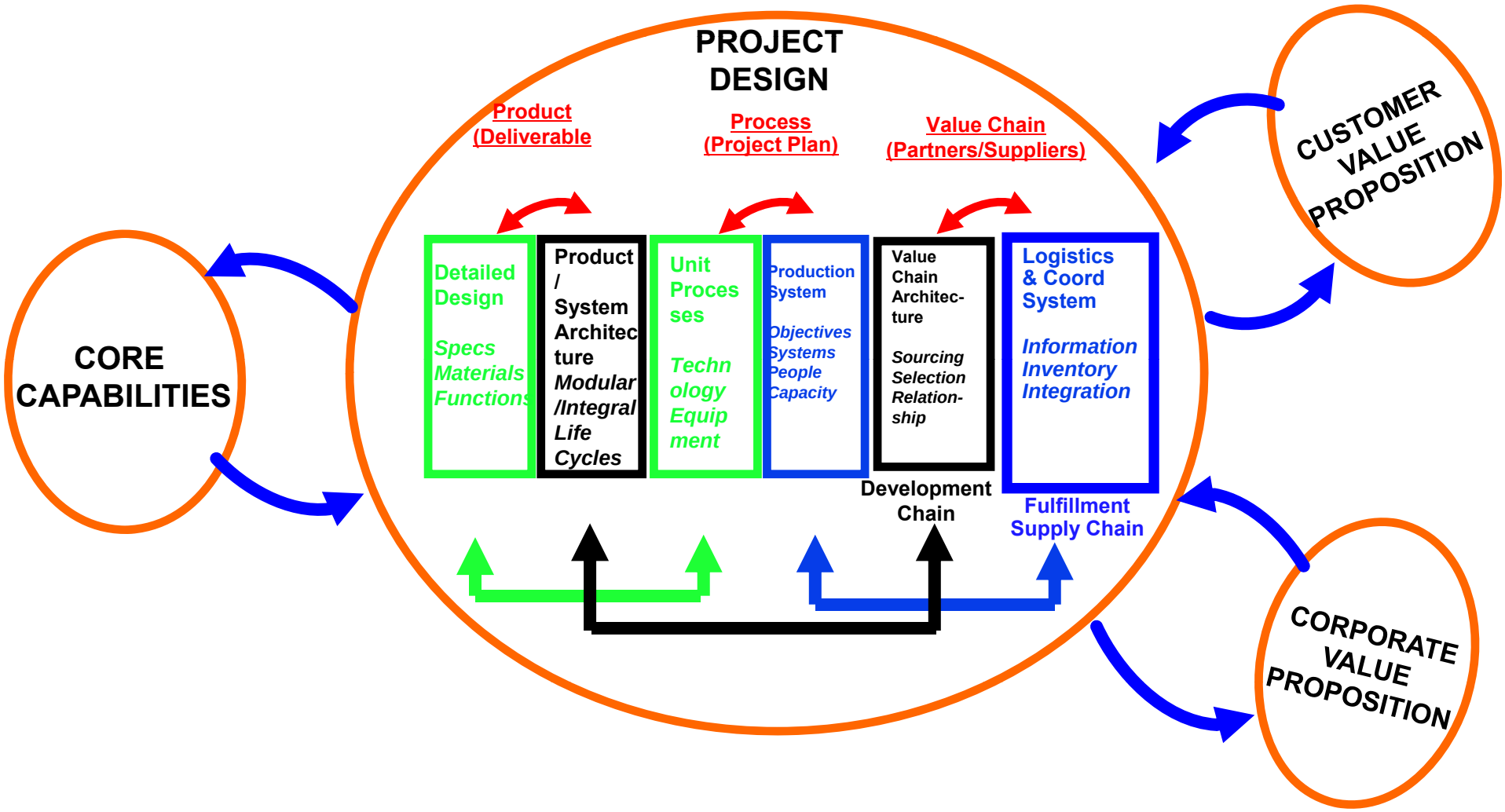
**2. Partner Selection**
***(Choice of suppliers and partners for the chain)***

**3. The Contractual Relationship**
***(Arm's length, joint venture, long-term contract, strategic alliance, equity participation, etc.)***

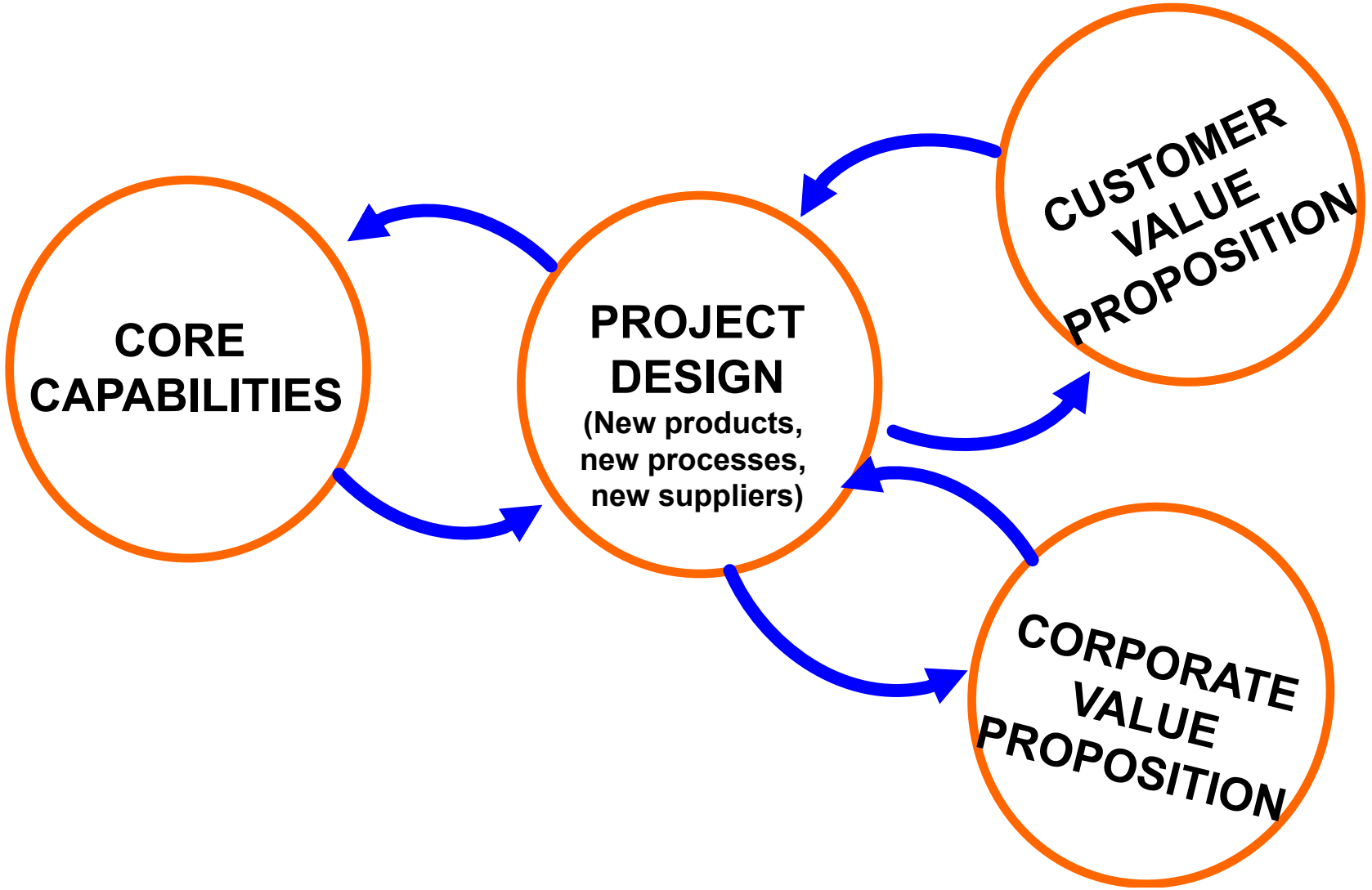
# 3-D Concurrent Engineering & *the imperative of concurrency*



# IMPLEMENTATION OF *PROJECT DESIGN:* FRAME IT AS 3-D CONCURRENT ENGINEERING



# Do you have to think strategically about every project?



# 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**

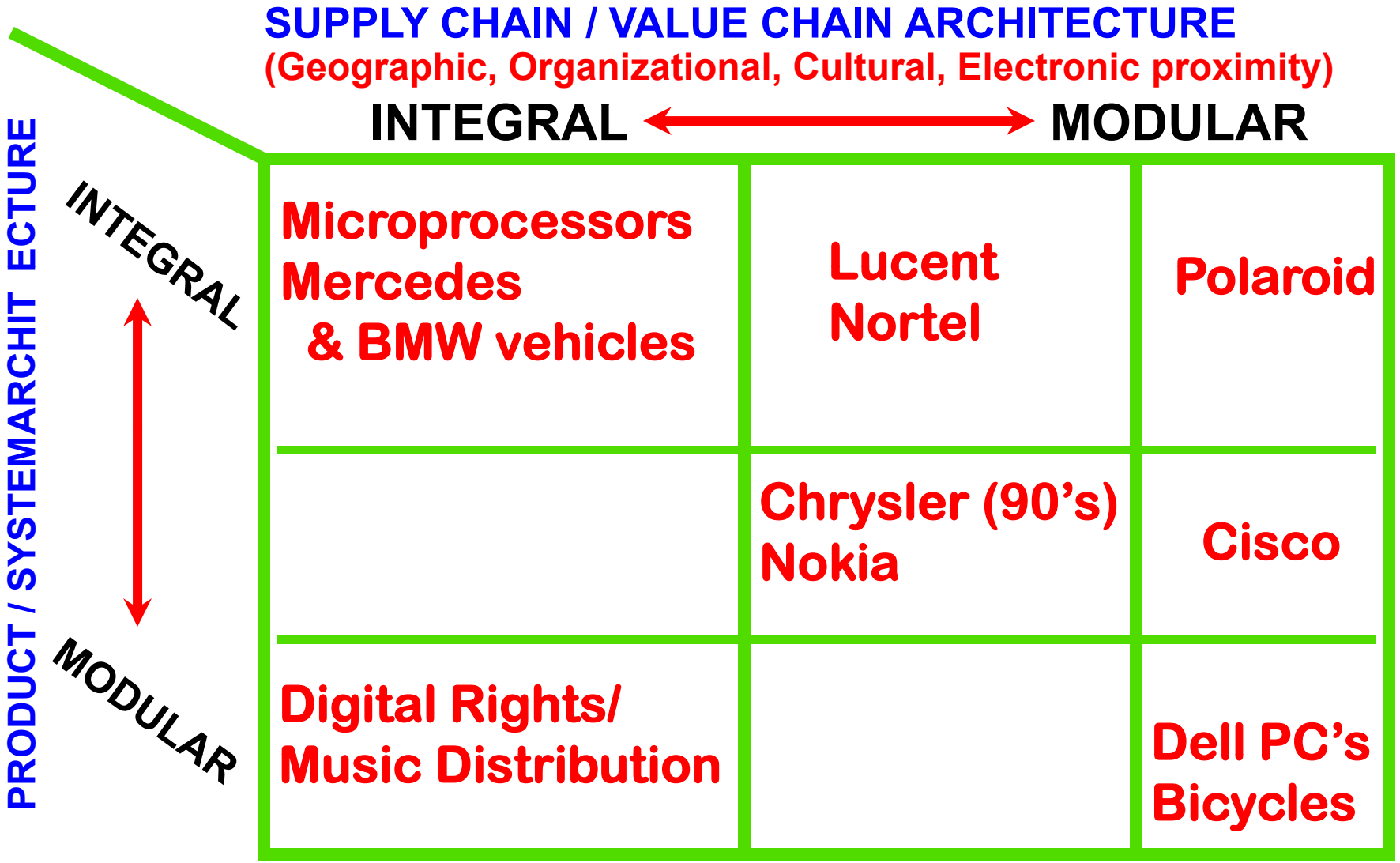
- **Ex: stereo system, desktop PC, bicycle**

# *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**

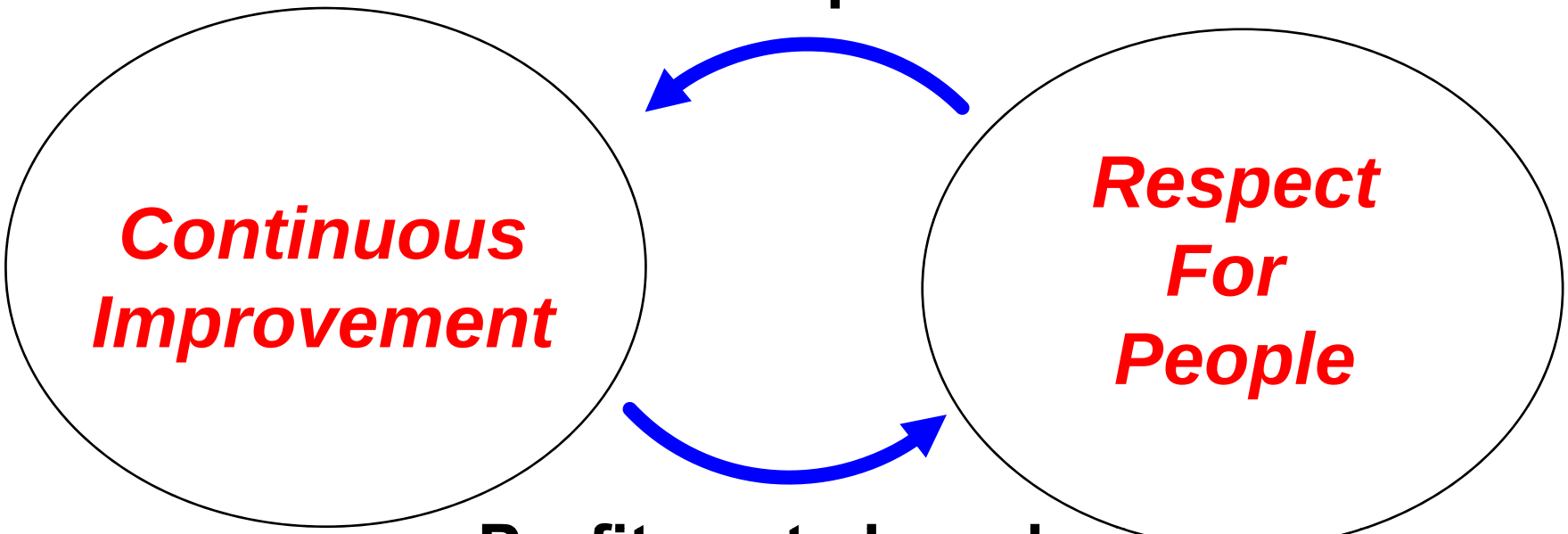
**Modular value-chain architecture features multiple,**
**interchangeable supplier and standard interfaces**
**- Example: Garment industry**
**- Example: PC industry**
**- Example: General Motors' global sourcing**
**- Example: Telephones and telephone service**

# ALIGN ARCHITECTURES ACROSS SYSTEMS AND VALUE CHAINS



# TPS Dynamics between Continuous Improvement & Respect for People (Stakeholders)

**Motivated People**
**Drive faster Improvement**



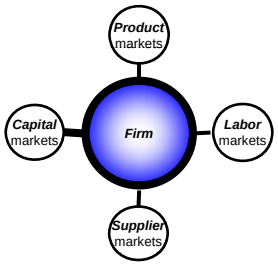

**Profits get shared**
**to reward and incentivize alignment**

# The Evolution of Business Ecosystems

## Operations (or "quantity") Loop

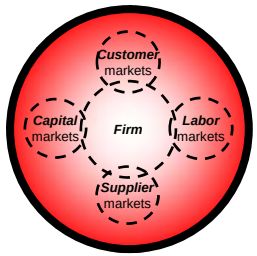
Ted Piepenbrock, MIT

**Modular** Enterprises




Maximization of **Shareholder Value**

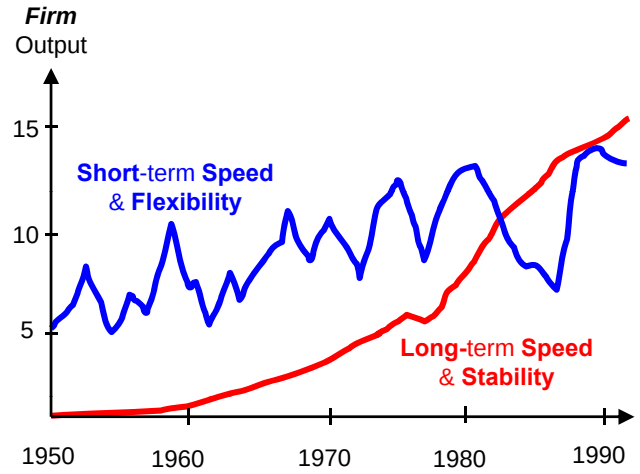
**Integral** Enterprises




Maximization of **Stakeholder Surplus**

**which drive…**

***Competitive Dynamics***

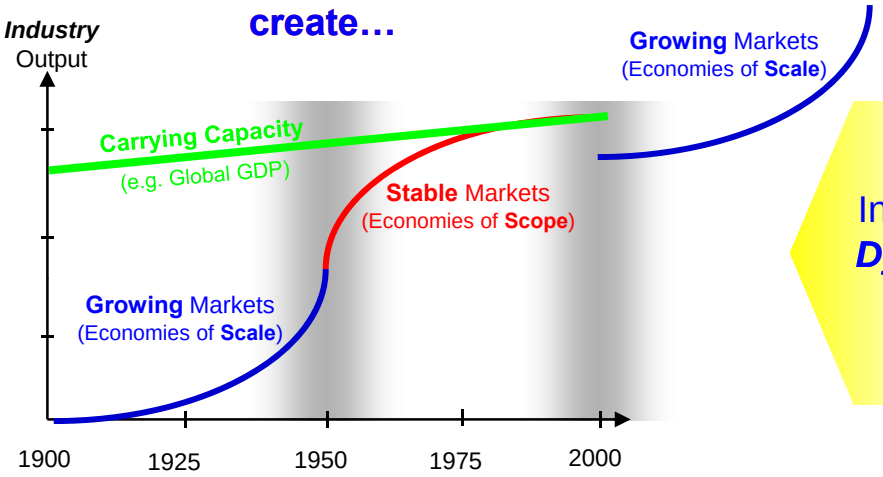



**which generates…**

Firm ***Long-Term Performance***

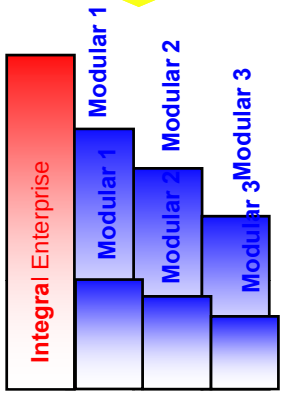
Enterprise ***Architectural***

**create…**



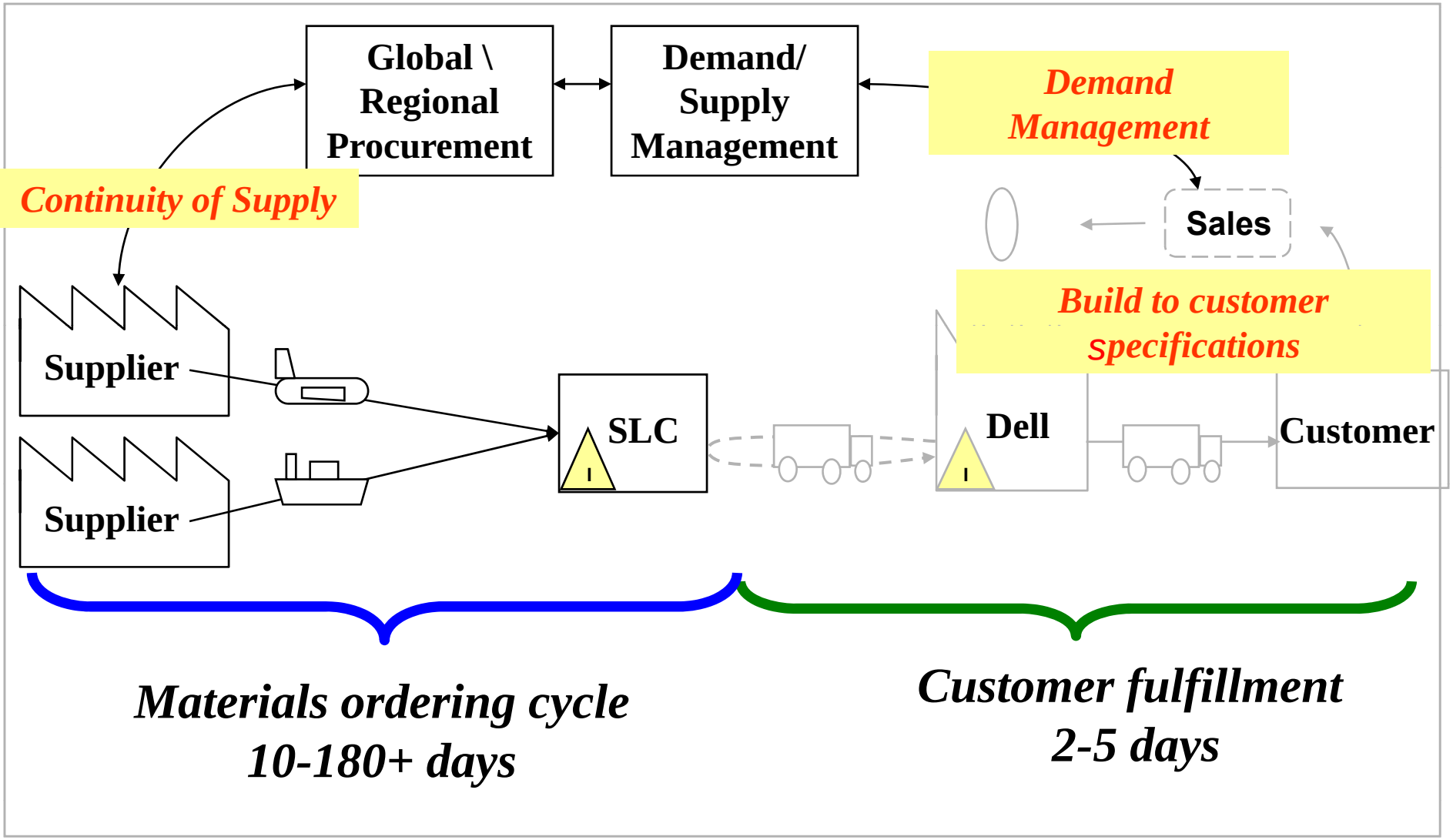

Industrial ***Dynamic***

**which shapes…**



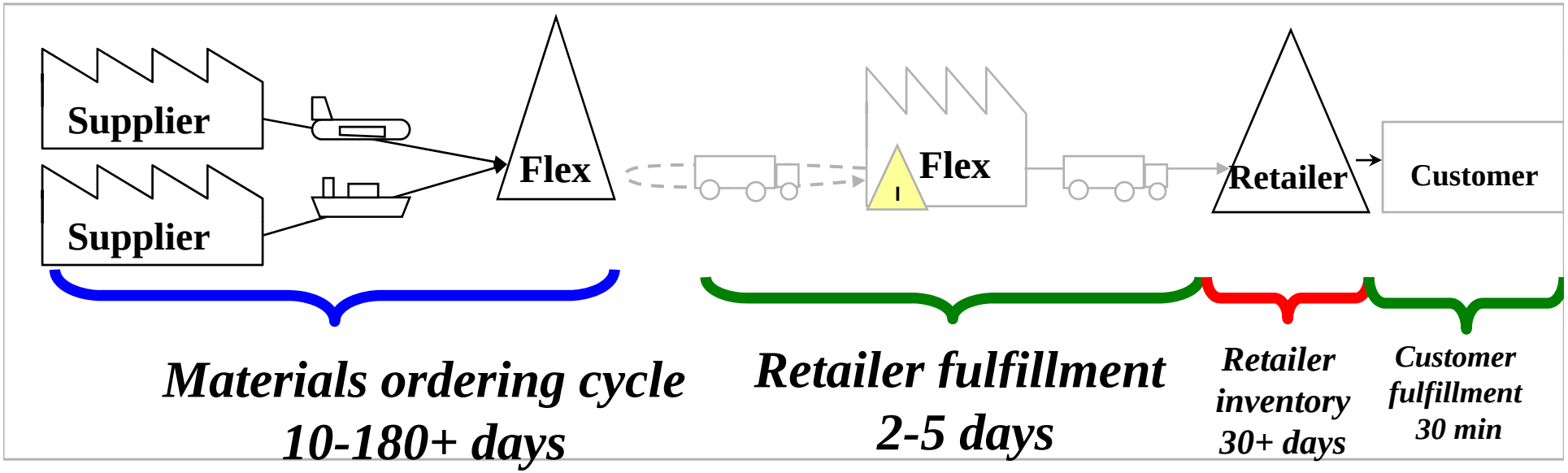

Market Capitalization

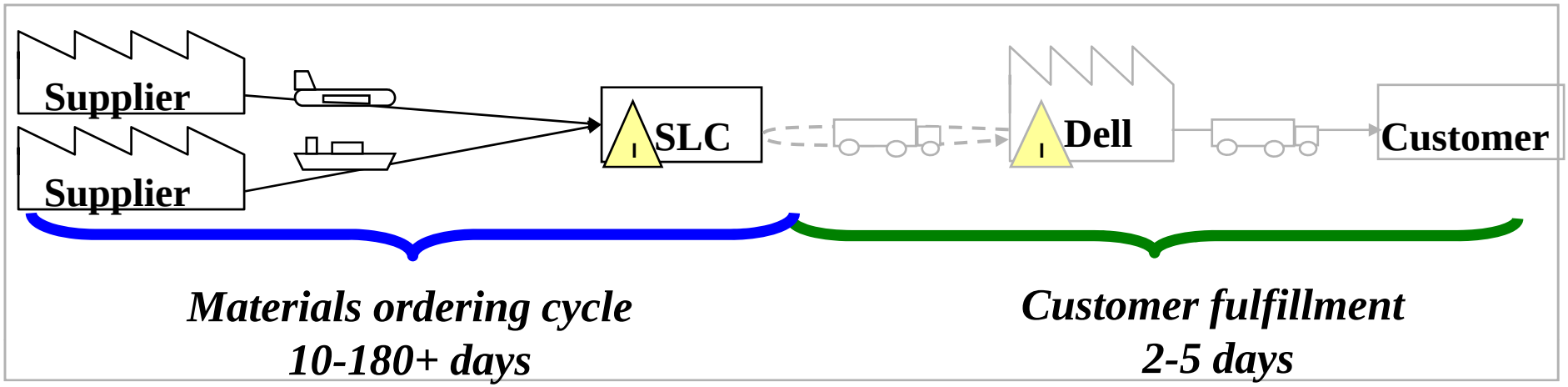
# Dell Supply Chain




**Modular Product Architecture enables Modular Supply Chain**

# HP/Flextronics vs. Dell Supply Chain




**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

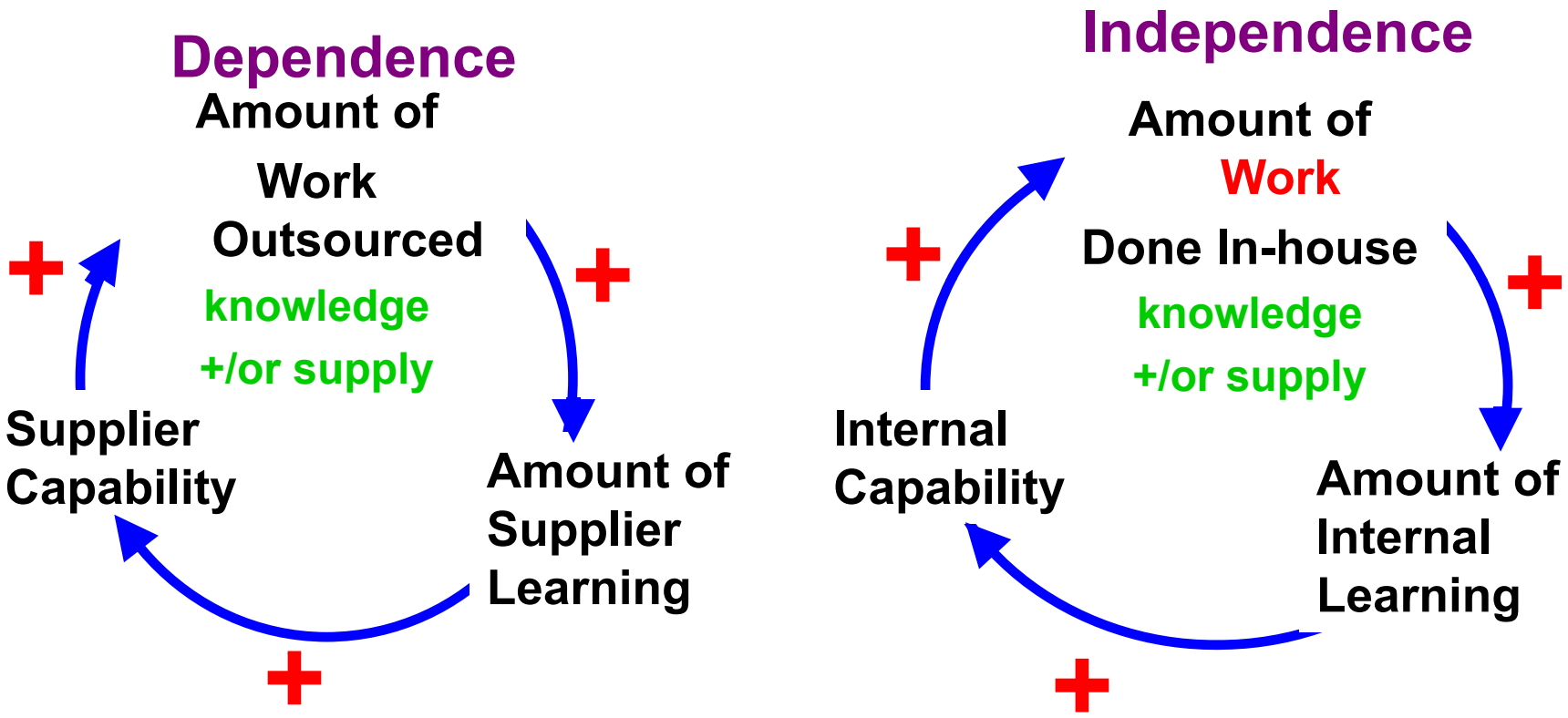
# BUT, A Car is not a Computer!!

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

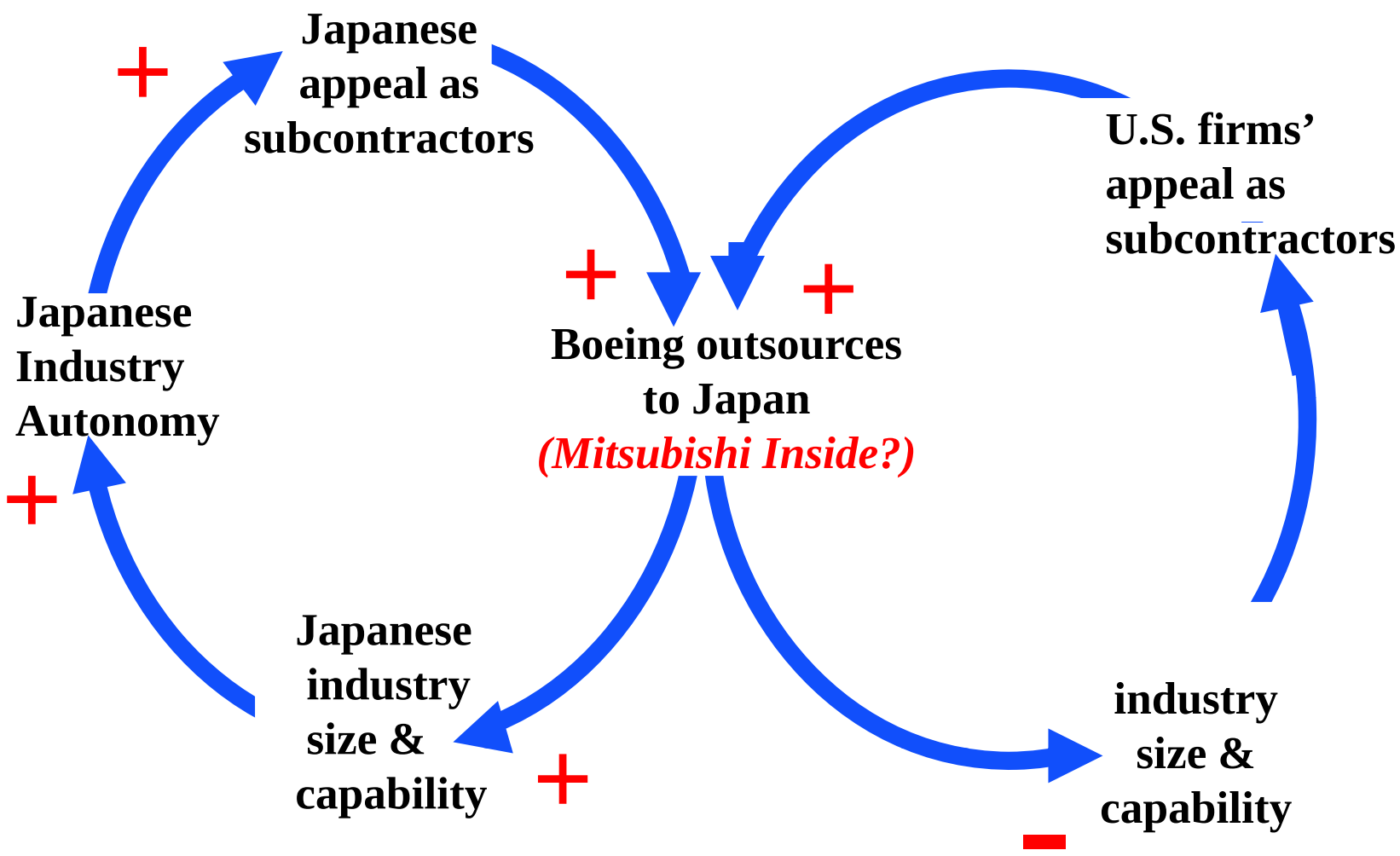
- ***Car***
- ~ 4000 components
- 100 key subsystems
- 300 key suppliers
- 12 month validation
- 1,000,000 variations
- Integral Architecture

Adapted from Prof. J.P. MacDuffie, IMVP & The Wharton School

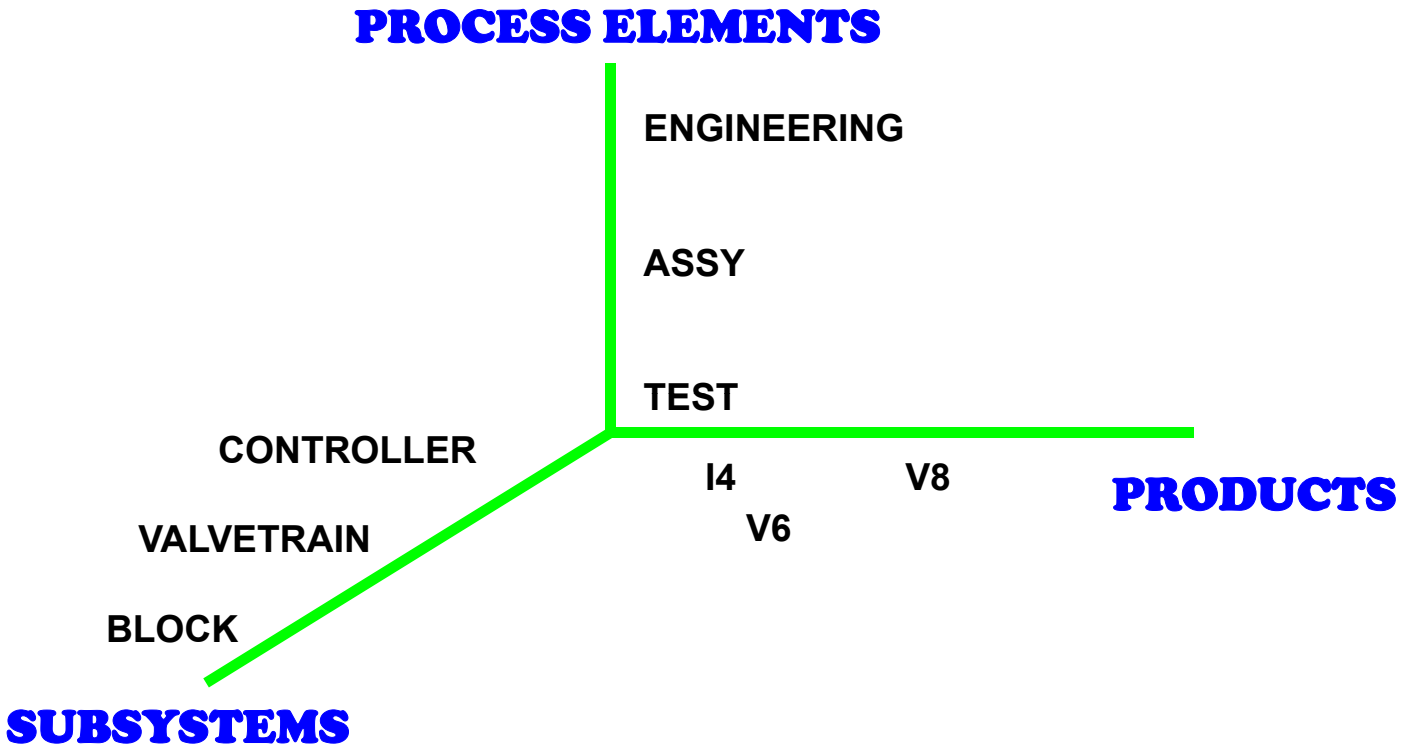
# In/Outsourcing: Sowing the Seeds of Competence Development to develop dependence for knowledge or dependence for capacity



# Technology Dynamics in the Aircraft Industry:
# LEARNING FROM THE DINOSAURS



# SOURCEABLE ELEMENTS

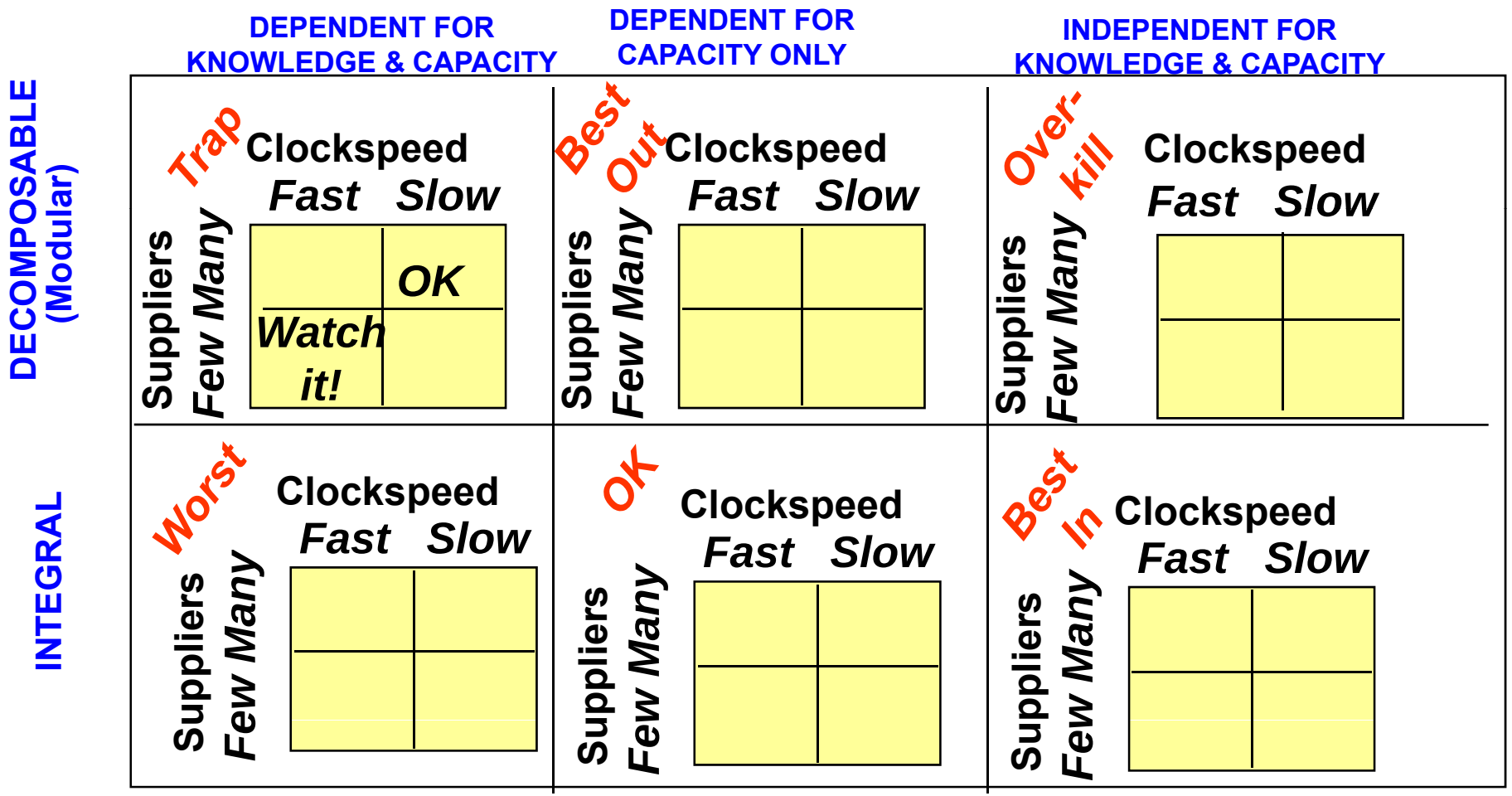


# Strategic Make/Buy Decisions: Assess Critical Knowledge & Product Architecture

| ITEM IS INTEGRAL ITEM IS MODULAR | DEPENDENT FOR KNOWLEDGE & CAPACITY | INDEPENDENT FOR KNOWLEDGE & DEPENDENT FOR CAPACITY | INDEPENDENT FOR KNOWLEDGE & CAPACITY |
|---|---|---|---|
| | A POTENTIAL OUTSOURCING TRAP | BEST OUTSOURCING OPPORTUNITY | OVERKILL IN VERTICAL INTEGRATION |
| | WORST OUTSOURCING SITUATION | CAN LIVE WITH OUTSOURCING | BEST INSOURCING SITUATION |

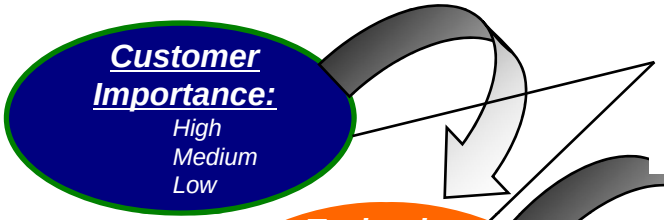
Adapted from Fine & Whitney, "Is the Make/Buy Decision Process a Core Competence?"

# Strategic Make / Buy Decisions: Also consider Clockspeed & Supply Base Capability



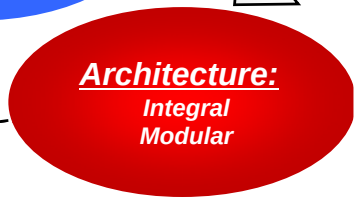

Adapted from C. Fine, *Clockspeed*, Chap. 9

# Qualitative analysis of strategic importance uses five key criteria









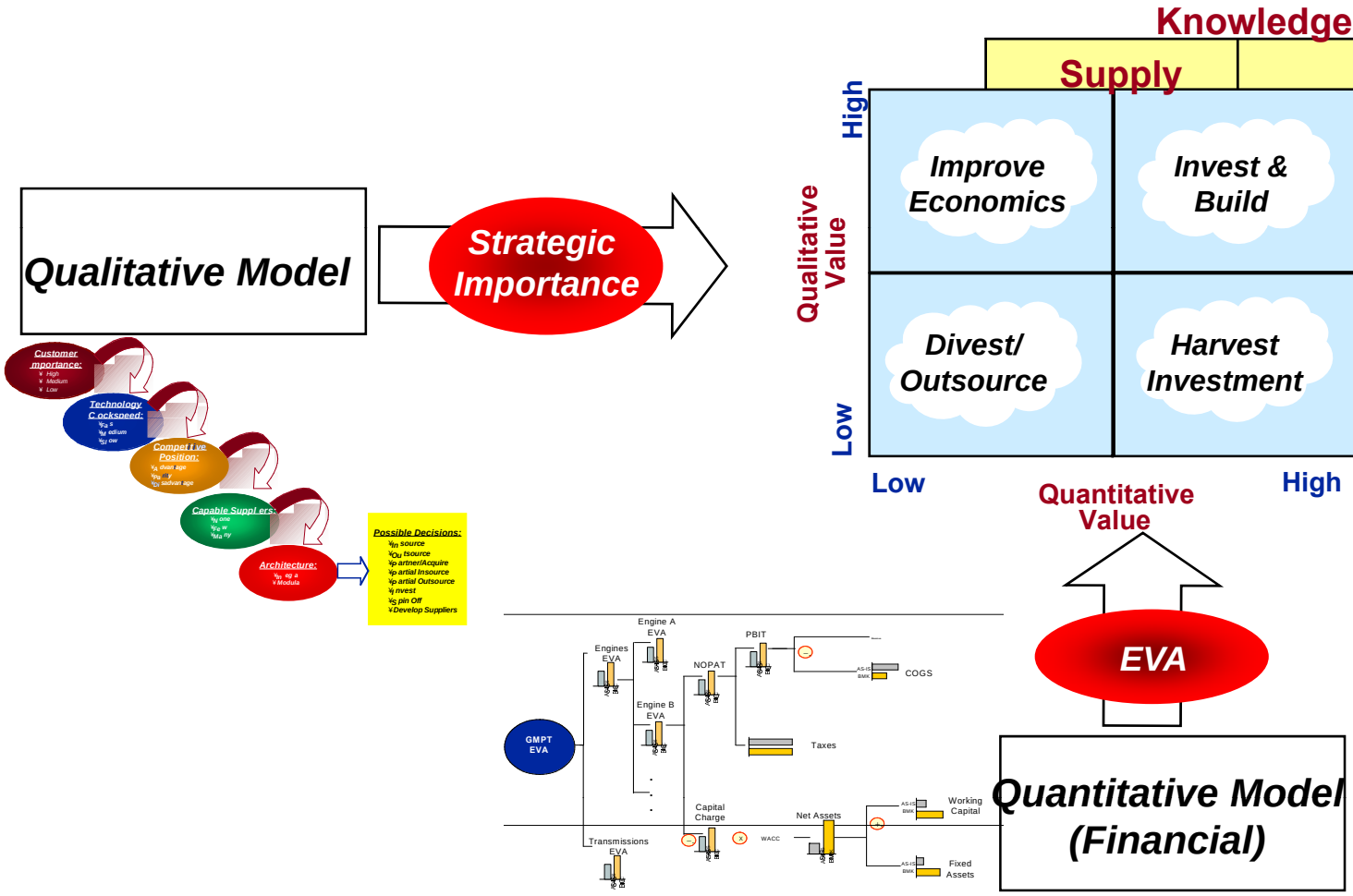

- *Value chain elements with high customer importance and fast clockspeed are generally strategic (unless there are many capable suppliers)*
- *Competitive position is seldom the primary consideration for strategic importance, rather it serves as a "tie-breaker" when other criteria are in conflict*
- *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*

***Possible Decisions (Knowledge & Supply):***

- *Insource*
- *Outsource*
- *Partner/Acquire*
- *Partial Insource*
- *Partial Outsource*
- *Invest*
- *Spin Off*
- *Develop Suppliers*

**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 |

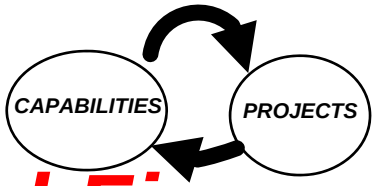
**Underlying Assumption: You have to draw the maps before you can assess their dynamics.**

# 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:

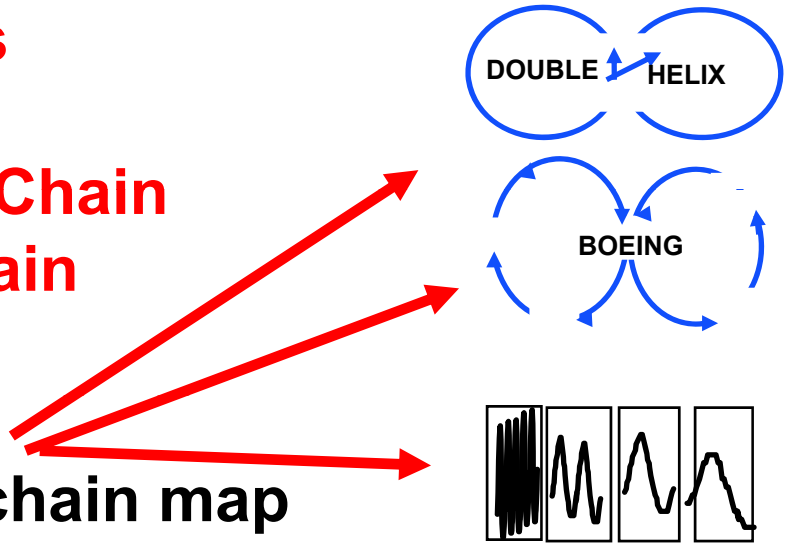
1. **Forecasting the dynamic evolution of market power and market opportunities**
2. **Anticipating Windows of Opportunity**
3. **3-D Concurrent Engineering:**
   **Product, Process, Value Chain**

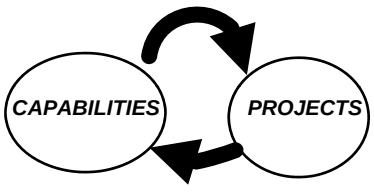



***Fortune Favors the Prepared Firm***

# PROCESS FOR VALUE CHAIN DESIGN

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

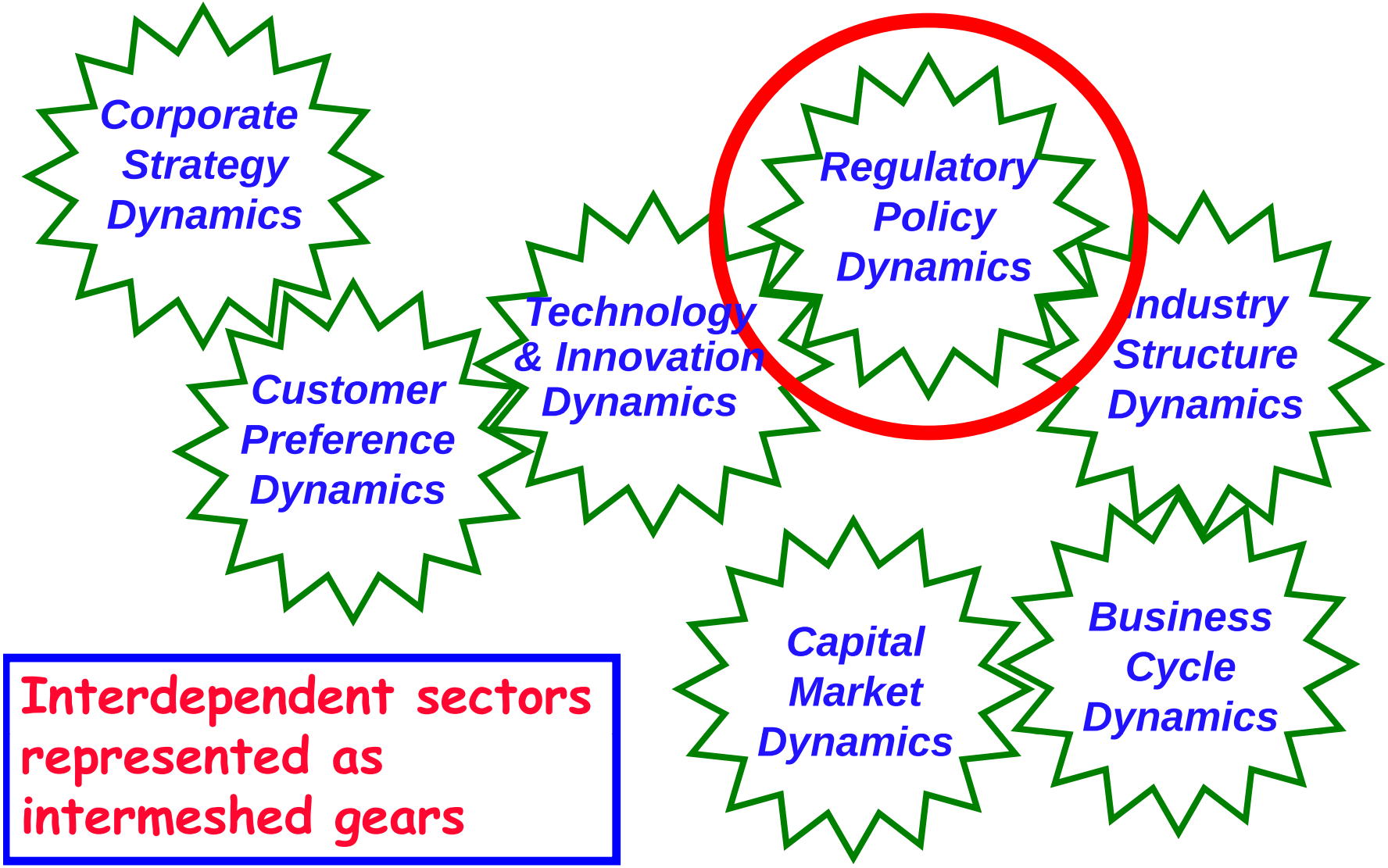
1. *Value Chains are dynamic*
   - *industry structure dynamics*
   - *technology & innovation dynamics*
   - *customer and channel dynamics*
2. *Innovation happens along the value chain* ***and*** *in the value chain model itself.*
3. *All advantage is Temporary*
4. *Strategic Sourcing is a key leverage 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**

# BACKUP SLIDES

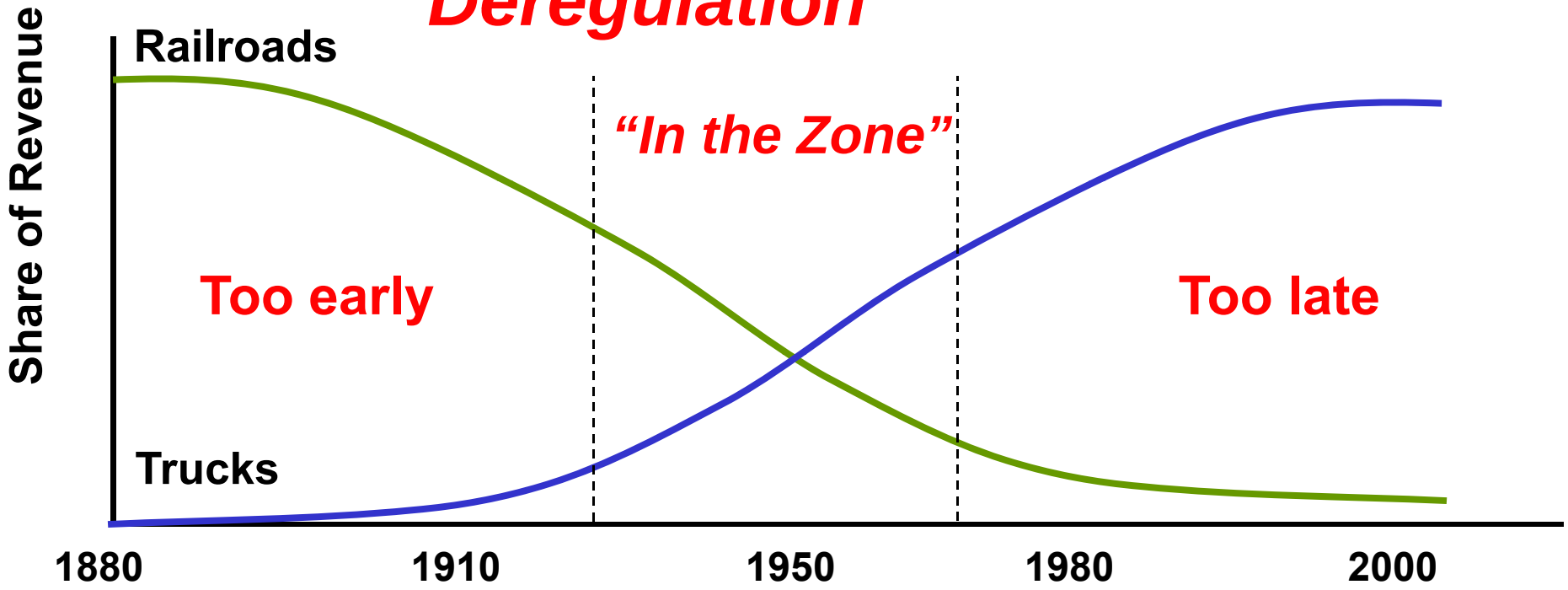
# "Gear Model" to support Roadmapping of Value Chain Dynamics (VCD)




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*




**Regulation reins in "monopoly"**

**Shocks happen; Environment changes; Substitutes mayarise**

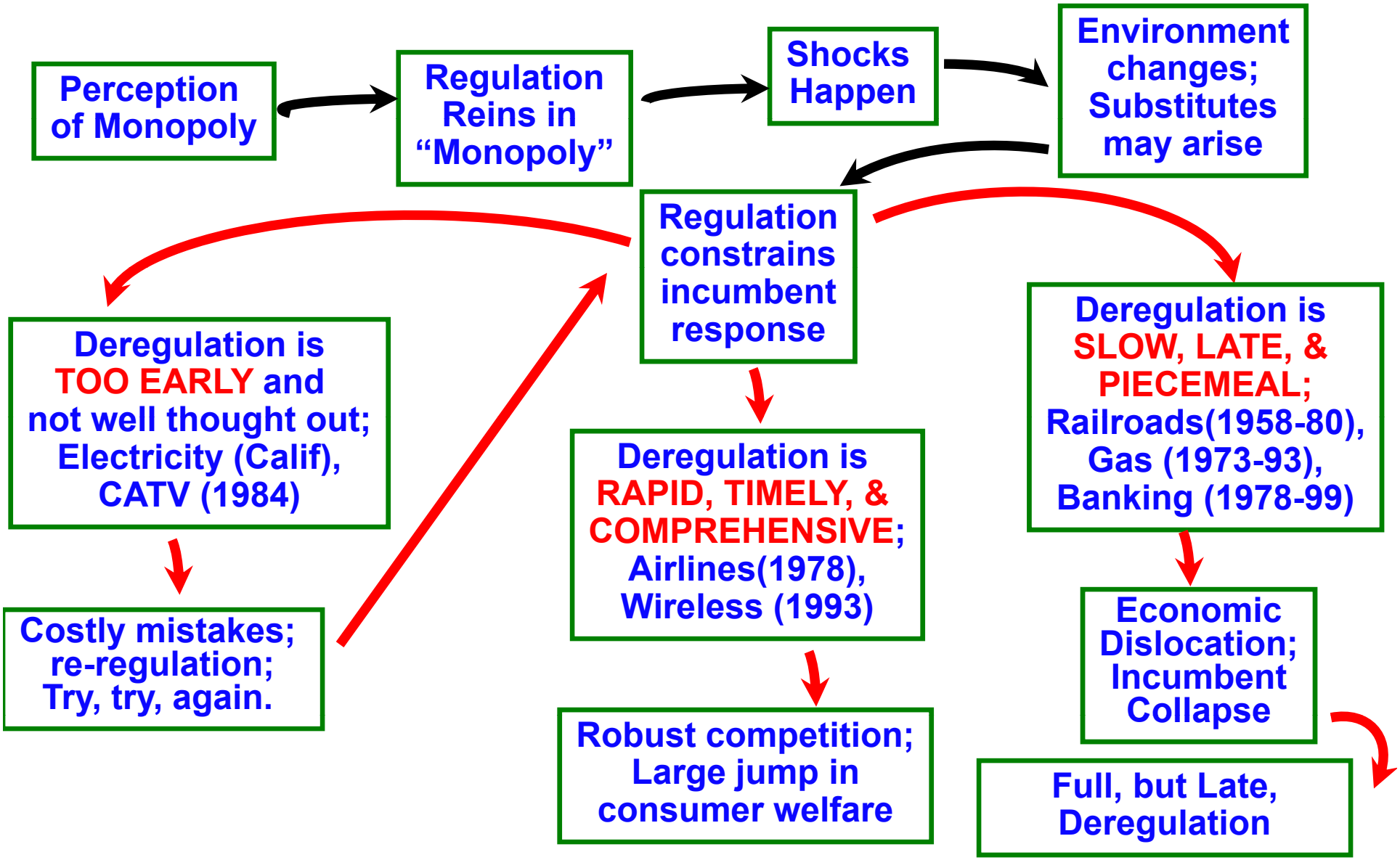
**Regulation constrains response; deregulation timing is critical**

**If deregulation is SLOW, LATE, & PIECEMEAL; then Economic Dislocation; Incumbent Collapse**

# Histories: Dynamics of Regulation

| | Regulation Reins in "Monopoly" | Shocks Happen | Environment Changes; Substitutes arise | Regulation Constrains response | Deregulation timing is Critical | Mistakes harm incumbents, consumers & taxpayers |
|---|---|---|---|---|---|---|
| RailRoads | Rockefellar & Morgan "Robber Barons" | Autos & Highways | Trucking arises | Prices, Exit, Innovation | 1958 vs. 1980 | Weak rail capabilities; Trucking dominant |
| Natural Gas | "Natural" Monopoly | Oil Embargo; Fall of Iran | Gas Demand Explodes | Low prices inhibit new supply | Long lag for new sources (1978 v 1989) | Shortages; price swings; LT consumer costs of take or pay contracts |
| Banking | Bank size limited to limit power | Inflation in the 1970's | Money Market Funds | Deposits Shrink; Riskier investments | 1978 vs. 1989 | S&L's died; $160B+ Bailout |
| 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*

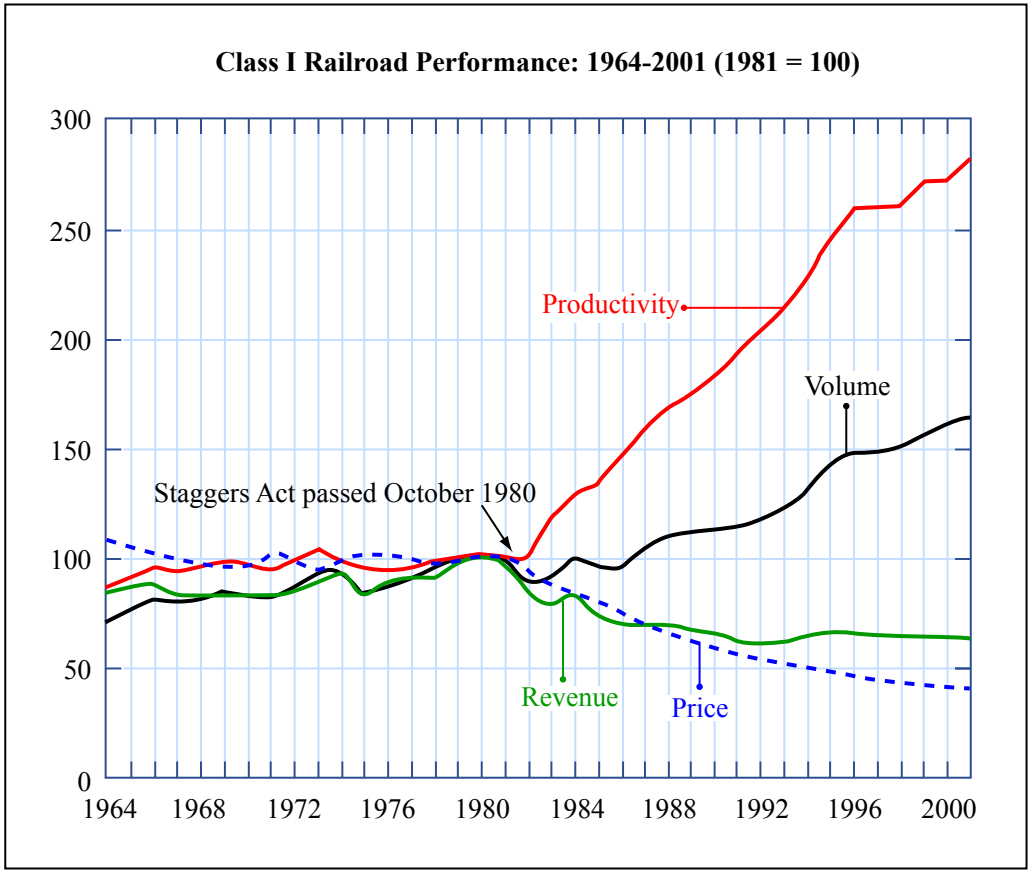


# Collapse of the railroads

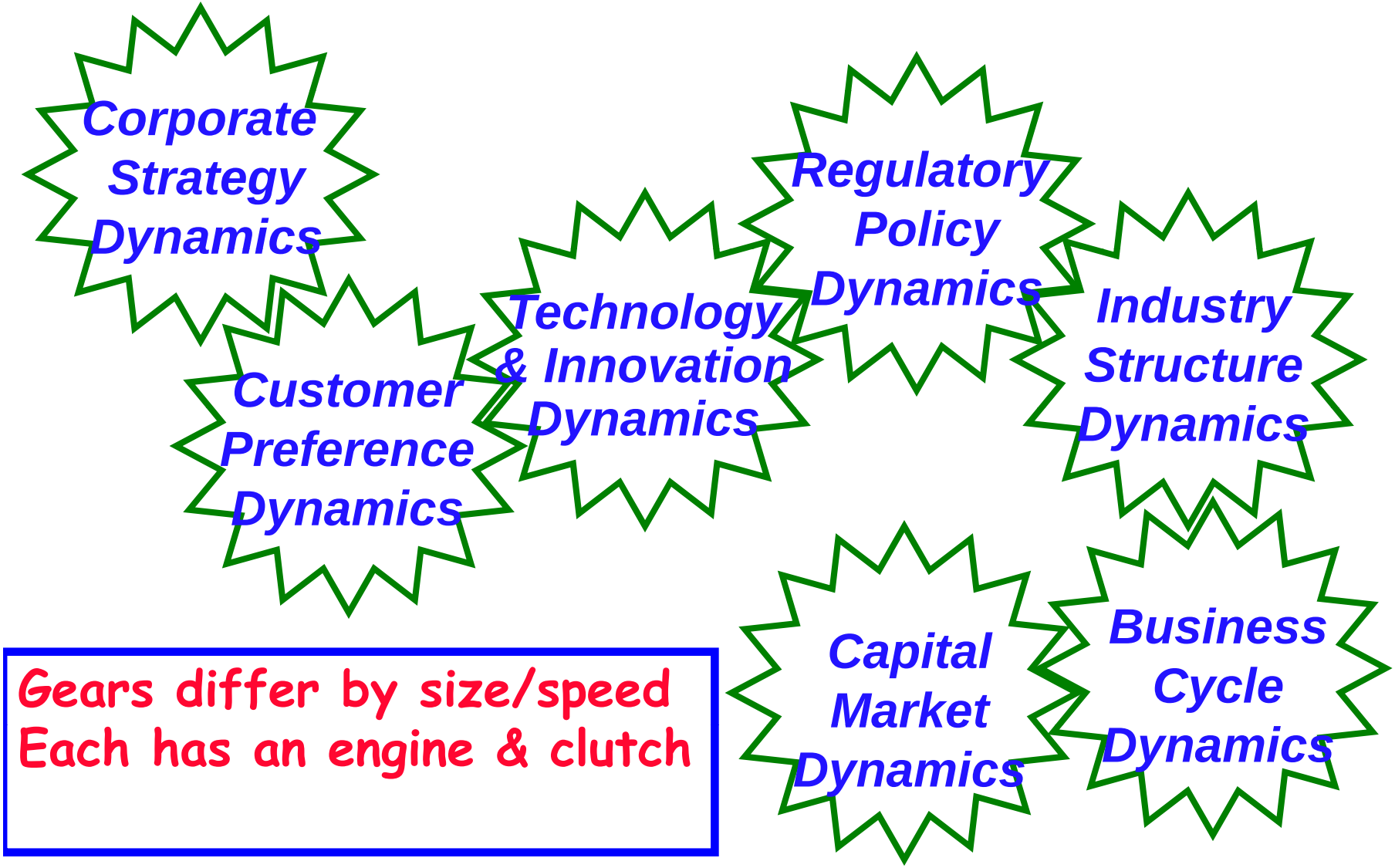
- number of Class I railroads dropped from 230 → 7 between 1907-1999
- railroad mileage declined from 254,000 → 99,000 between 1916-1999
- by the 1970s, every major Northeast railroad filed for bankruptcy
- By the 1970s, 21% of track-miles were operated by bankrupt railroads
- deferred maintenance and 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)



# Gear Teeth Dynamics

| | Business cycles | Industry/ Organization Structure | Regulatory Policy | Technology | Consumer Preferences | Corporate Strategy | Clockspeed |
|---|---|---|---|---|---|---|---|
| Business Cycles | | | | | | | |
| Industry/ Organization Structure | | | | | | | |
| Regulatory Policy | | | | | | | |
| Technology | | | | | | | |
| Consumer Preferences | | | | | | | |
| Corporate Strategy | | | | | | | |
| Clockspeed | | | | | | | |

# Gear Teeth Dynamics

| | Business cycles | Industry/ Organization Structure | Regulatory Policy | Technology | Consumer Preferences | Corporate Strategy | Clockspeed |
|---|---|---|---|---|---|---|---|
| **Business Cycles** | | Downturns trigger dis-integration | | downturns stifle R&D investment | | Downturn triggers outsourcing; Search for smoothness | |
| **Industry/ Organization Structure** | Integration buffers downturns | Integration/ Disintegration | | | Wrap services around commodities | | integrality slows clockspeed |
| **Regulatory Policy** | | | | regulation slows incumbent innovation | | | deregulation speeds innovation |
| **Technology** | | innovation Attacks incumbent & supports integration | innovation can obsolete regulations | Integration/ Disintegration | innovation slowdowns drive brand investment | | technology innov drives clockspeed |
| **Consumer Preferences** | | | | | | | branding slows disintegration |
| **Corporate Strategy** | | branding slows disintegration | | | | | project frequency drives Capab. life |
| **Clockspeed** | faster innovation moderates downturns | | | customer power drives clockspeed | | Capability life drives project frequency | |

# 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.**

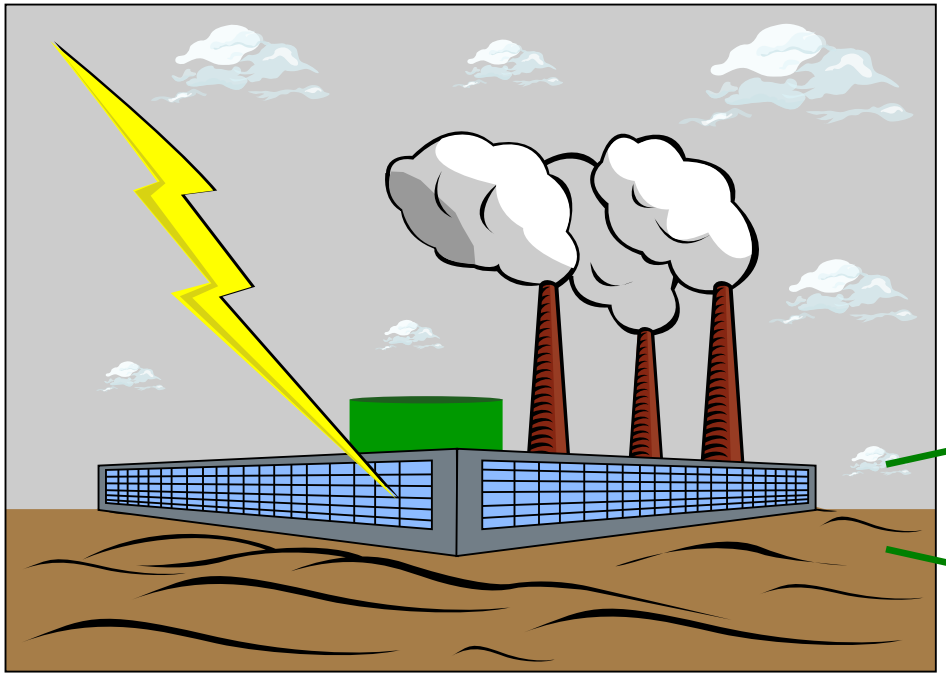


Image by MIT OpenCourseWare

**Philips Chip Factory**

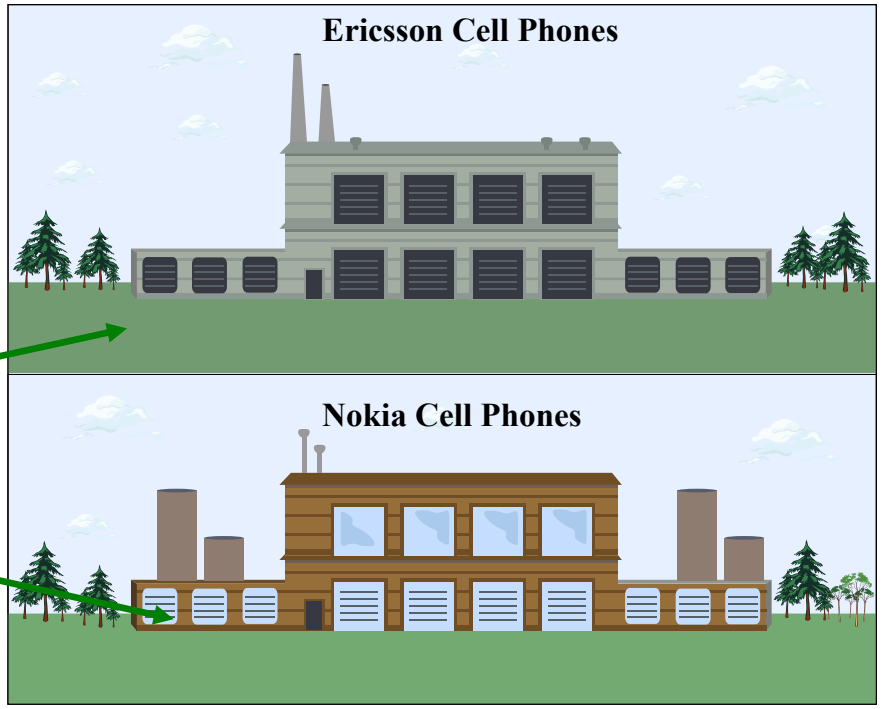



Image by MIT OpenCourseWare

**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.**

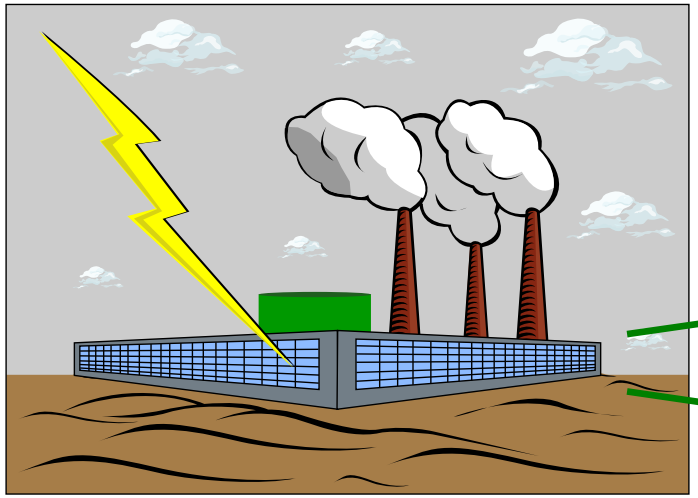


Image by MIT OpenCourseWare.

**Philips**
**Chip Factory**

## ERICSSON

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

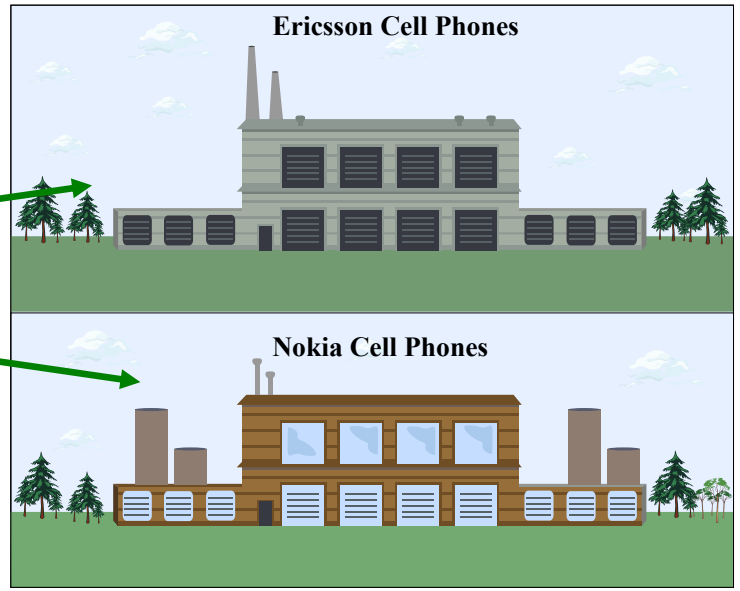



Image by MIT OpenCourseWare.

**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.

**RFID tag**
5¢
10B/yr

**Mobile phone chip**
$20
1B/yr

**Microprocessor**
$800
40M/yr

**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?**

***Energy***

***Automotive***

***Consumer Products***

***Telecoms***

***Financial Services***

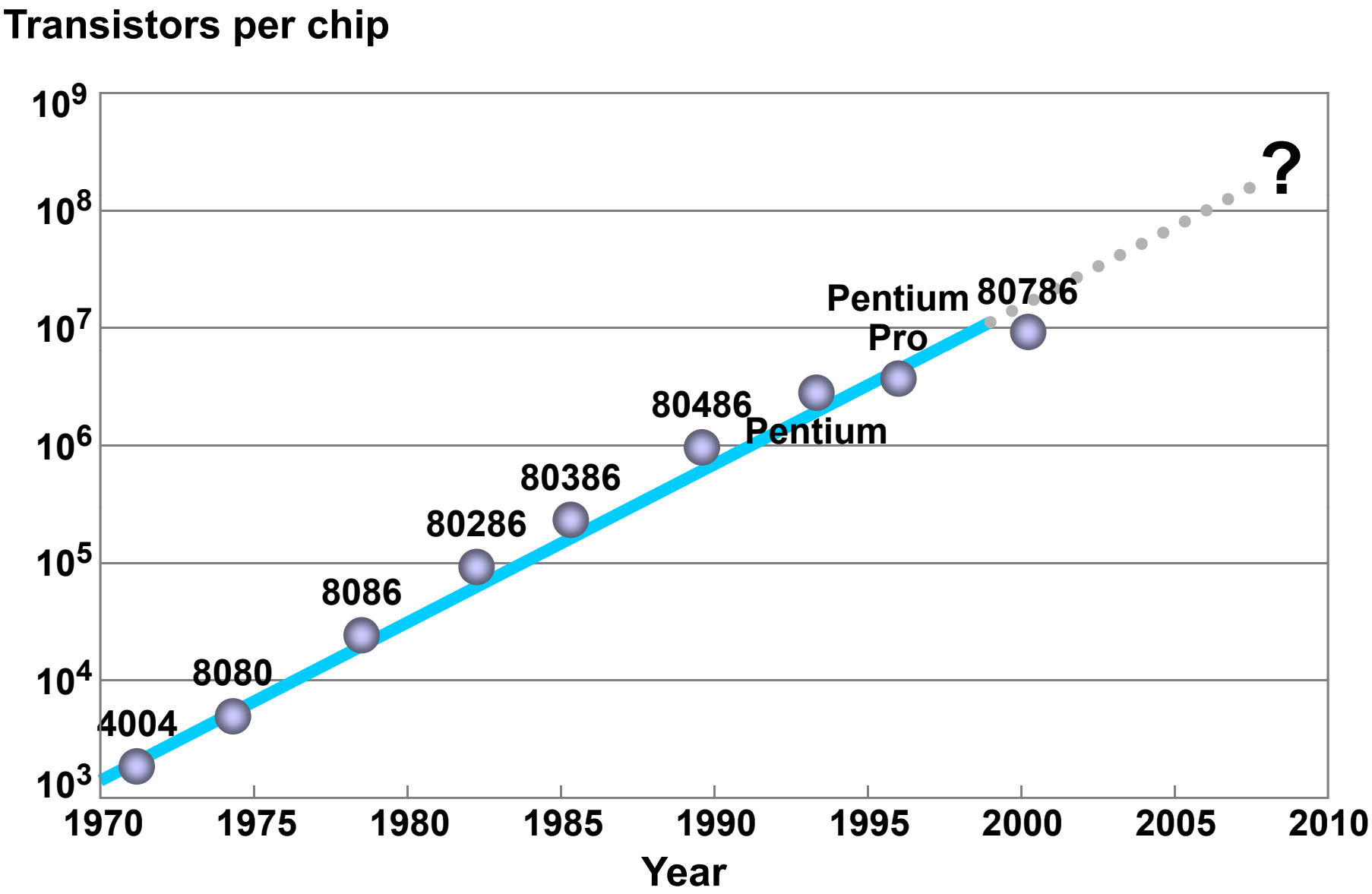
***Construction***

***Health Care***

***Food***

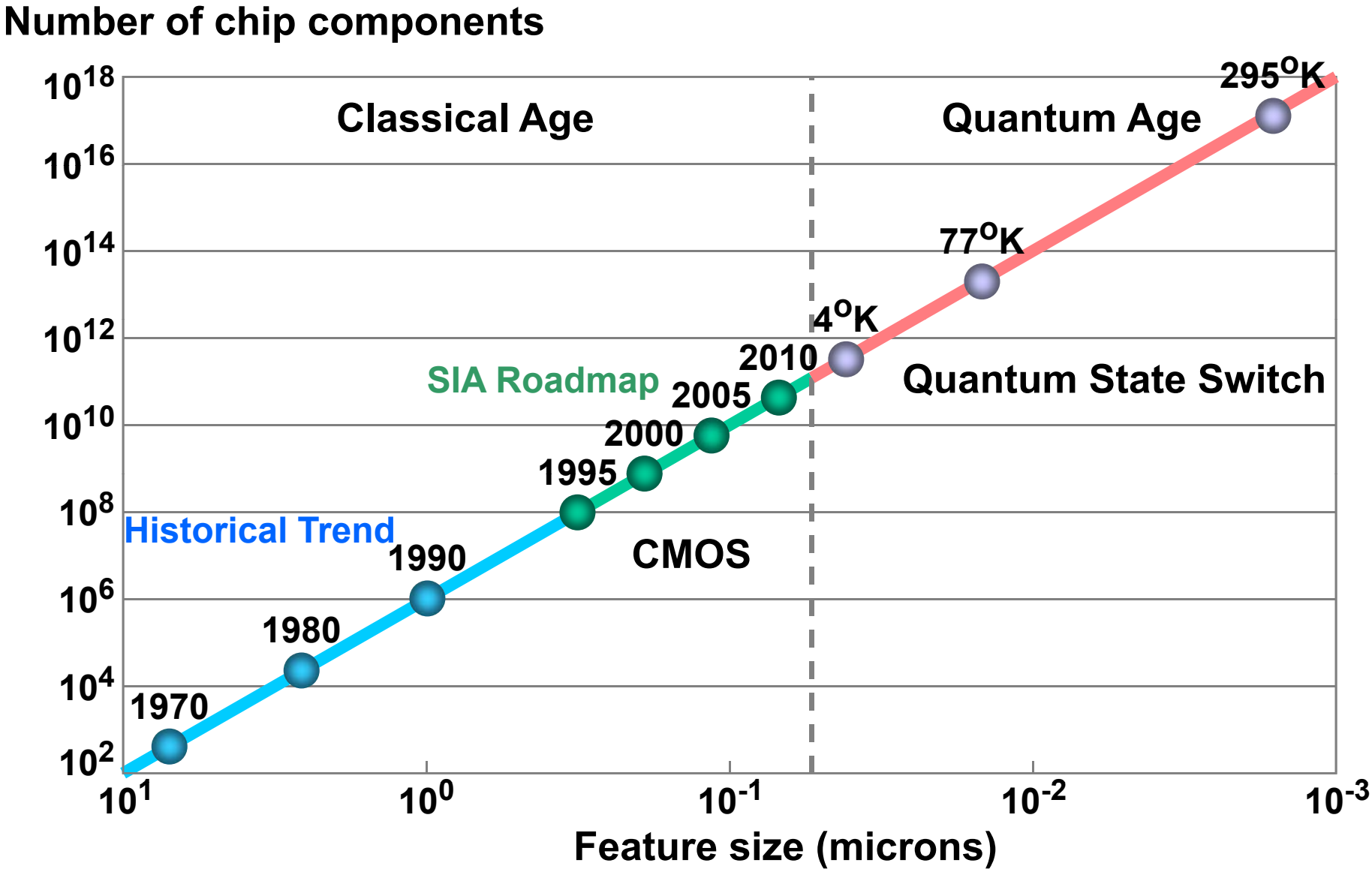
***Chemicals***

# Moore's Law

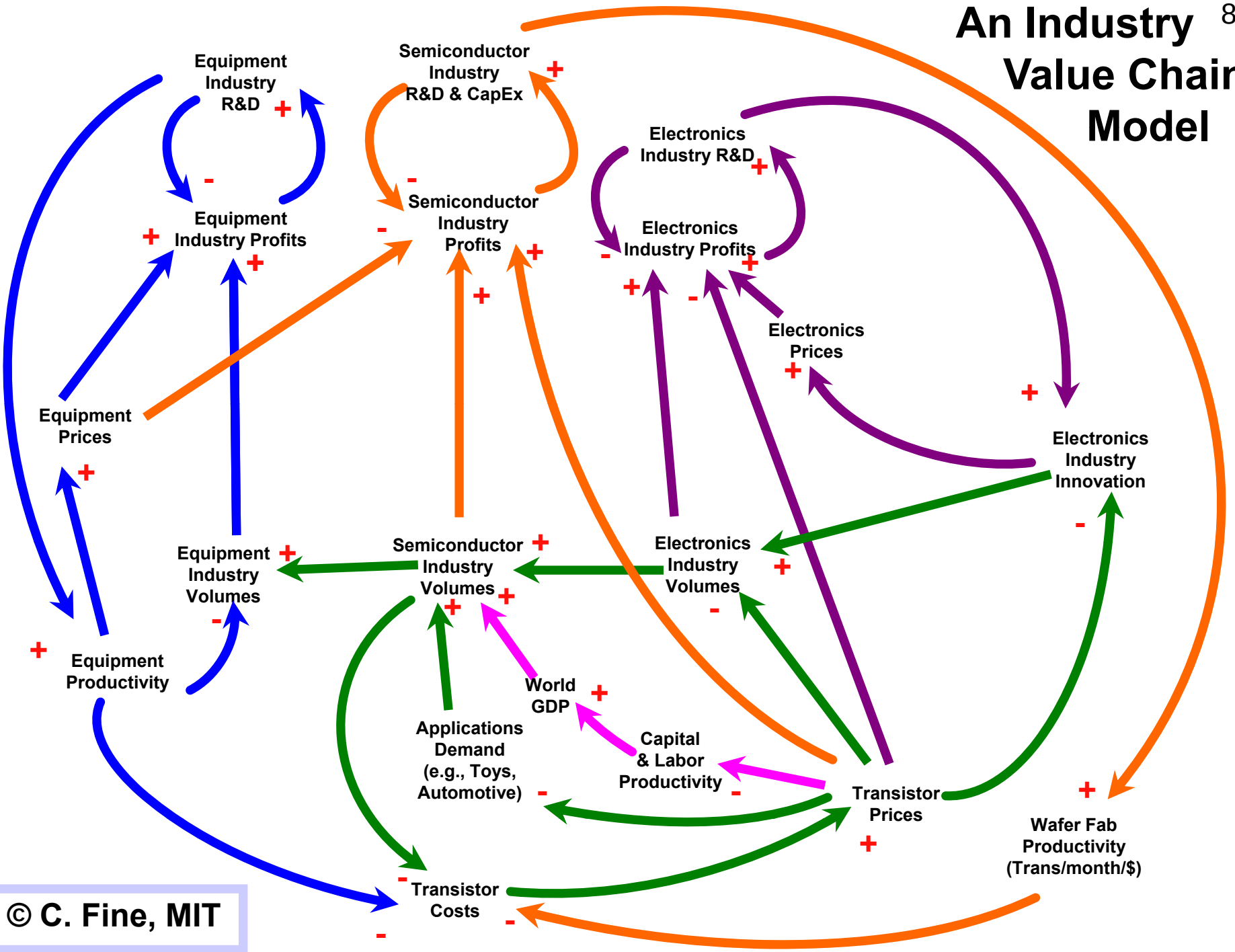



Source: Joel Birnbaum, HP, Lecture at APS Centennial, Atlanta, 1999

# Roadmap for Electronic Devices



# An Industry Value Chain Model



# *The Outsourcing Trap*: A Novel of Four Families

- **Navy Pilot:** Crash, Investigation, SC education, "Columbo"
  - Visits, Toyota, Dell, Zara & aircraft supply chain
- **Pilot's sister:** MIT grad; laid off; discovers entrepreneurship
- **Pilot's wife:** Policy analyst for Senator;
- **Pilot's son:** outsources homework; *outsource capacity, not knowledge*
- **Pilot's daughter:** business student; Zara shopper

- **Chinese Entrepreneur:** (e.g., Morris Chang / Terry Gou)
  - "Benevolent Father:" Chinese coexistence; Henry Ford; HongSing
    - Ultimately brokers cooperation
- **Warrior Daughter:** Chinese domination; aggressive growth

- **Defense contractor:** Three Generations
  - Grandfather (England), Father (USA), Grandson (affair w/Chinese daughter)
  - Makes avionics systems; lobbies senator; Outsource to HongSing
  - losing commercial business to Chinese

- **U.S. Senator:** Loses son in crash, orders investigation
  - Pork to military contractors; but cost pressures as well
  - How to keep good jobs in USA?
  - Campaign contributions from Americans & Chinese
  - "Caused" the death of his son
  - Ultimately works on collaboration with Chinese CEO & Gov't

- **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**