eClockspeed-based Principles for Value Chain Design
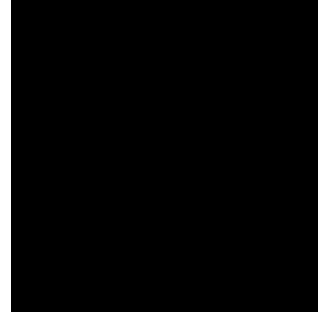
Professor Charles Fine
Massachusetts Institute of Technology
Sloan School of Management
Cambridge, Massachusetts   02142

May 2000

charley@mit.edu
www.clockspeed.com
Tel: 1-617-253-3632, Fax: 1-617-258-7579

eClockspeed-based Principles for Value Chain Design

1. Fruit Flies & Temporary Advantage
(defs, Intel, dependence, Helix, acceleration)

2. Supply Chain Design & 3-DCE
(architectures, dependencies, core comps, make/buy, mapping, decision process)

3. Mapping Exercise
(mapping)

4. eBusiness Phenomena: Business Model Innov.
(e-tailing, B2B=mkts+e2e+NPD, CPM, free info flow,

5. Sense & Respond: Analyze, Innovate, Experiment
(Group Exercise: experiment design)

Value Chain Design in a **Fast-Clockspeed** World: Study the **Industry Fruitflies**

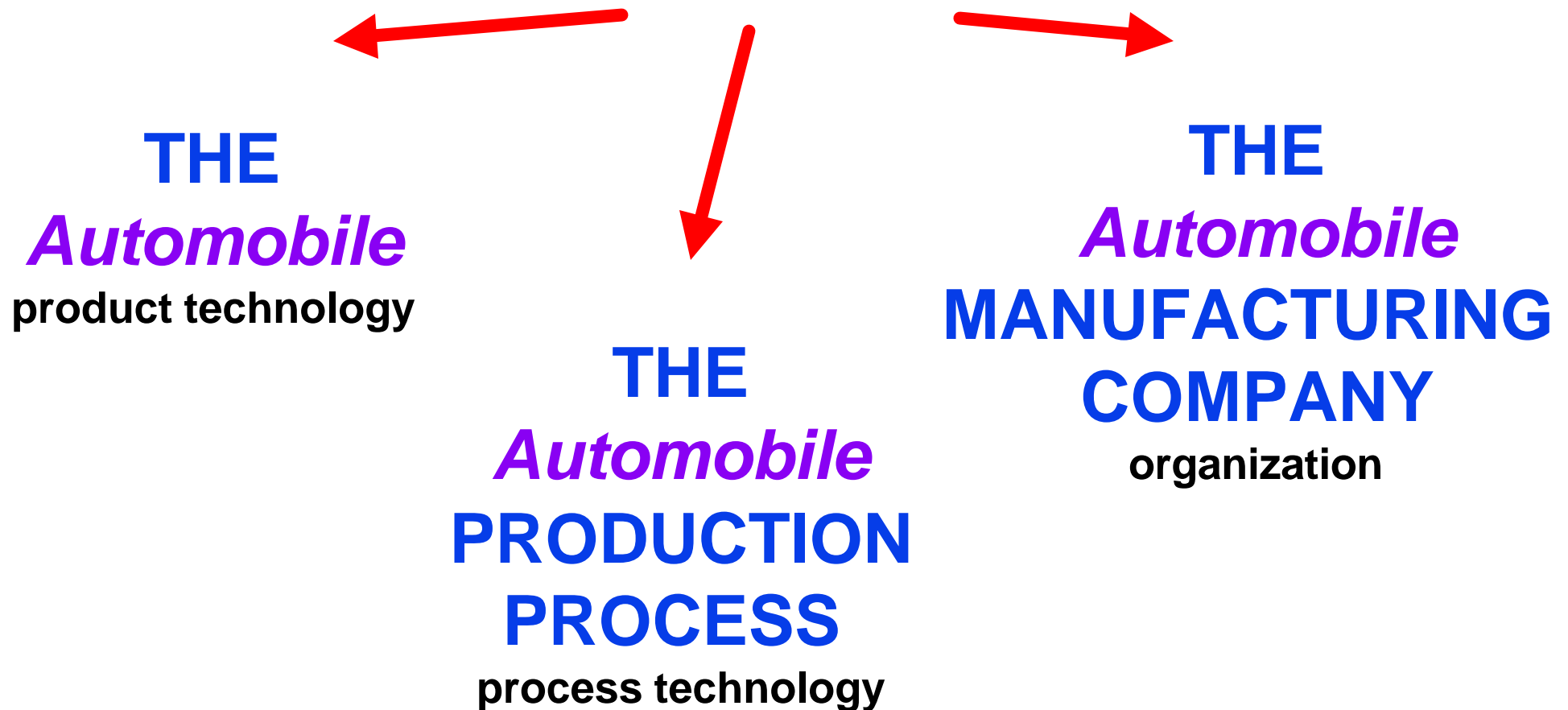| *Evolution in the natural world:*	*Evolution in the industrial world:*
FRUITFLIES *evolve faster than* **MAMMALS** *evolve faster than* **REPTILES**	**INFOTAINMENT** evolves faster than **MICROCHIPS** evolve faster than **AUTOS** evolve faster than **AIRCRAFT** evolve faster than **MINERAL EXTRACTION**
THE KEY TOOL:	*THE KEY TOOL:*
Cross-SPECIES Benchmarking of Dynamic Forces	*Cross-INDUSTRY Benchmarking of Dynamic Forces*

INDUSTRY CLOCKSPEED IS A COMPOSITE:
OF PRODUCT, PROCESS, AND ORGANIZATIONAL CLOCKSPEEDS

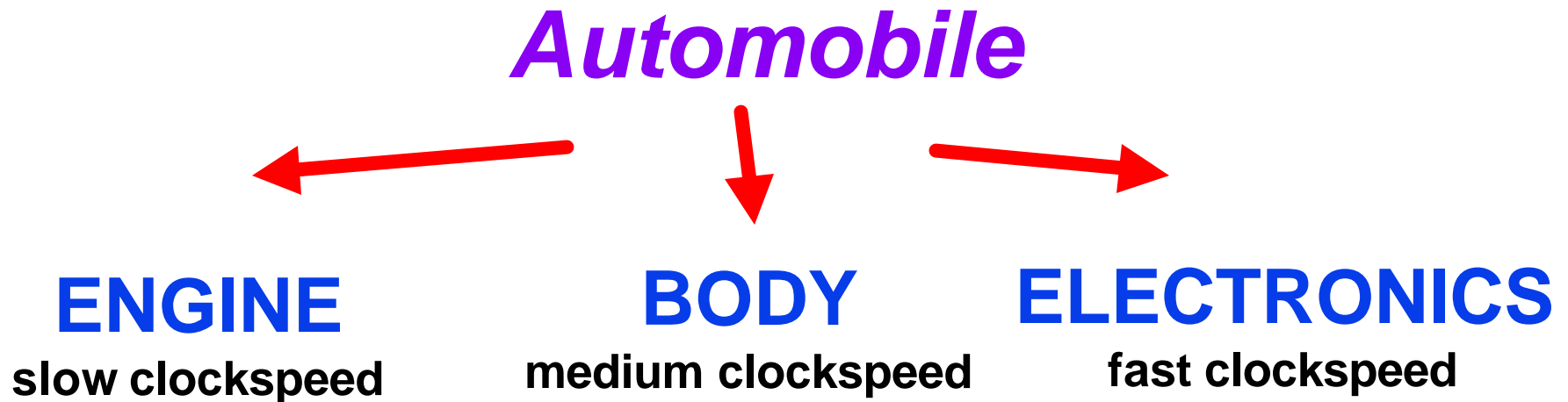# *Automobile* INDUSTRY CLOCKSPEED

THE
Automobile
product technology

THE
Automobile
PRODUCTION PROCESS

process technology

THE
Automobile
MANUFACTURING COMPANY

organization

Automobile CLOCKSPEED IS A MIX OF ENGINE, BODY & ELECTRONICS

Automobile

ENGINE
slow clockspeed

BODY
medium clockspeed

ELECTRONICS
fast clockspeed

ISSUE: MOST AUTO FIRMS OPERATE AT *ENGINE OR BODY CLOCKSPEEDS*; IN THE FUTURE THEY WILL NEED TO RUN AT *ELECTRONICS CLOCKSPEED.*
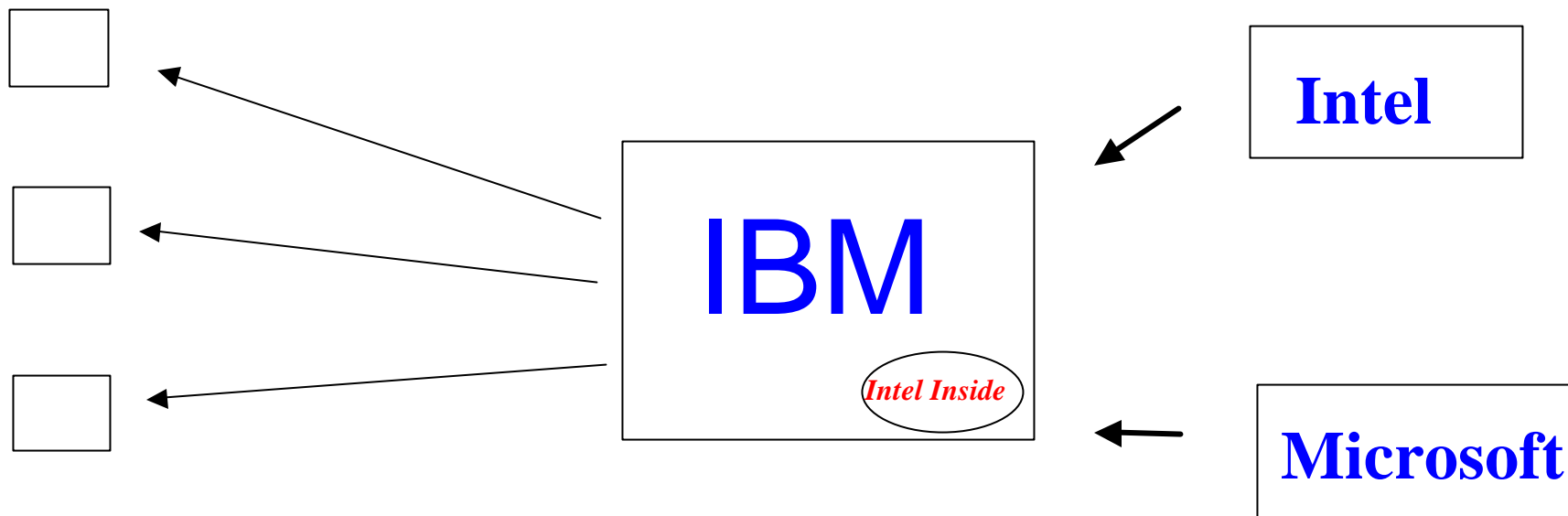
The Strategic Leverage of Supply Chain Design:
Who let Intel Inside?

1980: IBM designs a product, a process, & a supply ch

Customers

IBM

Intel Inside

Intel

Microsoft

The Outcome:

A phenomenonally successful product design

A disastrous supply chain design (for IBM)

LESSONS FROM A FRUIT FLY:
THE PERSONAL COMPUTER

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

2. MAKE/BUY IS **NOT** ABOUT WHETHER IT IS
    TWO CENTS CHEAPER TO OUTSOURCE

3. SUPPLY CHAIN DESIGN CAN DETERMINE
    THE FATE OF **COMPANIES** AND **INDUSTRIES**,
    AND OF **PROFIT** AND **POWER**

4. THE LOCUS OF SUPPLY CHAIN CONTROL
    CAN SHIFT IN **UNPREDICTABLE** WAYS

Controlling the Chain Through Distribution:
The End of *P&G Inside* ?

Controlling the Channel Through Closeness to Customers:

consumer research, pricing, promotion, product development
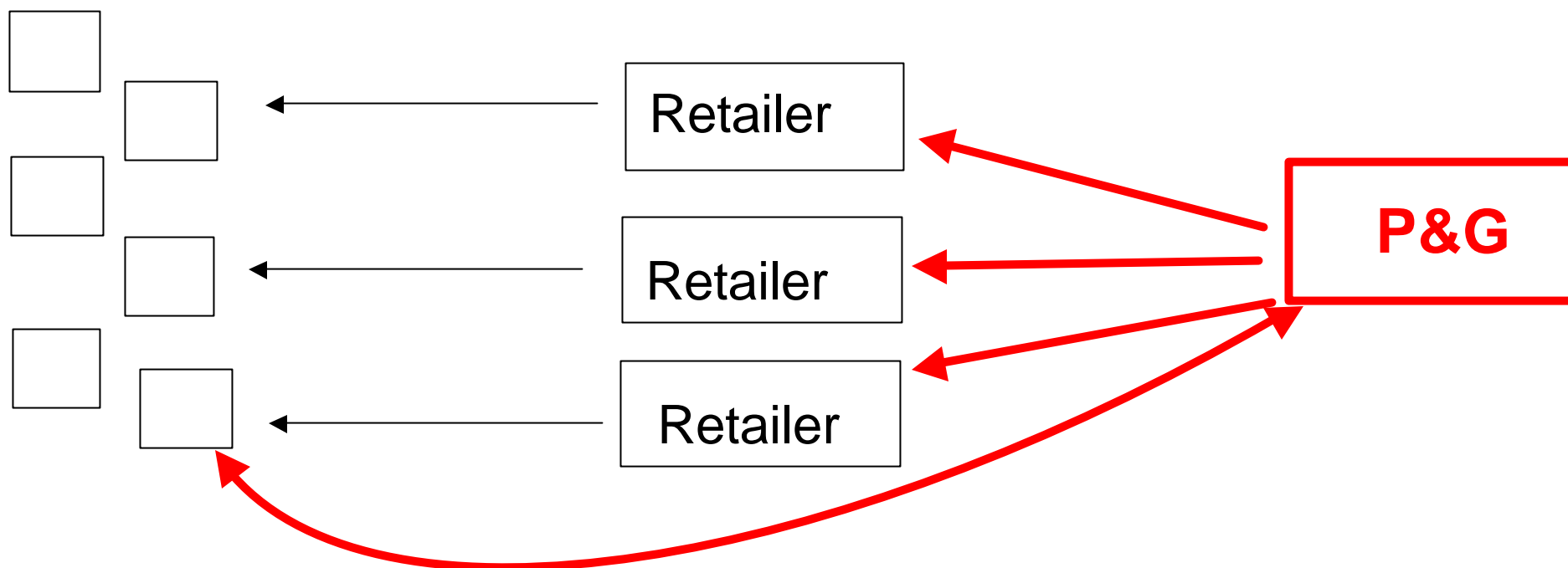
Customers

Controlling the Chain Through Distribution:
Beware of *Walmart Outside*

Controlling the Channel Through Closeness to Customers:

Chain Proximity

Customers

WalMart

Retailer

Retailer

Retailer

P&G

WalMart Private Label
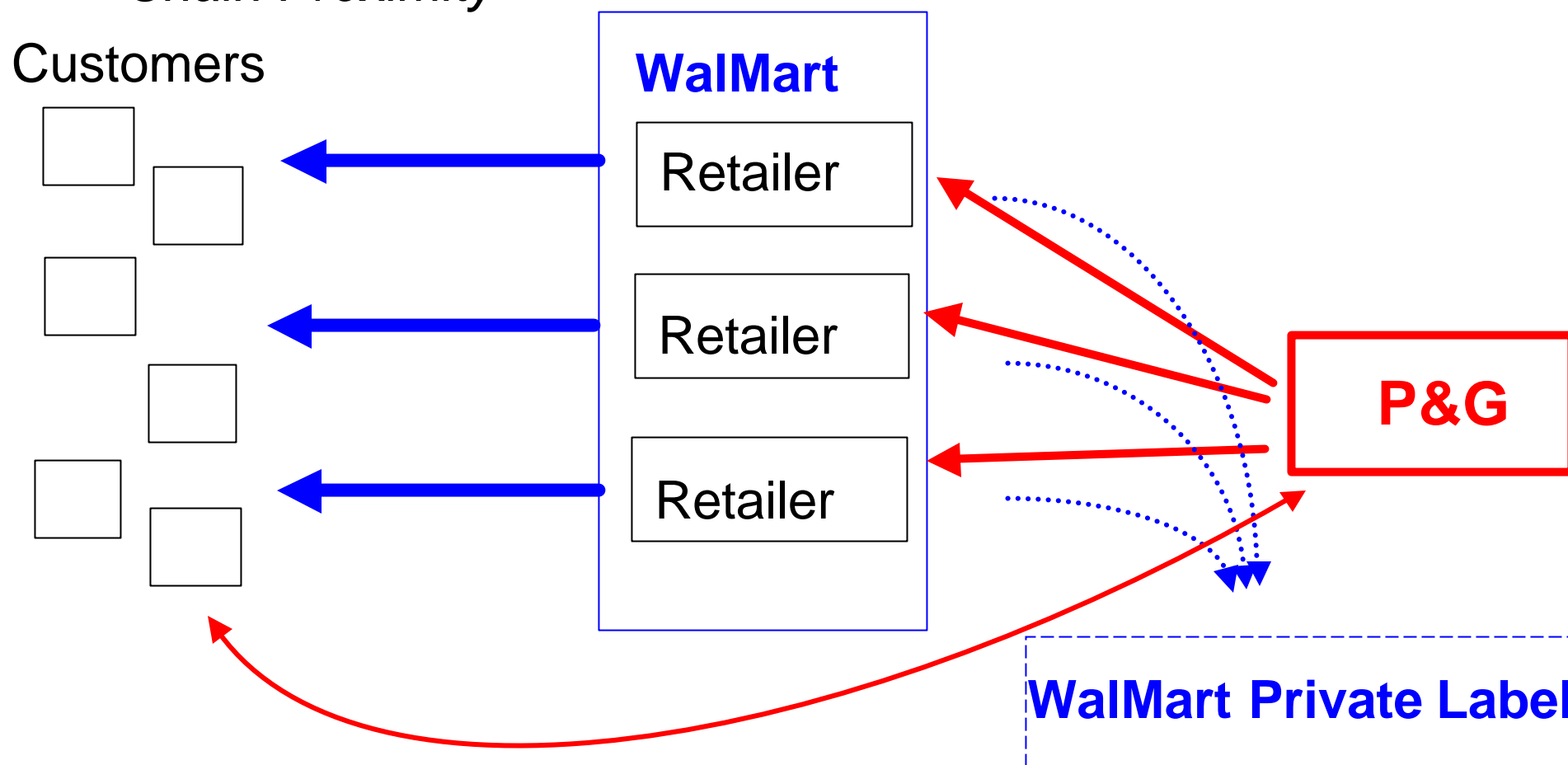
Battle for Channel Control - Proprietary Systems v. Closeness to Customers

Customers

Compaq

Dell

Gateway

AMD

Nexgen

Intel

Vertical Industry Structure
with *Integral* Product Architecture

Computer Industry Structure, 1975-85
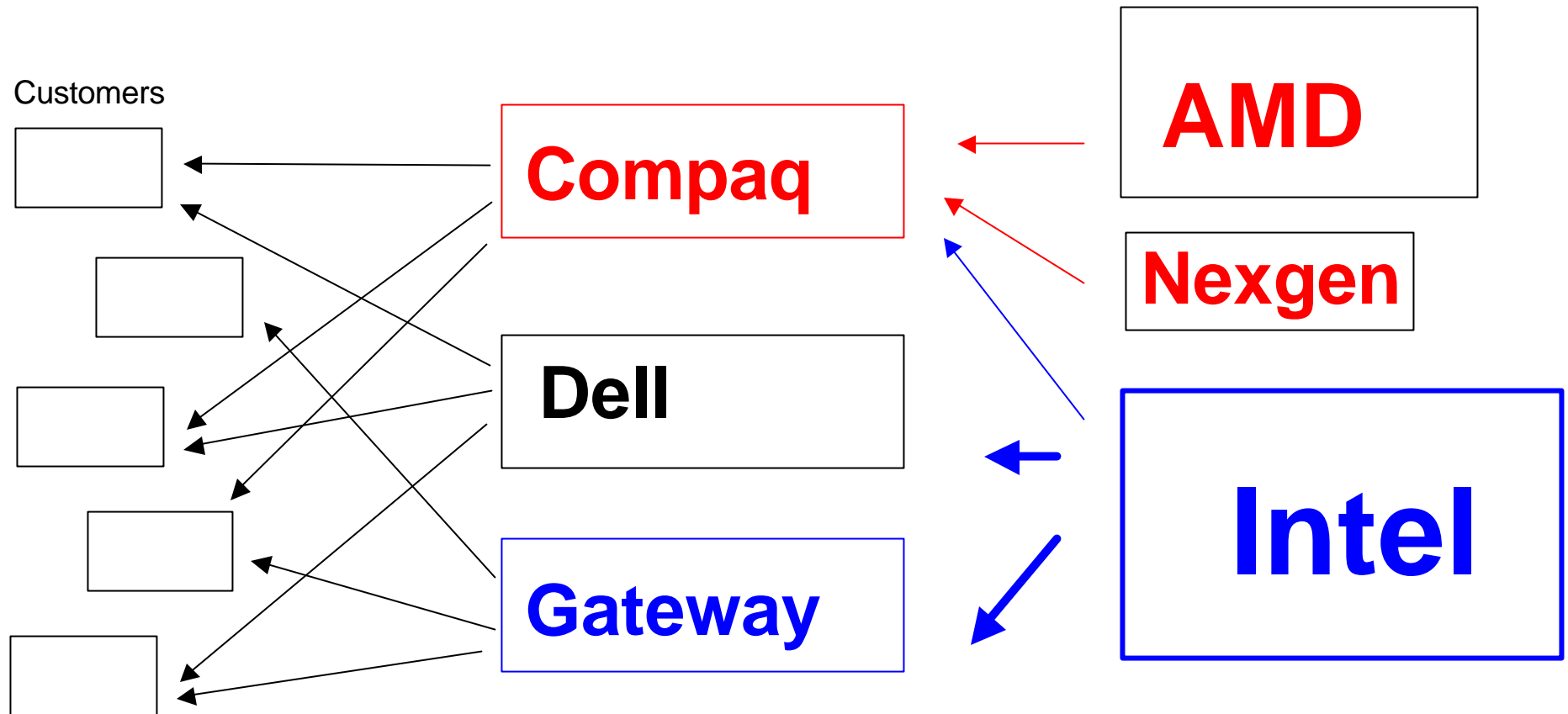
	IBM	DEC	BUNCH
Microprocessors **Operating Systems** **Peripherals** **Applications Software** **Network Services** **Assembled Hardware**	All Products	All Products	All Products

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

Horizontal Industry Structure
with *Modular* Product Architecture

Computer Industry Structure, 1985-95

Microprocessors	Intel		Moto	AMD etc
Operating Systems	Microsoft		Mac	Unix
Peripherals	HP	Epson	Seagate	etc etc
Applications Software	Microsoft	Lotus	Novell	etc
Network Services	AOL/Netscape	Microsoft	EDS	etc
Assembled Hardware	HP Compaq	IBM	Dell	etc

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

THE DYNAMICS OF PRODUCT ARCHITECTURE AND INDUSTRY STRUCTURE:
THE DOUBLE HELIX

NICHE COMPETITORS

INTEGRAL PRODUCT VERTICAL INDUSTRY

MODULAR PRODUCT HORIZONTAL INDUSTRY

TECHNICAL ADVANCES

HIGH-DIMENSIONAL COMPLEXITY

SUPPLIER MARKET POWER

ORGANIZATIONAL RIGIDITIES

PRESSURE TO DIS-INTEGRATE

PRESSURE TO INTEGRATE

PROPRIETARY SYSTEM PROFITABILITY
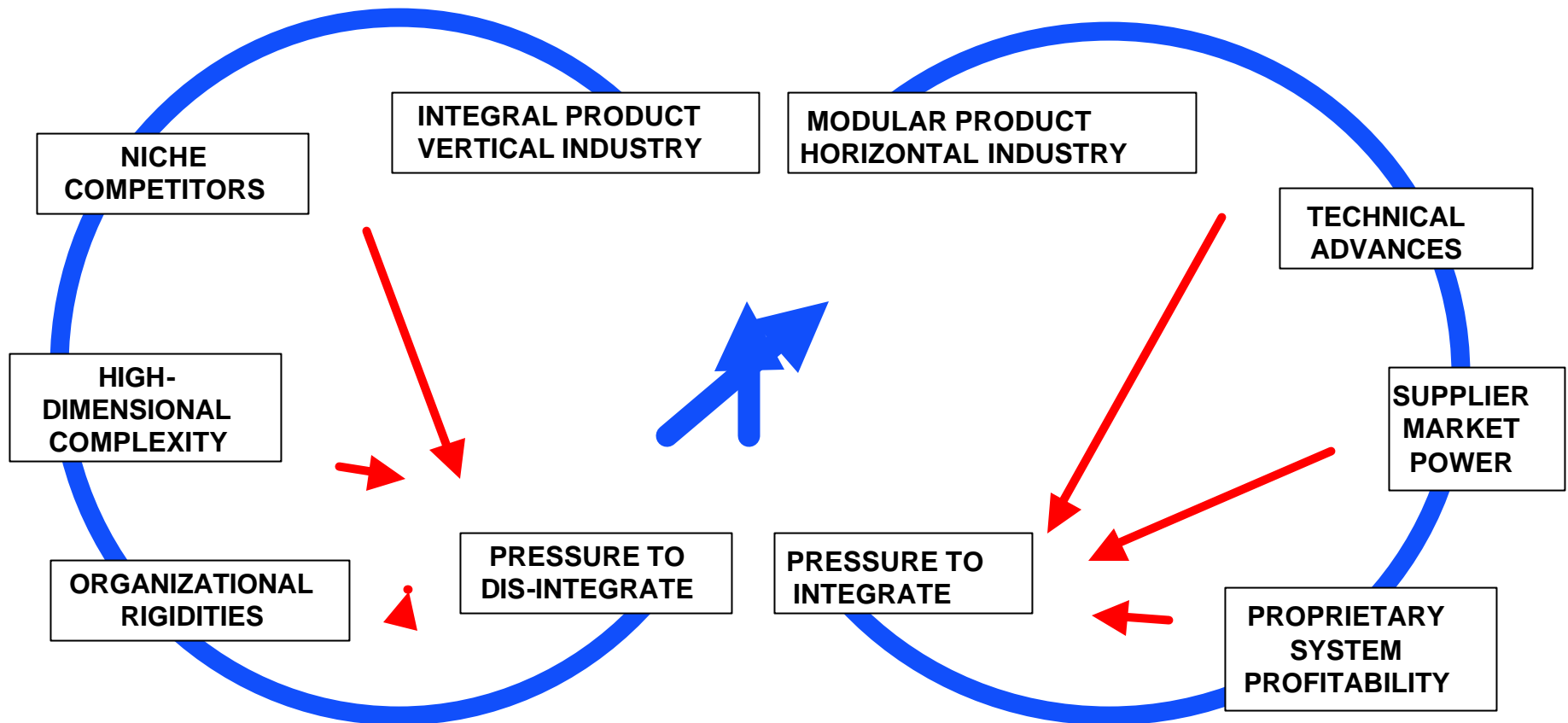
Fine & Whitney, "Is the Make/Buy Decision Process a Core Competence?"

THE *DOUBLE HELIX*
IN OTHER INDUSTRIES

- *TELECOMMUNICATIONS--*
  - "MA BELL" was Vertical /Integral
  - BABY BELLS & LONG LINES & CELLULAR are Horizontal/Modular
  - Today's AT&T going back to Vertical /Integral

- *AUTOMOTI VE --*
  - Detroit in the 1890's was Horizontal/Modular
  - Ford & GM in the mid 1900's were Vertical /Integral
  - Today's Auto Industry is going back to Horizontal/Modular

- *TELEVISION--*
  - RCA was Vertical /Integral
  - 1970'S THROUGH 1990'S were Horizontal/Modular
  - Today's media giants are going back to Vertical /Integral

- *BICYCLES--*
  - Safety Bikes to 1890's boom to Schwinn to *Shimano Inside*

Volatility Amplification in *"The Bullwhip Effect" and*[*]
Clockspeed Amplification in *"The Speedup Effect"*
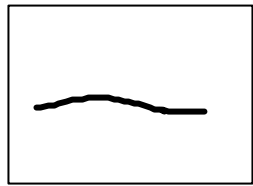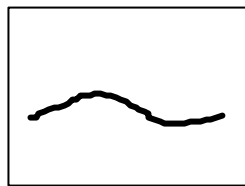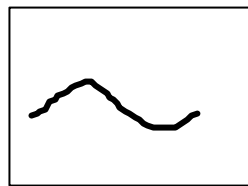
Customer	Retailer	Distributor	Factory	Tier 1	Equipment
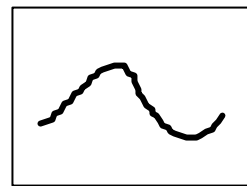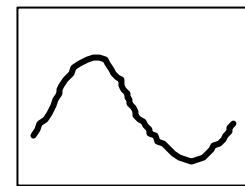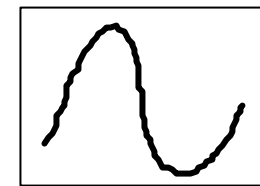
Inventories & Orders fluctuate more
s you look upstream, tough on suppliers, but
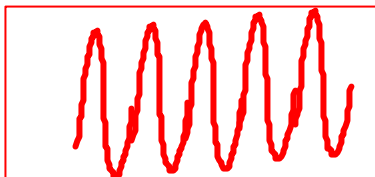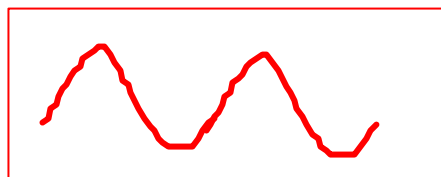
Web Site Developer	PC Maker	Chip maker	Equipment Maker
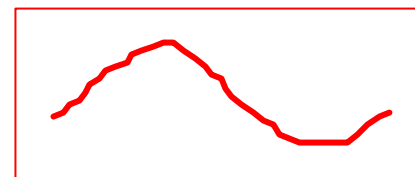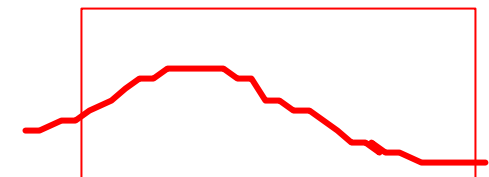
lockspeeds accelerate as you head downstream,
closer to the final customer

Media Supply Chains:
An Industry at *Lightspeed*

Customers   **The box**   **The Pipe**   **The Content**
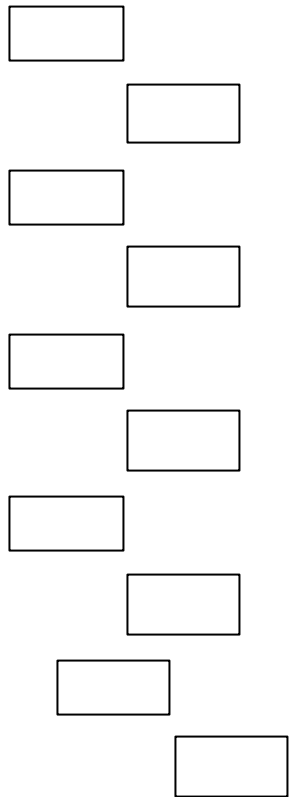
Telephone

Personal Computer

Local Area Networks

Television

VCR

Pager

Phone network:
 -copper
 -fiber optics

Cable Networks

Airwaves:
   -broadcast TV
   -cellular tel
   -satellite/microwave

Retail Outlets
 for CD's, tapes, print:
 -Blockbuster
 -Seven-Eleven

Video/Audio:

Movies & Art
 & News & Sports

Print:
newspapers &
magazines &
books

Communication:
 voice & video
   & email

Education

Shopping

Internet, *et al*

ALL COMPETITIVE ADVANTAGE* IS TEMPORARY

Ford in the late 1910's and early 1920's
GM in the 1950's and 1960's
IBM in the 1970's
Microsoft in the 1990's

The *Greeks*, The *Romans*,
The *Ottomans*, The *Huns*

The *Yankees*, The *Cowboys*,
The *Celtics*, The *Canadiens*

The faster the clockspeed, the shorter the reign

eClockspeed-based Principles for Value Chain Design

1. Fruit Flies & Temporary Advantage
(defs, Intel, dependence, Helix, acceleration)

2. Supply Chain Design & 3-DCE
(architectures, dependencies, core comps, make/buy, mapping, decision process)

3. Mapping Exercise
(mapping)

4. eBusiness Phenomena: Business Model Innov.
(e-tailing, B2B=mkts+e2e+NPD, CPM, free info flow,

5. Sense & Respond: Analyze, Innovate, Experiment
(Group Exercise: *experiment design)*

SUPPLY CHAIN DESIGN:
Three Components

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

2. Supplier 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.)

IMPLEMENTATION OF SUPPY CHAIN DESIGN: EMBED IT IN 3-D CONCURRENT ENGINEERING

PRODUCT

Performance Specifications

PROCESS

Recipe, Unit Process

Technology, & Process Planning

Details, Strategy

Product Architecture, Make/Buy components

Time, Space, Availability

SUPPLY CHAIN

Manufacturing System, Make/Buy processes
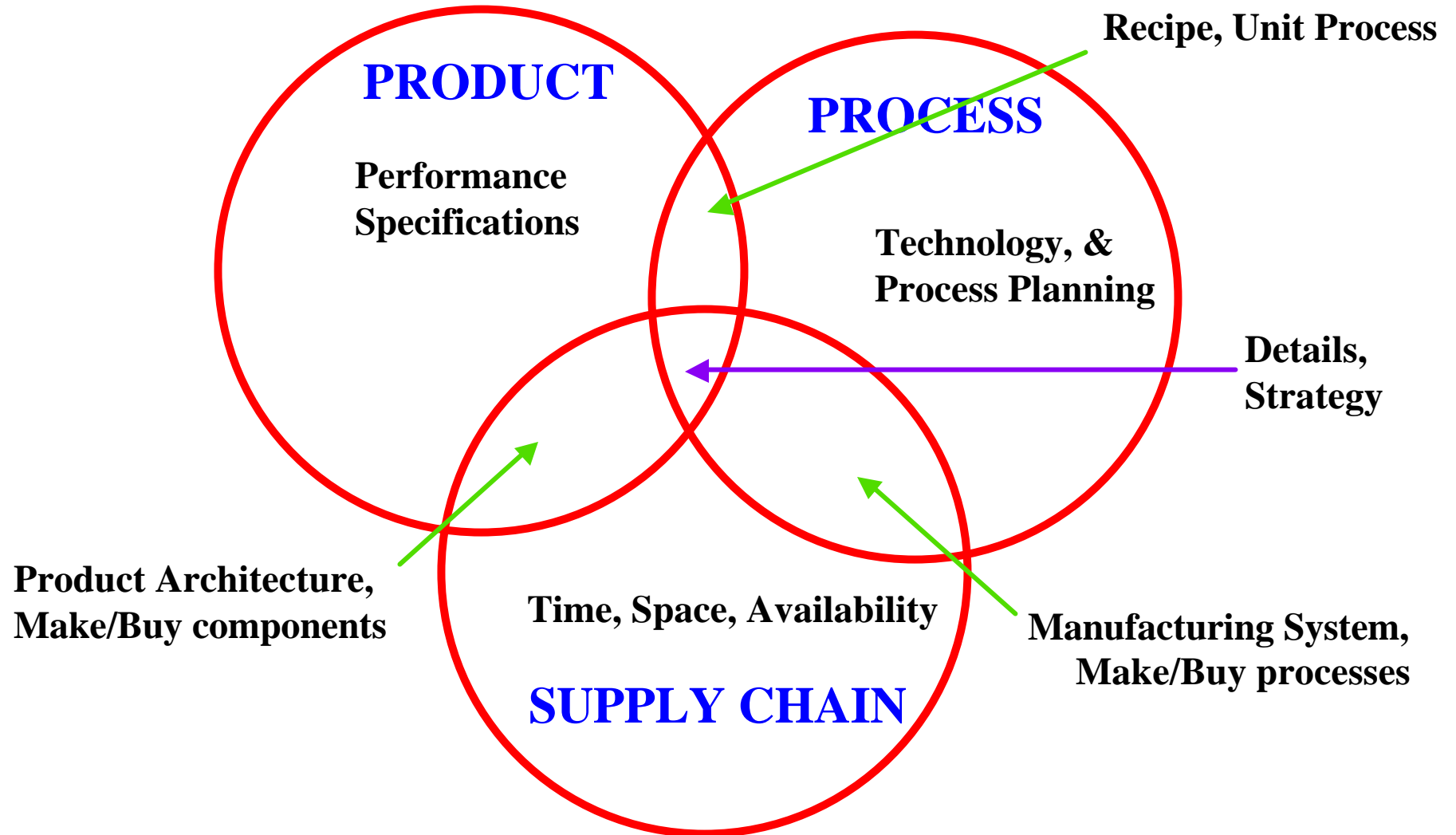
In/Outsourcing: Sowing the Seeds
of Competence Development to develop
dependence for knowledge or dependence for capacity

Dependence

Amount of
Work Outsourced
knowledge
+/or supply

+

+

Supplier
Capability

Amount of
Supplier
Learning

+

Independence

Amount of Work
Done In-house
knowledge
+/or supply

+

+

Internal
Capability

Amount of
Internal
Learning

+
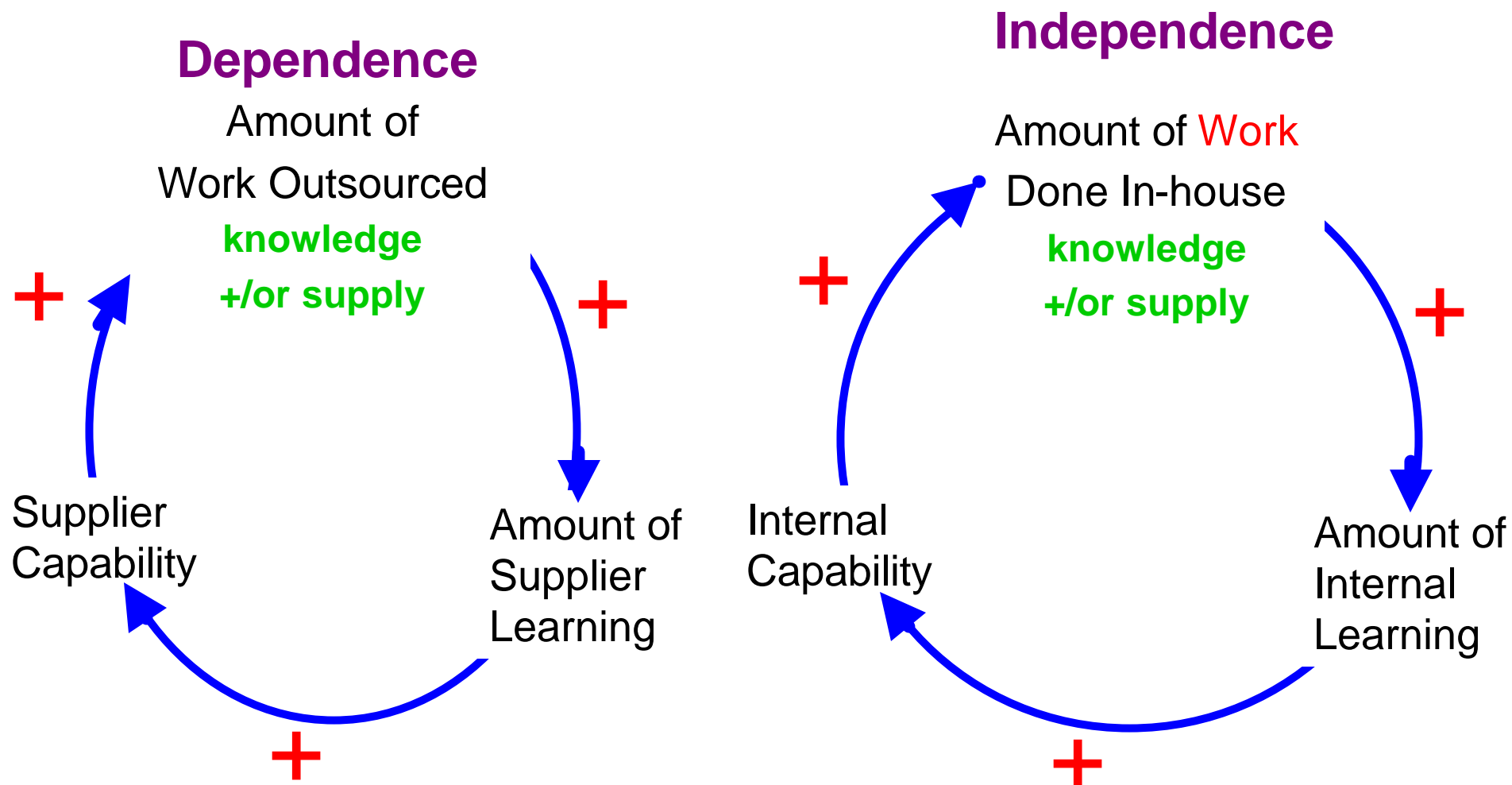
Dynamics between New Projects and Core Capability Development

CORE CAPABILITIES

NEW PROJECTS
*(New products,
new processes,
new suppliers)*
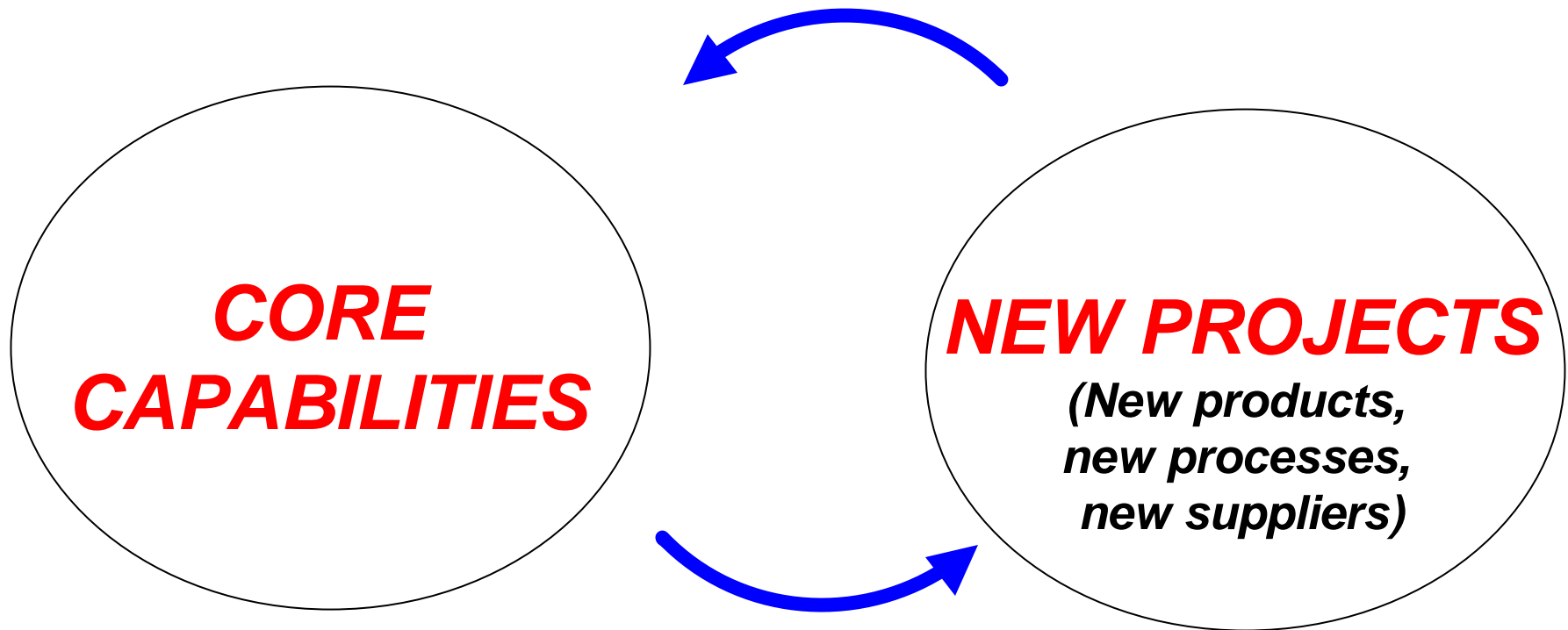
Leonard-Barton, *Wellsprings of Knowledge*

Technology Dynamics in the Aircraft Industry: LEARNING FROM THE DINOSAURS
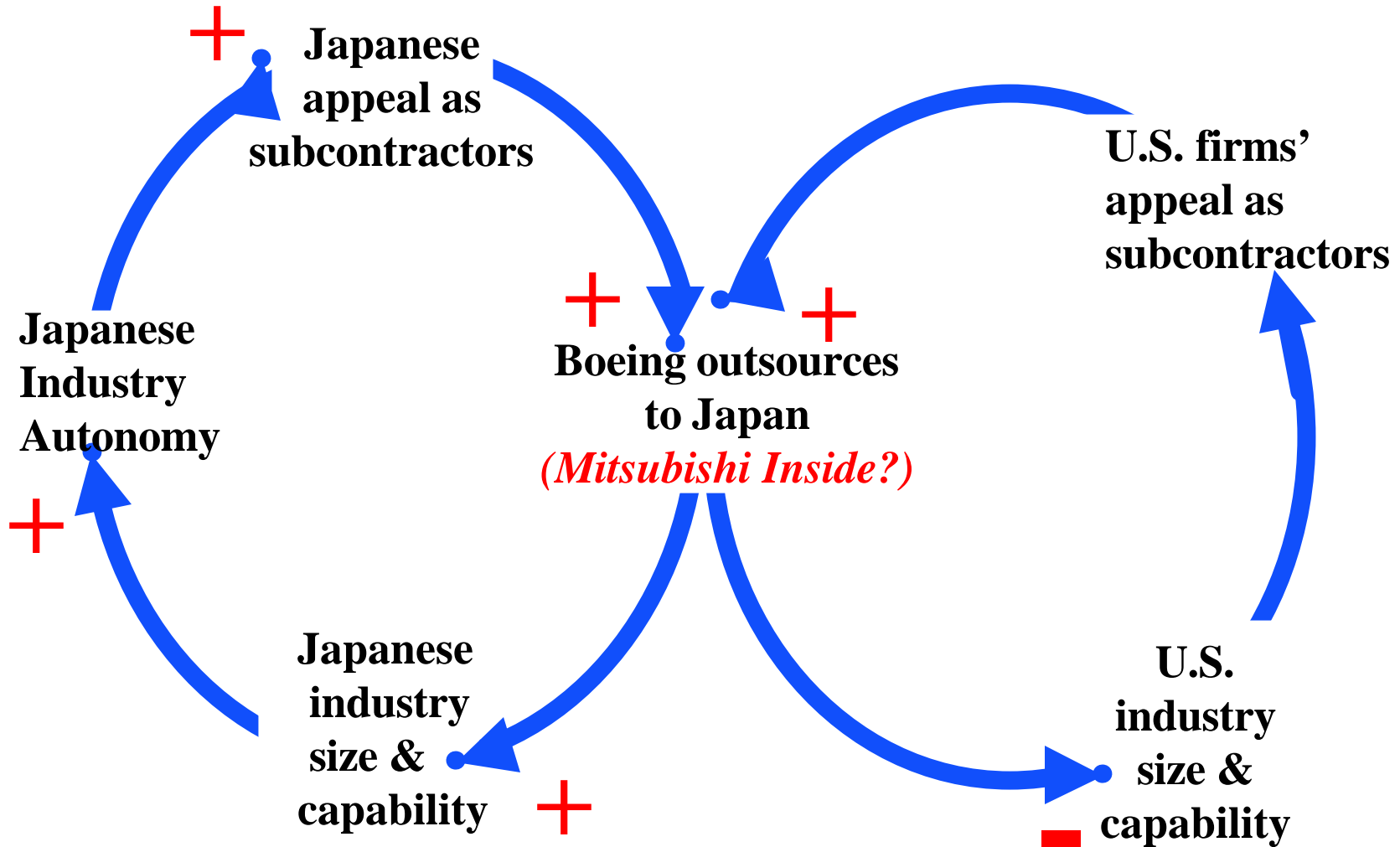
ARCHITECTURES IN 3-D
INTEGRALITY VS. *MODULARITY*

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**

SUPPLY CHAIN ARCHITECTURE

Integral supply-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 supply-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

Some things are just not outsourceable

- Toyota has a vibration spec. for an outsourced drive shaft
- The drive shaft is part of a complex NVH "system"
- But, you can't outsource NVH engineering (D. Whitney)

ENGINE

ENGINE MOUNT

SUSPENSION

TRANS-MISSION

BRAKES

HALF SHAFT

WHEELS and TIRES

NVH Chain
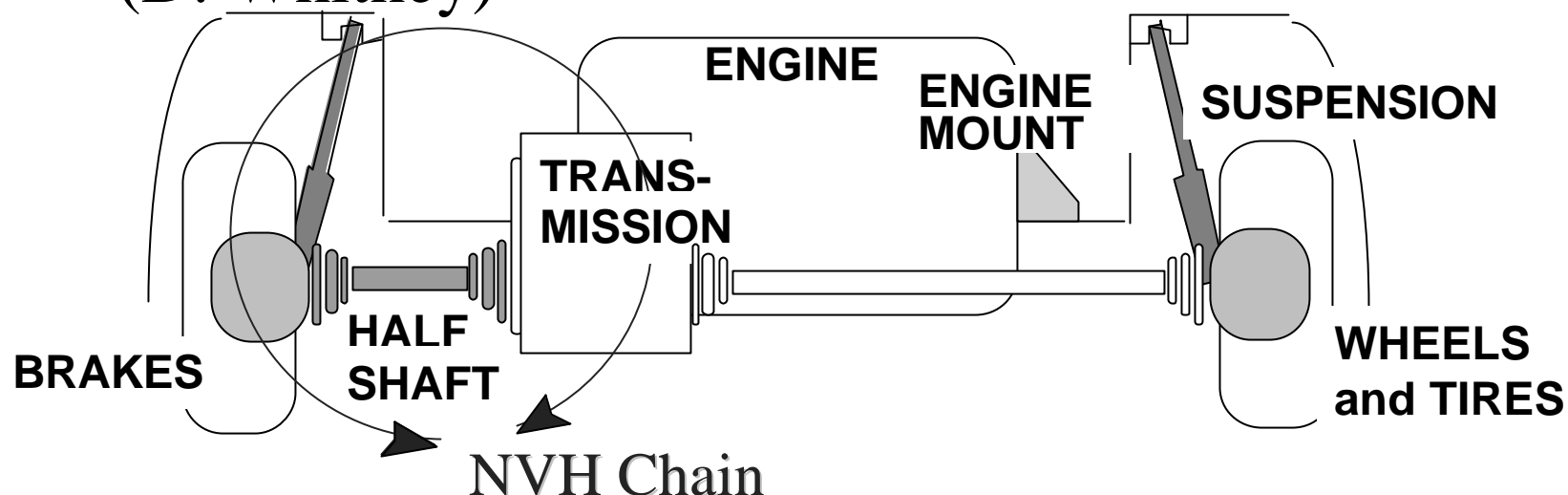
Source: "Identifying Integration Risk During Concept Design," T. Cunningham,, USAF & D. Whitney, MIT

DESIGNING ARCHITECTURES FOR PRODUCTS & SUPPLY CHAINS: THE NEED FOR ALIGNMENT

SUPPLY CHAIN (Geog., Organ., Cultural, Elec.) ARCHITECTURE

PRODUCT ARCHITECTURE

	INTEGRAL	MODULAR
INTEGRAL	Jet engines Microprocessors Mercedes vehicles	Polaroid Nortel
MODULAR	Automotive Supplier Parks	Personal Computers Bicycles Chrysler Vehicles

DESIGNING ARCHITECTURES FOR PRODUCTS & SUPPLY CHAINS: MODULARITY VS. OPENNESS

ARCHITECTURAL PROPRIETARINESS

	CLOSED	OPEN
INTEGRAL	Pentium Chip Mercedes Vehicles SAP ERP	Linux
MODULAR	IBM Mainframes Microsoft *Windows* Chrysler Vehicles	Palm Pilot software & accessories Phones & service Web-based ERP

ARCHITECTURAL STRUCTURE

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

	DEPENDENT FOR KNOWLEDGE & CAPACITY	**DEPENDENT FOR CAPACITY ONLY**	**INDEPENDENT FOR KNOWLEDGE & CAPACITY**
ITEM IS MODULAR (DECOMPOSABLE)	**A POTENTIAL OUTSOURCING TRAP** YOUR PARTNERS COULD SUPPLANT YOU. THEY HAVE AS MUCH OR MORE KNOWLEDGE AND CAN OBTAIN THE SAME ELEMENTS YOU CAN.	**BEST OUTSOURCING OPPORTUNITY** YOU UNDERSTAND IT, YOU CAN PLUG IT INTO YOUR PROCESS OR PRODUCT, AND IT PROBABLY CAN BE OBTAINED FROM SEVERAL SOURCES. IT PROBABLY DOES NOT REPRESENT COMPETITIVE ADVANTAGE IN AND OF ITSELF. BUYING IT MEANS YOU SAVE ATTENTION TO PUT INTO AREAS WHERE YOU HAVE COMPETITIVE ADVANTAGE, SUCH AS INTEGRATING OTHER THINGS	**OVERKILL IN VERTICAL INTEGRATION** YOU DON'T GET TO TAKE ADVANTAGE OF SUPPLIER CAPABILITIES WHICH MIGHT SPEED DEVELOPMENT AND REDUCE COSTS
ITEM IS INTEGRAL (NOT DECOMPOSABLE)	**WORST OUTSOURCING SITUATION** YOU DON'T UNDERSTAND WHAT YOU ARE BUYING OR HOW TO INTEGRATE IT. THE RESULT COULD BE FAILURE SINCE YOU WILL SPEND SO MUCH TIME ON REWORK OR RETHINKING.	**CAN LIVE WITH OUTSOURCING** YOU KNOW HOW TO INTEGRATE THE ITEM SO YOU MAY RETAIN COMPETITIVE ADVANTAGE EVEN IF OTHERS HAVE ACCESS TO THE SAME ITEM.	**BEST INSOURCING SITUATION** YOU CAN CONTROL ALL SUBSYSTEMS AND OPTIMIZE THEIR INTERFACES AS WELL AS ITERATE ON INTERDEPENDENT SUBSYSTEM DEVELOPMENT

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

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

DEPENDENT FOR KNOWLEDGE & CAPACITY **DEPENDENT FOR CAPACITY ONLY** **INDEPENDENT FOR KNOWLEDGE & CAPACITY**

DECOMPOSABLE (Modular)

Trap

Clockspeed
Fast   Slow

Suppliers *Few   Many*

OK
Watch it!

Best Out

Clockspeed
Fast   Slow

Suppliers *Few   Many*

Over-kill

Clockspeed
Fast   Slow

Suppliers *Few   Many*

INTEGRAL

Worst

Clockspeed
Fast   Slow

Suppliers *Few   Many*

OK

Clockspeed
Fast   Slow

Suppliers *Few   Many*

Best In

Clockspeed
Fast   Slow

Suppliers *Few   Many*

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

◆ *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 <u>level</u> 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

Sourcing Strategy Decision Tree - High Customer Importance Path

High Customer Importance Path

Customer Importance? — Low //

High

Technology Clockspeed?

Fast — **Competitive Position?** — Slow — **Competitive Position?**

Strong / Weak (Fast branch)

Strong / Weak (Slow branch)

Minimal Outsource - Invest (Strong, Fast)

Capable Suppliers? — None / Many / Few

Minimal Outsource - Invest

Architecture? — Integral / Modular

Minimal Outsource - Equity / Acquire and Partner

Minimal Outsource - Equity / Acquire

Architecture? — Integral / Modular

Minimal Outsource - Equity/Acquire & Partner

Capable Suppliers? (Slow, Strong) — None / Many / Few

Minimal Outsource - Maintain Internal Knowledge (possibly develop suppliers)

Architecture? — Integral / Modular

Outsource All

Partial Outsource

Partial Outsource (less integral components)

Outsource All

Capable Suppliers? (Slow, Weak) — None / Many / Few

Minimal Outsource - Invest for Parity, Develop Suppliers

Architecture? — Integral / Modular

Partial Outsource - Invest in Internal Capability

Mostly Outsource - Specify & Integrate

Outsource All

Sourcing Strategy Decision Tree - Low Customer Importance Path

MIT
00
ckspeed.com

Actual knowledge work compared to outcome of Decision Framework

Percentage of Knowledge Work Currently Done

0%   50%   100%

Percentage of Knowledge Work that Should be Controlled

100%

0%

No Outsourcing

Minimal Outsource- Equity/Acquire & Partner

Minimal Outsource- Maintain Internal Knowledge

Partial Outsource

Mostly Outsource - Specify & Integrate

Mostly Outsource - Develop More Suppliers

Spin-off and Develop Suppliers

Outsource All
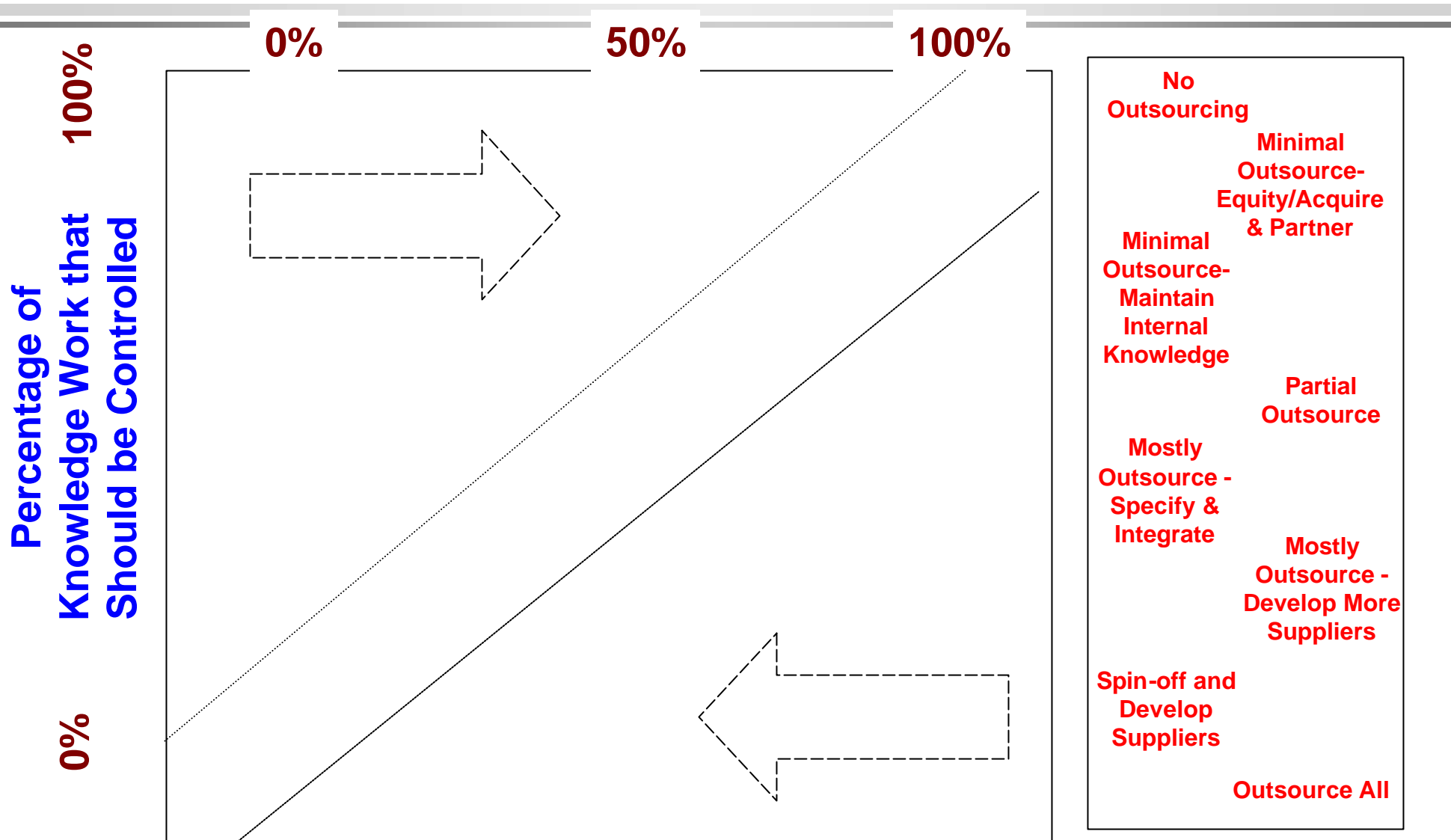
Every decision requires qualitative and quantitative analysis to reach a conclusion *
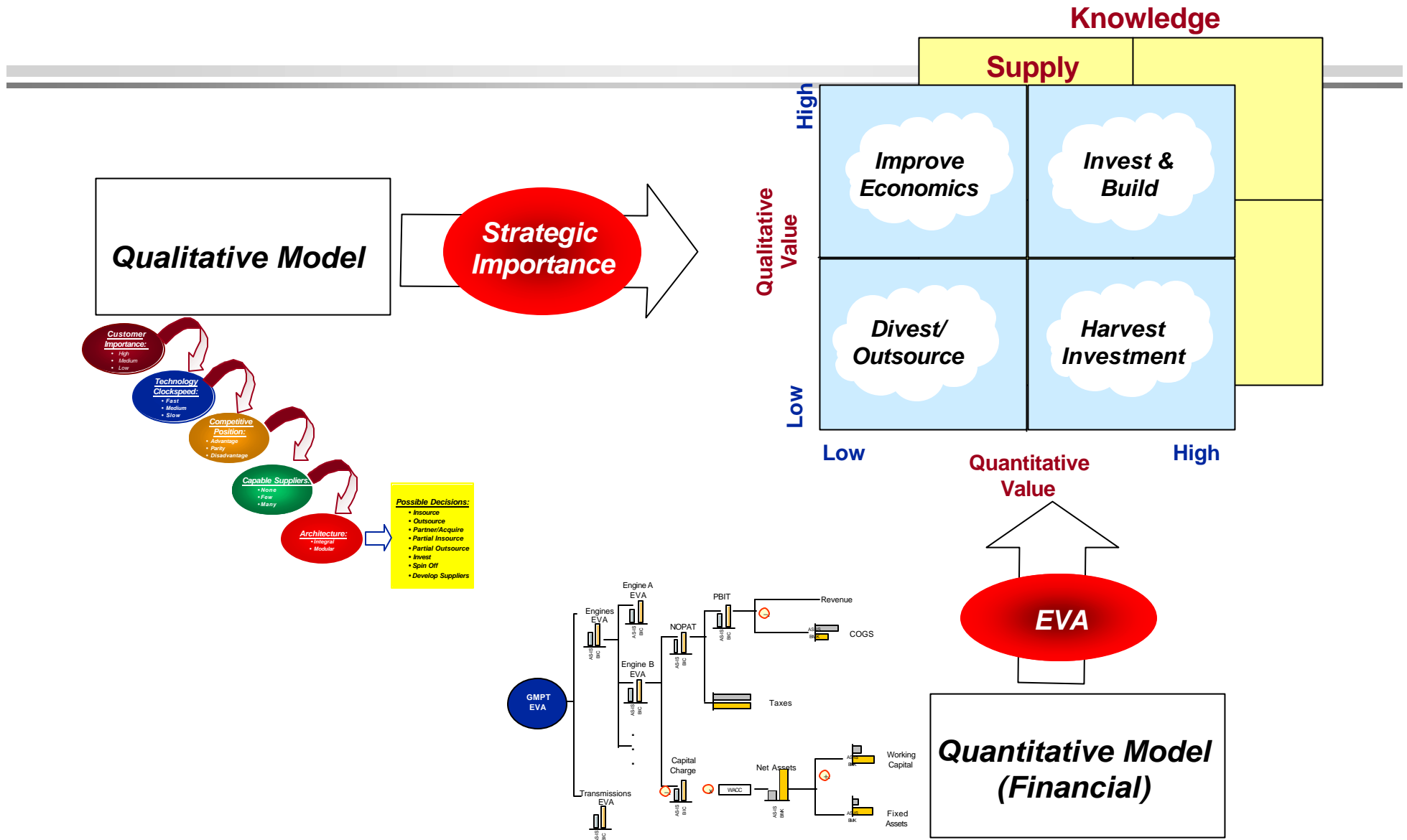
Value Chain Strategy in a Nutshell
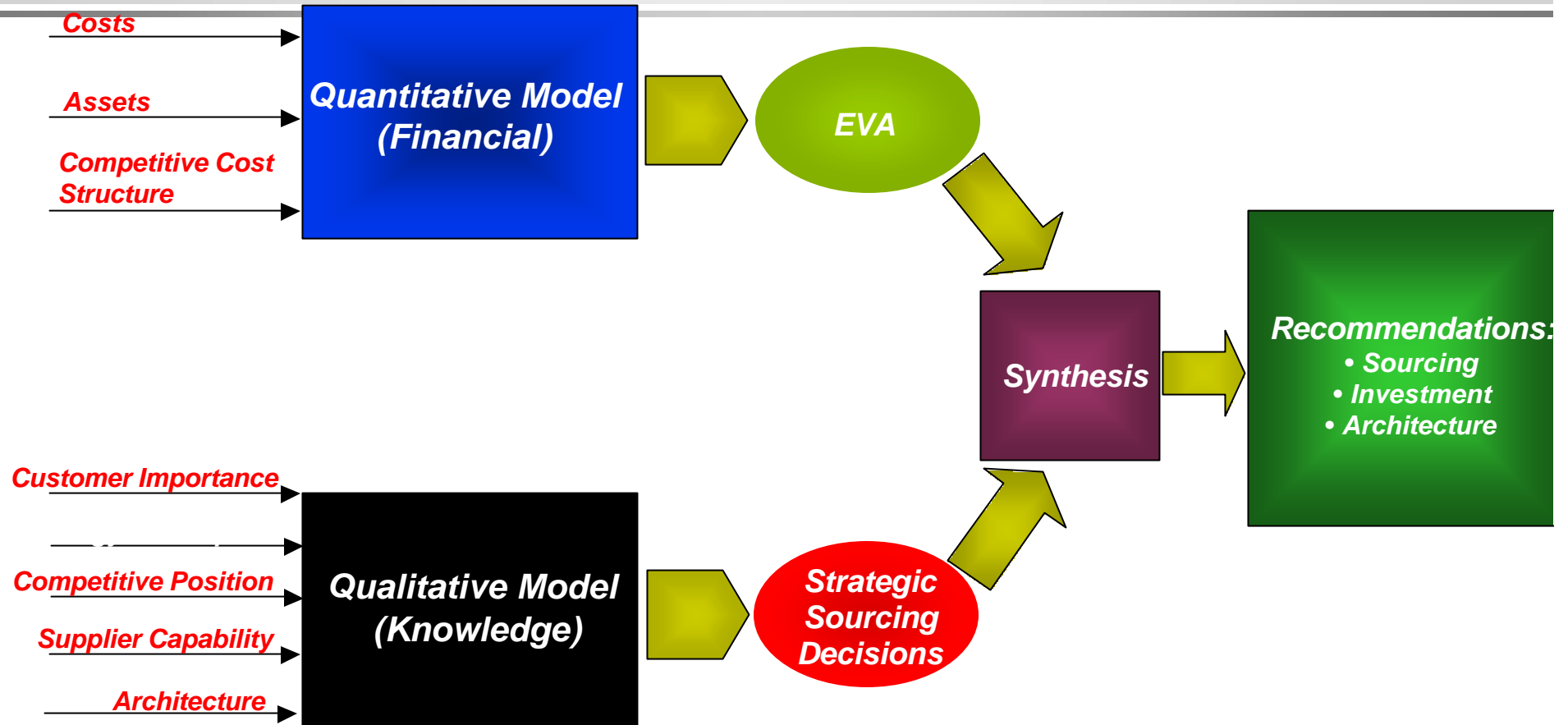
Subsystem level synthesis of qualitative and quantitative analyses for manufacturing supply*

Strategic Value

High

- Maintain in house
- Investigate ways to increase EVA (e.g. decrease costs, consolidate assets)

- Maintain in house
- Invest as needed to maintain flexibility, low costs, and high quality

Low

- Minimize investment in new assets
- Longer term -Spin Off or Develop Supply base and outsource

- Short term - use up remaining asset life and invest sparingly
- Long term - develop suppliers and outsource

Low   **High**

D Economic Value Added

* © MIT 2000 clockspeed.com

product knowledge integral with process knowledge?

YES

NO

NO

Product/ process knowledge integral with manufacturing supply?

NO

YES

NO

Product Knowledge

Process Knowledge

NO

process knowledge integral with manufacturing supply?

YES

Manufacturing Supply
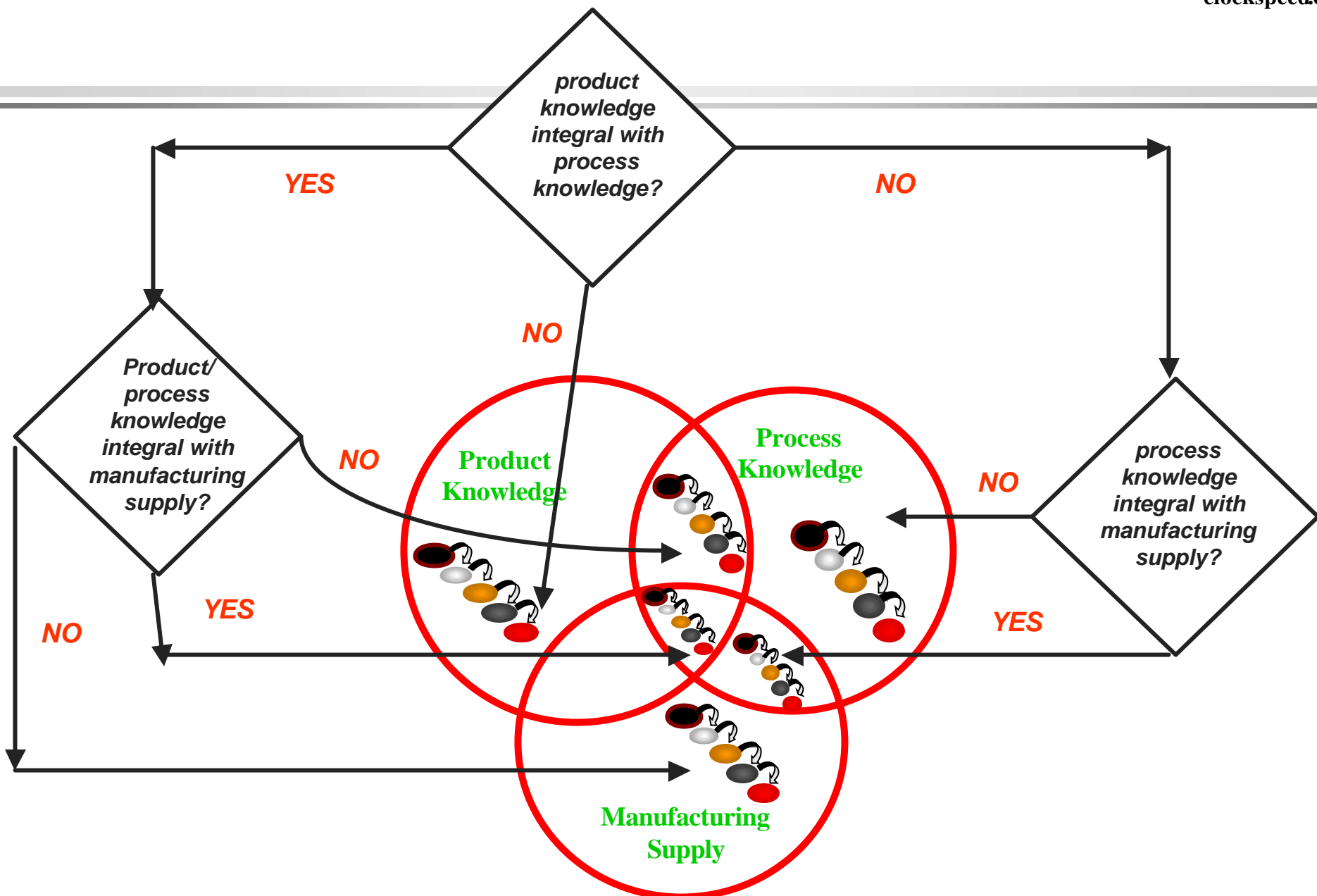
Supply Chain Mapping

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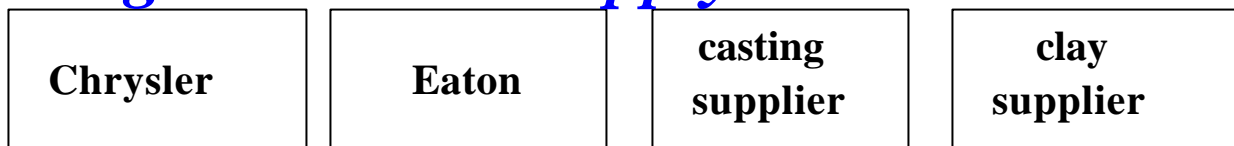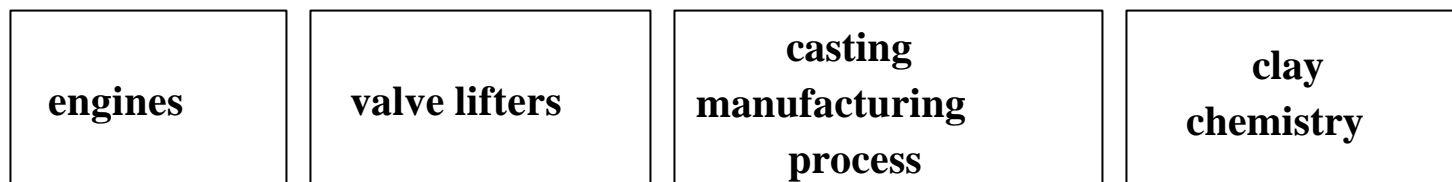
Underlying Assumption: You have to draw the maps before you can assess their dynamics.

A Fourth Map:
Industry Structure w/Product Architecture

Computer Industry Structure, 1985-95

Microprocessors	Intel		Moto	AMD	etc
Operating Systems	Microsoft			Mac	Unix
Peripherals	HP	Epson	Seagate	etc	etc
Applications Software	Microsoft	Lotus	Novell	etc	
Network Services	AOL/Netscape	Microsoft	EDS	etc	
Assembled Hardware	HP	Compaq	IBM	Dell	etc

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

VALUE CHAIN MAP:
An *Aggressive Outsourcing and Strategic Alliance* strategy might result in new market creation with more outsourcing

100%

Vertical Integration

Division

Product & Tech Strategy

Research

Hardware Design & Engineering – Fast Clockspeed

System Integration

Manufact Engineering

Procurement

Corporate

External

Hardware Design & Engineering – Slow Clockspeed –

Casting

Component Fab

Machining

Assembly

Perceived Value Added ⟶ 100%

Legend

% of Work Internal/ external (Total=100%)

New Strategy

1998 Baseline

% of Perceived Value by Element (Total=100%)

Mutually Reinforcing Clockspeed Drivers:
Technological Innovation & Competitive Intensity

Technological Innovation in Computing & Communications

Industry & Organization Clockspeeds

Industry & Organization Clockspeeds

Competitive Intensity from Reduced Trade Barriers and Internet Commerce

+ + + +
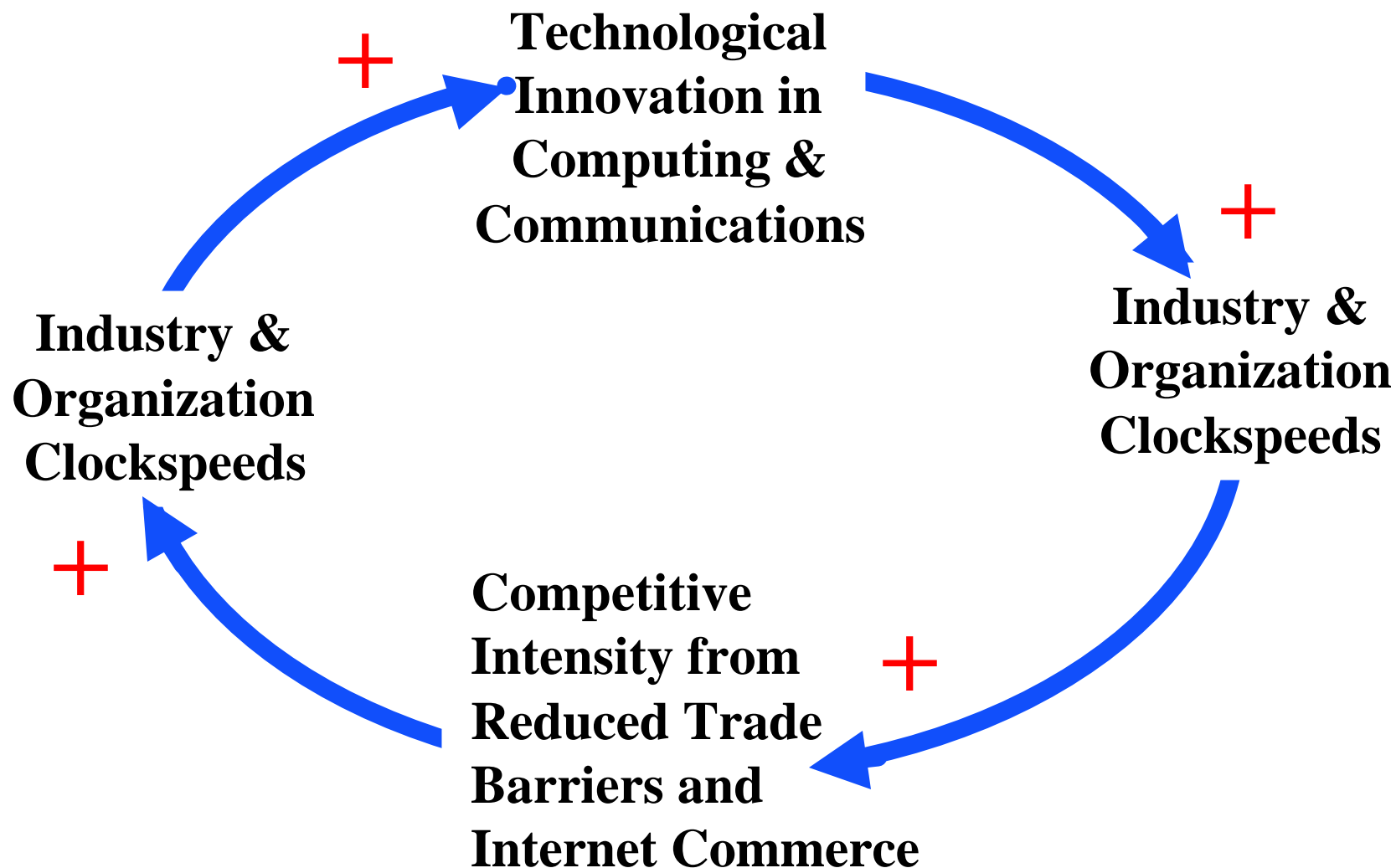
SUPPLY CHAIN DESIGN IS
<u>*THE ULTIMATE*</u> CORE COMPETENCY

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

<u>KEY SUB-COMPETENCIES:</u>

1. Forecasting the dynamic evolution of market power and market opportunities

2. Anticipating Windows of Opportunity

3. 3-D Concurrent Engineering:
Product, Process, Supply Chain

CAPABILITIES — PROJECTS
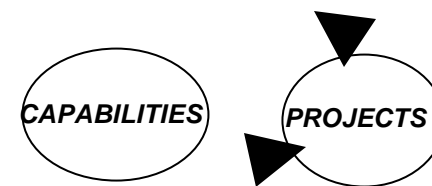
Fortune Favors the Prepared Firm

PROCESS FOR SUPPLY CHAIN DESIGN

1. **Benchmark the Fruit Flies**
2. **Map your Supply Chain**
   - **-Organizational Supply Chain**
   - **-Technology Supply 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

DOUBLE HELIX

BOEING

CAPABILITIES   PROJECTS
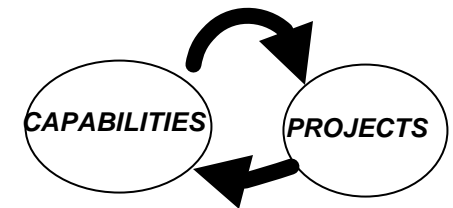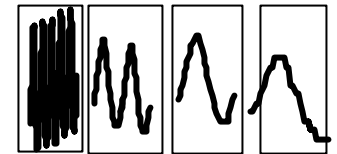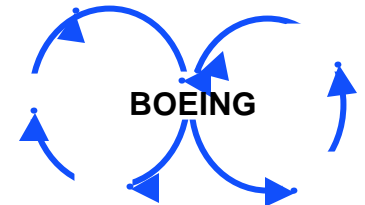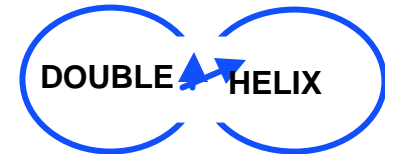
STRATEGY IN 3-D: CASE EXAMPLES

Boeing: **Static 3-D in airplane Projects**
Dynamic, Strategic Supply Chain,
unintegrated w/ Product & Process

Intel: **Modular Product vs. Process**
Integral Process and Supply Chain

Chrysler: **Modular Product & Supply Chain**
(weak on process?)

Toyota: **Integral 3-D in Nagoya**
(weak on global 3-D?)

Product   **Process**   **Supply Chain**

| Design Detailed Perform. Specs & Funct. | Architect. Modular vs. Integral | Unit Processes Tech. & Equip. | Mfg.Syst Functnl Cellular. | S.C. Architect. Orgs Set & Alloc. of Tasks | Logistics & Coord System Auton vs. Integrated |

* 2000 clockspeed.com
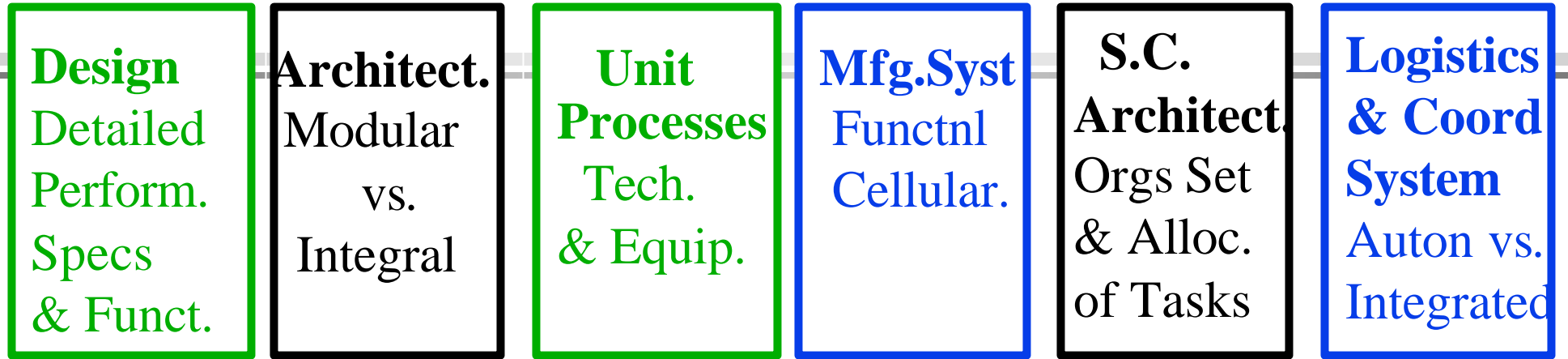
- **F**ocus
- **A**rchitecture
- **T**echnology

A 3-D CE decision model illustrating the *imperative* of concurrency

Components of Product, Process, and Supply Chain Strategy

Product

- **Customer Needs**
- **Market Segments**
- **Product Architecture**

Process

- **Mission Statement**
- **Operating Objectives**
- **Policies & Procedures**
  - -Structural: Bricks, Tech, Org
  - -Infrastructural:
    - HR, Business Processes

Supply Chain

1. **Sourcing:** *Make/Buy*
2. **Supplier Selection**
3. **Relationship Design**
   (spot, alliance, equity, etc.)
4. **Logistics System Design**
5. **Inventory management Policies**
6. **Supplier Management**
7. **Supply Chain Architecture**
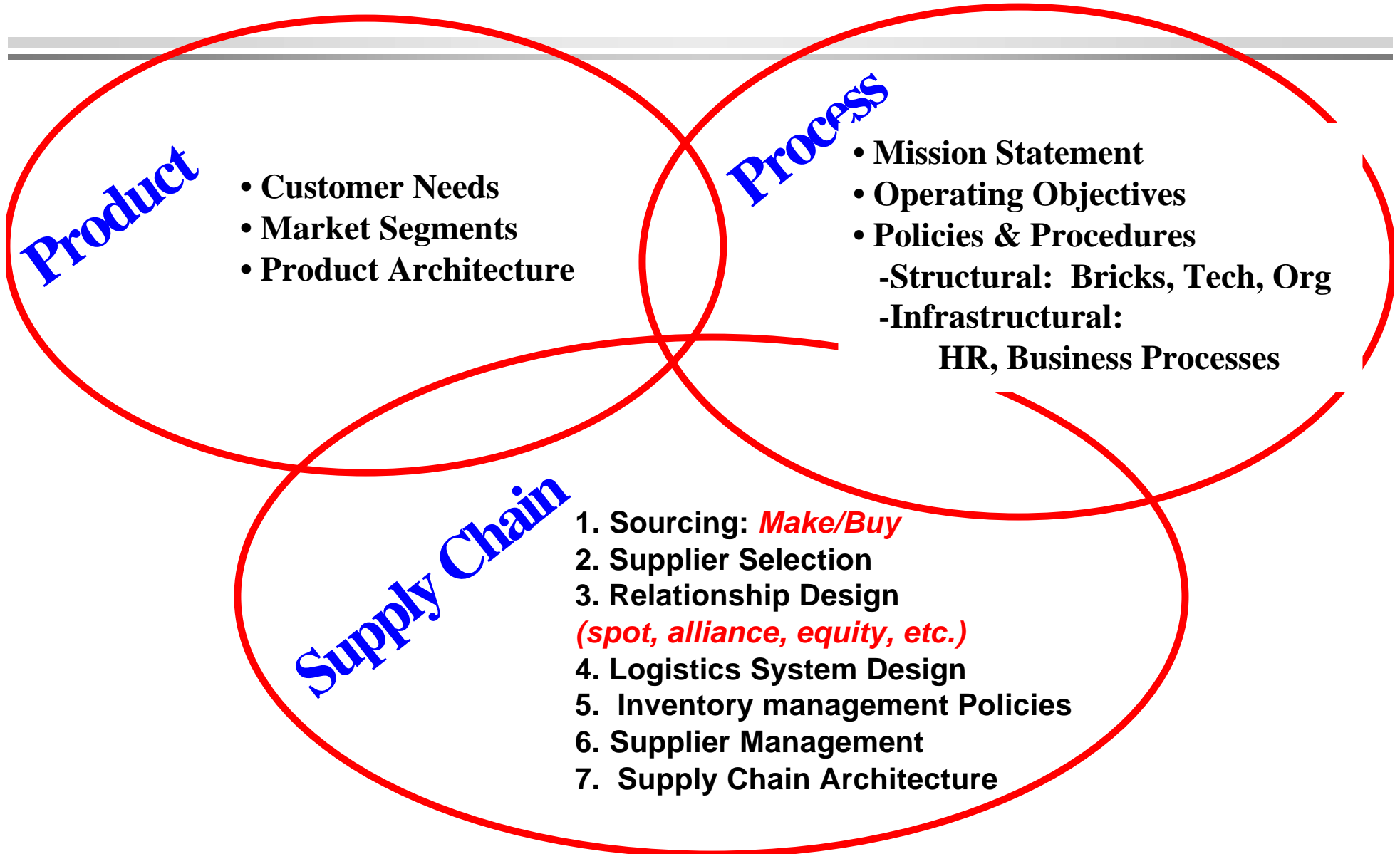
MAPPING EXERCISE

1. **Pick a key Product or Service**
2. **Map your Supply Chain-- Static (snapshot) Maps**
    - **-Organizational Supply Chain**
    - **-Technology Supply Chain**
    - **-Capability Chain**
    - **-Value Chain**
3. **Dynamic chain maps**
    - **-location on double helix**
    - **-clockpeed drivers**
    - **-dependency analysis**
4. **Identify Windows of Opportunity**
5. **Present insights, questions, & puzzles**

eClockspeed-based Principles for Supply Chain Design

1. Fruit Flies & Temporary Advantage
(defs, Intel, dependence, Helix, acceleration)

2. Supply Chain Design & 3-DCE
(architectures, dependencies, core comps, make/buy, mapping, decision process)

3. Mapping Exercise
(mapping)

4. eBusiness Phenomena: Business Model Innovation *(e-tailing, B2B=mkts+e2e+NPD, CPM, free info flow,*

5. Sense & Respond: Analyze, Innovate, Experiment
(Group Exercise: experiment design)

Internet Era Phenomena:
eCompetition in Business Model Design

E-tailing:
Attack: Amazon, Webvan
Defend: Walmart.com, Ford.com, Office Depot.com

B2B:
E2E integration: Cisco, Dell, Fedex, UPS
Market Creation:eSteel (eBay), Ariba, Freemarkets, AutoEx
Product Dev:CISCO

Customer as Product Manager:
Product Design/Spec: Dell, Herman Miller, Reflect, iMotors

Free & Open Digital Content:
Collaborative Construction: Linux, Lego, Palm Pilot
Ubiquitous Sharing/Theft: Napster, Macster, Gnutella

ATTACK E-TAILIING
Amazon.com: A fruit fly is born

» **Amazon.com began in 1995 as a website only with organized book listings, discount prices, and outsourced fulfillment**

- *Differential advantages via B&N and Borders were lower overhead costs, larger selection presented, lower customer search costs, and no need for the customer to leave his couch*

- **Amazon developed a fast-growing & loyal customer base by**

- *Providing fast, reliable fulfillment*

- *Adding services like individualized recommendation lists*

» **Amazon lost money on many/most transactions, but attracted a high market valuation due to its capture of upscale "eyeballs" (to be monetized at a "later" date)**

ATTACK E-TAILIING
Amazon.com: A fruit fly evolves

» **By 1999 Amazon had added music, videos, toys, and electronic products to its offerings**

   – *A broader product line <u>could</u> help to monetize the eyeballs*

   – *Goal: 20 million SKU's; exceeds largest previous model by 10x*

» **Amazon owns and operates six distribution centers**

   – *Last on-time shipment for Xmas 1999 at 23:00 on 23 Dec 99*

   – *Vs. Fingerhut stopped taking orders on 13 Dec 99*

Key Lessons to date:
1. **Sequential Chain moves: Site to Fulfillment to Variety**
2. **Early entry established the brand; service captured loyal eyeballs**
3. **Differentiation moved from website to fulfillment**
   (but imitation barriers are low; continual innovation is key)
4. **Eyeballs are not simple to monetize (for profits) in**
   hypercompetitive web-centric marketing

Cisco's E2E Integration for Fulfillment & Product Development

Customers

- **New product development on-line with supply base**
- **Technology Supply Chain Design: Innovation through Acquisition**

Cisco

Order info flows direct to Cisco and suppliers

Finished Product flows direct to customer via logistics supplier

Contract Manufacturers

- **Single enterprise information system**
- **Dynamic replenishment, direct fulfillment, merge in transit**
- **Customer orders through Cisco Connection online**

Component Suppliers & Distributors

Cisco's Value Chain Design

Product Design

- minimal prototype iteration
- shared product databases
- highly modular products
- joint with suppliers

Process Design

- orders go from CCO website to CM's
- products go from CM's to customer via logistics supplier
- order & forecast data online to supply chain

Supply Chain Design

- innovation through acquisition
- outsourced manufacturing (e.g., Solectron)
- outsourced logistics (e.g., Fedex)
- independent for knowledge in IT system

B2B marketplace: eSTEEL Business Model

- **Market making**: neutral, one-to-one negotiation, qualification and regulation process, more efficient transactions
- **Products**: currently limited to 6 types (hot rolled, cold rolled, coated sheet, plate, tin mill, rebar)
- **Economics**: 7/8 of 1% to sellers; no fee for buyers
- **Enabling Tool - STEELDIRECT**: BroadVision technology, flexibility to choose audience (capacity and capability), pricing flexibility

3D Concurrent Engineering

	Product	**Process**	**Supply Chain**
Traditional	•All Steel Products	•Traditional bidding •Phone, Fax, Email&Meetings •Personal Relationships •More Sales and Service Personnel •Self regulating	•Fragmentation •Traditional relationship building •Strong effect of geographic limitation •Asymmetric & Delays in information
e-STEEL	•Selected Steel products	•Digital Marketplace •Third-party Medium (e-STEEL) •Standardized Process and Documents	•Real Time Pricing and information update •Better Matching of Supply/Demand •Allows efficient exchange of logistics •Dynamic

e-STEEL
www.e-steel.com

Strengths

Neutrality: Equality of information

Strong management team: Tremendous industry experience, extensive contact

Good understanding of the needs of a true online market

- » Real time transfer of information
- » Streamlining repetitive tasks
- » Standardization

e-STEEL
www.e-steel.com

Weaknesses

Does not provide an absolute advantage

» Lack of personal relationships

– a need to maintain an active sales force, particularly for customers with lumpy orders

» Lowers switching costs

Limited safeguard to prevent participants from bypassing e-STEEL

» "Take out the middleman"

e-STEEL
www.e-steel.com

Opportunities

Efficiencies in buyer/supplier search costs

Immediate Reduction in Process Clockspeed

Low variable costs for e-STEEL

Opportunities to generate other revenues
  besides transactional revenues

  » Sell other products/services

  » Banner advertisement

e-STEEL
www.e-steel.com

Specialized portals & exchanges may support many types of transactions: e.g., pharmaceutical clinical trials

Drug Development Process

Trial Supplies Portal

Data Exchange Portal

Patient Enrollment Portal

CRO/Support Services Exchange
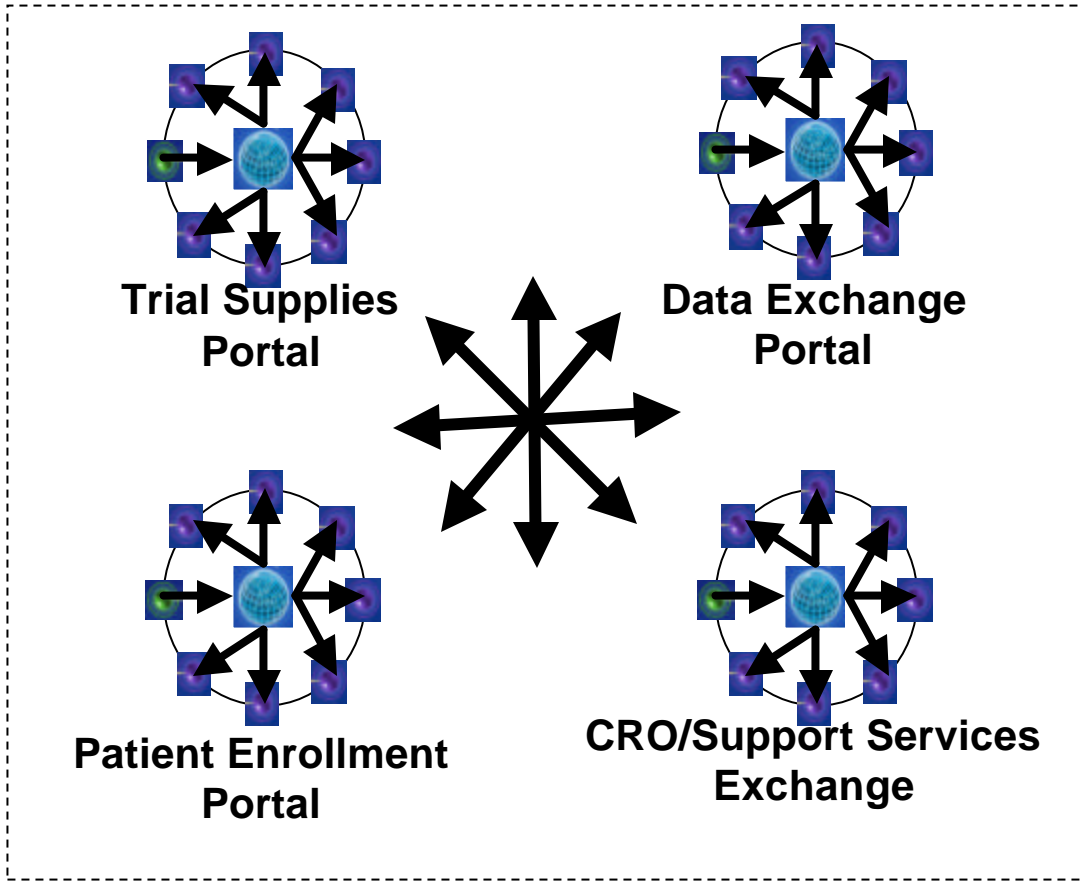
Device Development Process

From PRTM, April 26, 2000

Industry-specific B2B exchange portals are powered by TradeMatrix and allow for additional synergy through cross-connects

I2 - industry-specific portals

Sample industries

Oil and gas	Aerospace	Telecommuncations	Consumer Electronics	Automotive	Transportation	Textile	High Tech

MyAircraft

HomeElectr. Matrix

iStarXchange

Freight Matrix

SoftGoods Matrix

HighTech Matrix

eServiceMatrix

B2B exchange functionality

| Procurement |
| Commerce |
| Fulfillment |
| Product Development |
| Retail |
| Planning |
| Customer Care |

Synergy

Synergy

Source: industry interviews, company web site

I2 covers a broad spectrum of products and processes in the nascent B2B exchange platform business

I2 - competitive positioning

Positioning of B2B exchange platform providers

Complexity of interaction

Complex

Simple

**I2
(TradeMatrix)**

**Commerce
One**

Ariba

Direct

Indirect

Type of the traded components
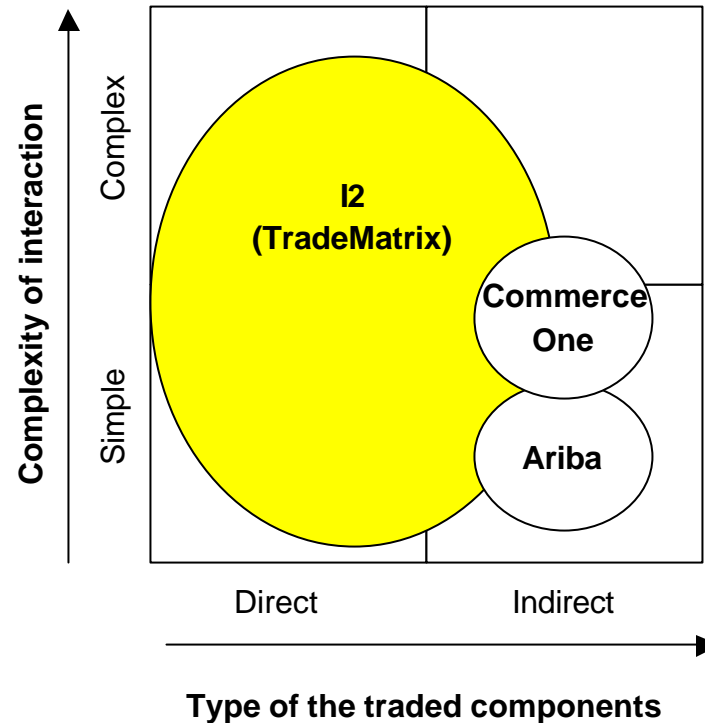
Source: industry interviews

Automotive B2B2C:
Supply Chain as a Network of Markets

Extranet

Intranet

Internet

(Linux standards for the Auto Industry)

(Yahoo like Consumer Portals)

Value Chain
(Ford's Manufacturing, Design and Engineering)

(AutoXchange for the FSN)

Aggregation
(Ford.com, MSN Carpoint, Autobytel)

The e-Consumer

Distributive Network
(The "Fat Pipes" that provide IT infrastructure)
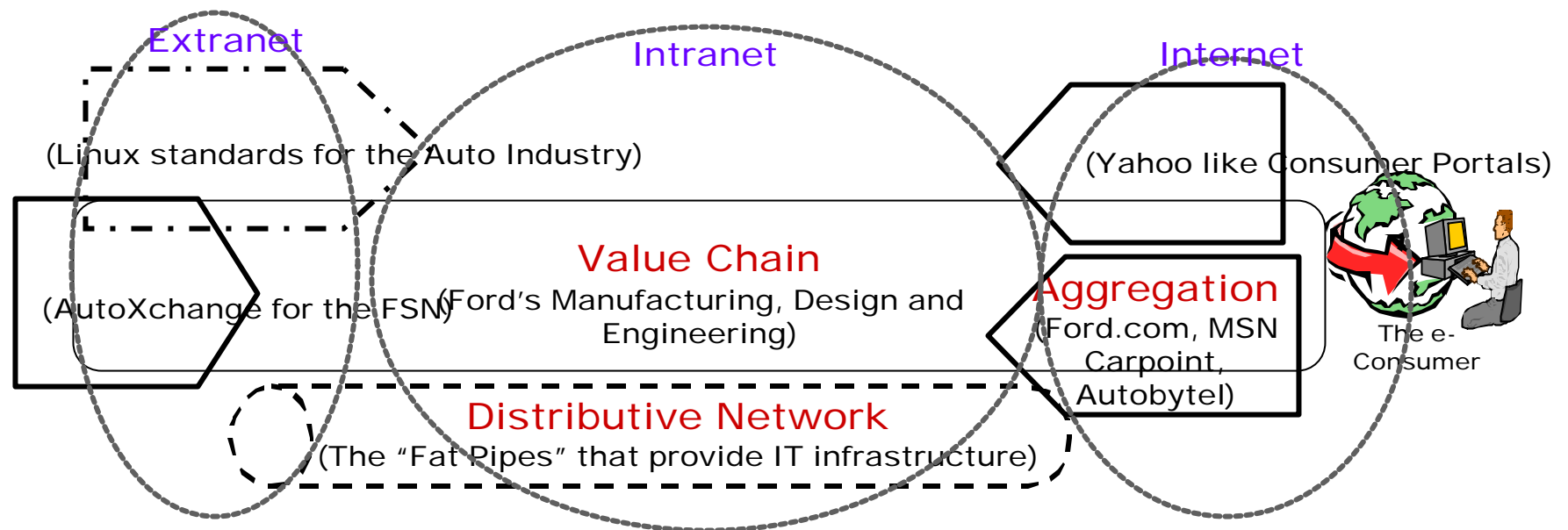
Physical Logistics: Inventory & Transportation

Information Logistics: Seamlessness, Substitute for Inventory, Demand Stimulation,

Ford: eSupply Chain Strategy

From "pushing cars" (make and sell), Jac Nasser wants to transform Ford into the *largest customer-centric (sense and respond) auto solutions provider*

» *Manufacturing & Sales of a vehicle is dwarfed by the sum of the after-sales services sold*

» *Pull-to-Order will be much tougher for cars than for PC's*

» *B2B Strategy: from e-procurement, AutoXchange need to find a culture of Supplier relations that satisfies all parties*

Chrysler'sExtended Enterprise Model

Key Elements of the model:

1. **Build Trust in Relationships**
   -ask for suggestions and act on them
   -honestly and aggressively seek mutual benefits
   -communicate frequently and broadly across the org.
      (understand each other's problems)
   -manage the relationship constantly
   -pre-select suppliers very early and work together
   -act for long-term gain, avoid short-term temptations

Stallkamp: "You are our supplier forever if you can be the leader in cost, quality, technology, and delivery. If you fall behind, we will give you a chance to catch up. If you cannot catch up (with our help), we will drop you."

Chrysler's Extended Enterprise Model

Key Elements of the model (continued):

2. **Share cost savings**
   - -start with target costs and learn jointly
   - -provide economic incentives for partnerships
   - -share data with scorecards on performance
   - -collaborate to reduce system costs along the entire chain
   - -better to have a low-cost supplier than a low-price supplier

3. **Develop products jointly**
   - -utilize co-located, cross-functional teams; common CATIA

4. **Develop *both* a strategy toward each supplier (how strategic; areas of joint interest), and a strategy for each commodity (e.g., we only source tires from Goodyear & Michelin)**

Chrysler's Extended Enterprise Model

Results:

Lower development costs:

joint incentives, ECN's come early

Faster development speed:

early involvement, fewer late ECN's

Lower procurement costs:

less time haggling and soliciting bids

Lower production costs:

suppliers get scale, more advanced planning

Improved quality:

joint incentives, better designs

Three Secrets to success:

Relationships, Relationships, Relationships

Marketplace Culture:
The Missing Link in AutoExchange?

Chrysler	*Mercedes*	*General Motors*
High profits/vehicle via:	**High profits/vehicle via:**	**Low profits/vehicle via:**
• **Value for the customer**	• **Luxury for the customer**	• **Variety for the customer**
• **Heavy reliance on independent suppliers**	• **Close integration with supplier activity**	• **Distance from supplier activity**
• **Lean internal technical infrastructure**	• **Rich, deep internal technical infrastructure**	• **Rich, deep internal technical infrastructure**
• **Dependent for knowledge**	• **Indp'dent for knowledge**	• **Indp'dent for knowledge**
• **Relatively modular vehicle architecture**	• **Relatively integral vehicle architecture**	• **Relatively modular vehicle architecture**
• **Cut costs to the bone**	• **Performance over cost**	• **Cost/Perform. Midpoint**
• **Cooperative Supplier Relations Culture**	• **Intermediate Supplier Relations Culture**	• **Aggressive Supplier Relations Culture**

What will be the culture of an industry-wide AutoExchange; GM/Freemarkets or Chrysler/Toyota?

Categorizing Business Webs:
What are the dimensions?
(adapted from *Digital Capital*, Tapscott, Ticoll, & Lowy, HBSP, 2000)

VALUE INTEGRATION

CONTROL

LOW   HIGH

SELF-ORGANIZING

Yahoo! Classifieds   Linux

Palm Pilot

Nasdaq

Human Genome Project

Ebay

AOL

Amex

AT&T

USAir Fedex

Amazon

Cisco

HIERARCHICAL

Travelocity   E-Trade   Dell

Walmart   P&G   Ford

eClockspeed-based Principles for Supply Chain Design

1. Fruit Flies & Temporary Advantage
(defs, Intel, dependence, Helix, acceleration)

2. Supply Chain Design & 3-DCE
(architectures, dependencies, core comps, make/buy, mapping, decision process)

3. Mapping Exercise
(mapping)

4. eBusiness Phenomena: Business Model Innovation (e-tailing, B2B=mkts+e2e+NPD, CPM, free info flow)

5. Sense & Respond:
Analyze, Innovate, Experiment
(Group Exercise: *experiment design*)

Sense & Respond:
Analyze, Innovate, Experiment

Group Discussion: *experiment design for* surviving in the age of temporary advantage

g. What strategic changes do you think your company will have to make to survive the coming decade?

h. What are the principal organizational barriers your company faces in implementing needed change?

i. What experiments might you run as part of your continuous learning approach to fast-clokspeed business strategy?

eBUSINESS EXERCISE:
HOW MIGHT YOU ATTACK AND DEFEND, AS WELL AS ANTICIPATE SUCH MOVES

	ATTACK	DEFEND
US		
THEM		
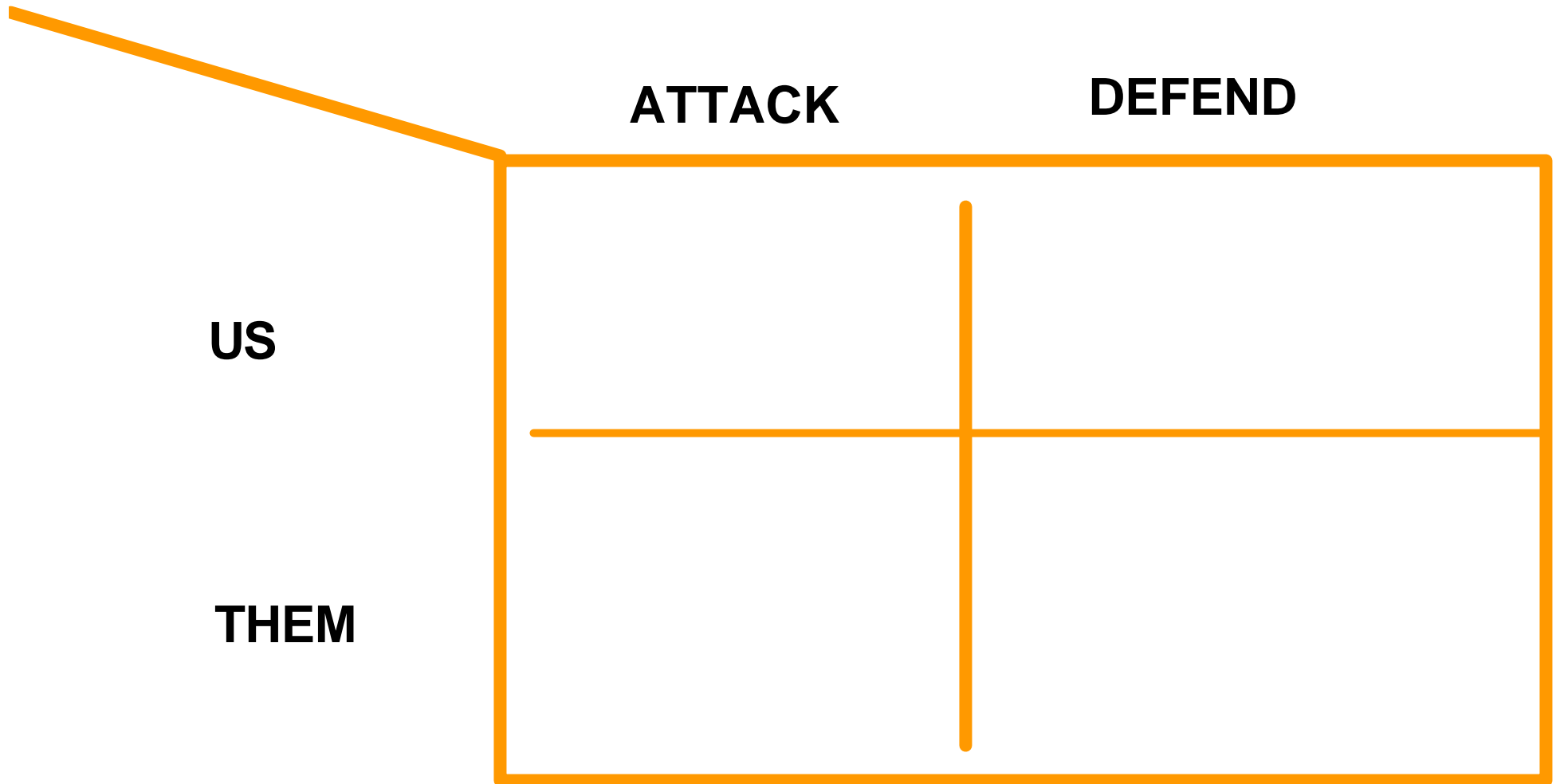
Supply Chain Design is the Ultimate Core Competency:
Competency of passing judgement on all other competencies

Benchmark the Fruit Flies
- **Beware of *Intel Inside***
- **SC control point unstable**
  (comp, assem, distrib)
- **SC structures oscillate**
  -- int/int or mod/mod
- **Cisco is open & modular: PDT & SC**
- **Dependence/Independence has**
  positive feedback
- **Projects feed capabilities & vice-versa**
- **eBusiness accelerates Clockspeeds**
- **All Advantage is Temporary**
- **Align Architectures in Pdt, Proc, & SC**

QUESTIONS
- **Does Amazon need Warehouses?**
- **Or should they buy Fedex?**
- **Can Delphi be the Cisco of mobile media?**
- **Can Ford be the Dell of Cars?**
- **Is Dell done innovating?**
- **How can P&G get tree-to-toilet**
  time down to seven days?
- **What comes after open & modular?**
- **When will brick/click integration pay?**
- **When not?**

Vertical/Integral

DOUBLE HELIX

Horizontal/Modular

BOEING Dependency

CAPABILITIES   PROJECTS

Product   Process
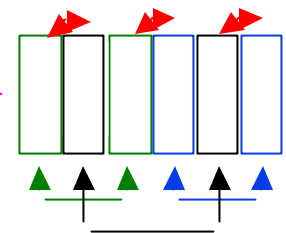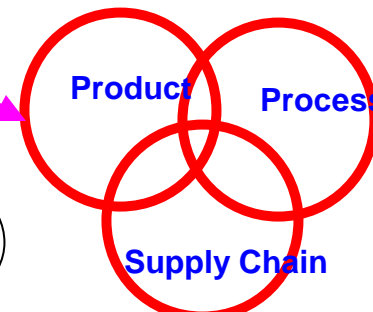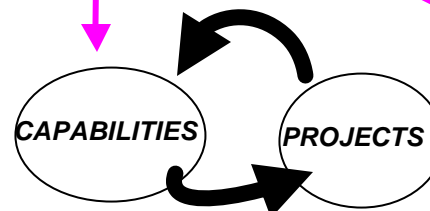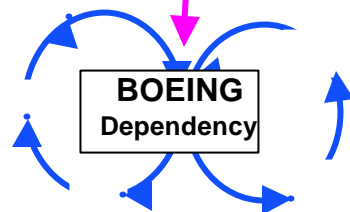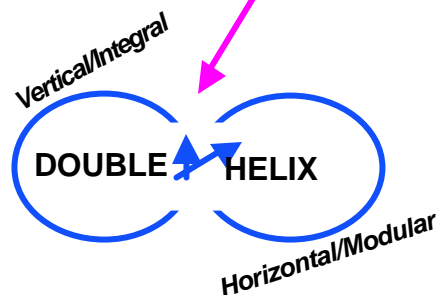
Supply Chain

All Conclusions are *Temporary*

Clockspeeds are increasing almost everywhere

eCommerce is a clockspeed driver

Supply chain design is a key competency

Study of eFlies can help with crafting strategy

Dissecting the Double Helix:
Industry Structure Dynamics:

1. Stable at Vertical/Integral
2. Stable at Horizontal/Modular
3. Cycles between Vertical/Integral
   and Horizontal/Modular

Transition Horizontal-Vertical

Horizontal Structure Reinforcers

cost of entry

- modularity +

standardized interface

entrants' profits in row k +

B *competition loop*

number of niche entrants in row k

R *Modular utility loop*

utility of modular components +

outsource

entrants' price -

+

+

-

entrants' relative component competency

entrants' dimensional complexity -

R *Modular market attractiveness loop*

R *Modular opportunity loop*

incumbent's profit in row k

entrants' RD in components

entrants' product and process innovations

<incumbent's utility of integrated systems>

R *product and process innovation loop*

incumbent market share row k

Transition Vertical-Horizontal

© MIT 2000

clockspeed.com

incumbent's profits

incumbent's volume of sales

number of niche entrants in row k

B

Organizational rigidity loop

incumbent's market share

incumbent's vertical scope

<entrant's ability to bundle components>

incumbent's scale

incumbent's relative system integration skills

incumbent's utility of integrated systems

B

Niche entrant loop

incumbent's organizational rigidity

incumbent's relative component competency

responsiveness

B

Dimensional complexity loop

incumbent's dimensional complexity

Vertical Structure Reinforcers *

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incumbent's R D budget

incumbent's profits

vertical scope budget

systems integration budget

R Economies of vertical scope loop

incumbent's volume of sales

component budget

incumbent's vertical scope

incumbent's market share

vertical scope R D

R1   **R2**

incumbent's production costs

R Economies of scale loop

systems integration R D

<entrant's ability to bundle components>

R3

R Systems integration loop

R Vertical scope RD loop

incumbent's price

component R D

R Component innovation loop

R1 - Components/ Vertical scope R&D spillover

R2 - Systems Integration/ vertical scope R&D spillover

R3 - Component/ Systems integration R&D spillover

incumbent's systems integration capability

incumbent's utility of integrated systems

Automotive Power Dynamics
of Technology Value/Content

1965

Steel

Autos

-styling
-structural integrity

Elec.

2005

Steel

Autos
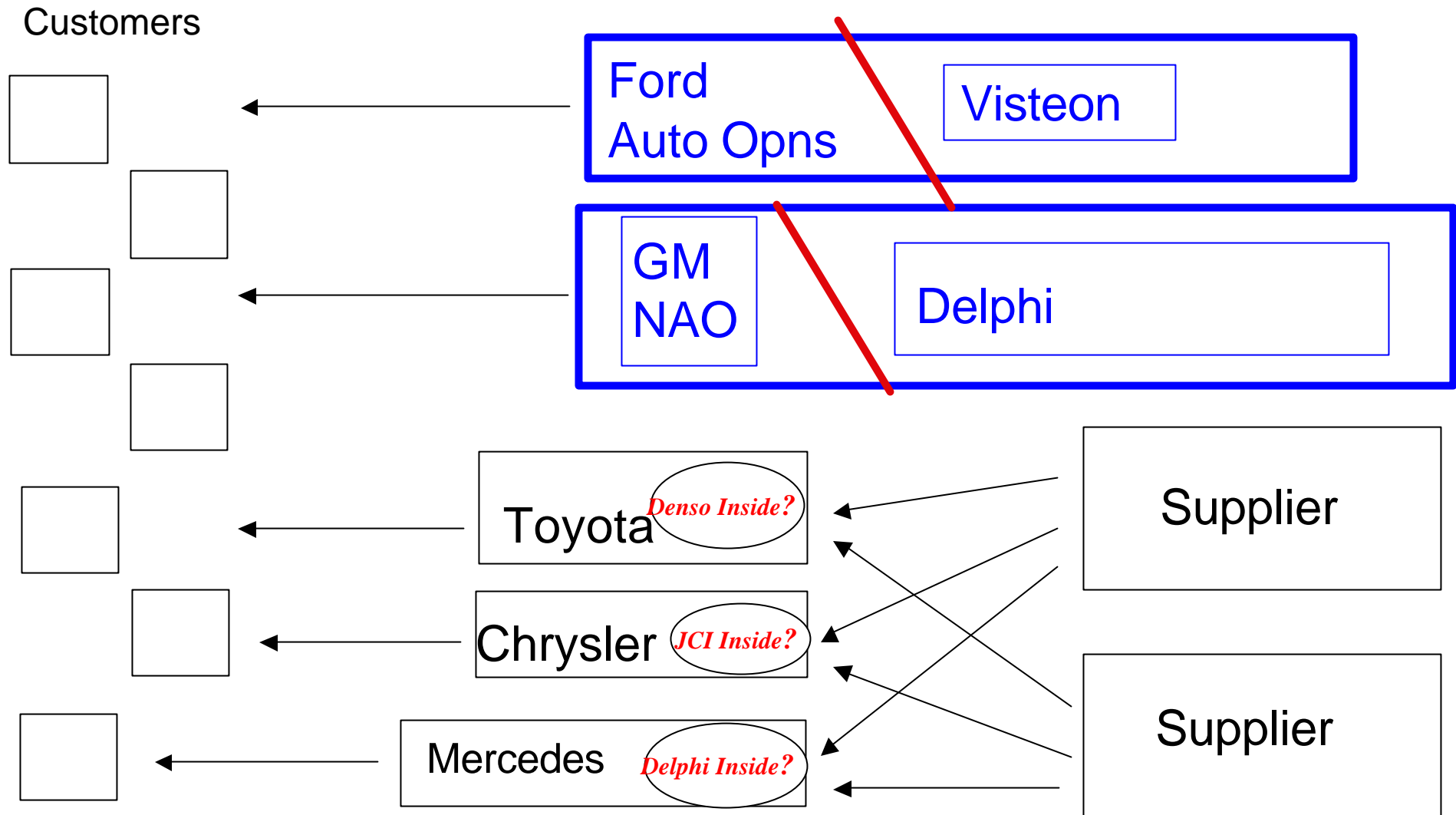
Electronics
-$/vehicle
-customer interface

Will electronics replace sheet steel . . .

. . . as the most integral subsystem in the automobile, driving shifts in the relative strategic and financial importance of various members in the supply chain?

Strategic Design of
Automotive Electronics Supply Chains

Customers

Ford Auto Opns — Visteon

GM NAO — Delphi

Toyota — *Denso Inside?*

Chrysler — *JCI Inside?*

Mercedes — *Delphi Inside?*

Supplier

Supplier

8:30 - 10:00 am   Strategic Supply Chain Design
                -application of clockspeed & fruit fly principles
PREPARATION QUESTIONS:
a. What do you think are the drivers of clockspeed in your principal line of business?
b. What other companies or industries do you think might be useful fruitflies for your company to benchmark?

10:30 - 12:00 End-to-end eBusiness integration
                -ebusiness fruit fly lessons
                -physical/logistics integration and information integration
PREPARATION QUESTIONS:
c. What are the principal benefits from achieving more seamless integration in the end-to-end chains in which you participate?
d. What are the principal barriers to achieving more seamless integration in the end-to-end chains in which you participate?

1:00 - 2:30 Business-to-business marketplaces
                -examples and lessons
PREPARATION QUESTIONS:
e. What do you expect are the principal benefits   to your company of participating in B2B marketplaces?
f. What do you expect are the principal risks   to your company of participating in B2B marketplaces?

3:00 - 4:30 Organizational responses to Supply Chain and eBusiness challenges
                -implementing strategic and tactical change
                -surviving in the age of temporary advantage
PREPARATION QUESTIONS:
g. What strategic changes do you think your company will have to make to survive the coming decade?
h. What are the principal organizational barriers your company faces in implementing needed change?

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