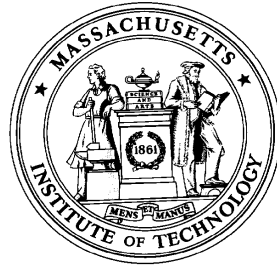# Strategic Sourcing and Supply Chain Design

Strategic Sourcing and Supply Chain Design

1. Fruit Flies & Temporary Advantage

2. Supply Chain Design & 3-DCE

3. eBusiness Phenomena: Business Model Innovation

4. Technology Roadmapping: A telecom example

Business System Design 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
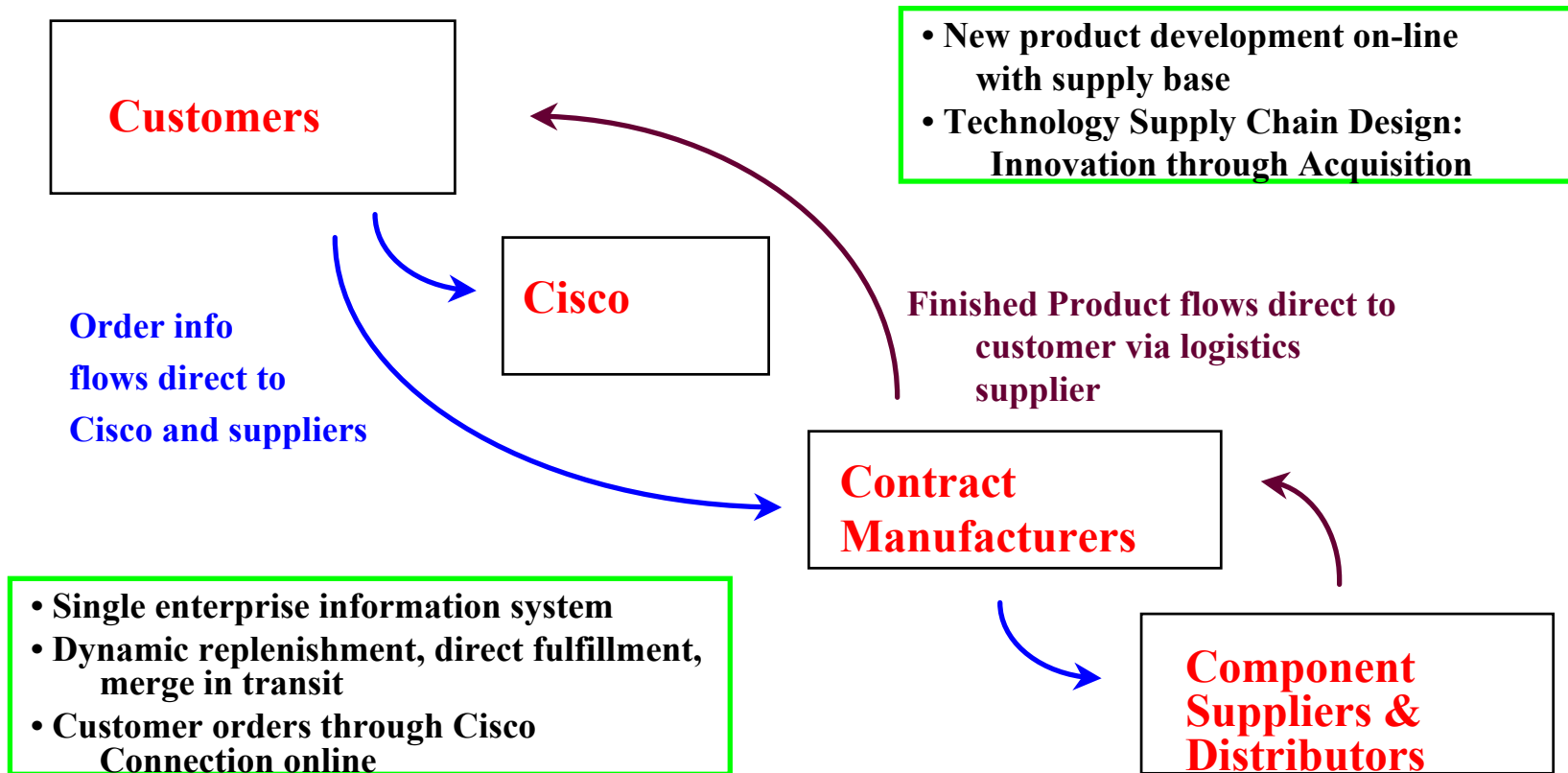**MICROCHIPS** is faster than
AUTOS evolve faster than
AIRCRAFT evolve faster than
MINERAL EXTRACTION

THE KEY TOOL:

Cross-INDUSTRY Benchmarking of Dynamic Forces

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

Customers

Cisco

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

Order info flows direct to Cisco and suppliers

Finished Product flows direct to customer via logistics supplier

Contract Manufacturers

Component Suppliers & Distributors

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

Basic Design Principle: Arm's length Relationship with Fulfillment Chain Partners

Cisco's Strategy for Technology Supply Chain Design

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"

Customer   Retailer   Distributor   Factory   Tier 1 Supplier   Equipment
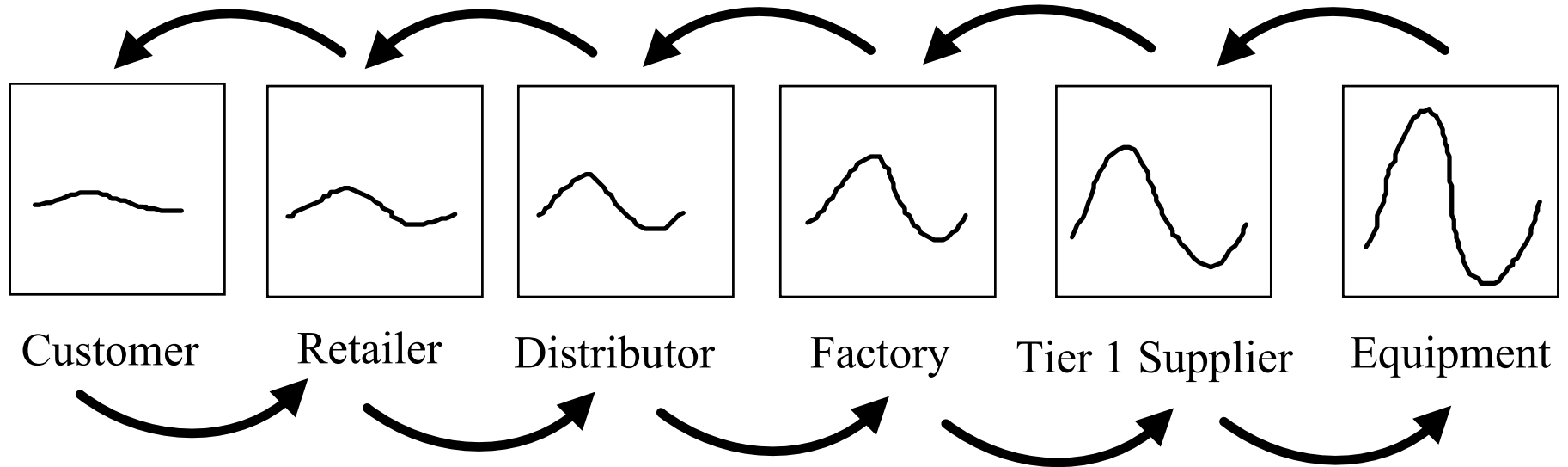
Information lags
Delivery lags
Over- and underordering
Misperceptions of feedback
Lumpiness in ordering
Chain accumulations

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

See "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.

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

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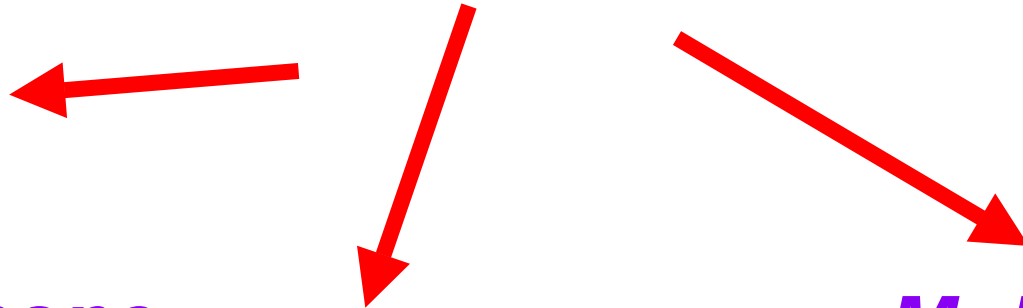## OF PRODUCT, PROCESS, AND ORGANIZATIONAL CLOCKSPEEDS

Mobile Phone **INDUSTRY CLOCKSPEED**

THE
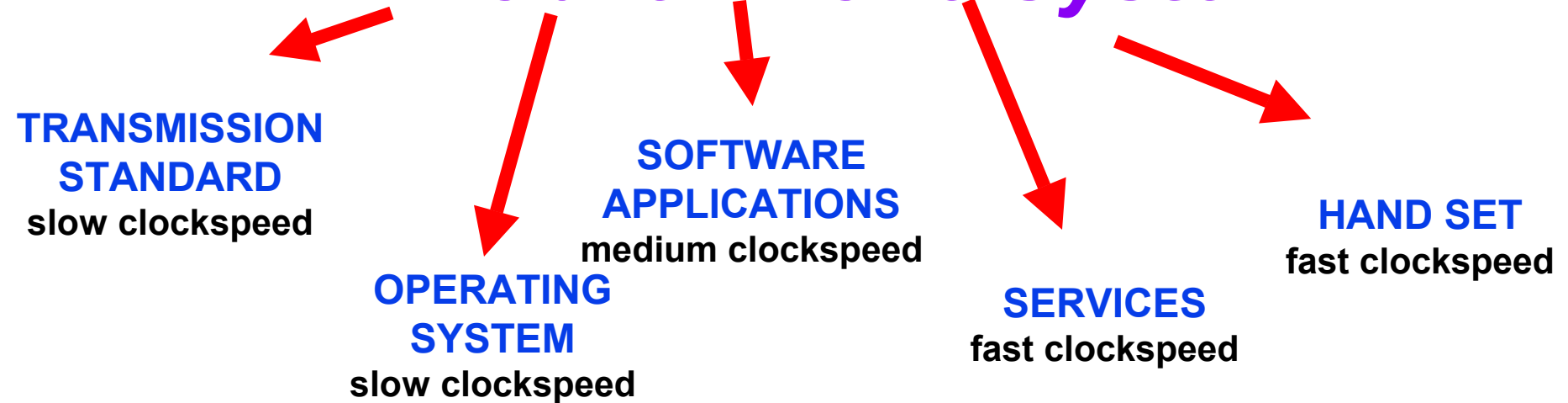*Mobile Phone*
product technology

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

Mobile Phone System

TRANSMISSION STANDARD
slow clockspeed

OPERATING SYSTEM
slow clockspeed

SOFTWARE APPLICATIONS
medium clockspeed

SERVICES
fast clockspeed

HAND SET
fast clockspeed

ISSUE: THE FIRMS THAT ARE FORCED TO RUN AT THE FASTEST CLOCKSPEED ARE THE MOST LIKELY TO STAY AHEAD OF THE GAME.

Clockspeed drives
Business Strategy Cadence

Dynamics between New Projects and Core Capability Development: PROJECTS MUST MAKE MONEY AND BUILD CAPABILITIES

CORE CAPABILITIES

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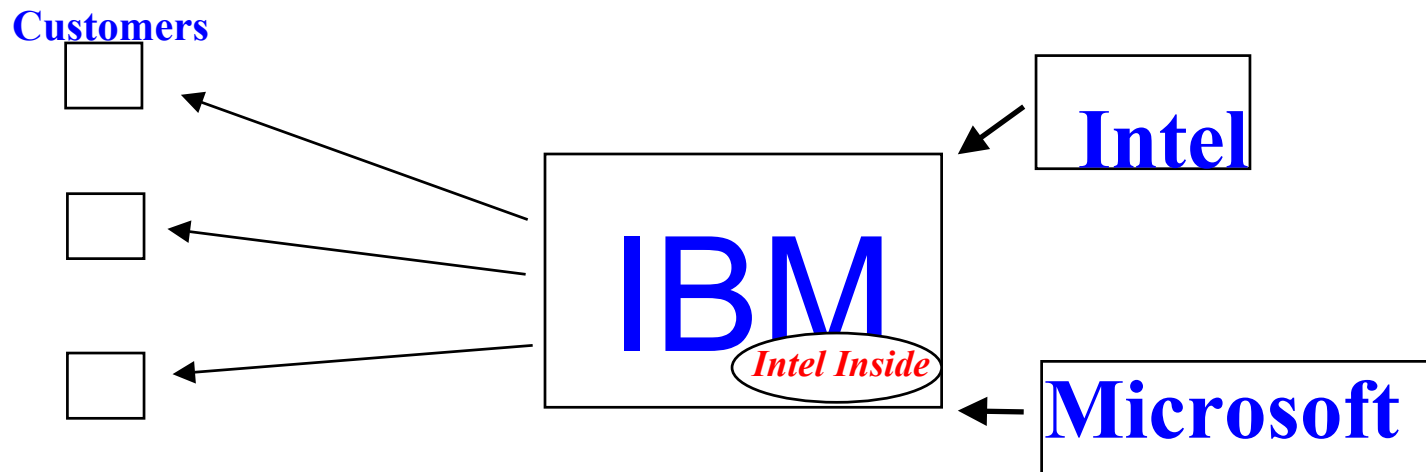*(New products, new processes, new suppliers)*
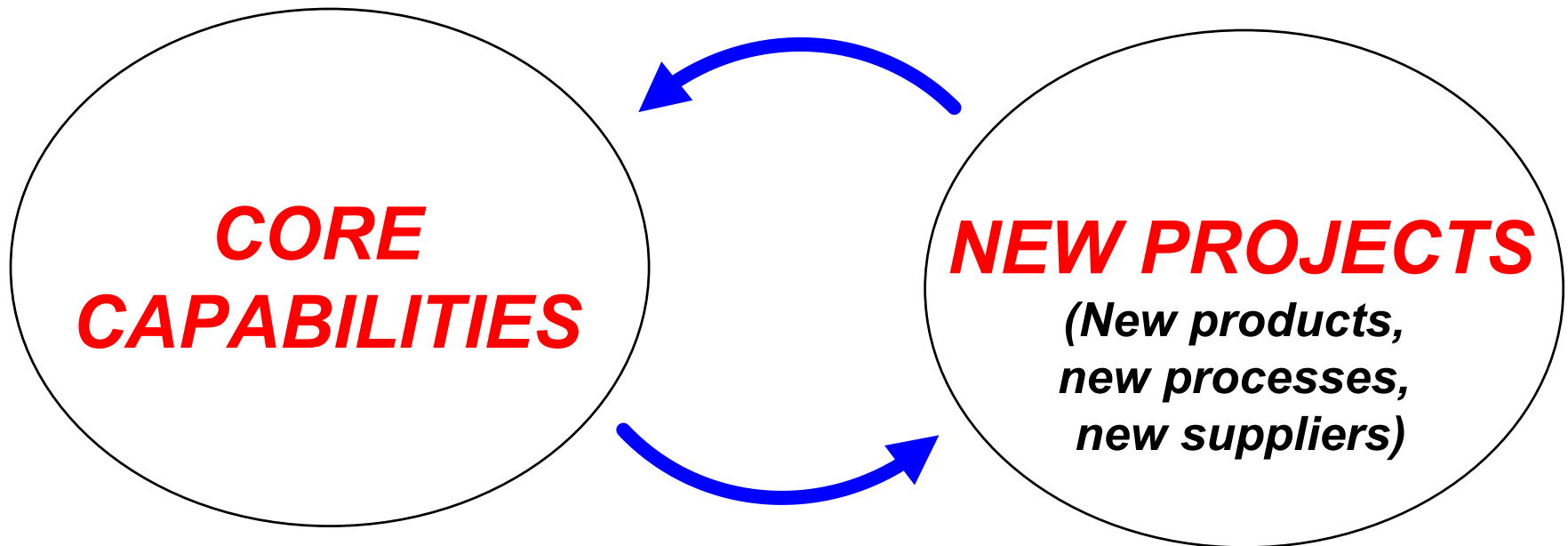
See Leonard-Barton, D. *Wellsprings of Knowledge*

The Strategic Leverage of Supply Chain Design:
Who let Intel Inside?

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

Customers

IBM

Intel Inside

Intel

Microsoft

The Outcome:
   A phenomenally successful product design
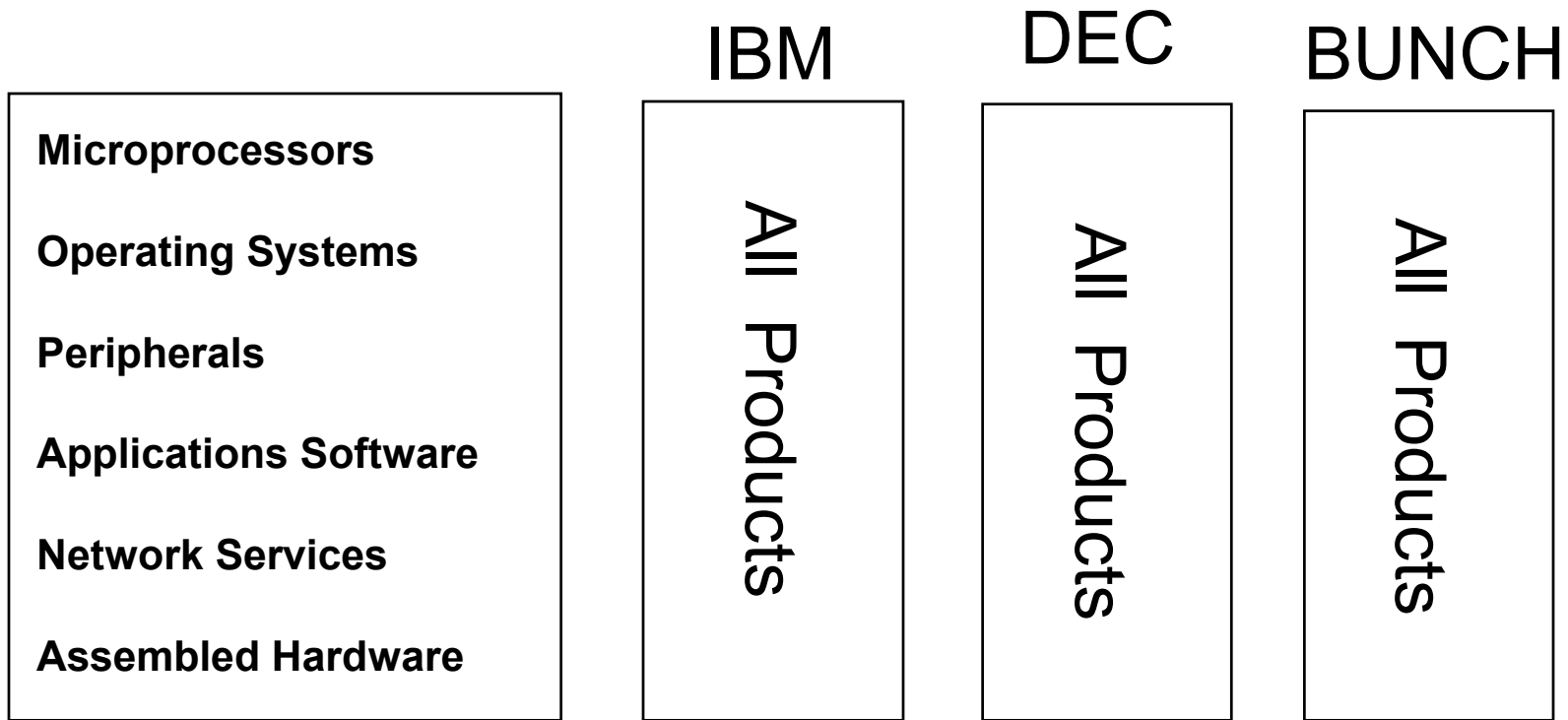   **A disastrous value chain design (for IBM)**

LESSONS FROM A FRUIT FLY:
THE PERSONAL COMPUTER

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

2. MAKE/BUY IS **NOT** ABOUT WHETHER IT IS
   TWO CENTS CHEAPER OR TWO DAYS FASTER
   TO OUTSOURCE VS. INSOURCE

3. SUPPLY 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 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

(See 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

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

THE DYNAMICS OF PRODUCT ARCHITECTURE AND VALUE CHAIN STRUCTURE:

THE DOUBLE HELIX

See 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 Verizon is going back to Vertical /Integral

- *AUTOMOTIVE--*
  - 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*

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

- *Controlling the Channel Through Closeness to Customers:*
- *consumer research, pricing, promotion, product development*
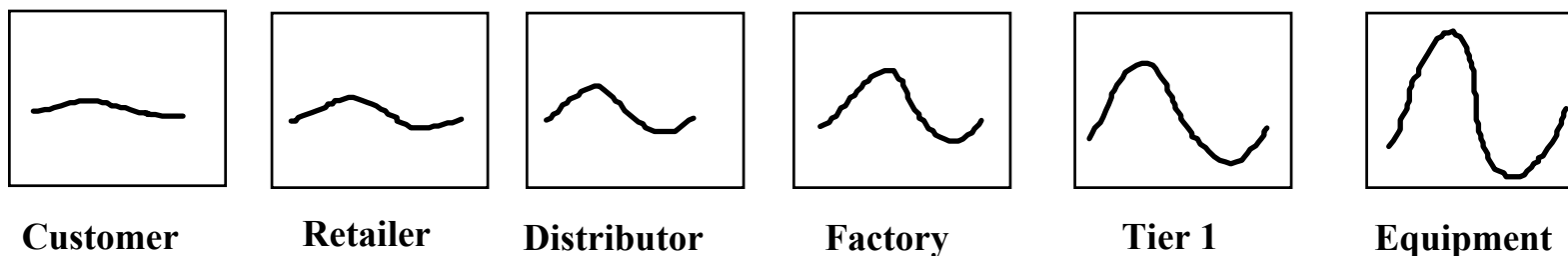
Customers
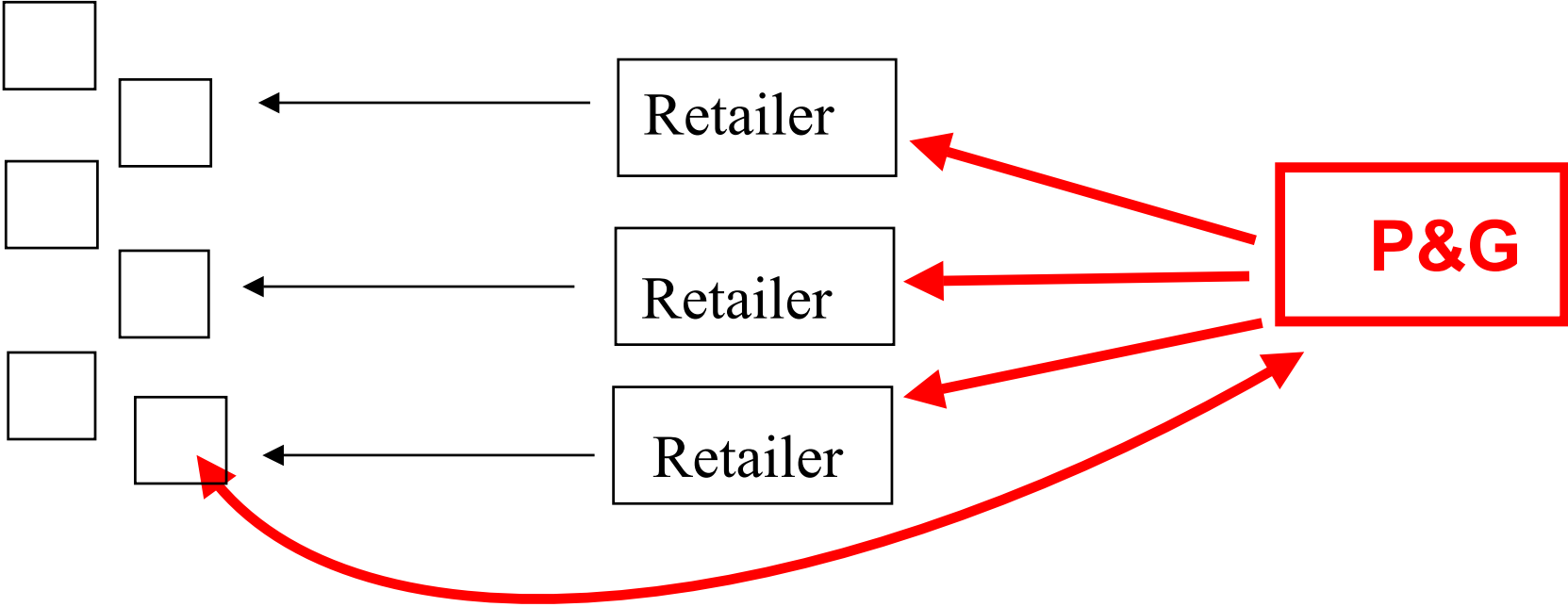
Controlling the Chain Through Distribution:
Beware of *Walmart Outside*

Controlling the Channel Through Closeness to Customers: Chain Proximity

Customers

WalMart

Retailer

Retailer

Retailer

P&G

WalMart Private Label
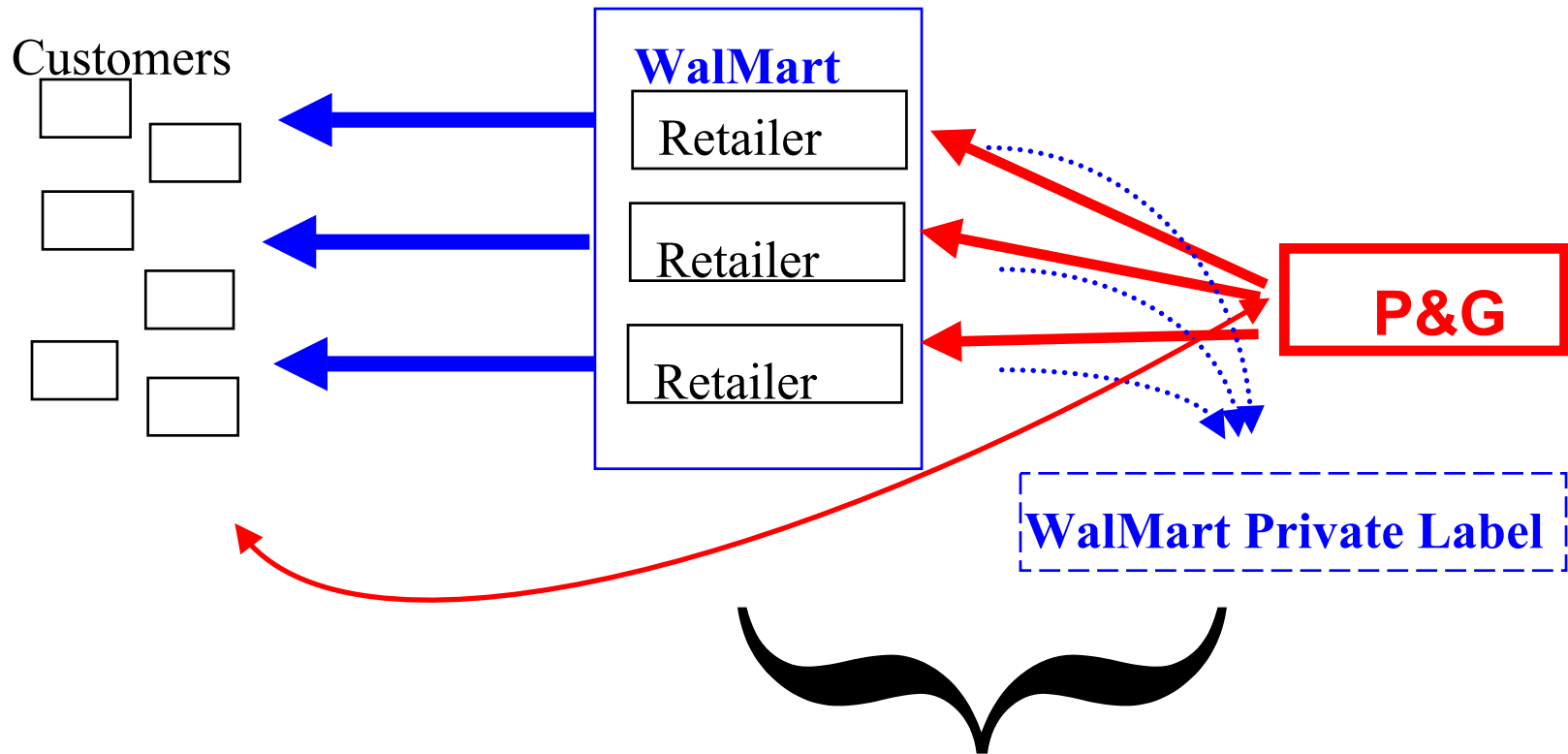
Vertical Growth on the Double Helix

Volatility Amplification in *"The Bullwhip Effect"* and Clockspeed Amplification in *"The Speedup Effect"*

| Customer | Retailer | Distributor | Factory | Tier 1 | Equipment |

Inventories & Orders fluctuate more as you look upstream, tough on suppliers, but

New Phone Applications

Handsets

Telecom Equipment

Optical Components
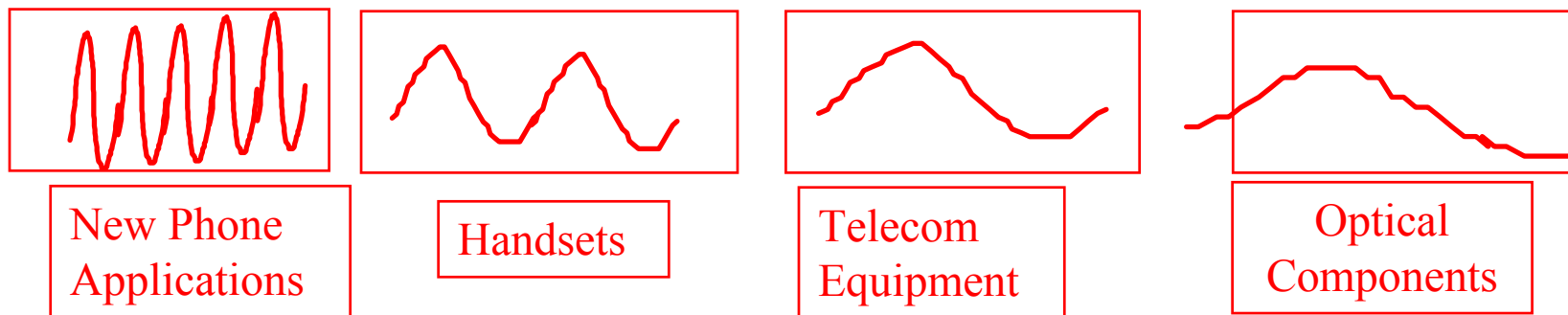
Clockspeeds accelerate as you head downstream, closer to the final customer

Media Supply Chains: An Industry at *Lightspeed*

Customers	The box	The Pipe (Access, Metro, Backbone)	The Content

Customers
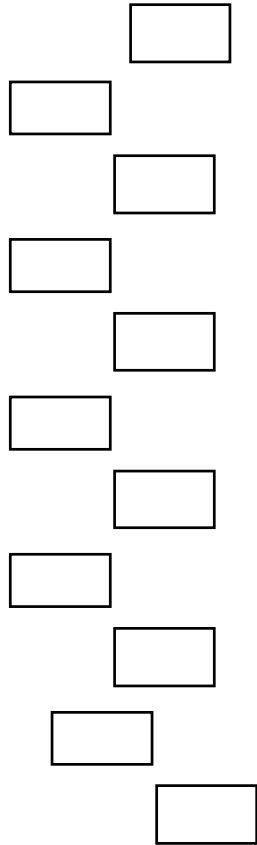
The box

Wired Phone

Wireless phone

PC/laptop

PDA

Television

VCR

Pager

The Pipe
(Access, Metro, Backbone)

Land-basedTelco:
-copper POTS
-fiber
-DSL

Cable
Networks

Wireless:
-broadcast TV
-CDMA, TDMA, GSM
-satellite/microwave

Retail Outlets
-Borders:
-Blockbuster
-Seven-Eleven

Delivery (e.g., Fedex)

The Content

Video/Audio:

Movies & Art
& News & Sports

News/articles/books
(newspapers &
magazines)

Communication:
voice & video & email

Banking

Education

Shopping

Internet, *et al*

ALL COMPETITIVE ADVANTAGE IS TEMPORARY

Autos:
Ford in **1920**, *GM* in **1955**, *Toyota* in **1990**

Computing:
IBM in **1970**, *DEC* in **1980**, *Wintel* in **1990**

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

Sports:
Bruins in **1971**, *Celtics* in **1986**, *Yankees* **no end**

The faster the clockspeed, the shorter the reign

Strategic Business System Design And Technology Roadmapping

1. Fruit Flies & Temporary Advantage

2. Supply Chain Design & 3-DCE

3. eBusiness Phenomena:
   Business Model Innovation

4. Telecom Value Chains:
   A fruit fly example

SUPPLY 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.)

IMPLEMENTATION OF GUSINESS SYSTEM DESIGN: EMBED IT IN 3-D CONCURRENT ENGINEERING

PRODUCT

PROCESS

Recipe, Unit Process

Performance Specifications

Technology, & Process Planning

Details, Strategy

Product Architecture, Make/Buy components

Time, Space, Availability

Manufacturing System, Make/Buy processes

VALUE CHAIN
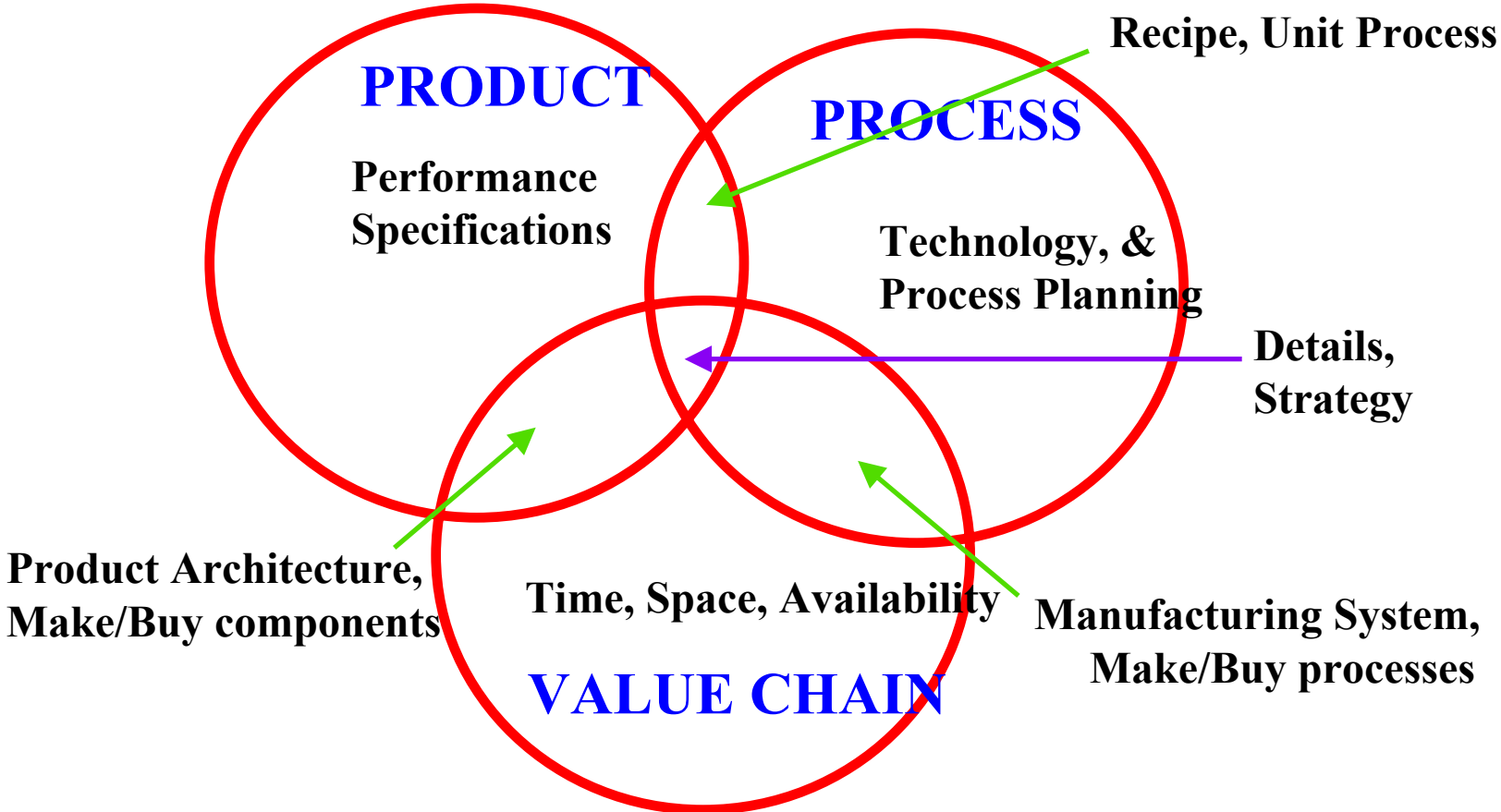
ARCHITECTURES IN 3-D
INTEGRALITY VS. *MODULARITY*

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 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

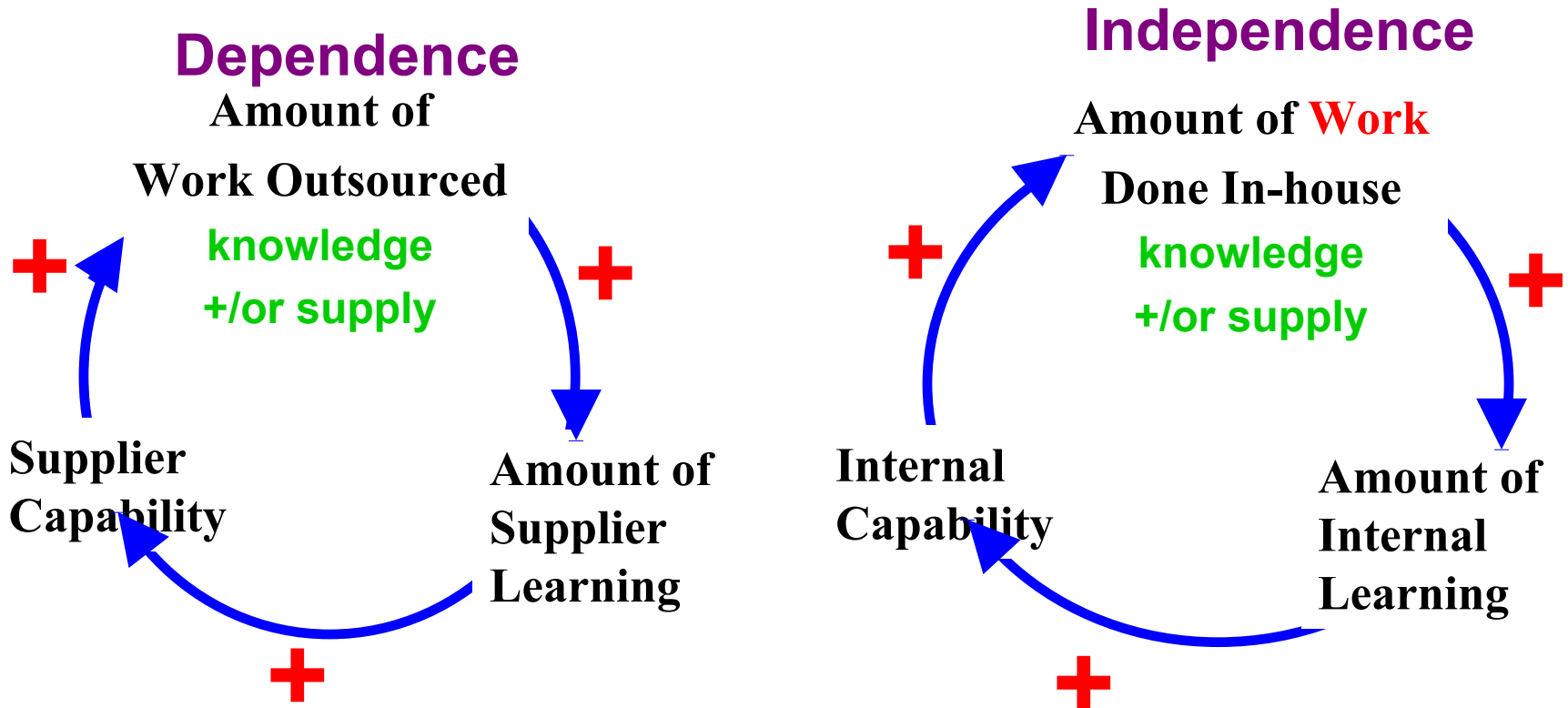# DESIGNING ARCHITECTURES FOR PRODUCTS & SUPPLY CHAINS: THE NEED FOR ALIGNMENT

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

	INTEGRAL	**MODULAR**
PRODUCT ARCHITECTURE **INTEGRAL**	Jet engines Microprocessors Mercedes vehicles	Polaroid Nortel, Lucent
MODULAR	Automotive Supplier Parks	Personal Computers Bicycles Chrysler Vehicles Cisco

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**

+

Technology Dynamics in the Aircraft Industry: LEARNING FROM THE DINOSAURS

Japanese appeal as subcontractors

U.S. firms' appeal as subcontractors

Japanese Industry Autonomy

Boeing outsources to Japan
(Mitsubishi Inside?)

Japanese industry size & capability

U.S. industry size & capability

SOURCEABLE ELEMENTS

PROCESS ELEMENTS

ENGINEERING

CONTROLLER   ASSY

VALVETRAIN

BLOCK   TEST

I4   V6   V8   **PRODUCTS**
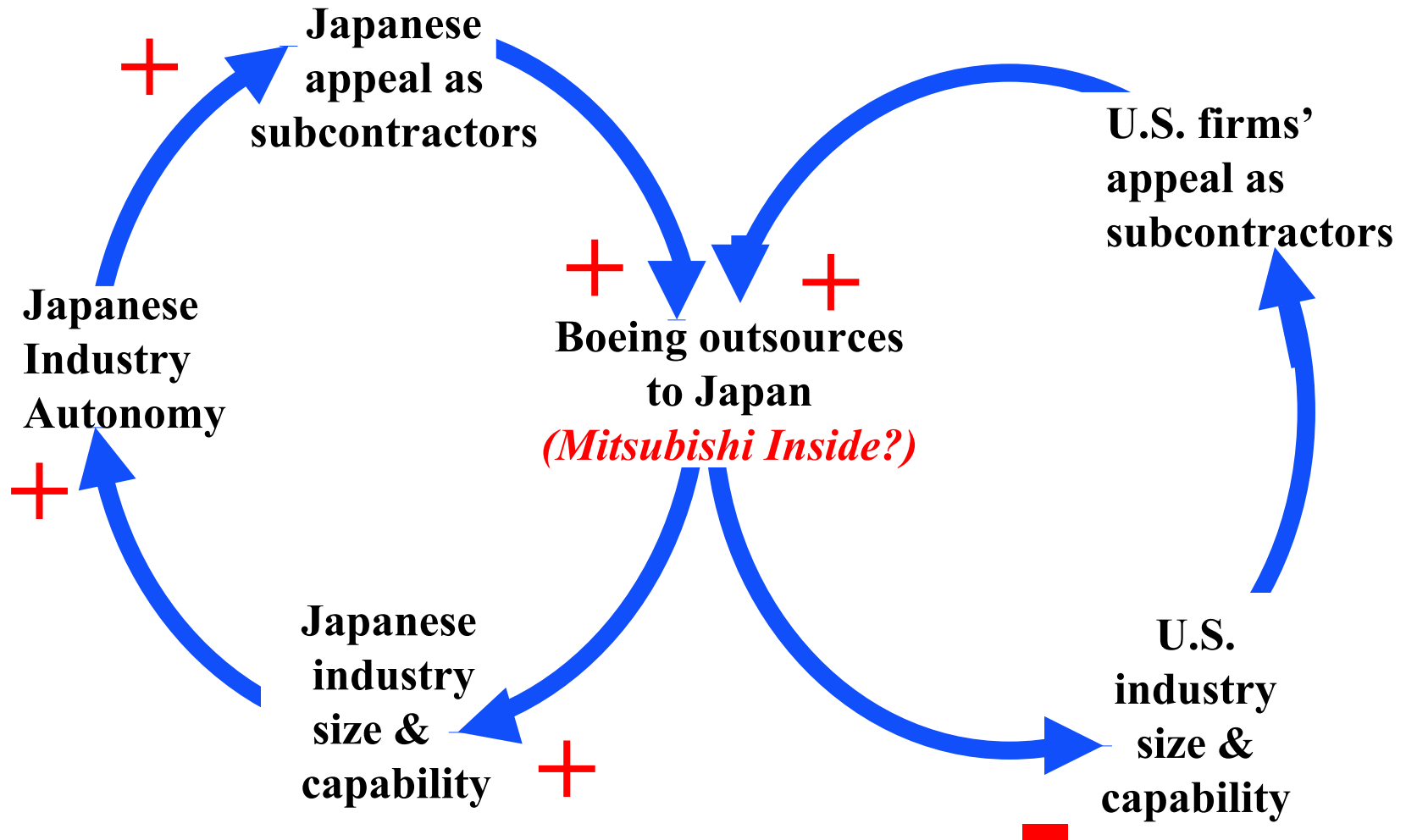
SUBSYSTEMS
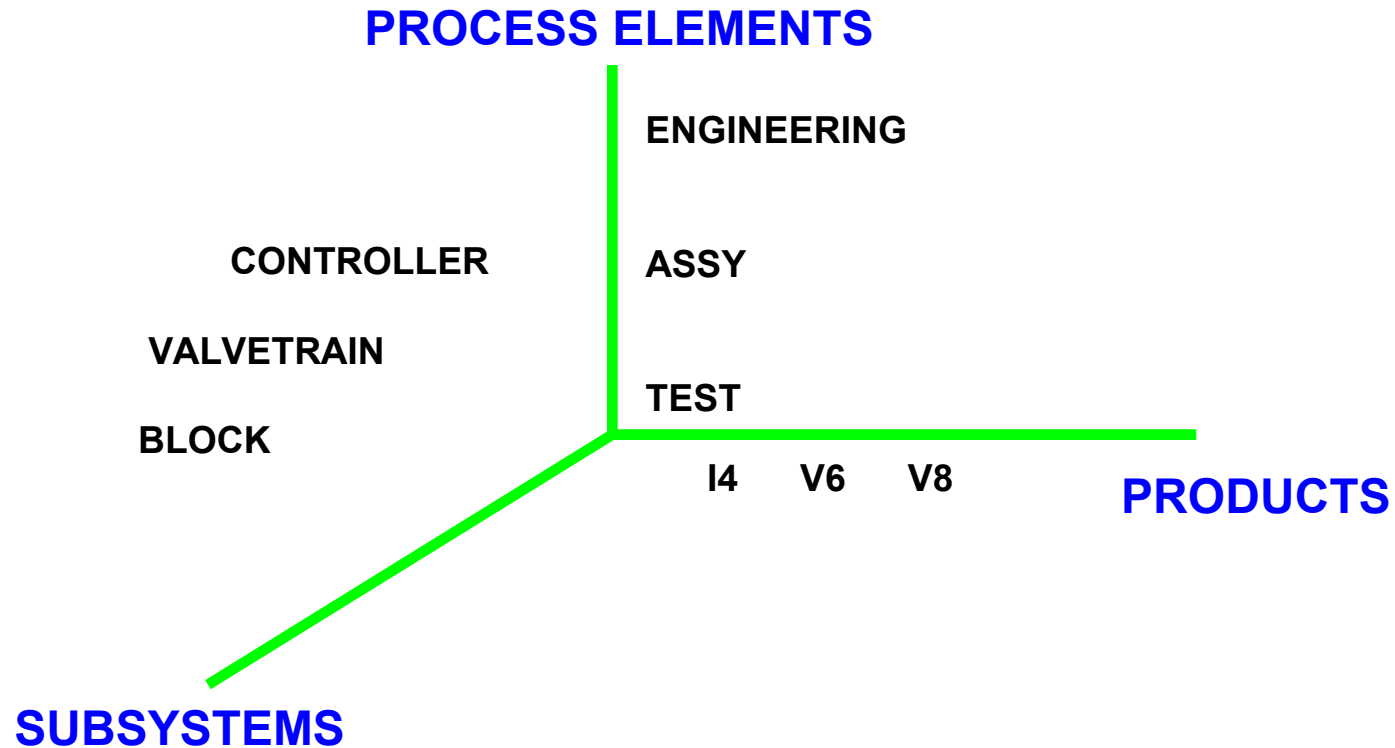
Strategic Make/Buy Decisions:
Assess Critical Knowledge & Product Architecture

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

Adapted from Fine & Whitney, "Is the Make/Buy Decision Process a Core Competence?"
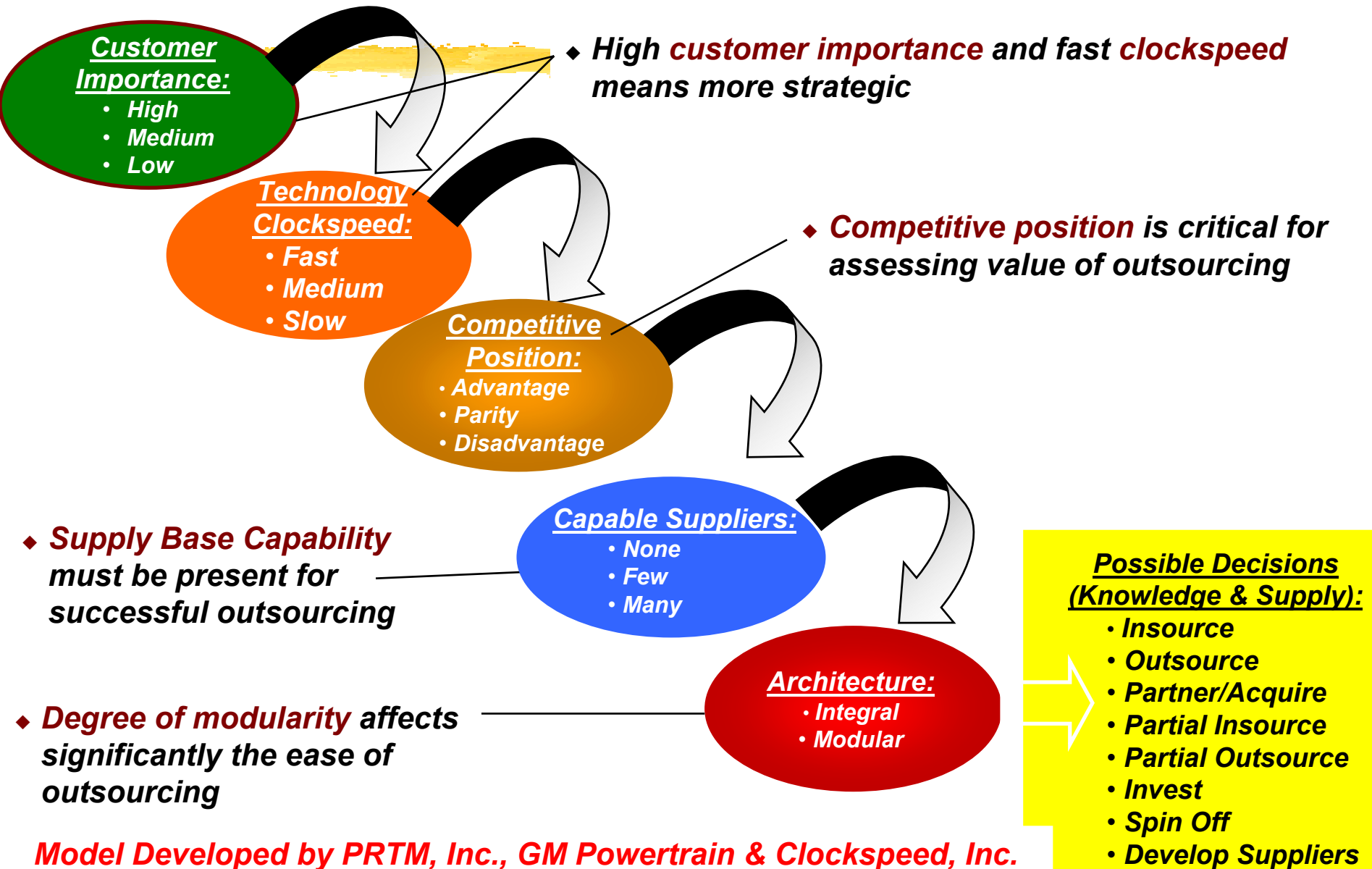
Strategic Make/Buy Decisions:
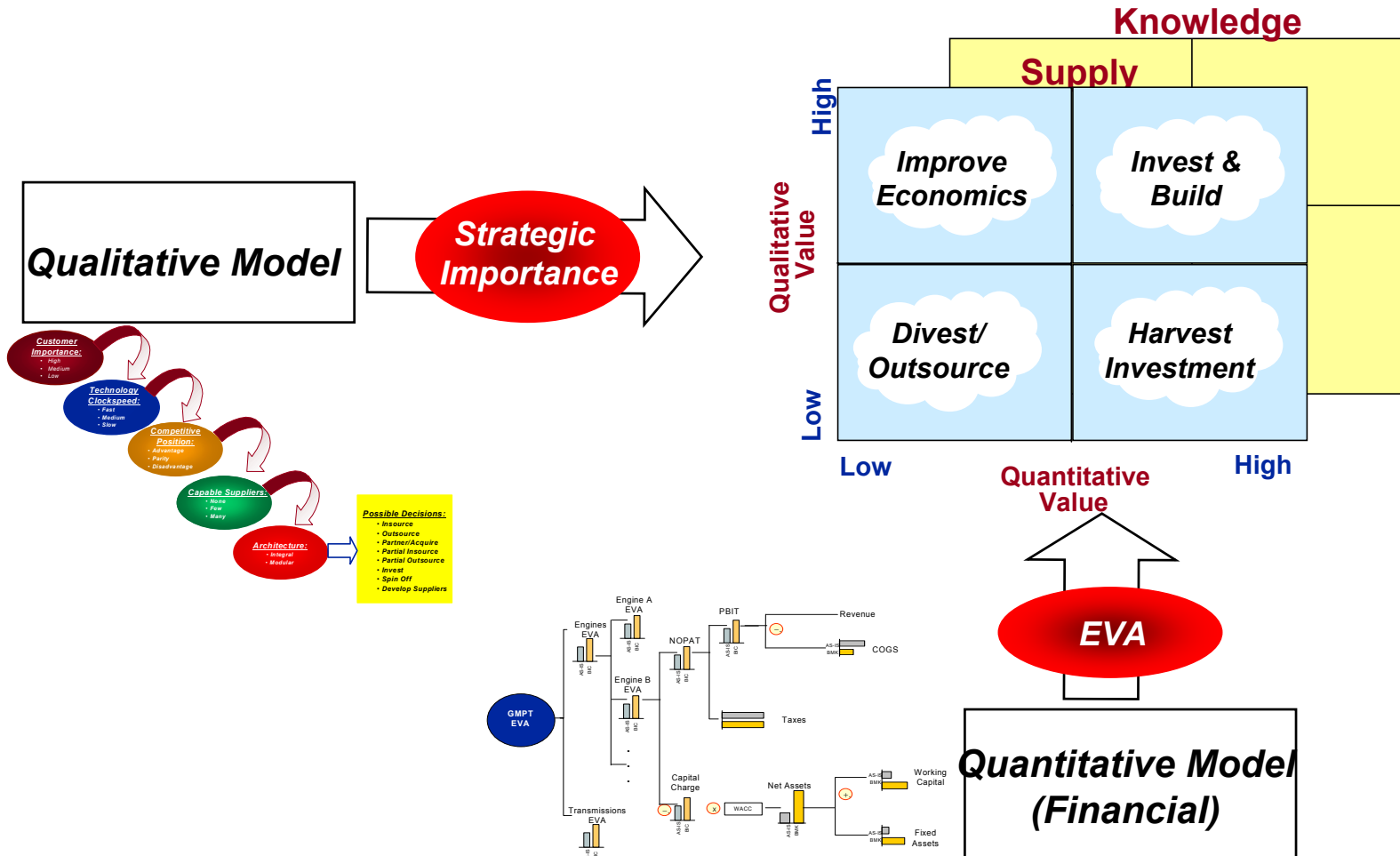## Also consider Clockspeed & Supply Base Capability

	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

Strategic Sourcing Assessment requires evaluation of 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*

◆ **High *customer importance* and fast *clockspeed* means more strategic**

◆ ***Competitive position* is critical for assessing value of outsourcing**

◆ ***Supply Base Capability* must be present for successful outsourcing**

◆ ***Degree of modularity* affects significantly the ease of outsourcing**

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

Model Developed by PRTM, Inc., GM Powertrain & Clockspeed, Inc.

Every decision requires qualitative and quantitative analysis to reach a conclusion

Qualitative Model

Strategic Importance

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:
• Insource
• Outsource
• Partner/Acquire
• Partial Insource
• Partial Outsource
• Invest
• Spin Off
• Develop Suppliers

Knowledge
Supply

High
Low

Qualitative Value

Improve Economics
Invest & Build
Divest/ Outsource
Harvest Investment

Low   High

Quantitative Value

EVA

Quantitative Model (Financial)

GMPT EVA
Engines EVA
Engine A EVA
Engine B EVA
Transmissions EVA
NOPAT
PBIT
Revenue
COGS
Taxes
Capital Charge
WACC
Net Assets
Working Capital
Fixed Assets

Model Developed by PRTM, Inc., GM Powertrain & 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
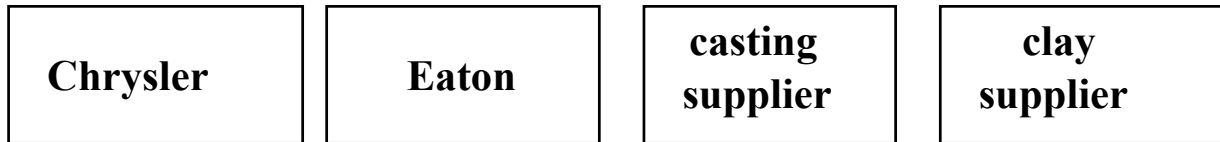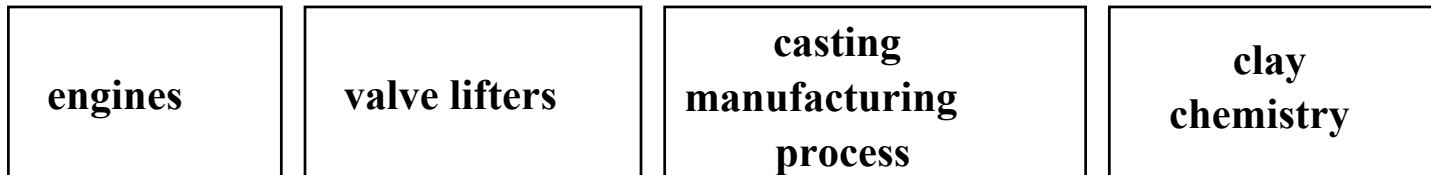
Underlying Assumption: You have to draw the maps before you can assess their dynamics.

SUPPLY 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
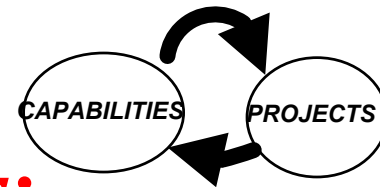
Fortune Favors the Prepared Firm

CAPABILITIES   PROJECTS

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
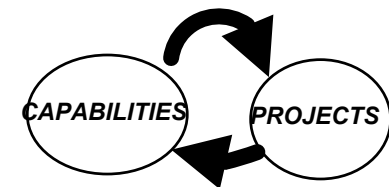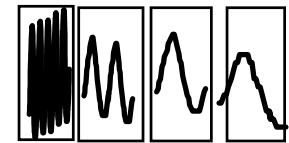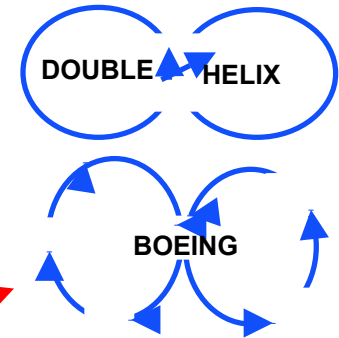
DOUBLE HELIX

BOEING

CAPABILITIES PROJECTS

Strategic Business System Design And Technology Roadmapping

1. **Fruit Flies & Temporary Advantage**

2. **Supply Chain Design & 3-DCE**

3. **eBusiness Phenomena: Business Model Innovation**

4. **Telecom Value Chains: A fruit fly example**

Internet Era Phenomena:
eCompetition in Business Model Innovation

Benchmarking the eFlies

E-tailing:
  Attack:
        Amazon, Webvan Market disruption in hopes of making a place
  Defend:
        Walmart.com, Ford.com Defense can require costly SC revamping

B2B:
  E2E integration:
        Cisco, Dell Integration pays off with modular products
  Marketplace Creation:
        Freemarkets Reverse auctions reduce short term costs
        Covisint Common standards reduced supplier investment cost

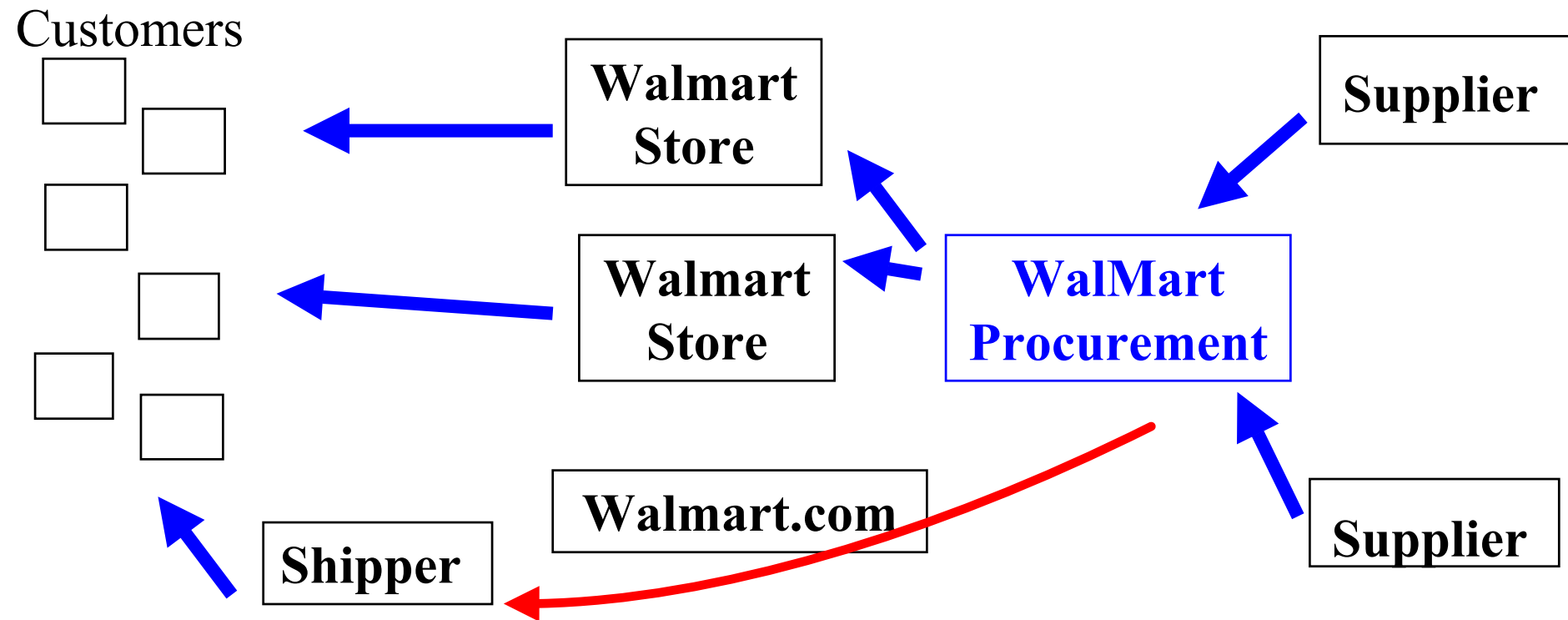**Free & Open Digital Content:**

  Peer-toPeer Sharing/Theft:
        Napster Industry-shaking disruptions require value chain SWAT team

DOT.COM COMPETITION: FOCUS ON THE SUPPLY CHAIN
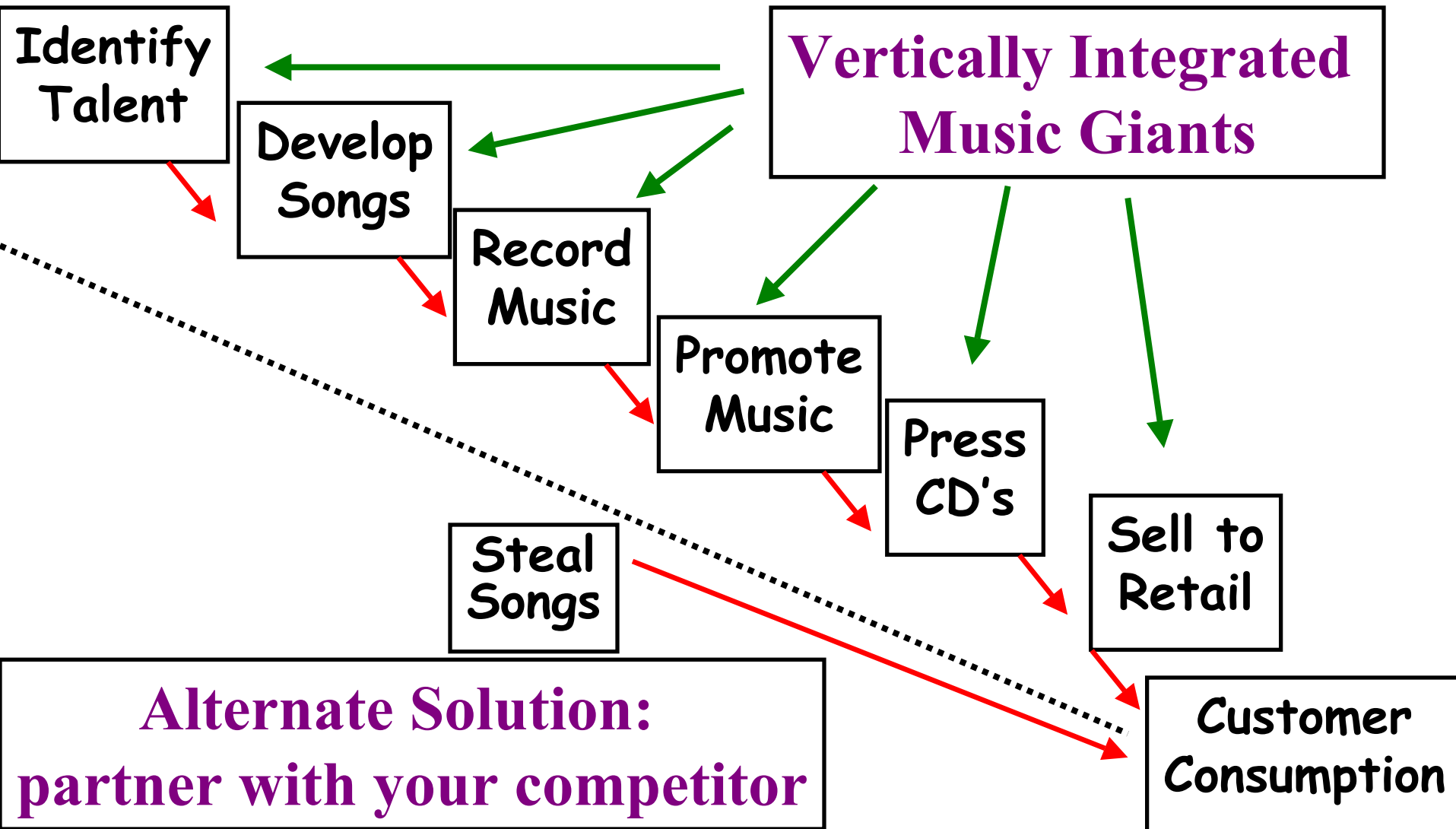
CASE#1: WALMART.COM GOT NO TRACTION

Customers

Walmart Store	Supplier
Walmart Store	WalMart Procurement
Shipper — Walmart.com	Supplier

Alternate Solution: Partner with UPS or Fedex

Napster's New Supply Chain Strategy
(go to the end and steal everything!)

Identify Talent

Develop Songs

Record Music

Promote Music

Press CD's

Sell to Retail

Vertically Integrated Music Giants

Steal Songs

Customer Consumption

Alternate Solution: partner with your competitor

Strategic Business System Design And Technology Roadmapping

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Moore's Law

Transistors per chip

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

Disk Drive Development 1978-1991

Disk Drive Generation	Dominant Producer	Dominant Usage	Approx cost per Megabyte
14"	IBM	mainframe	$750
8"	Quantum	Mini-computer	$100
5.25"	Seagate	Desktop PC	$30
3.5"	Conner	Portable PC	$7
2.5"	Conner	Notebook PC	$2

From 1991-98, Disk Drive storage density increased by 60%/year while semiconductor density grew ~50%/year. Disk Drive cost per megabyte in 1997 was ~ $ .10

"Killer Technologies" of the Information Age: Semiconductors, Magnetic Memory, Optoelectronics

"We define a _'killer technology'_ as one that delivers enhanced systems performance of a factor of at least a hundred-fold per decade."

C.H.Fine & L.K. Kimerling, "Biography of a Killer Technology: Optoelectronics Drives Industrial Growth with the Speed of Light," published in 1997 by the Optoelectronics Industry Develoment Association, 2010 Mass Ave, NW, Suite 200, Wash. DC 20036-1023.

Killer Question:

Will _Integrated Optics_ evolve linearly like Semiconductors with Moore's Law or like Disk Drives with repeated industry disruptions?

All Conclusions are *Temporary*

Clockspeeds are increasing almost everywhere

Supply Chain Relationships must anticipate Industry and Value Chain Dynamics

Proactive Relationships Design is a key organizational competency

Supply Chain Relationships must be designed concurrently with the products and systems they will deliver

Study of Fruit Flies can help with crafting strategy