15.912 Technology Strategy

Fall 2008

Creating Value with Effective Organization

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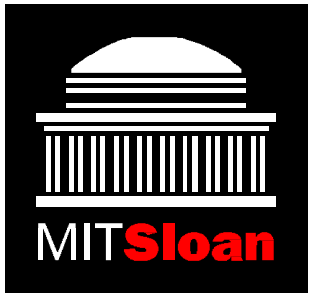
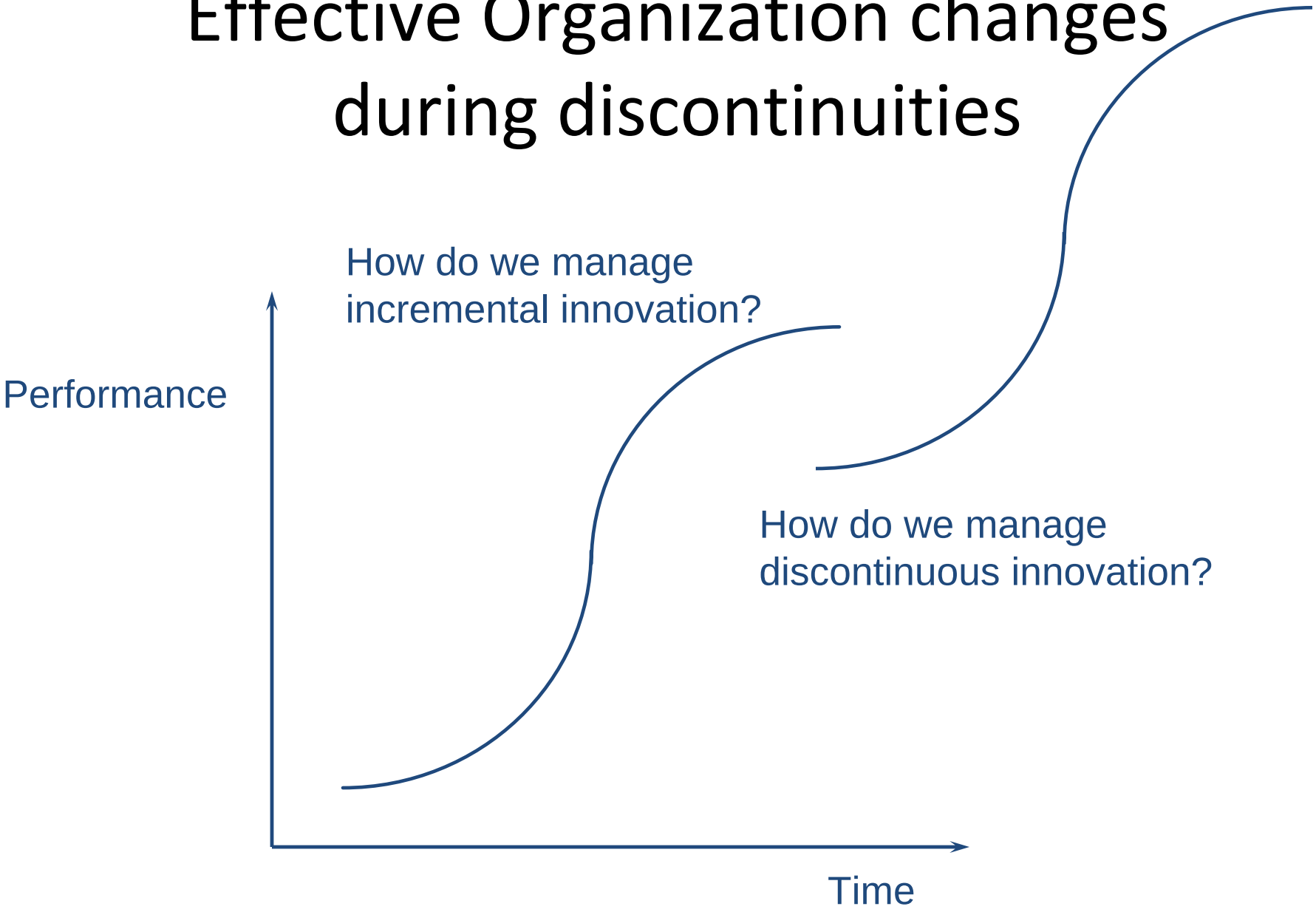


Creating Value:

- Understand how technologies will evolve
  - (Both your own and those on which you rely)
- Understand how customer needs will evolve

- **Use technologies** to develop world class products and services that **meet customer needs**
  - **How?**
    - **Get lucky…works once or twice**
    - **Do it consistently with effective Organization Structures and Processes**
      - **e.g., Apple, Google**

Effective Organization changes during discontinuities



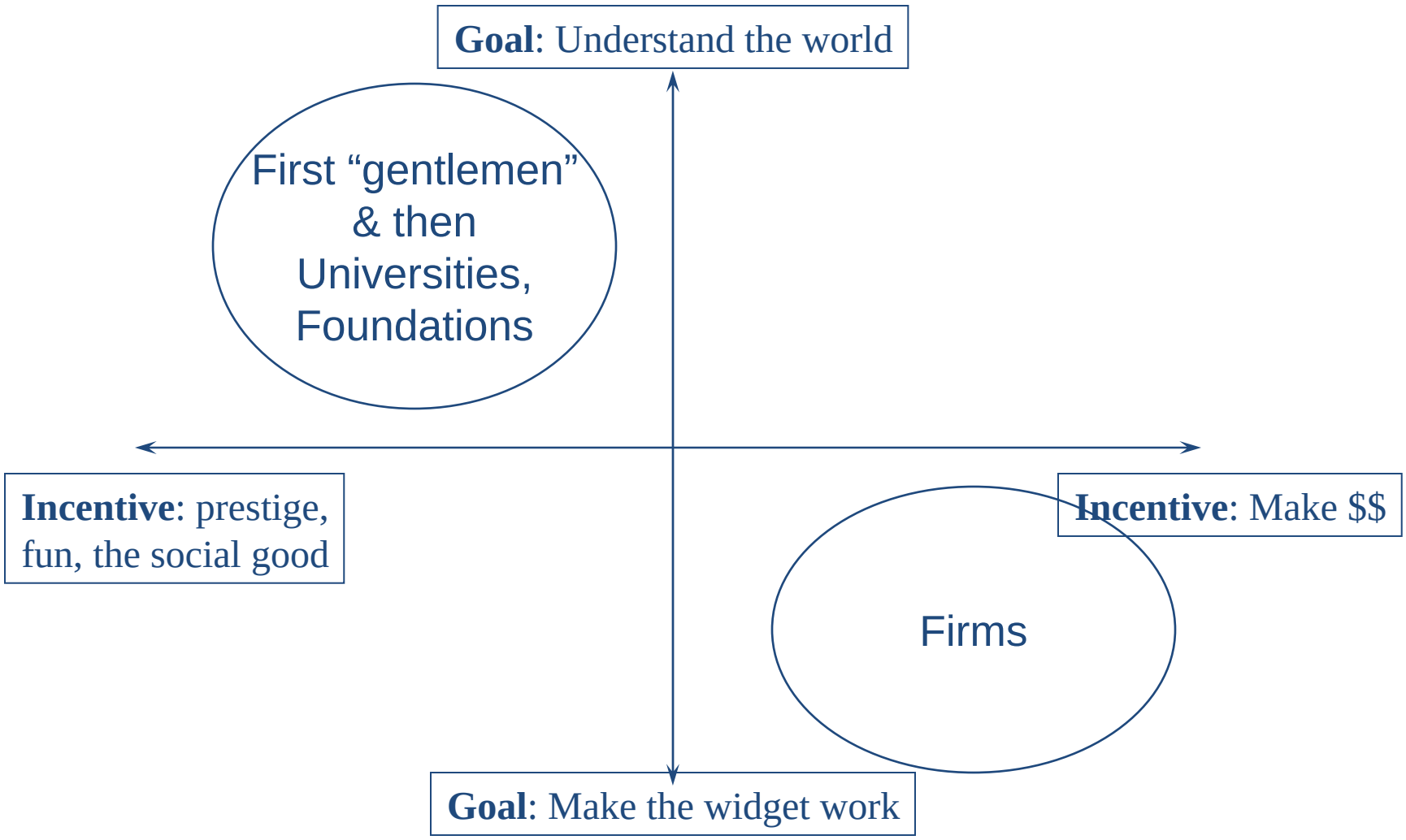
Illustrating the problem: to centralize or decentralize R&D?

- Answering this question involves two major problems:

- The role of CR&D
- Commercializing the technology

- These two issues cannot be addressed in isolation

Research before the World Wars



Research before the World Wars

“Basic”, “Curiosity driven” research

- Researchers motivated by the intrinsic interest of the problem,orientated to their peers, not to application
- Choice of problems dictated by individual researchers on the basis of curiosity

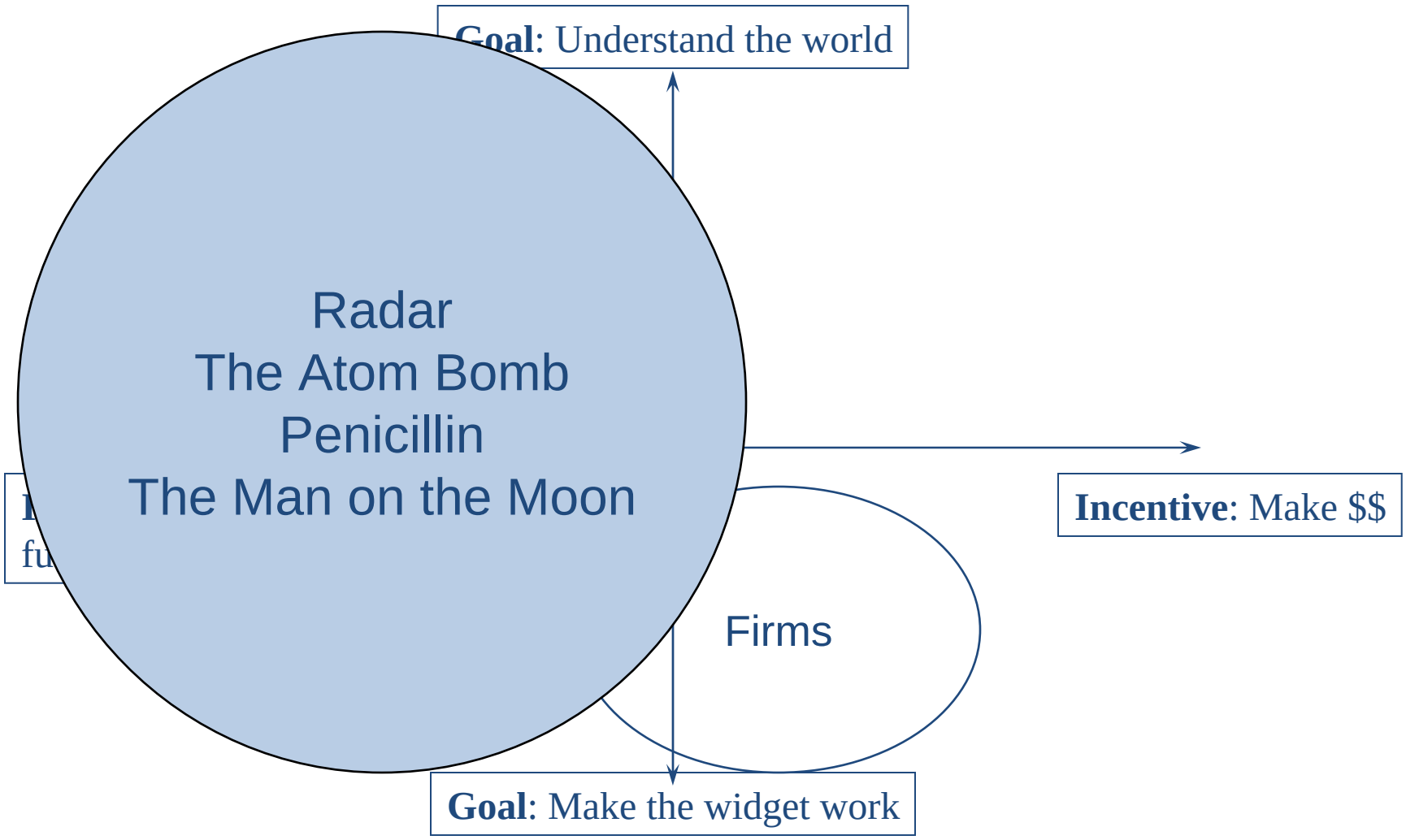
“Applied” research

- Researchers motivated by the desire to make money, have an impact on the world
- Choice or problems motivated by the needs of the market place

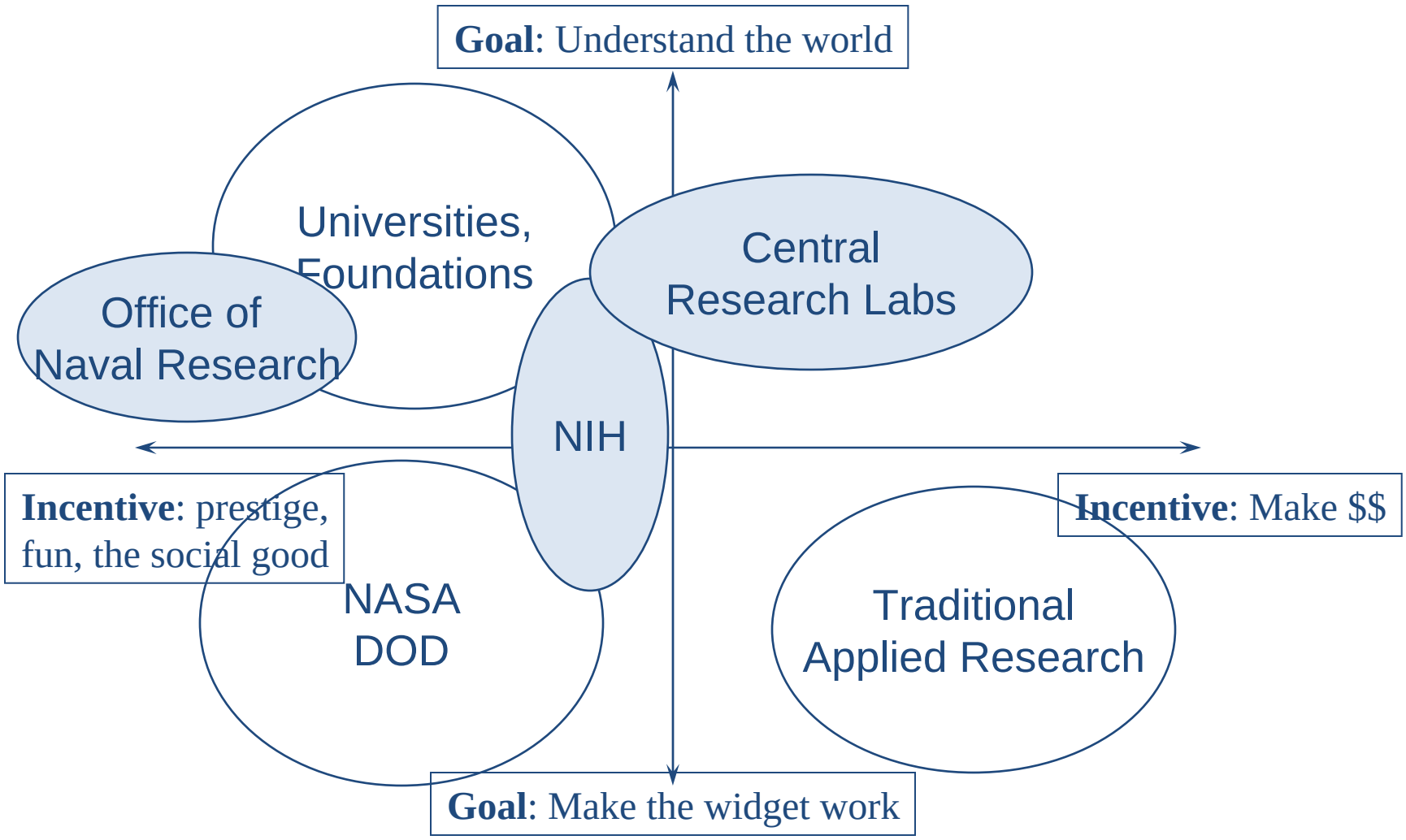
Research before the World Wars

- “Basic” research makes enormous progress, but few firms invest in it.
  - Except the German chemical industry
- Many major technological advances driven by engineers “tinkering”
  - Steel, Steam
- And technological advances that do use science use old, publicly available science
  - Electricity
  - Telephony

Sputnik and the World Wars



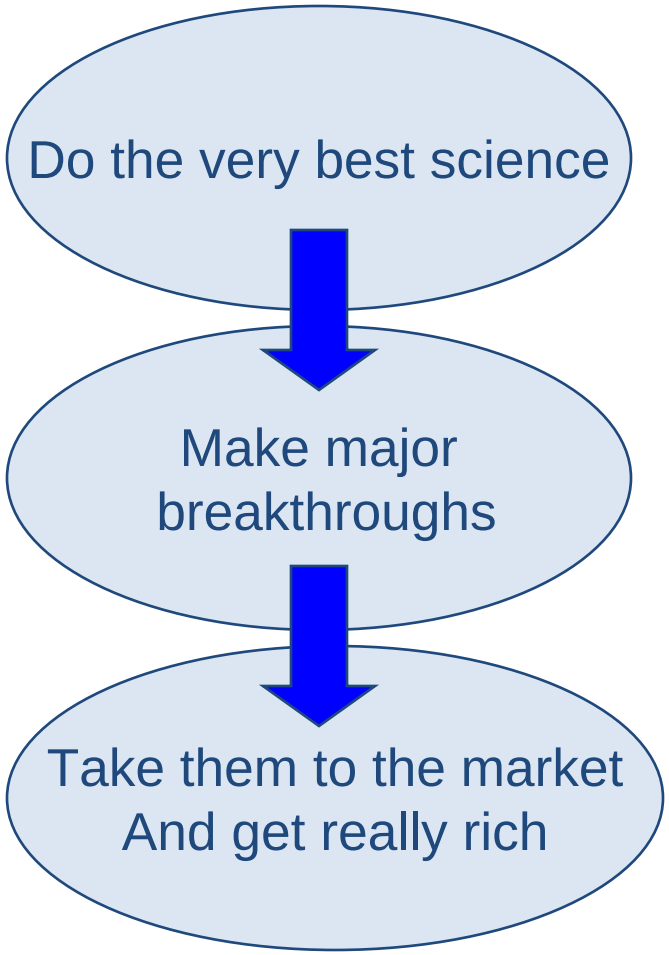
After the Wars



Corporate Research Labs in the Golden Age

- Bell Labs
- RCA Sarnoff Labs
- Xerox Parc
- IBM & the Watson Labs
- GE
- Alcoa
- DuPont

The Golden Age Research Model: "Build it and they will come"



For Example:

The transistor
The CAT scanner
Cohen/Boyer patent
Nylon
Protease Inhibitors

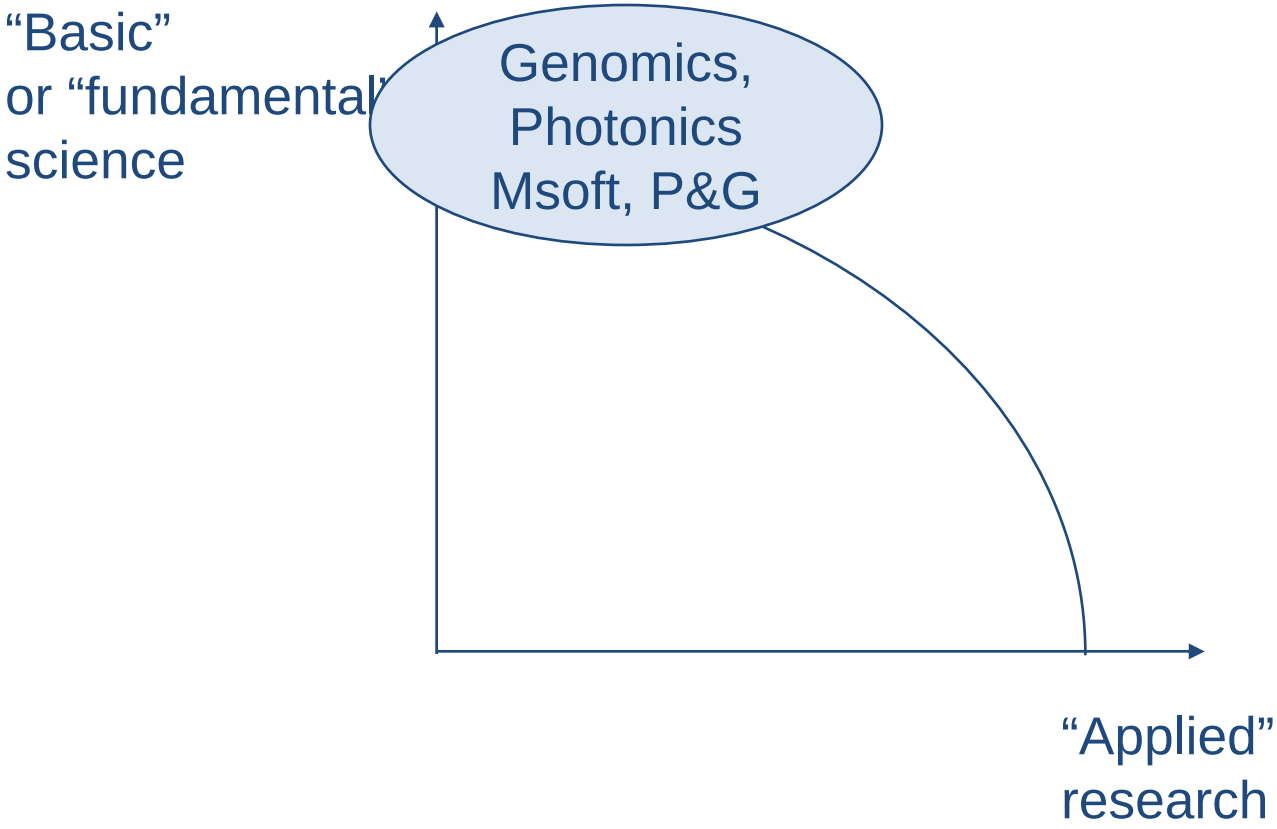
Core assumptions of “golden age” research

- Curiosity driven – understand the problems and the applications will follow
- Not overly constrained by financial or cost goals
- Hire the very best people and give them freedom
- Stay closely connected to the university and to the community of public science

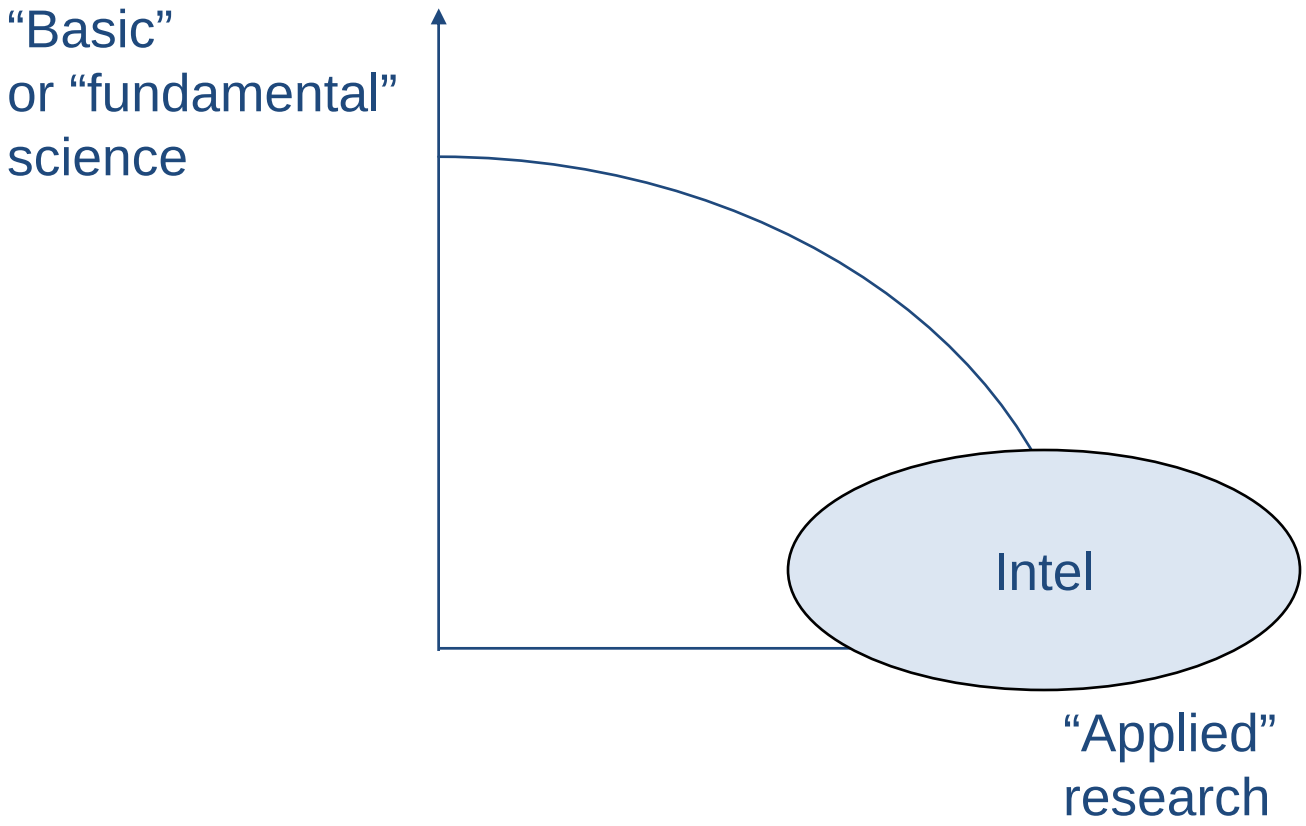
More recently:
The Golden Age model in question

- Many firms unable to capitalize on major discoveries, or benefits take years to emerge:
  - The RCA disc
  - Xerox PARC
  - Kevlar
  - Lucent & Bell Labs
- A significant number of breakthroughs come through close user/market contact (i.e., Open Innovation)…
- …and technology collaborations between firms (i.e., Collaborative Innovation).
  - Intel/MSFT, HP/Cisco, Apple/Google, etc.

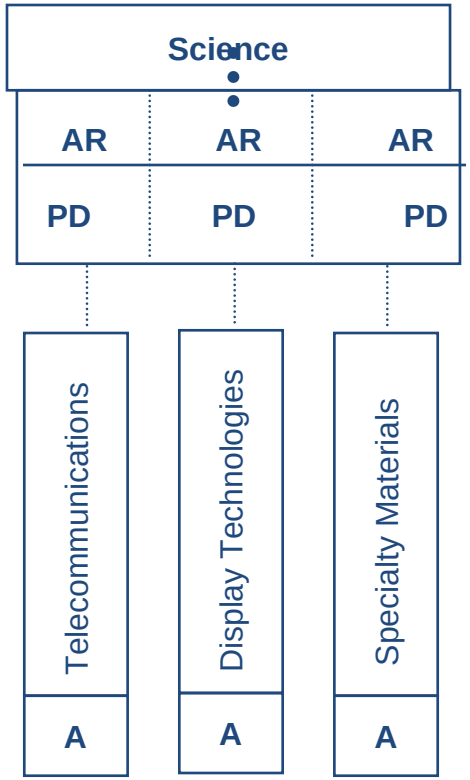
Some firms continue to fund central research aggressively



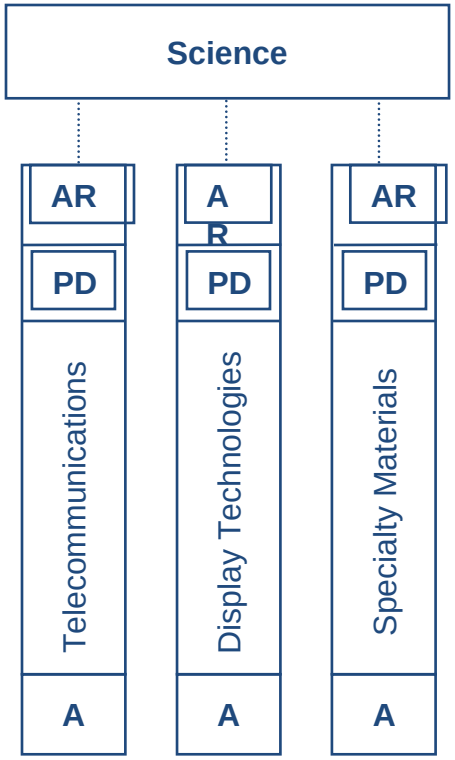
But others have moved away from central research completely



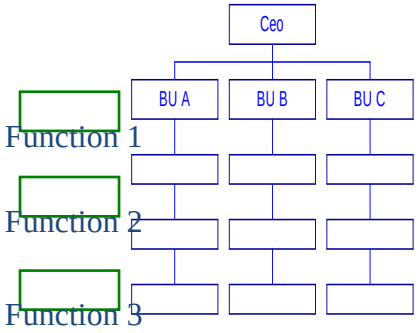
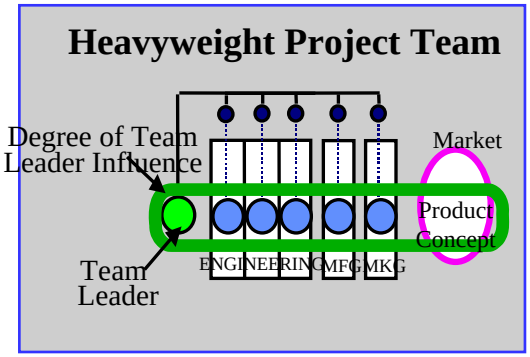
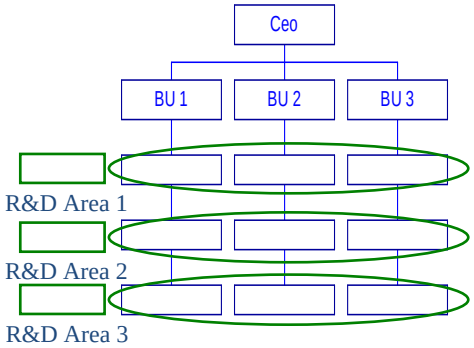
Or experiment with alternative organizational forms



AR= Applied Research
PD = Product development
A = Acquisitions



Other firms have experimented with hybrid organizational structures

	Centers of Excellence	Teams	Matrix
			
Pros	▪ Supports necessary scale for critical technologies ▪ Manage career paths ▪ Avoid redundancy	▪ Focused cross functional coordination ▪ More efficient development ▪ Development of team and management skills	▪ Focused attention to multiple objectives ▪ Best of both worlds: coordination and specialization
Cons	▪ Difficult inter-unit communication ▪ Restricted view of whole ▪ Can become too removed from the business	▪ Confusion of team roles ▪ Shortage of good project management ▪ Death by many teams ▪ Degradation of fxnl skills	▪ Confusion of roles ▪ High overhead ▪ Powerful individuals tip the balance of power ▪ Worst of both worlds

Strategic Challenge: Changing Environments are Unpredictable and Ambiguous!

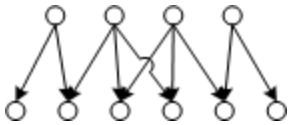
SOURCES

- Future S-curves and market evolution are hard to predict!
- Blurred timing and paths
- Shifting competitive basis, from products to business models
- Lack of control over key technology resources

IMPLICATIONS

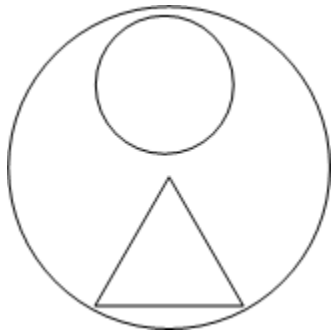
- Planning is limited
- Reacting is insufficient
- Traditional strategies of "defend a position" and "leverage core competence" are incomplete
- Shift from "closed" internal innovation to "open" innovation with partners

Potential Solution: Organizational Structures that respond to change

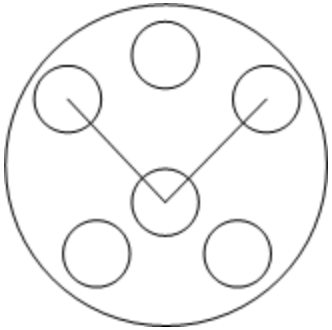


Hierarchy

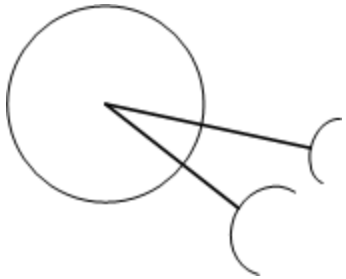
Rules



Roles



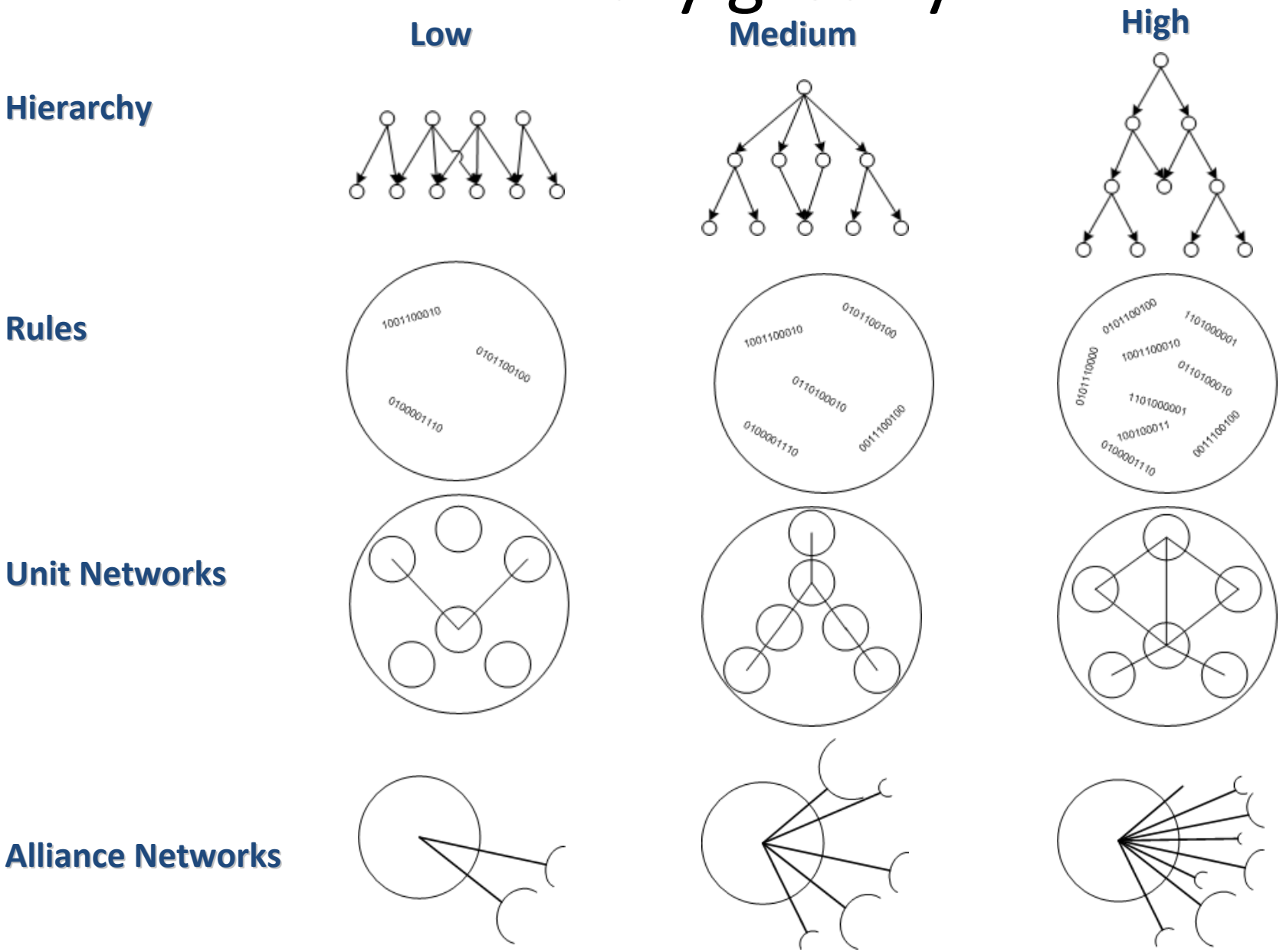
Unit Networks



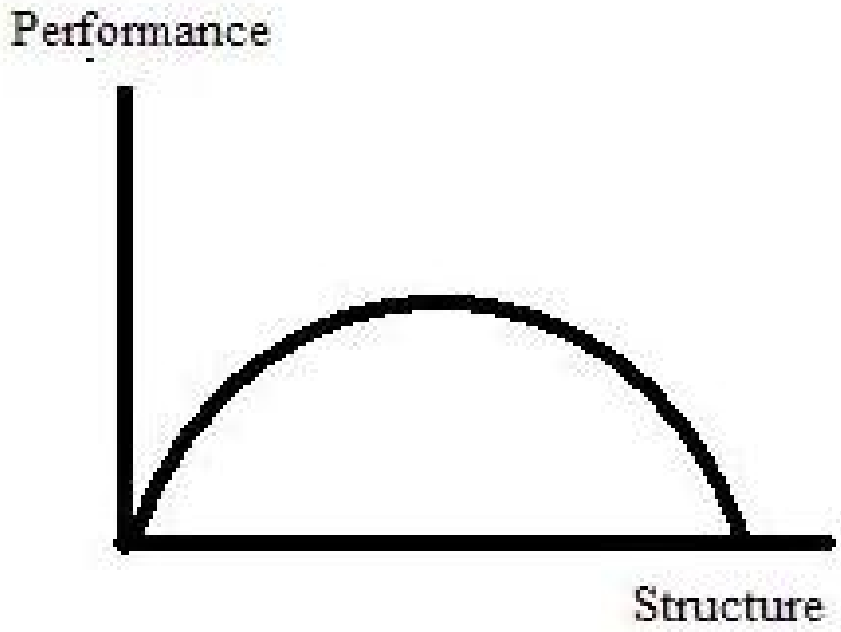
Alliance Networks

Organizational Structures enable coordinated responses to environmental change by shaping action in real-time

Amount of Organizational Structure can vary greatly!



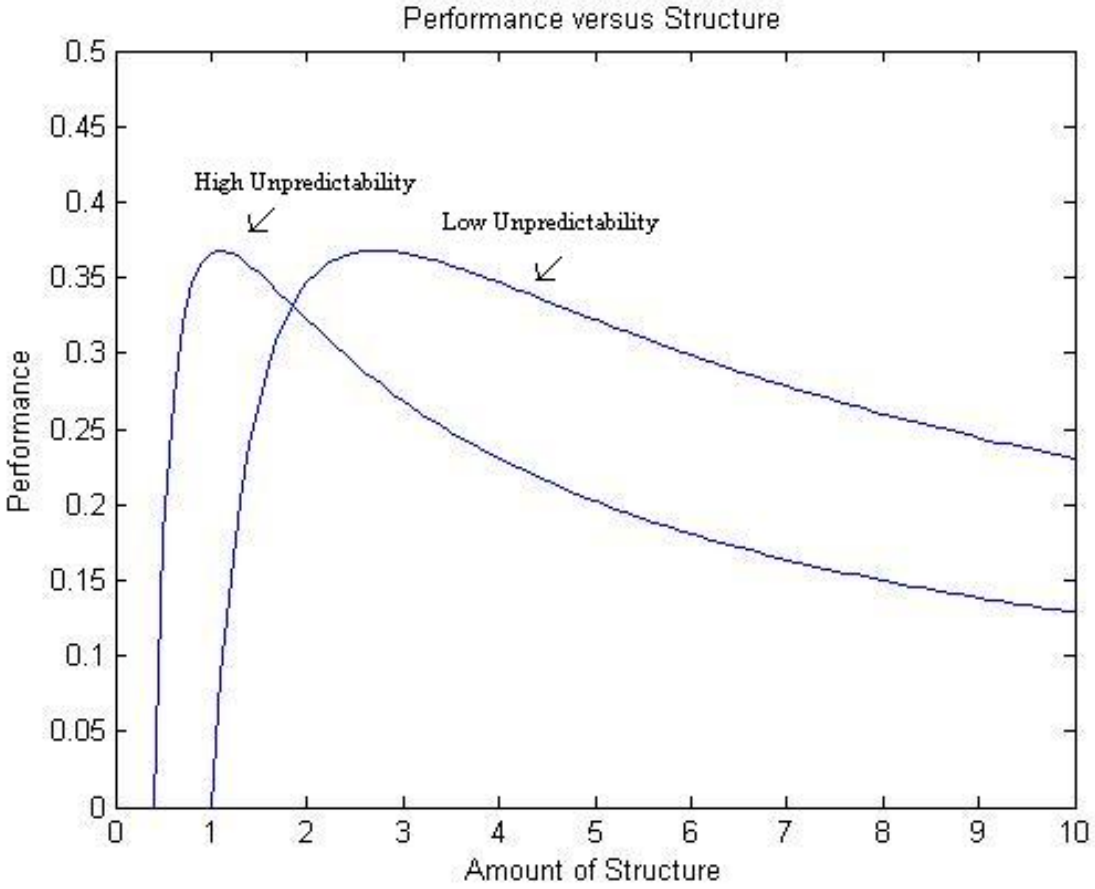
Inverted U-shaped Relationship btwn the Amount of Structure and Performance



Chaotic **Constrained**

- Fundamental Relationship illustrates the tension between efficiency and flexibility
- Observed in multiple industries and for multiple types of structure:
  - Hierarchy
  - Roles
  - Rules
  - Networks

New Modeling and Evidence suggests Asymmetry and Dependency on Market Dynamism



- Asymmetry: more forgiving on the side of too much structure
- Optimum is less structured and more severe in less predictable environments

Examples: Simple Rules in Dynamic Markets

Company	Simple rules
Intel®	• Priority Rules helped Intel shift from DRAMs to Microprocessors • Simple Rules about minimum project size • Copy Exactly
Pfizer®	• Clear ranking molecules types as research priorities • Maximum number of molecule types pursued at any one time • Projects "killed" according to step charts
Miramax Films® The Crying Game Pulp Fiction The English Patient Life is Beautiful Shakespeare in Love	• Movies must – Center on a basic human condition and flawed, but sympathetic character – Have a clear beginning, middle, and end • Disciplined financing (50% more efficient than industry standard)

Explains mysterious organizational phenomena:

- Liability of newness: less structured entrepreneurial firms can "collapse from within" while large firms w/ more structure can "muddle through" with little innovation
- Maintaining optimal structure is more precarious (more V-like than U-like!) in unpredictable markets:
  - Emerging markets
  - High-technology industries
- Effective strategy is more simple in highly dynamic markets
  - Less structure enables more flexible responses

Key Lessons about Organization Structure

- Managers need to manage not only the Content but the Amount Structure
- Employees can (and sometimes should) subvert structures!
- Structure is merely a constraint on actions… must be combined with improvisation and creativity to produce innovations.
- Organizational Processes that change over time are as strategically important as Organizational Structures that do not…

…All R&D structures have limitations that can (in principle) be managed with the right processes

Making Central Research more Decentralized

- Institute **"contracting" mechanism** whereby Business Units can invest their R&D dollars by sponsoring projects in central Research
- Create **Councils** comprising senior technical members (e.g. TDOs) from the business units to win endorsement for Research programs and ensure relevance
- Provide **communication mechanisms** for central Research to showcase their programs (conferences, "technology fairs", "catalogs", "trolling")
- Institute **funding mechanisms** that require project transfer to the business at a future date or require projects to win matching funds from the business
- Support **internship programs** that lend researchers to the businesses
- Organize by **product technology**

Making Decentralized Research more Central

- Employ **Portfolio process** that ensures balance between platforms, derivatives, and breakthroughs
- Create **cross-Business Councils** responsible for synergies between research done within the businesses
- Fund **outside research** in universities, start-up companies, or other outside organizations
- **Co-locate** Decentralized R&D resources within central labs to promote synergy and preserve critical mass in scientific disciplines

Comparing Org Structures & Org Processes

- Organizational Structures: repeatable patterns of behavior that are (nearly) always invariant
  - Act as a constraint on action; enable efficient coordination between multiple employees
  - Must be combined with real-time improvisation and creativity to execute new opportunities
- Organizational Processes: sequenced patterns of behavior that change & are contingent on time/place
  - Strategic impact of effective versus ineffective processes less well explored…
  - These "best practices" or "secret sauce" are so hard to imitate (e.g., Apple's design process), that they may provide more competitive advantage than structural solutions that all can copy (e.g., Matrix org charts)

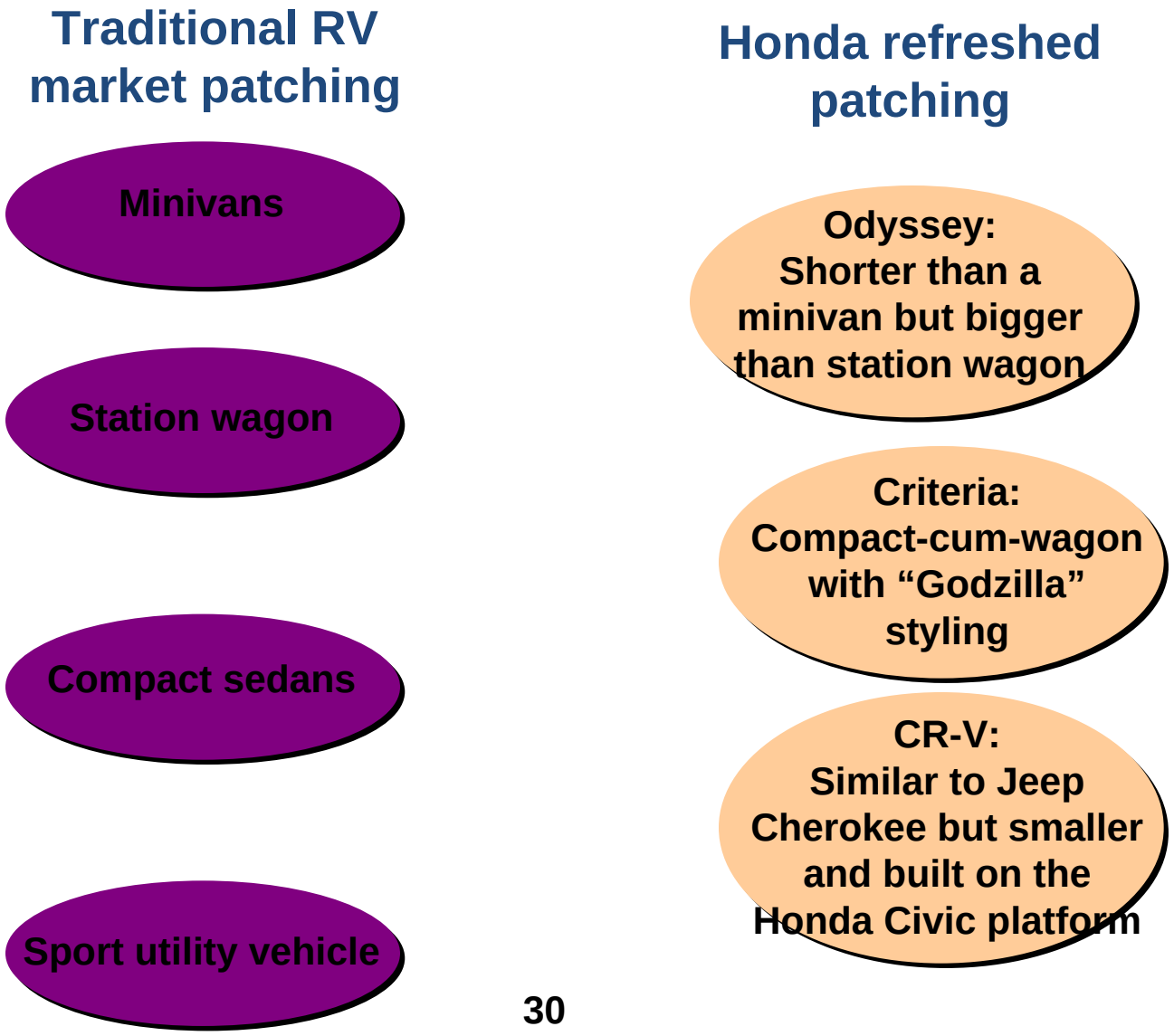
Patching: Restitching Business Portfolios

Common experiences	Myths	Best practice
• Coordinating across businesses to exploit opportunities is slow and political	• Critical issue is business focus (e.g., customer, products, geos)	• Regard match of business portfolio to markets as temporary
• Businesses are behind others in capturing opportunities	• Adjustment of business portfolio to match markets occurs in rare, major restructurings	• Pay attention to SCALE of businesses as well as focus • Patching executive at multibusiness level • Economies of scale AND agility

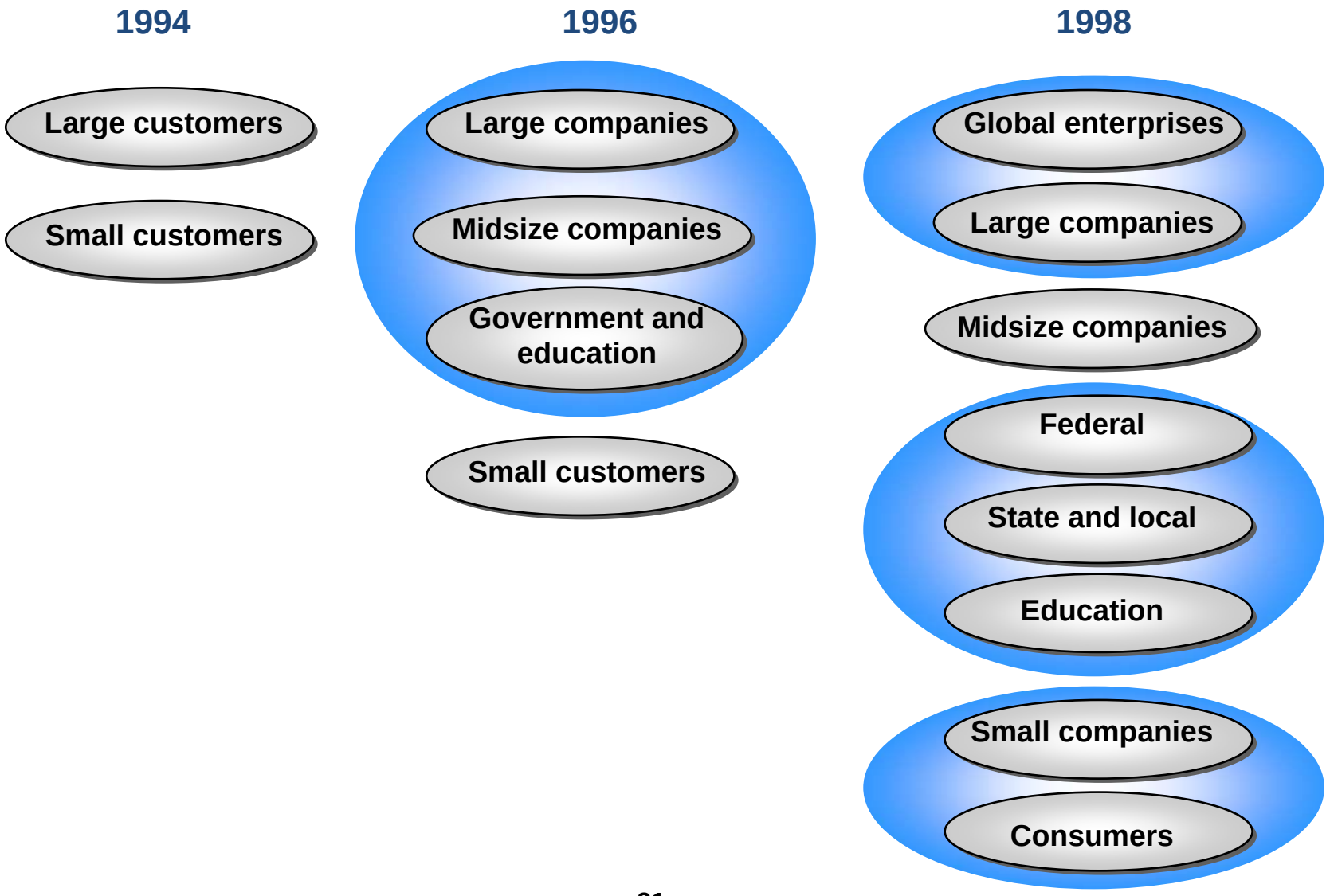
Patching: Restitching Business Portfolios

Company	Managing scale and focus
Dell®	• Patches customer segments and products • In 1994, 2 customer patches then 4 then 8 now about 18 • Decreased patch size with increasingly uncertain market
Hewlett Packard®	• Built printer businesses by frequently realigning divisions to market opportunities - add, exit, combine,split • Shifts products and businesses among divisions as needed • Prototypical patching results – From instruments to computing, from computing to printing and desktop publishing, and to digital photography
Honda®	• Took market lead in Japan by repatching traditional recreational vehicle businesses (minivans, station wagon, compact sedans, SUV) into three new, original patches

Patching example – Honda's domestic recreational vehicle (RV) business



Patching example – Dell



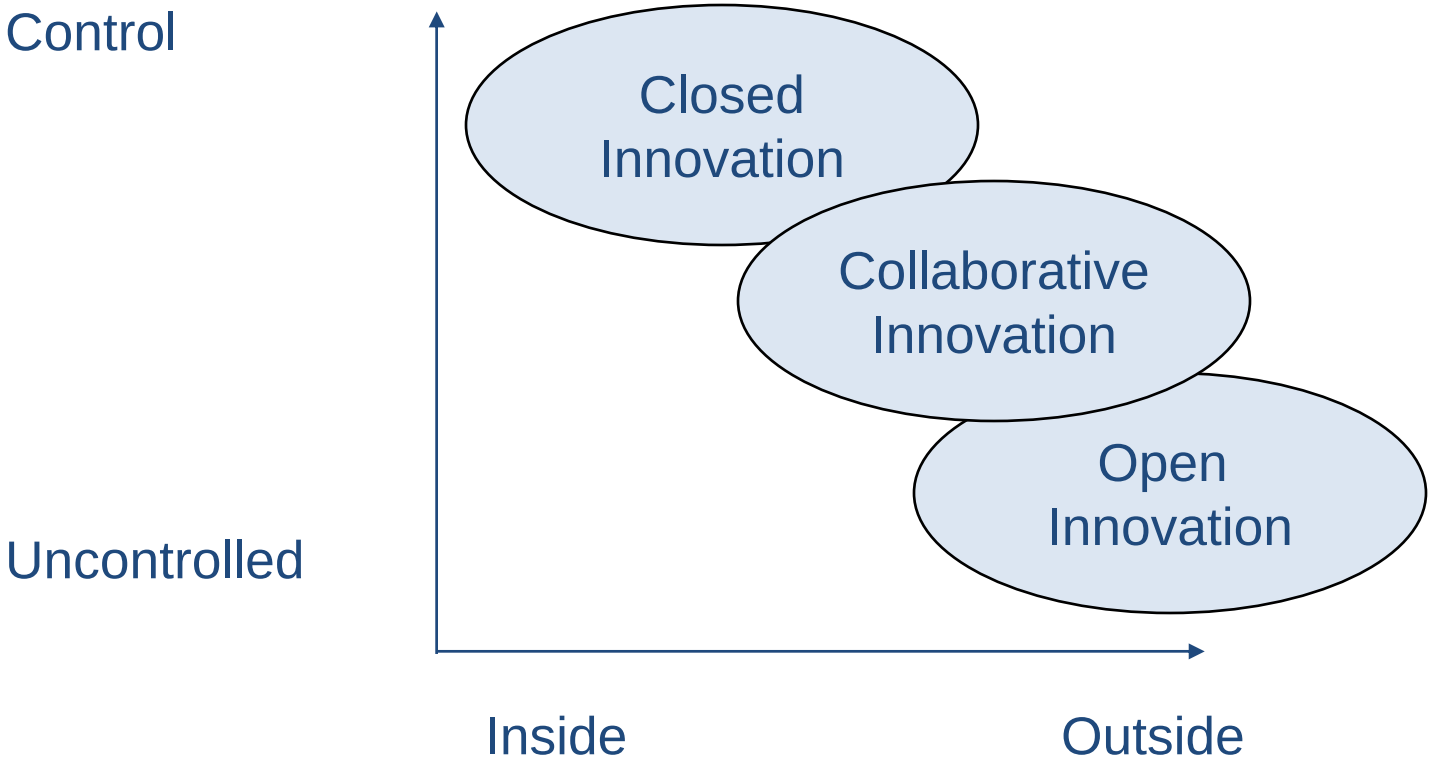
Coevolving: Cross-business Synergy

Common experience	Myths	Best practice
• Senior management wants cross-business synergies, but is unsuccessful	• Successful companies operate as a centrally controlled portfolio of related businesses	• A few temporary collaborations with exceptional payoffs
• Orchestrating collaboration across businesses is a time sink	• Successful companies operate as a portfolio of independent businesses	• Manage NUMBER of collaborations, not just focus
		• Senior managers set context for collaboration, businesses decide
		• Synergies AND individual business success

Coevolving: Cross-business Synergy

Company	A few collaborations
Disney	• "Multiplier effect" of sharing movie characters across businesses • Selective collaboration (e.g., Disney characters not shared with Touchstone) • Senior executives set collaborative context (e.g., synergy meetings, calendar, synergy managers, training boot camp), but business managers make the choices
Kroger	• Broadcast identity of best practice stores for specific capabilities (transactive memory) • Store managers select best practices most appropriate for their stores (receiver-based communication)
BP	• "Key to earning a big return is to replicate knowledge" – John Browne, CEO • SBUs belong to 1 of 4 peer groups for knowledge exchange, facilitated by electronic yellow pages • Participation is voluntary and comes out of SBU budget

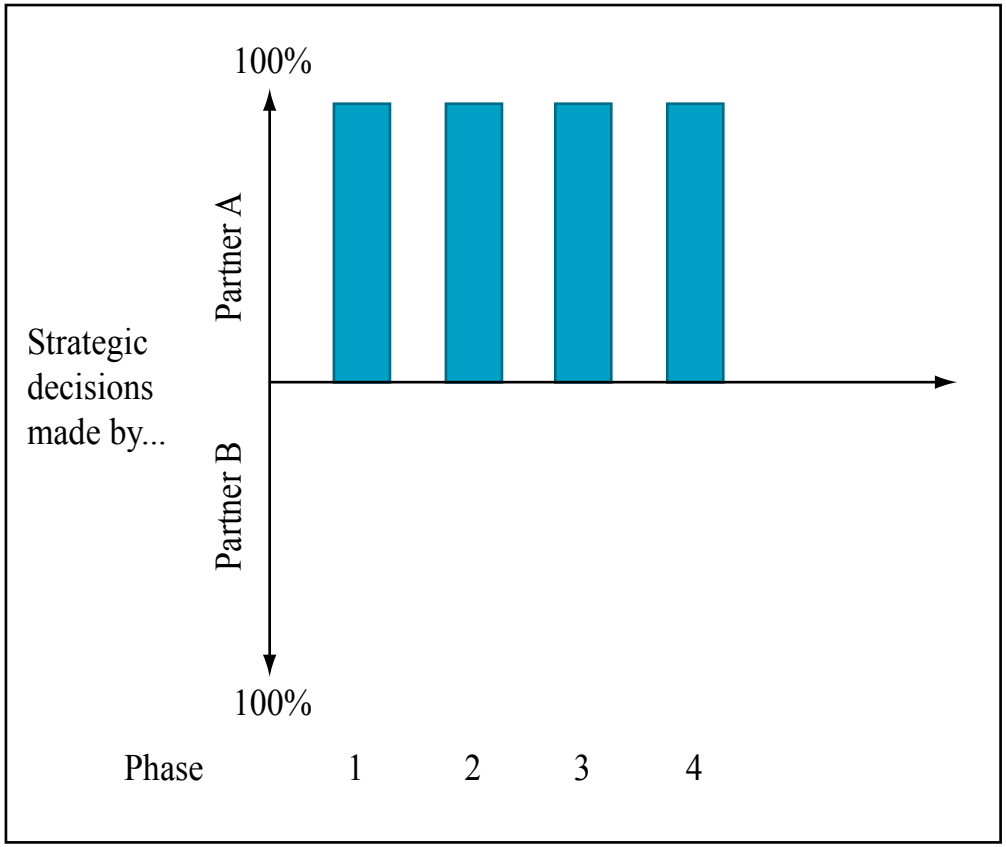
Relationship Processes: Towards Open & Collaborative Innovation



Relationship Processes & Collaborative Innovation

- Technology Collaborations between large established firms are becoming the predominant way that innovative component technologies are made in IT:
  - Google & Apple: iPhone collaborations: gMaps, YouTube player
  - Intel & Microsoft: Wintel technologies
  - Sun & SAP: Netweaver Java Platform
- What are the most effective Organziational Processes for managing these relationships?
  - Focus on Strategic Decision Making, Social Networks, Time-Pacing
  - Examined 8 collaborations between 10 large firms in the IT sector

Domineering Leadership



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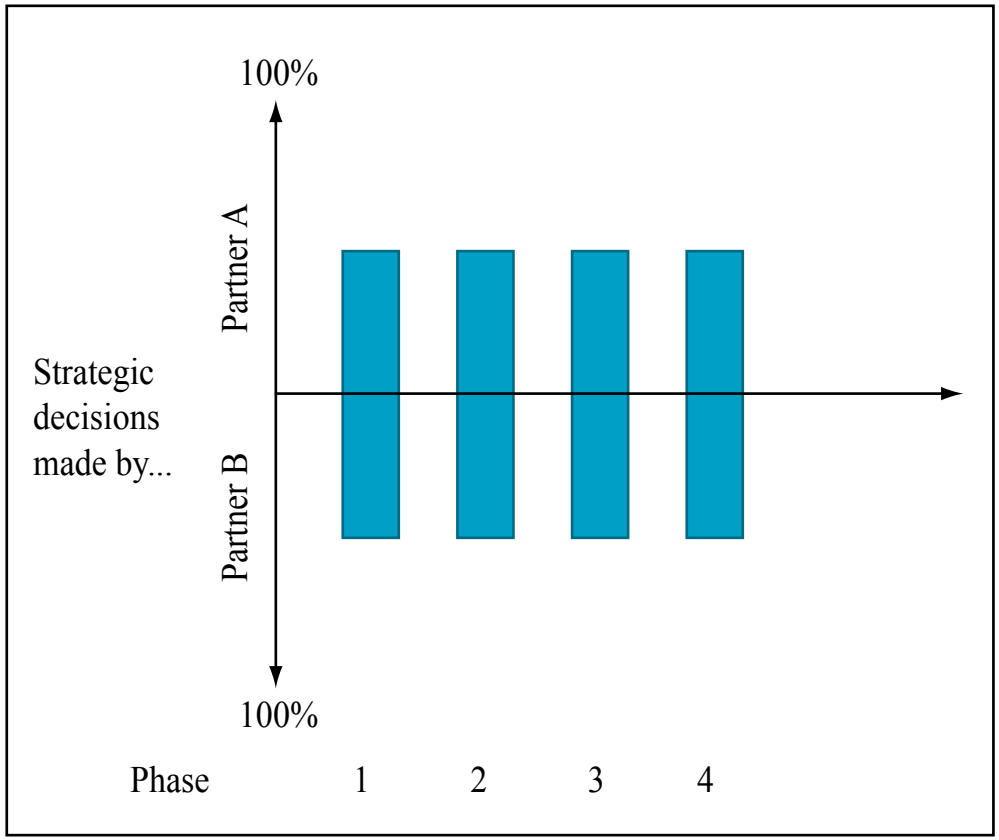
- De-motivated weaker partners do minimum required by contracts
- Achieves stronger partner's more routine objectives, but with…
- No innovation!

Consensus Leadership



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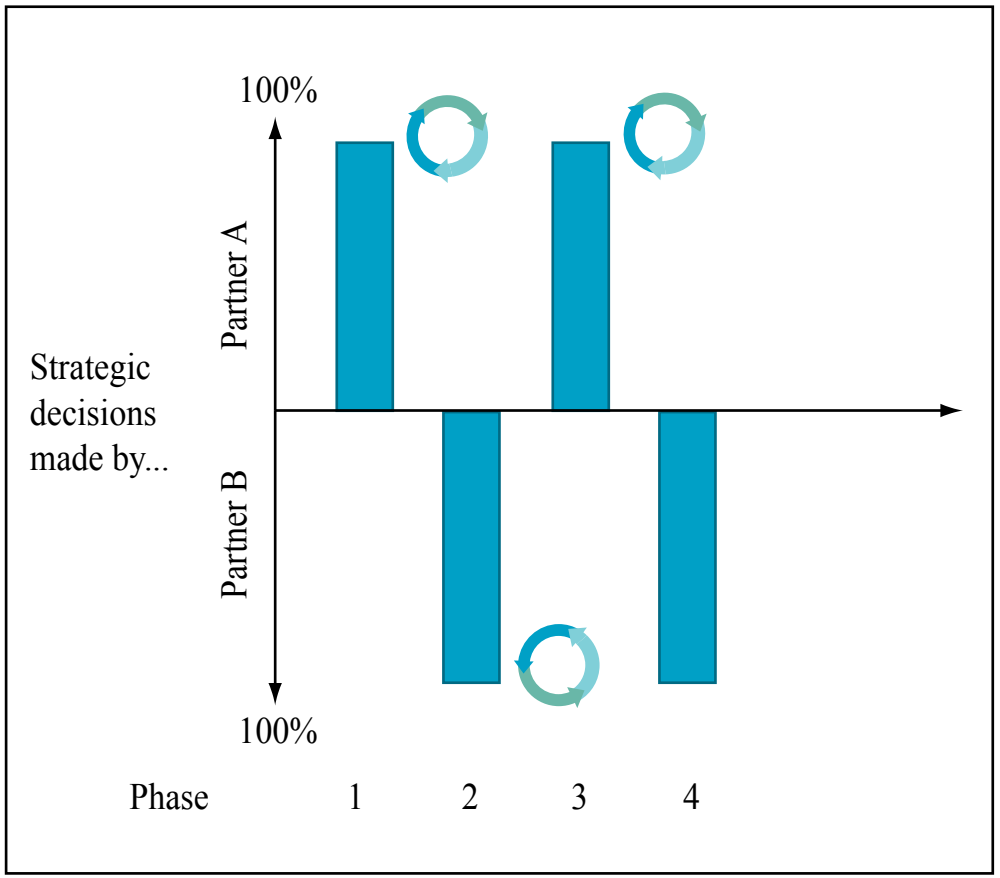
- Unclear Roles and Responsibility
- Many meetings!
- Slow development
- "Lowest common denominator" decision making

- No Innovation

Rotating Leadership & Collaborative Innovation



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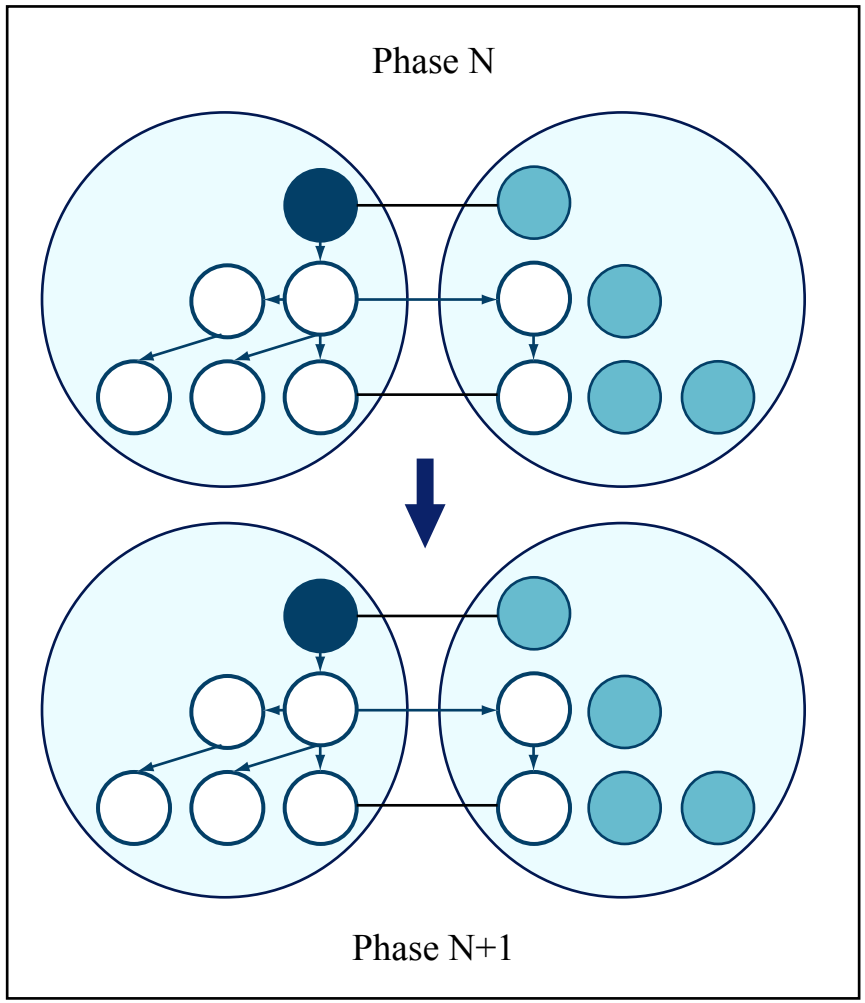
- Highly motivated partners contribute best technologies and IP
- Breaks inward focus of central-planning by single firms
- Rotations encourages recombination of technologies over time, leading to…

- Generation of Multiple Innovations:
  - New components
  - New platforms
  - New patents
  - Revenue growth: up to $1B+

Domineering Leadership



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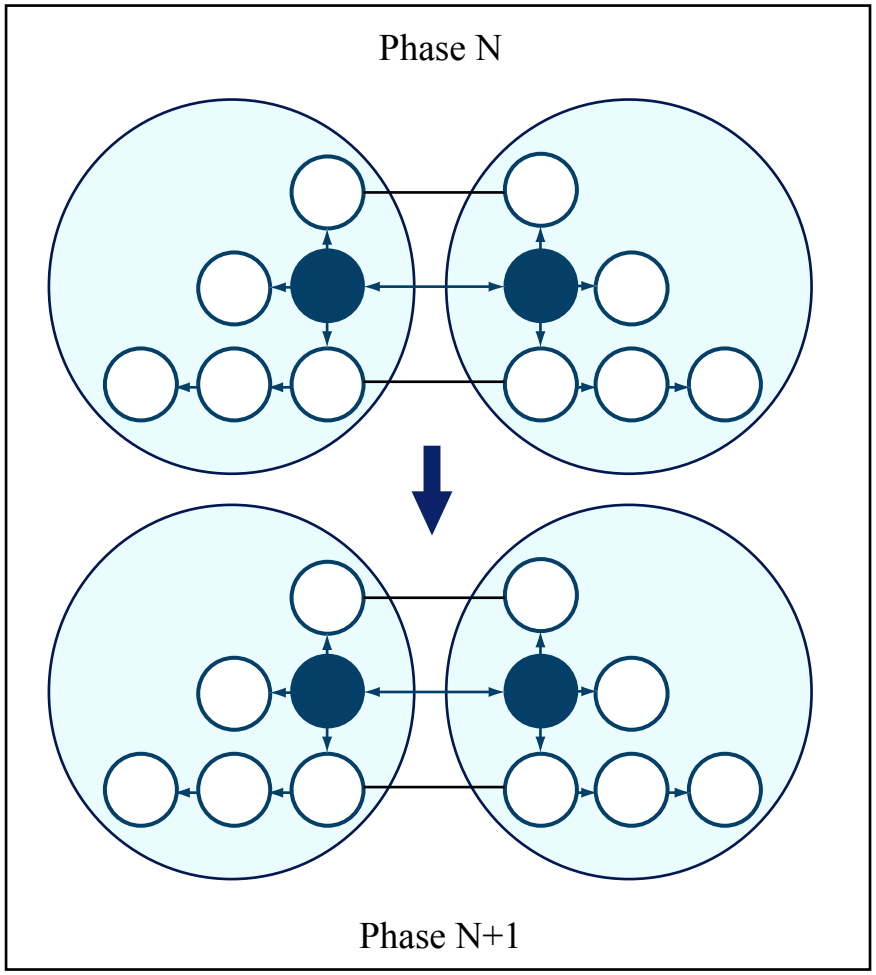
- Actors play same roles over time…
- …fails to involve many valuable employees in dominated firm

Consensus Leadership



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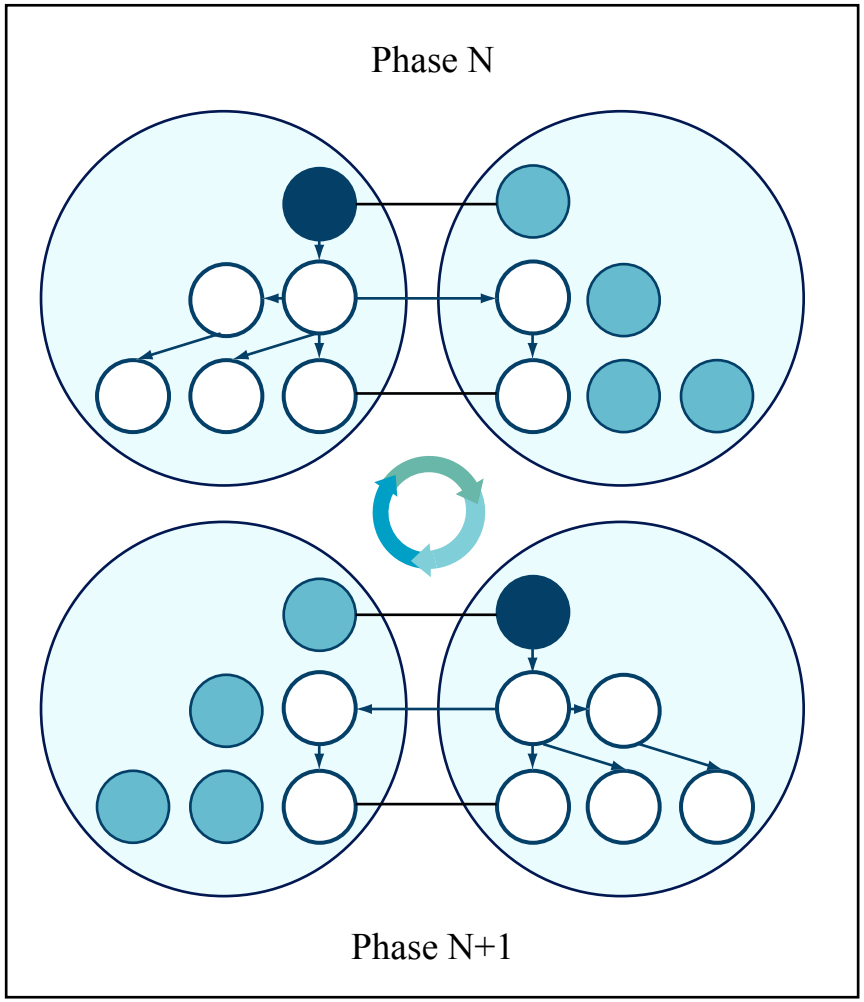
- Maximum involvement!
- Pair of project managers involves everyone in all aspects of work…

Rotating Leadership & Collaborative Innovation



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- Leadership rotations generate Fluctuating Cascades of Social Network Activation over phases of Collaboration
- Varies team composition
- Different people work at different times…new perspectives + needed time for rest!

Looking Forward:

- Creating Value through Effective Organization:
  - Organization Structure:
    - Centralization is a key dimension of R&D structuring
    - But there are many types of structure
    - Amount of Structure as important as the type!
    - Simpler strategies in more dynamic markets
  - Organization Processes:
    - Patching
    - Co-evolving
    - Relationships and Collaborative Innovation:
      - Rotating Leadership and Fluctuating Networks

- Next session we move to Value Capture & Abgenix (biotech!)