Development Bank of Japan
Pre-Opening Seminar, Ohtemachi Innovation Hub
Tokyo, March 19, 2013

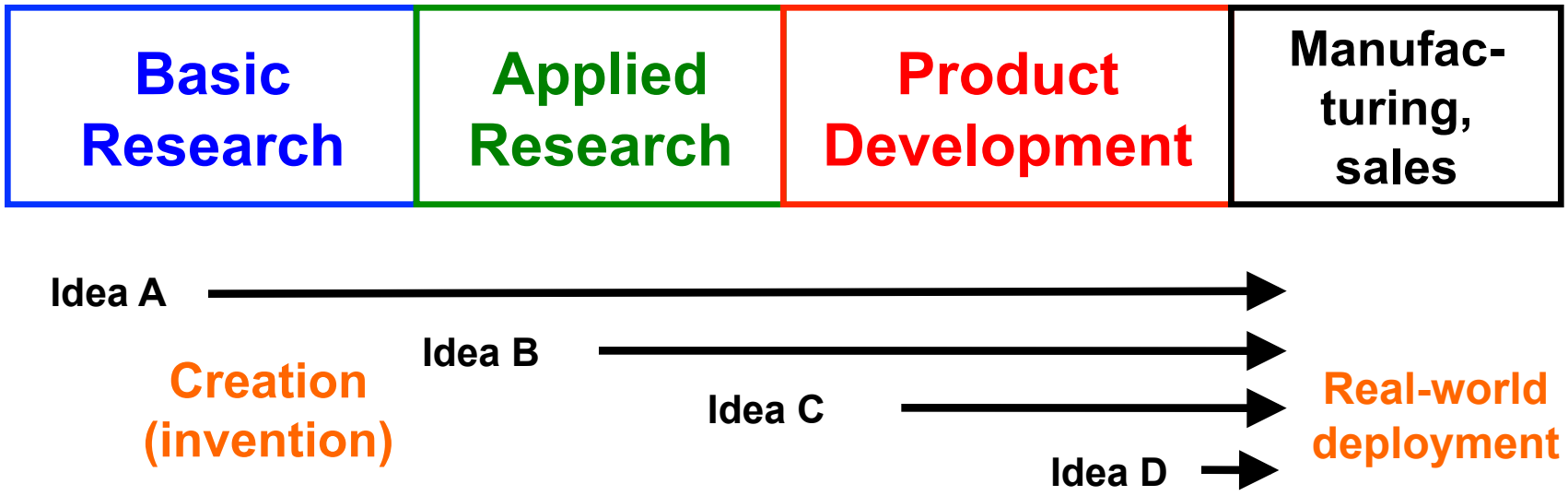
Toward a (New) Model for Japanese Innovation: Implications from the U.S. Model

Richard B. Dasher, Ph.D.
Director, US-Asia Technology Management Center
Executive Director, Center for Integrated Systems
Consulting Professor, Stanford University

Outline

- Processes and systems of innovation
- Open innovation
- Comparison of the innovation systems of Japan and the U.S.
- Toward a new model for innovation in Japan
  - Recent change and developments
  - On the role of an “innovation hub”

Innovation as a process



Definition of innovation: *process that leads from creation of a new idea (invention) to its real-world deployment (often by commercialization)*

New ideas can first appear at any stage of R&D

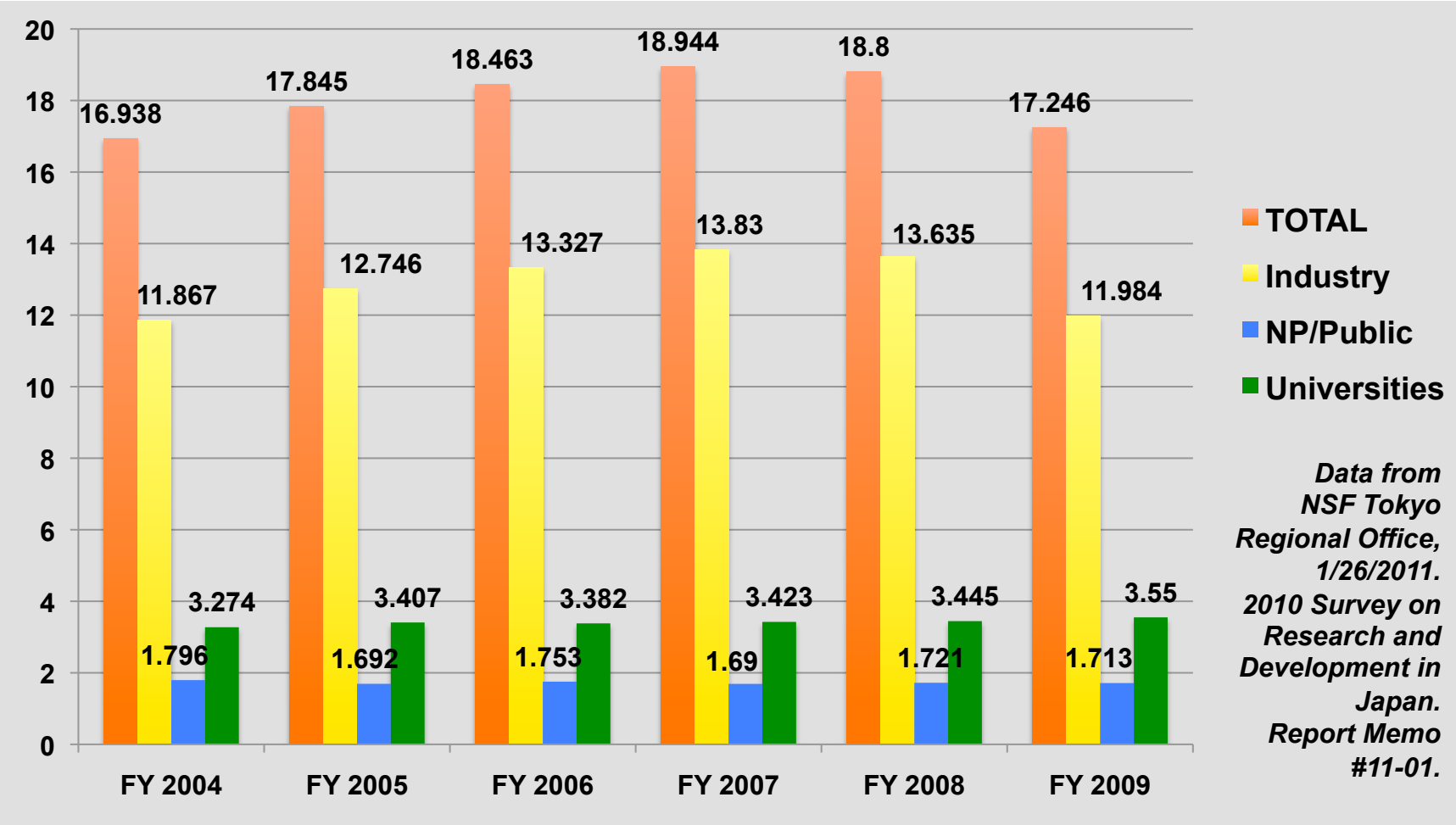
Innovation differs from invention

Invention	Innovation
Some inventions are instantaneous	Innovation is a process, and so it usually takes time
Some things are invented by individuals	Almost always, more than one person and group is required
Some inventions are unplanned	Innovation refers to an intentional, managed process or its result
At first, the practical value of an invention may be unknown; many inventions never yield economic value	Innovation always aims to provide value in the real world • New value-added product or service, or • Greater efficiency

Most business innovations are late stage (development-stage), incremental changes

Add new feature to existing product (category)	Nintendo “Wii”
Take existing product (category) to new market	Nintendo DS to “mature” markets
New combination of existing technologies	Apple i-Phone
Change of business process	Outsource employee medical services
New business model	SaaS, new types of online coupons (Groupon)
Completely new thing / category (rare)	(c. 1980) Personal computer ? Walkman?

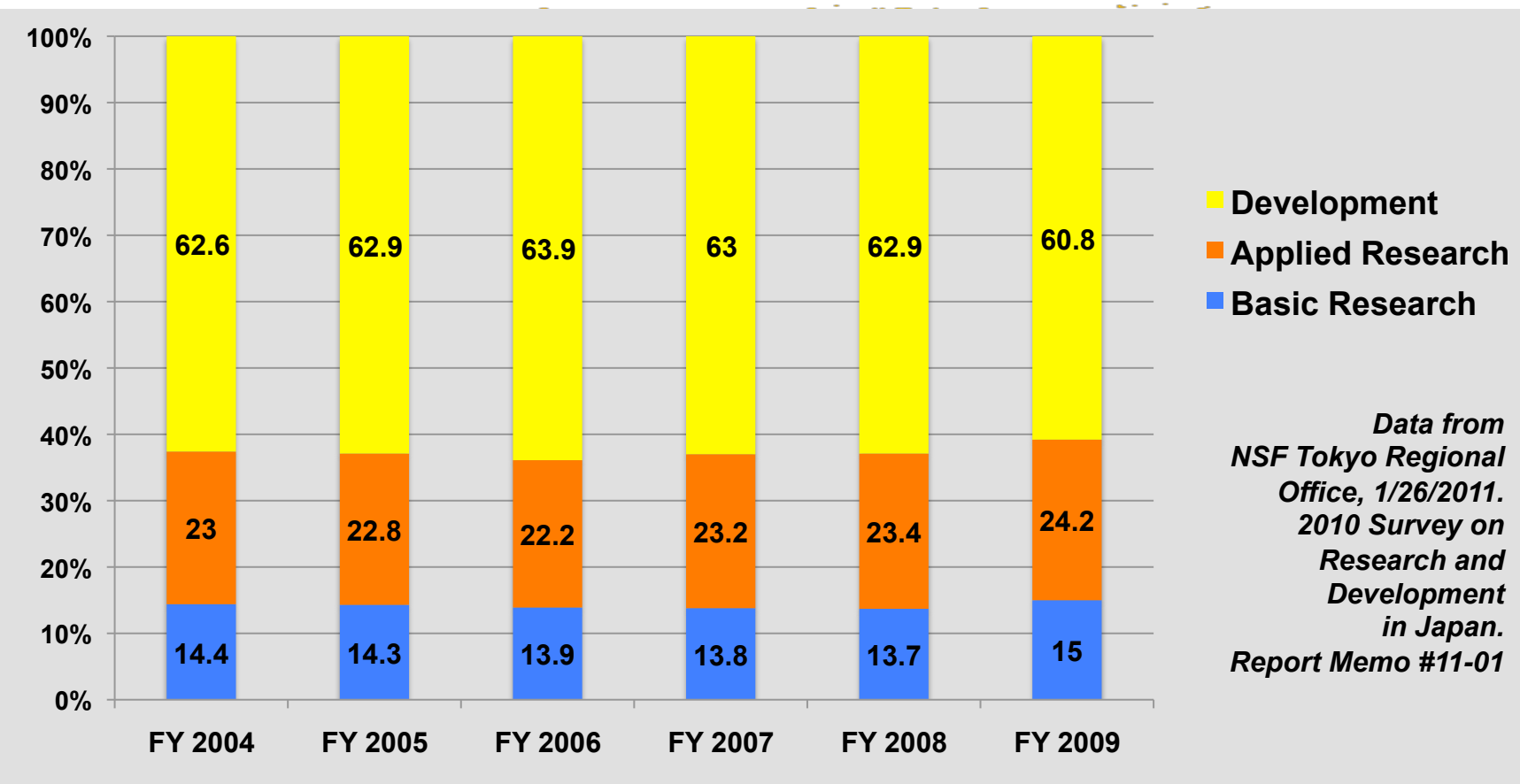
Industry spends more on R&D than do other sectors



Trillions of Yen

Japan R&D Expenditures by Sector – FY 2004 - 09

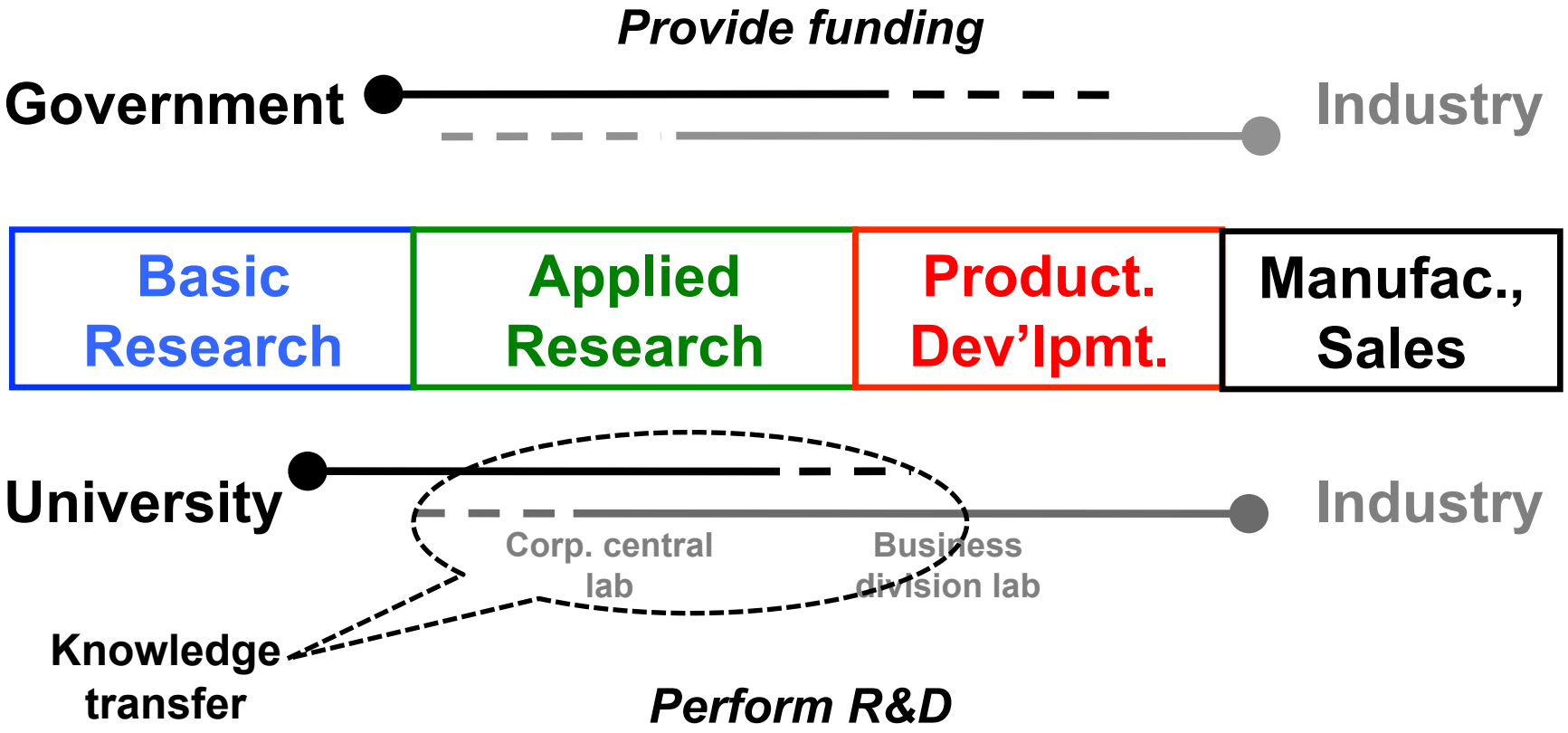
The ratio of spending on the different types of R&D is relatively stable



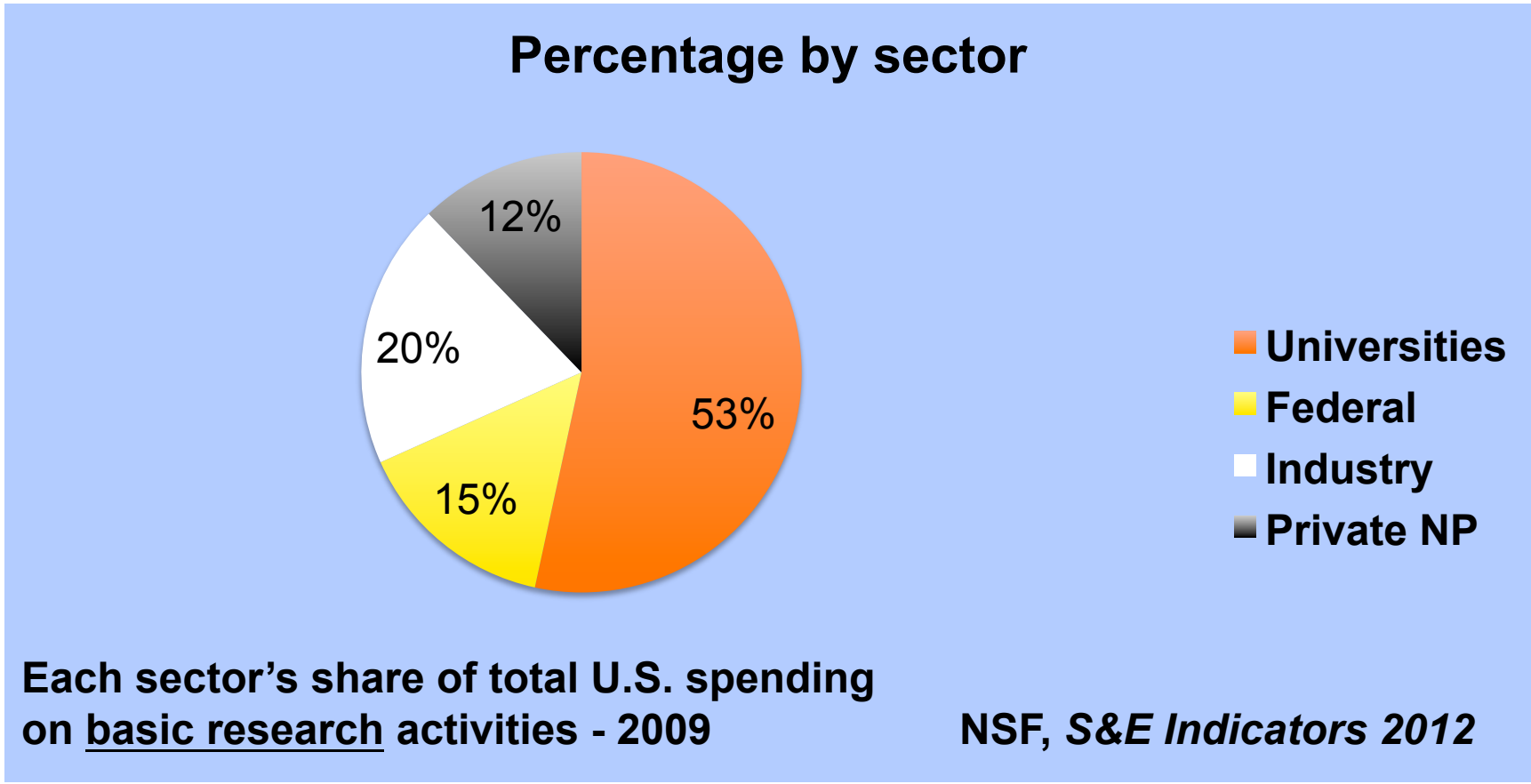
Japan R&D Expenditures in Natural Sciences by Type of Activity – FY 2004 – 09

'Natural Sciences' include Science, Engineering, Agriculture and Health. Of total 2009 R&D expenditures of ¥17,246.3 Billion ($185.4 Billion), ¥15,865.5 Billion ($170.6 Billion), 92 percent, went to Natural Science fields.

Government, university, industry: complementary roles in an innovation system



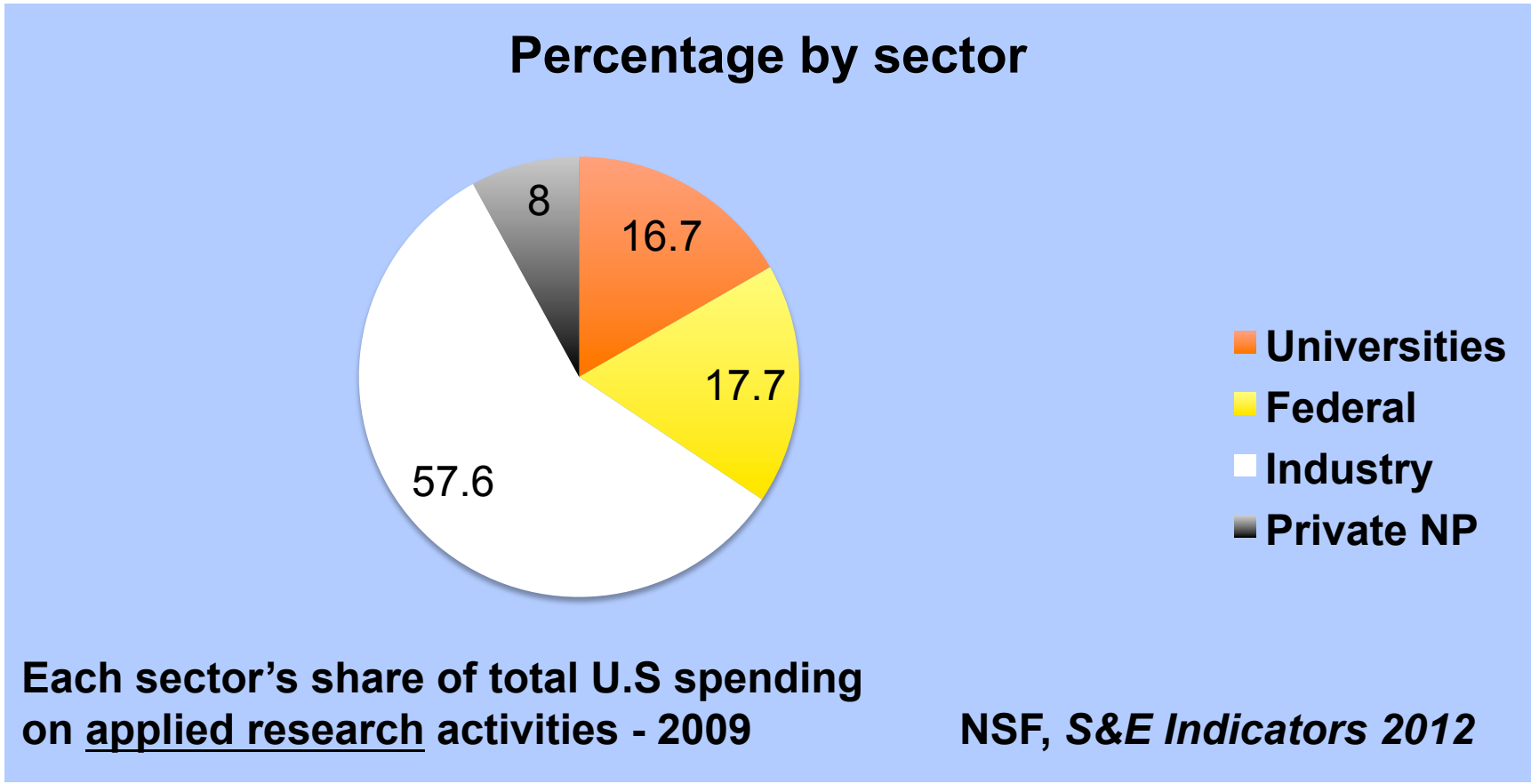
Sector roles in an innovation system: Industry = small share of basic research spending



Each sector's share of total U.S. spending on basic research activities - 2009

NSF, *S&E Indicators 2012*

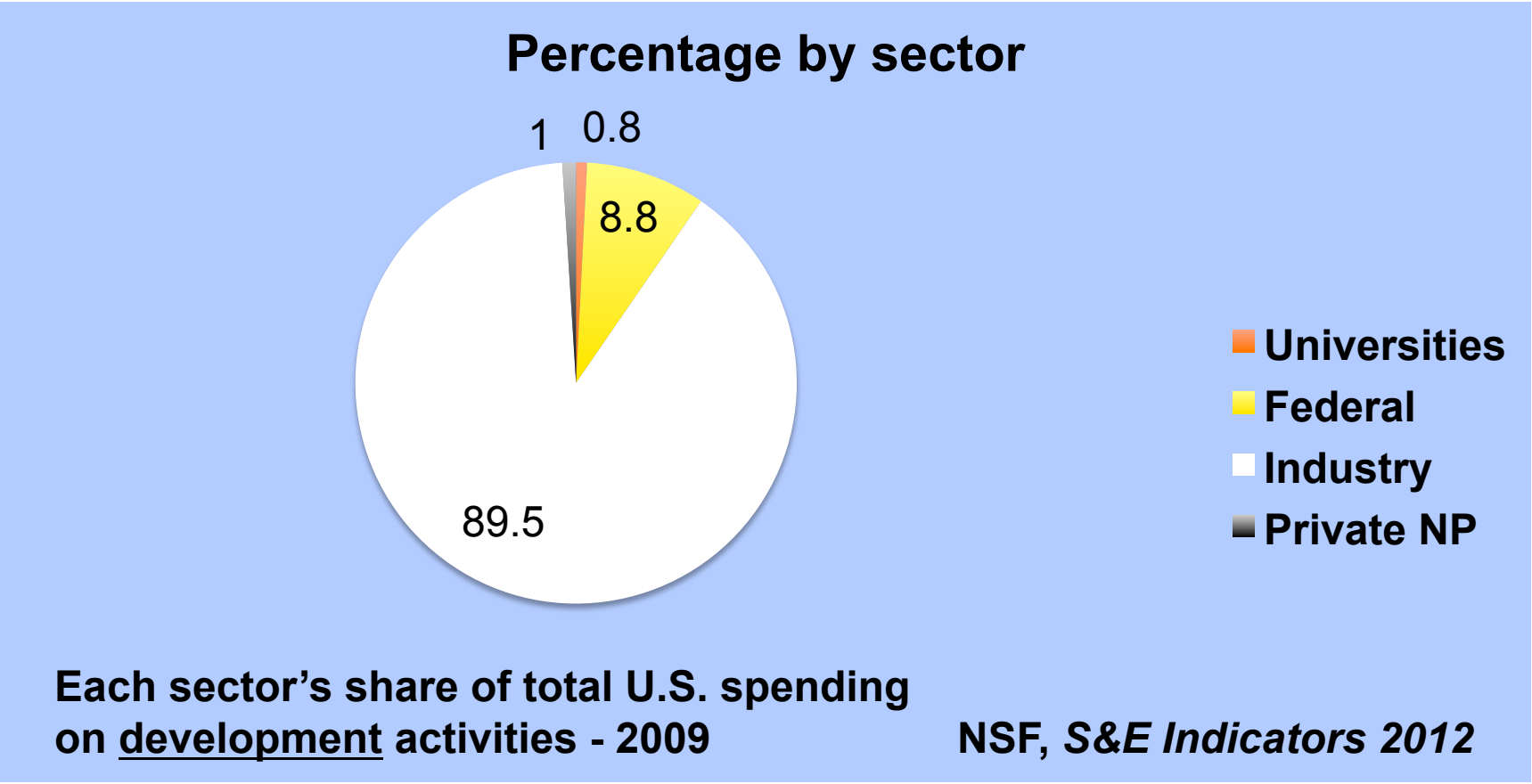
Sector roles in an innovation system: Industry and other sectors share applied research



Each sector's share of total U.S spending on applied research activities - 2009

NSF, *S&E Indicators 2012*

Sector roles in an innovation system: Industry does almost all the spending on development

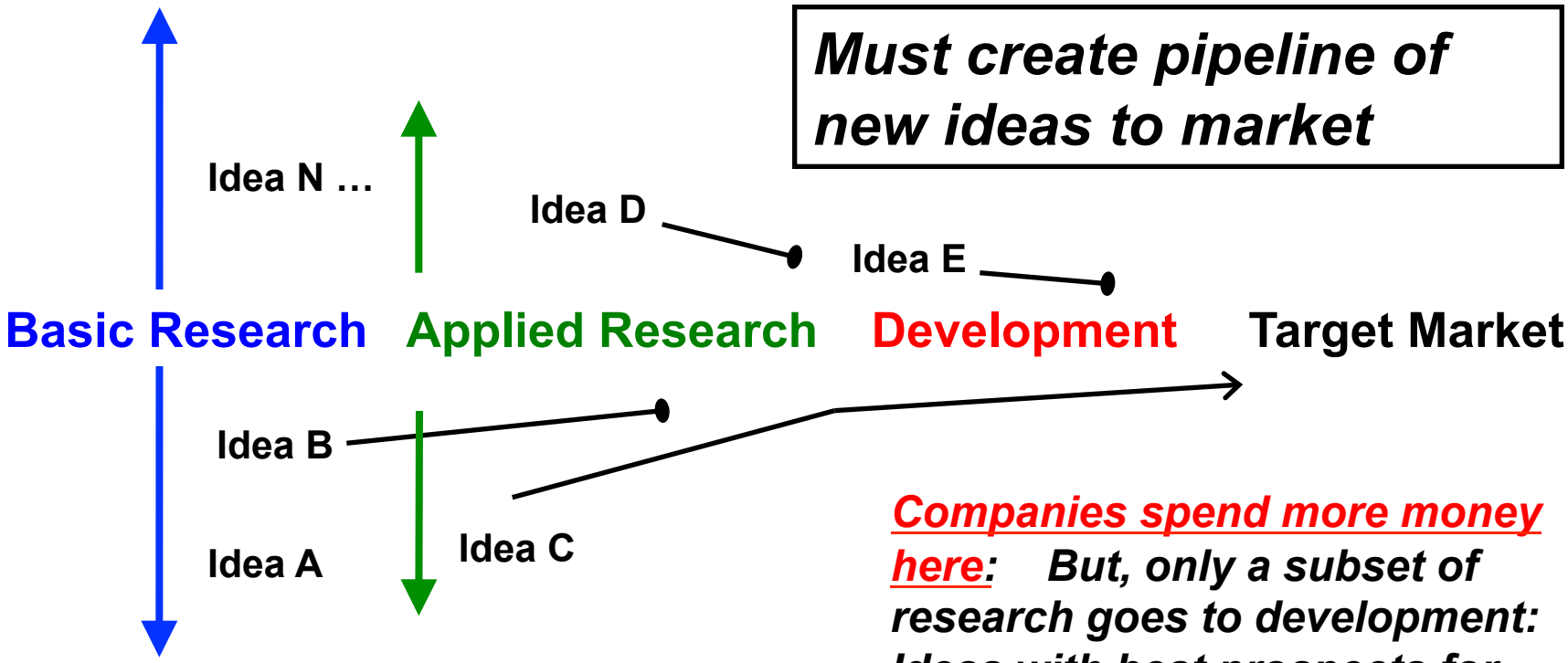


Each sector's share of total U.S. spending on development activities - 2009

NSF, *S&E Indicators 2012*

Open Innovation

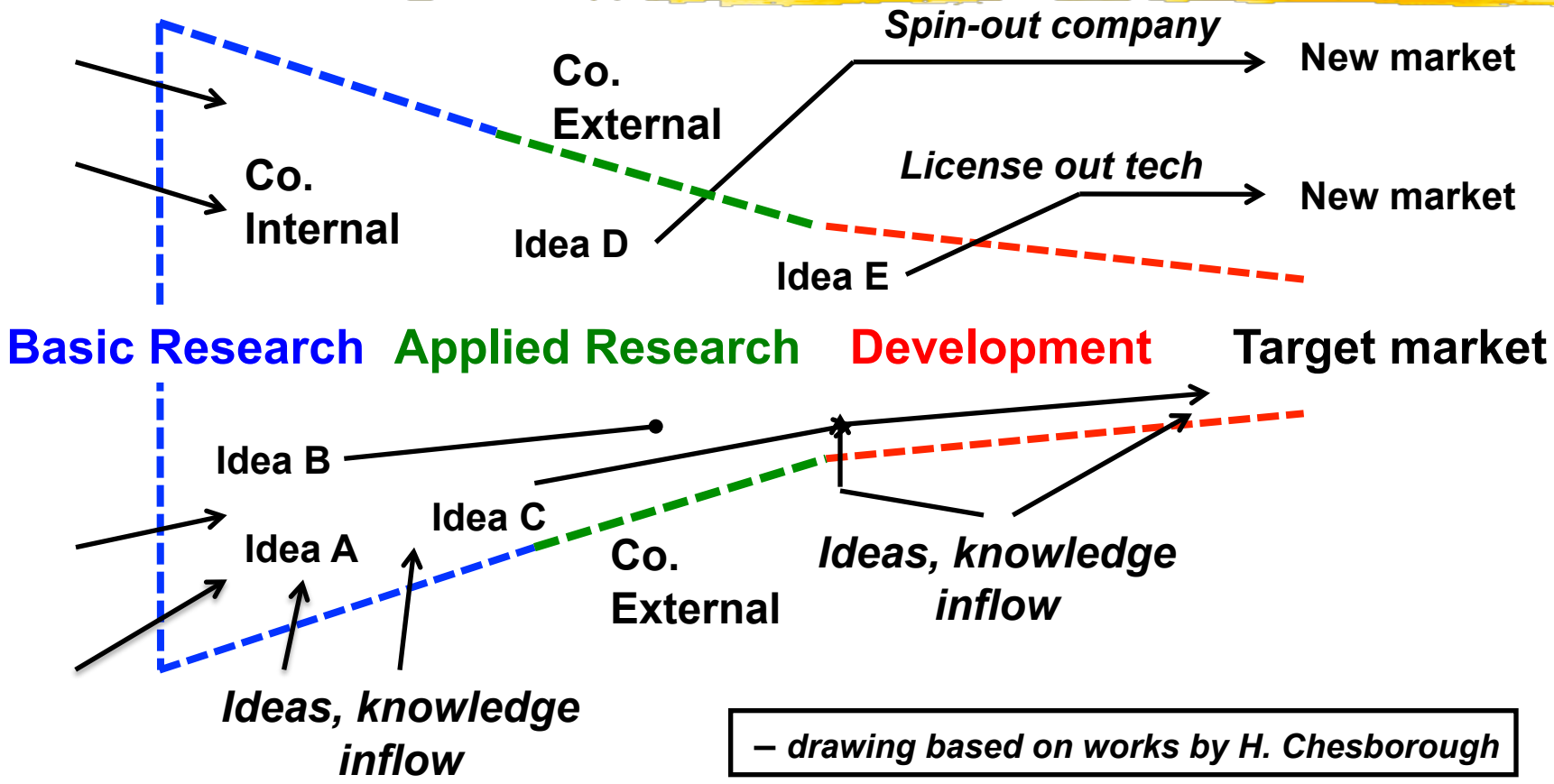
Challenge of innovation management for a company



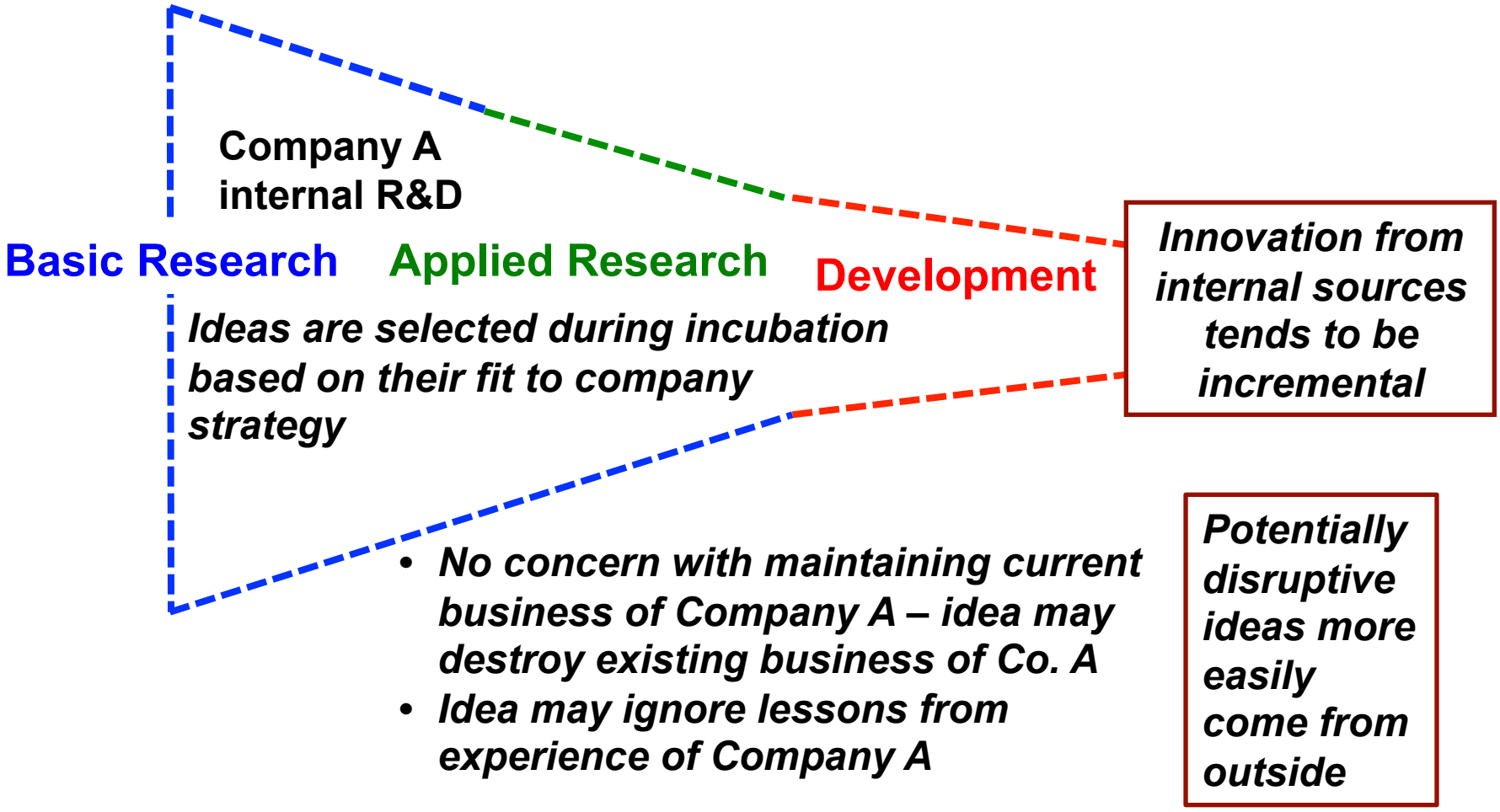
Companies spend less money here, *but need broad range of research for sufficient input to development*

Companies spend more money here: *But, only a subset of research goes to development: Ideas with best prospects for success, best fit to overall company strategy*

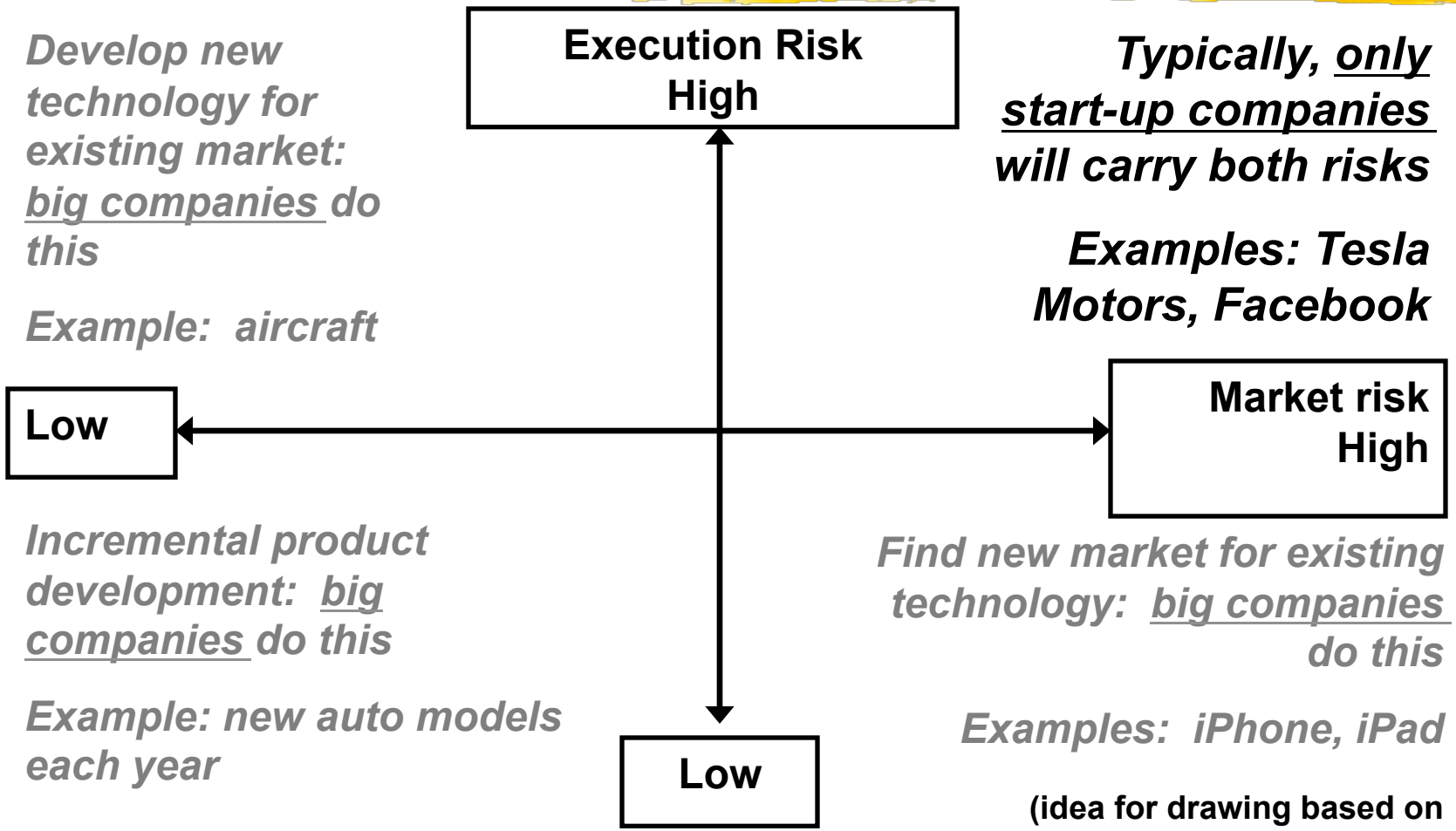
Open Innovation: strategic use of the flow of knowledge across company boundaries



Fundamentally different kinds of new ideas can be incubated outside a large company



Start-up companies' unique strength in innovation



Develop new technology for existing market: big companies do this

Example: aircraft

Typically, only start-up companies will carry both risks

Examples: Tesla Motors, Facebook

Incremental product development: big companies do this

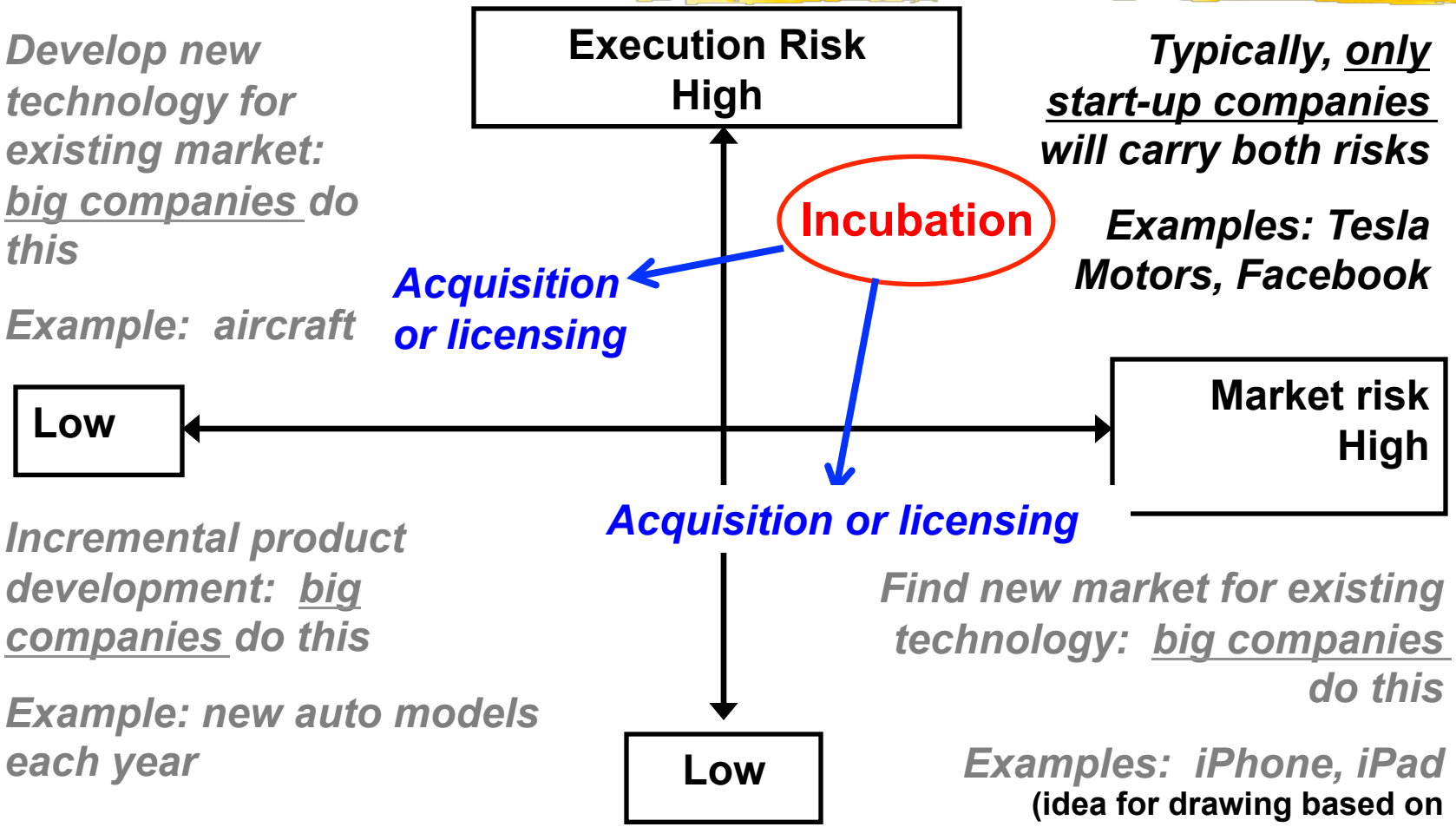
Example: new auto models each year

Find new market for existing technology: big companies do this

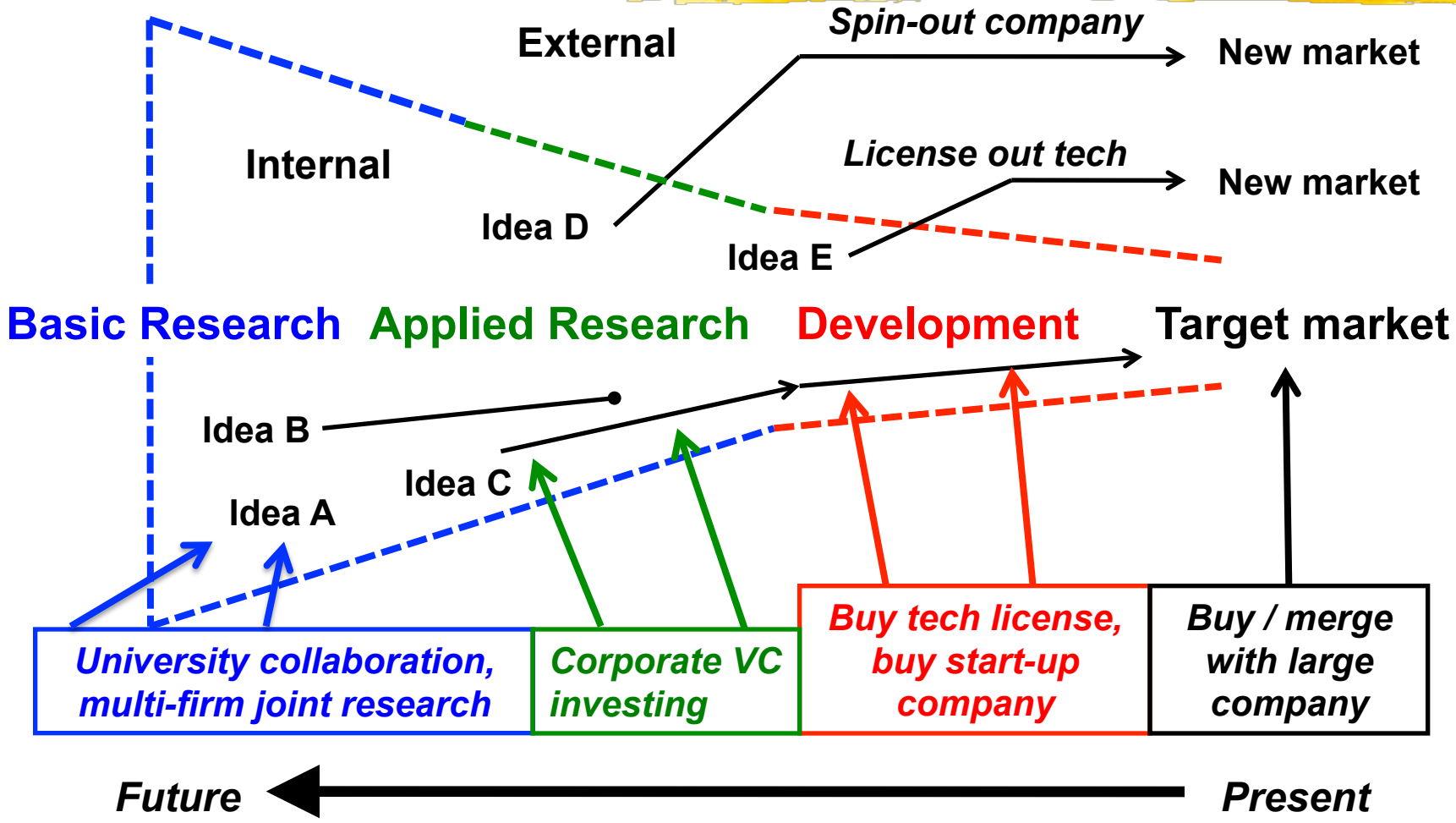
Examples: iPhone, iPad

(idea for drawing based on Christensen 1997)

Big companies "buy" start-up company ideas as they are incubated



Open innovation channels differ according to "distance" of R&D activity from market entry



Google: big company practicing open innovation

- R&D spending over the last 12 months (including 2012Q3) = $6.217 billion
  - 13.1% of revenues; average for software industries is 13.3%
  - Net income (after expenses) was $10.556 billion, and they paid no dividend
  - See <http://www.google.com/finance?q=NASDAQ:GOOG&fstype=ii>
- M&A, spin out activities
  - M&A not directly reflected in balance sheet: use of assets, not income
  - See <http://en.wikipedia.org/wiki/List_of_mergers_and_acquisitions_by_Google>
  - Between 2001 and Dec. 2010, Google bought 85 companies, most of which were start-up companies

Google acquisitions and venture capital activities

- In 2011, Google bought 25 companies
  - One large acquisition: Motorola Mobility (2011, $12.5 billion) was about present day business
  - 24 start-up company acquisitions (probably around $700 million) include:
    - *Ecommerce enhancement* (including loyalty programs, digital rights management, digital coupons, price comparisons, limited-time deals)
    - *Social network enhancement* (platforms, social media analysis)
    - *Mobile business enhancement* (Android-related)
    - *Online video and audio (content distribution)*
    - *Nontext data processing* (voice recognition, image recognition)
    - *Infrastructure software*: security
- Google Ventures established corporate VC fund in 2009
  - About $100M / year; in 2012.11 announced increase to $300M for 2013
- No specific numbers on sponsorship of university research, but active support of research at Stanford (and other leading universities)

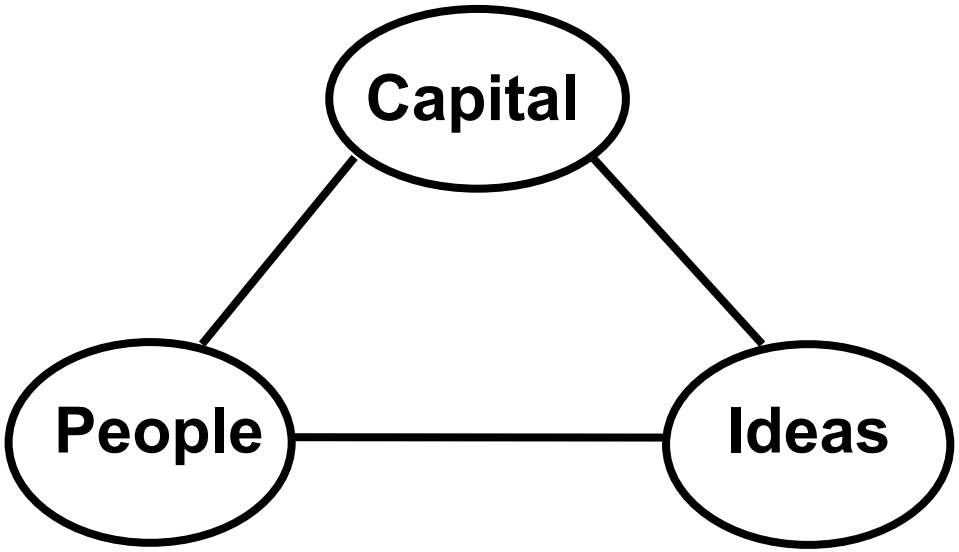
One major US – Japan difference:

- Open innovation in Japan tends to be done like outsourcing
  - Large companies look for an external partner to fill a particular niche in the supply chain
  - (Quasi-) Keiretsu affiliation is often the result of first sales from small company to large company
- Open innovation in the U.S. tends to border on (strategic) disruption of current company business
  - CTO is often independent office from R&D division
  - CTO provides independent views directly to CEO
  - Top-down major decisions about strategy meet bottom-up innovations that may be independent of existing R&D activities

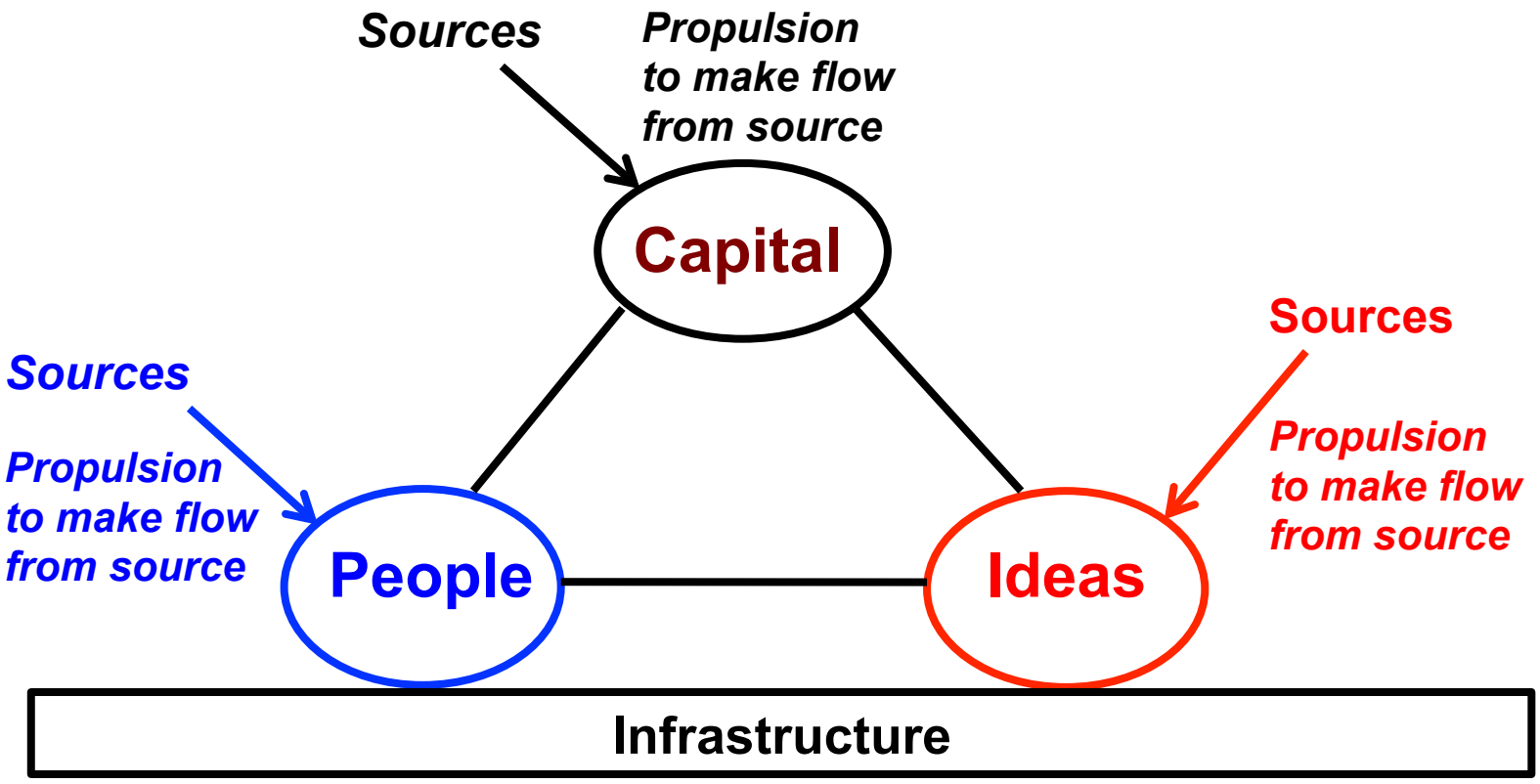
Comparing the Innovation Systems of Japan and the U.S.

Another definition of innovation

A new combination of people, a (business) idea, and capital



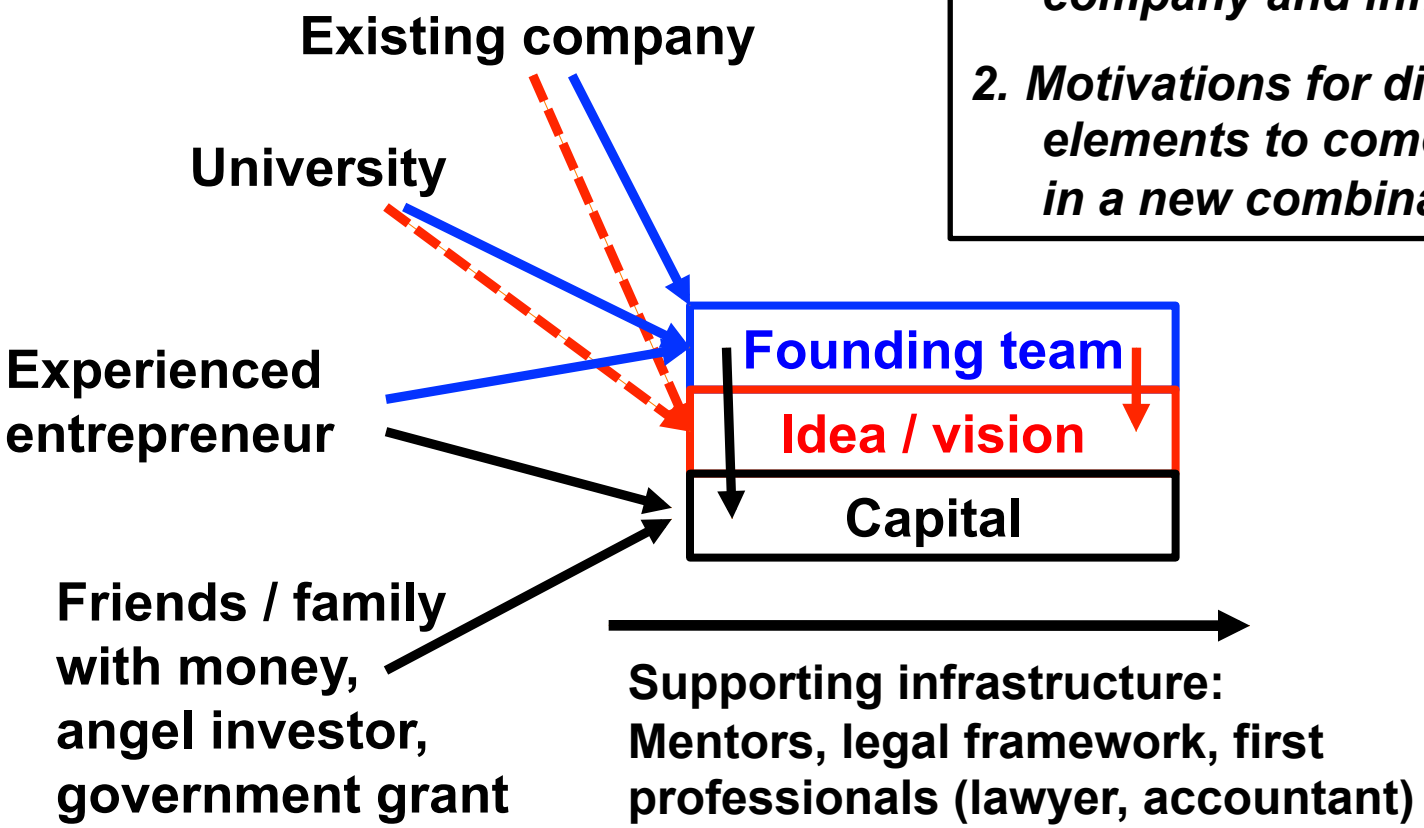
Basic elements of an innovation system



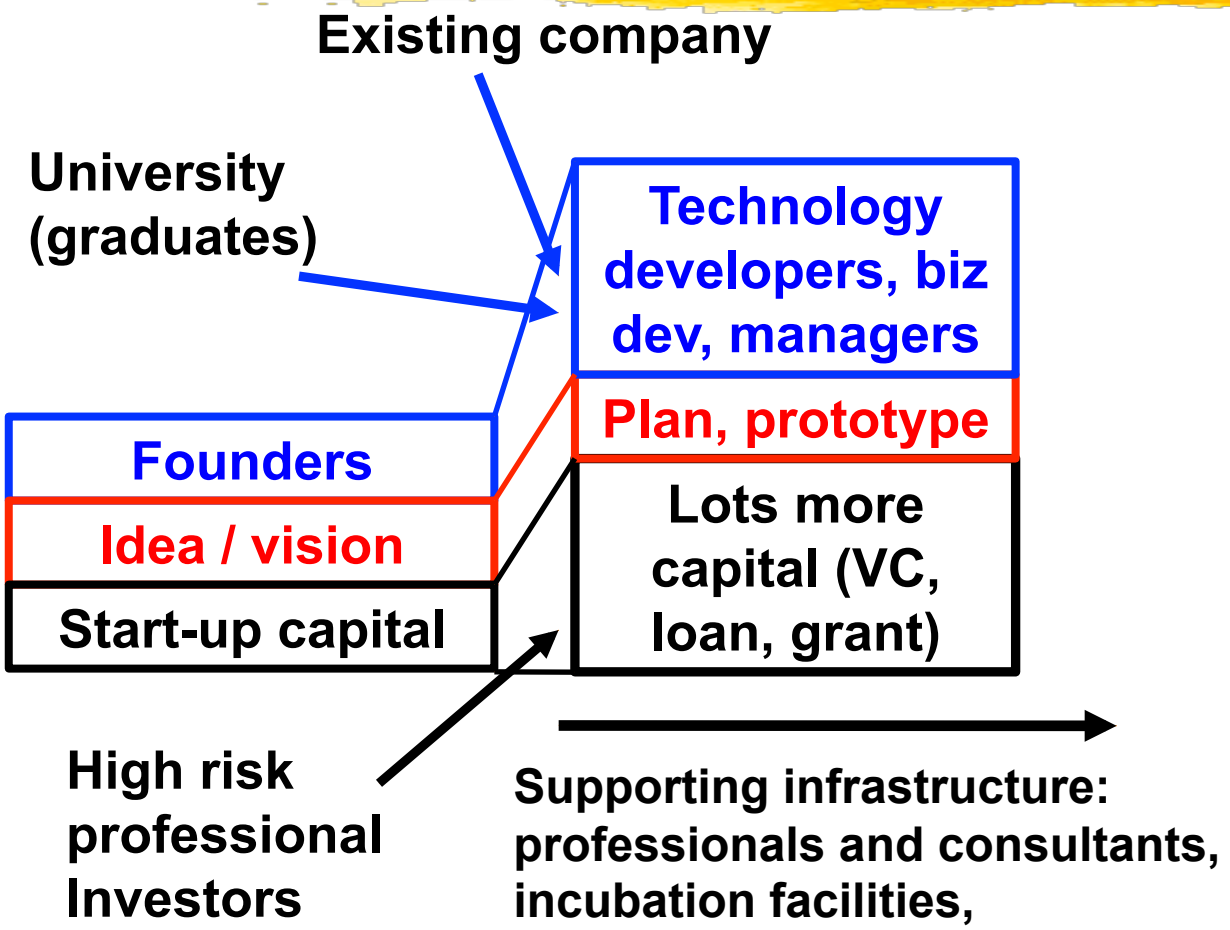
Stage 1: Company creation sources and resource needs

Habitat needs at this stage:

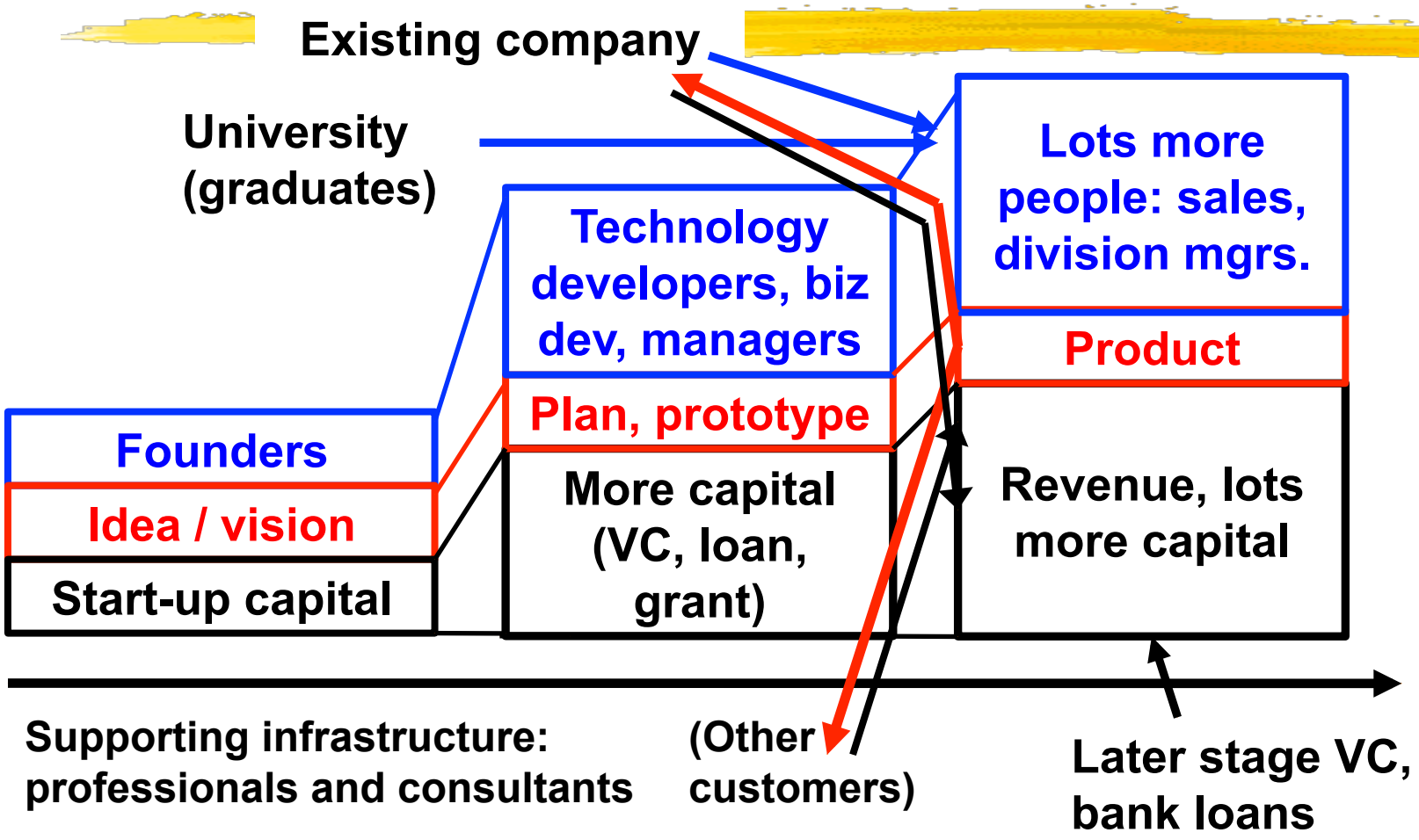
1. ***Sources for all elements of company and infrastructure***
2. ***Motivations for different elements to come together in a new combination***



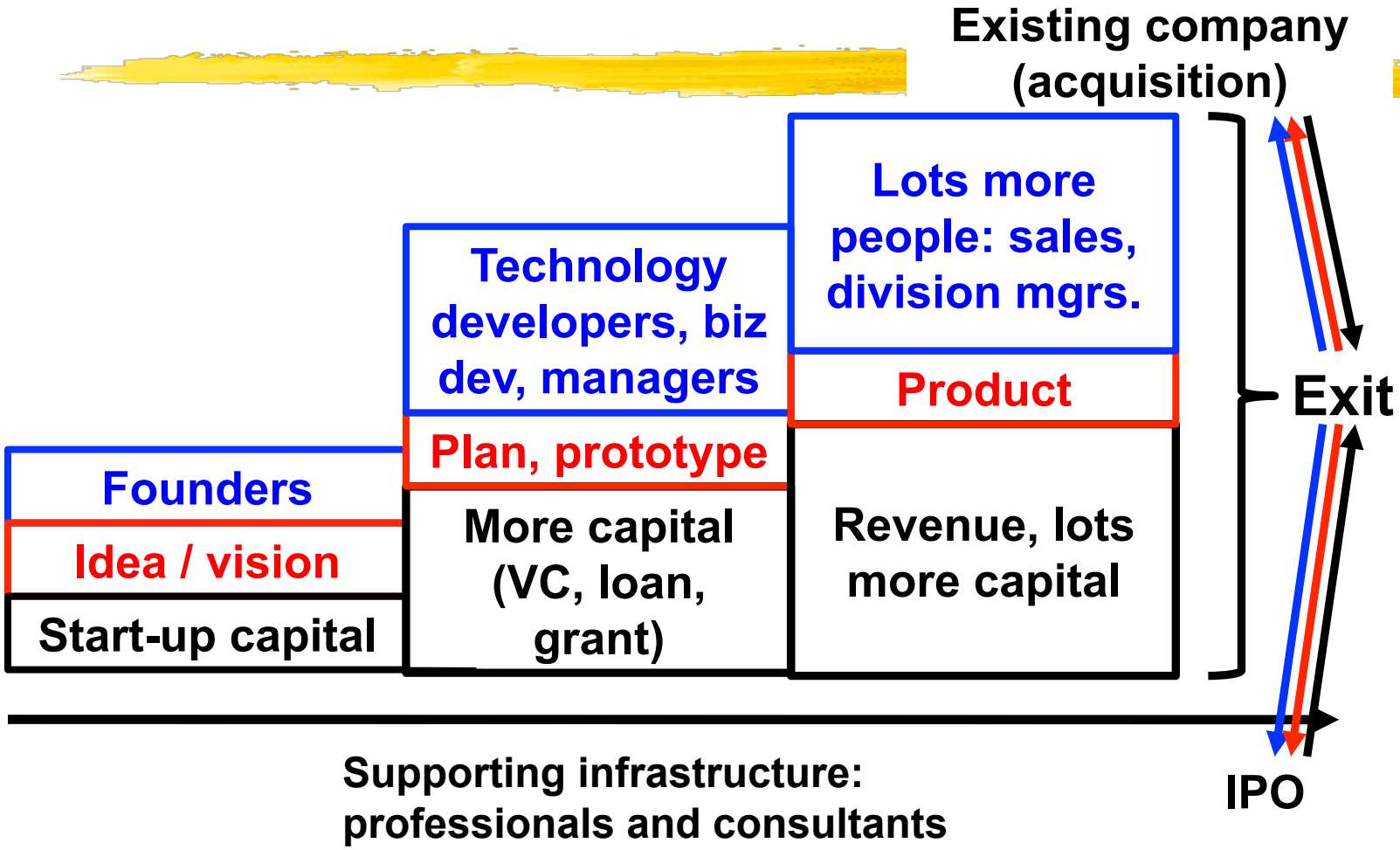
Stage 2: Company incubation and development



Stage 3: Customer acquisition / expansion



Stage 4: Exit


Existing company
(acquisition)
Lots more people: sales, division mgrs.
Technology developers, biz dev, managers
Product
Plan, prototype
Founders
Idea / vision
Start-up capital
More capital (VC, loan, grant)
Revenue, lots more capital
Exit
IPO
Supporting infrastructure:
professionals and consultants

Some factors in comparing national innovation systems - 1

- Flow of Capital:
  - Flow of government funding flows to R&D in academia, industry – what kind of cooperative relationships are created
  - Flow of various types of risk capital to start-ups
  - Flow of income from sales by start-up company
  - Flow of capital at exit
- Flow of People: Employment patterns of workers
  - E.g., high mobility – not just entrepreneurs but labor force
- Flow of Ideas: Knowledge transfer
  - At start-up: policies and mechanisms to establish rights ownership and licensing
  - During incubation and exit: shift in start-up company ownership, management control, assets licensing
    - Integration by acquiring company

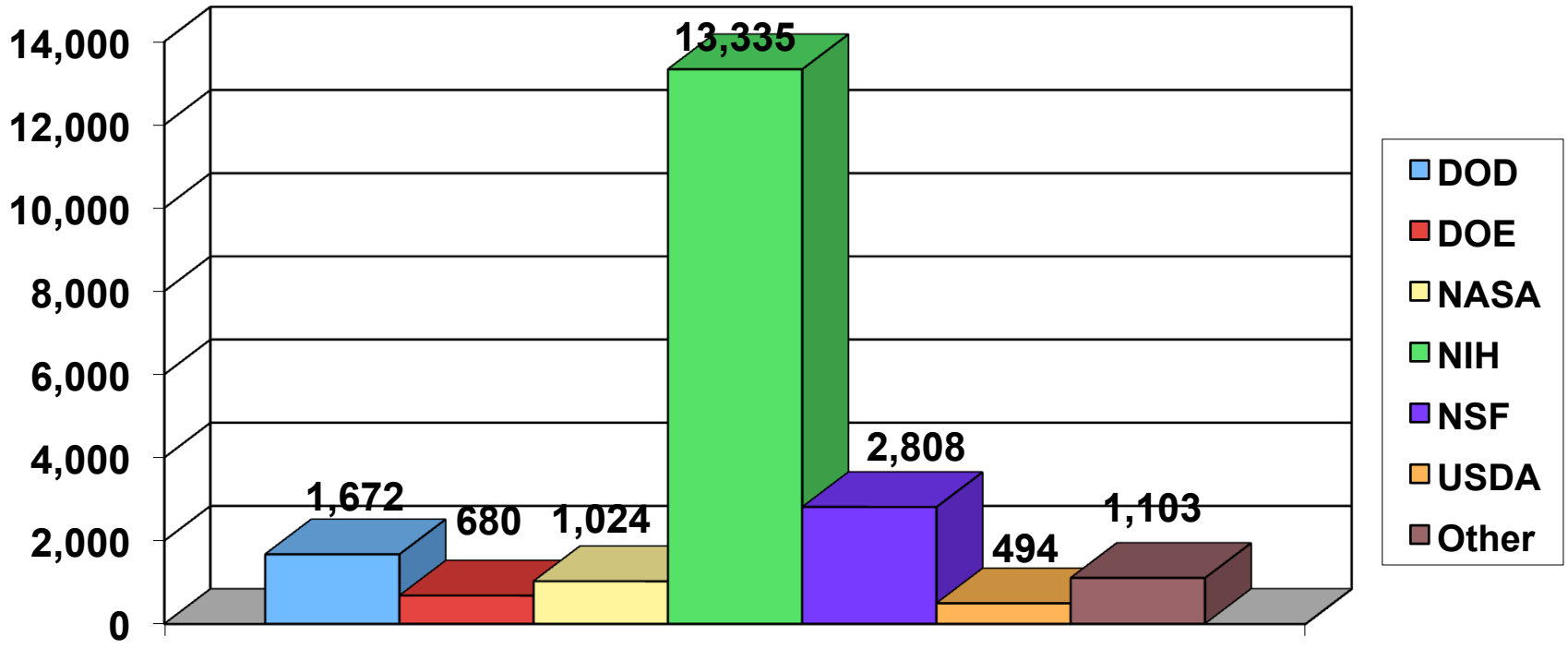
Some factors in comparing national innovation systems - 2

- Infrastructure factors
  - Degree of macro-economic development; speed of growth
    - Advanced economies rely on innovation for competitiveness more than do developing economies
    - As economy advances, must deal with natural flow of standardizable activities to cheaper offshore regions
  - Sector-internal characteristics
    - Example: Is there much M&A inside the industry sector?
  - National policy objectives
    - Examples: to spread out capital more than just to a few big companies or business groups), regional infrastructure development, encouraging high-growth start-ups companies
  - Legal framework and enforcement track record for IP protection and exploitation

Comparing the U.S. and Japan systems - Capital flow - 1

	U.S.	Japan
Government money for R&D	Almost all competition-based funding	Much funding still allocated by ranking, seniority
	Multiple agencies fund research in each sector (*see next slides*)	Separate systems: university R&D funds come from MEXT, industry R&D from METI, …
	Direct subsidy of industry R&D politically difficult	R&D policy: for industry / economic development (not much for defense)
	Matching fund requirements: create industry - university partnerships	Matching funds within industry for national government projects

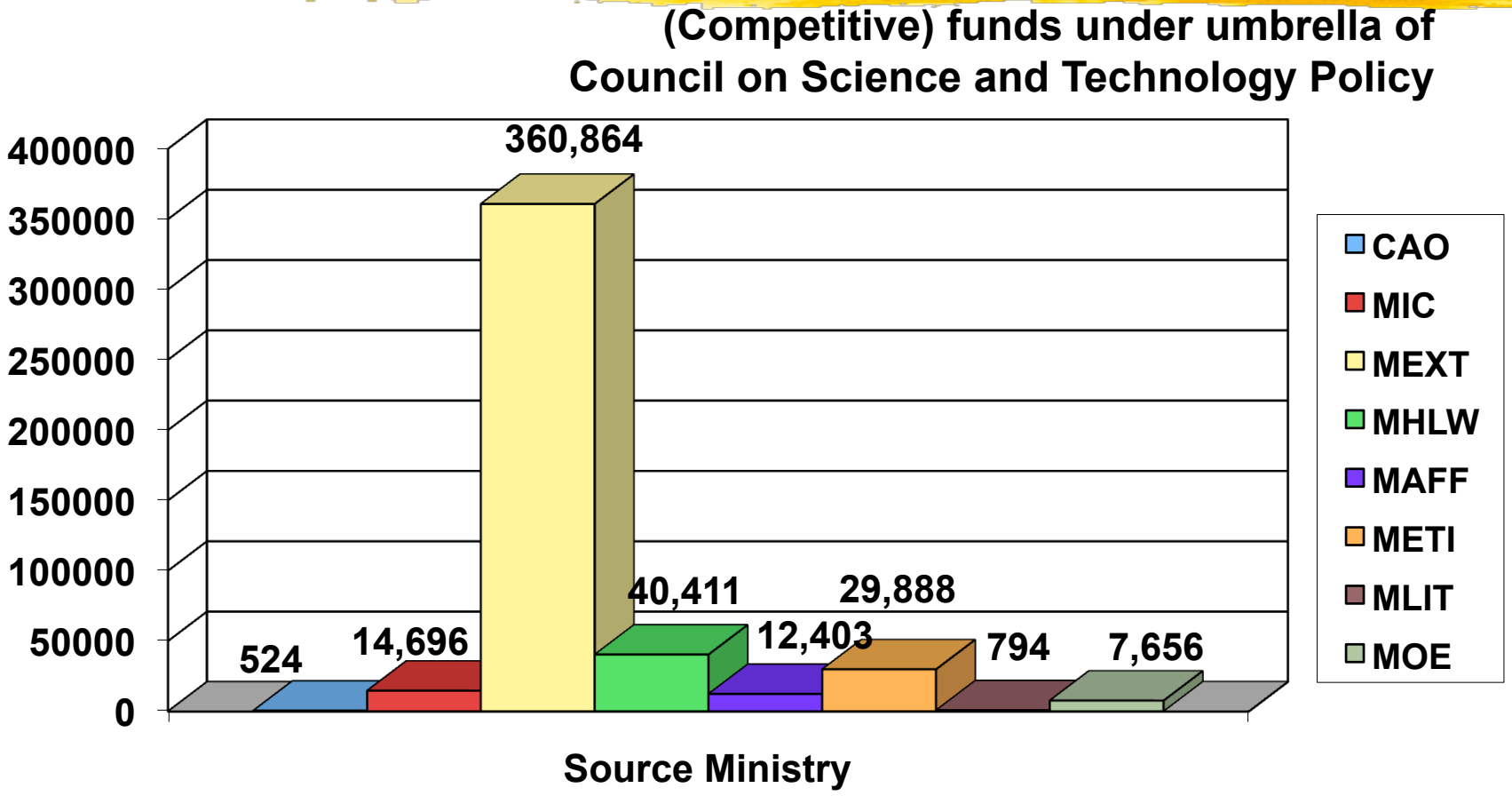
U.S. government agency R&D funding to U.S. universities (2007, est.)



Millions of $

NSF Science & Engineering Indicators, 2008

S&T funding for universities in Japan by ministry (JFY 2005)



Unit: million yen

Data from NSF/Tokyo 2006 (RM #06-03)

(Comparing previous slides)

- **US: Department of Education does not even appear in top six sources of government agency funds for university R&D**
  - **Neither does Department of Commerce**
- **Japan: Ministry of Education (MEXT) is by far the largest source of university R&D funds**
  - **And, funds on this slide do not include infrastructure facilities and operating budgets, which come from MEXT**
  - **METI now appears as third largest source of competitive S&T funds to universities**

  NOTE: S&T funding in Japan is coordinated by the umbrella "Council on Science and Technology Policy," but funds are actually appropriated to the individual agency/ministry budgets

Comparing the U.S. and Japan systems - Capital flow - 2

	U.S.	Japan
Flow of risk capital	Equity investments	Investments still tend to have characteristics of debt funding
	Leads to hands-on governance	Leads to "contingency" governance
	Great expectations of growth and exit	Tends to expect moderate but steady return -- dividends
	Exit is most often by M&A; exit puts people and capital back into system	Even after IPO, original founders retain majority of stock and management roles

Comparing the U.S. and Japan systems – Flow of people and ideas

	U.S.	Japan
Employment patterns	High mobility: many people willing to work in growth-phase start-ups	Lifetime employment tradition, attraction of prestige companies: difficult to get good workers into start-ups
Patterns of knowledge transfer	Highly developed licensing and also "spillover" relationships	New laws and patterns since 1998; still "bugs" in working out implementation
	Expectation of exit; exit puts knowledge and experience back into system	Creation of start-ups seems to lack expectation of exit; instead, leads to problem of leadership succession

Comparing U.S. and Japanese systems - 3

	U.S.	Japan
Infrastructure	Big companies strong at M&A to acquire knowledge, technology; open innovation	Highly developed company-internal knowledge transfer; tends to lead to keiretsu creation
	Both countries need innovation for high value-added business (that can sustain high costs of living)	
	Legal system well-established in general, consistent enforcement	

Recent trends and future outlook for Japanese innovation system

Recent innovation system developments –
1. Infrastructure

- Many new laws to encourage greater university-industry interaction (described more under People, Ideas, Capital)
- Fourth Basic Science and Technology Five-Year Plan (2011 – 15) focuses on societal challenges (demand side)
  - Sustainable energy
  - Medical issues of aging population
  - Global competitiveness
  - Reconstruction after March 2011 disaster
- Some important developments internal to industry sector
  - Increasing M&A activity (may encourage open innovation)
  - New industries include high-growth companies (e.g. social game platforms DeNA, GREE) that are aggressively seeking global markets through partnerships (and M&A)

Recent innovation system developments –
2. Flow of people

- Some general labor force changes (still at early-stage): fading away of lifetime employment, integration of new groups in R&D (women, immigrants)
- New laws and institutions (e.g. TLOs) encourage professors to consult, encourage entrepreneurs to create companies
- BUT:
  - Hiring by industry still centralized in Personnel Dept. and focused on general skills; labor force stays away from start-up companies
  - Students still under pressure from families to seek stable salaried jobs with prestige companies

Recent innovation system developments –
3. Flow of ideas

- Many new enabling tools: e.g. Technology Licensing Offices (university IP management offices), incubators
- BUT: Most of these new tools have not yet yielded major benefits
- Need:
  - More experience with tech transfer (not just the legal framework)
  - Better approaches for measuring productivity, impact
    - Not just (a) licensing revenue or (b) numbers of patents / start-up companies created
  - Clear definition of "idea" (not just "seeds")
    - Business idea = product or service + market target + revenue model
  - Clear expectation of "exit"

Recent innovation system developments –
4. Flow of capital

- Some important new government funding programs that aim at structural transformation: e.g. WPI (MEXT/JSPS)
- BUT:
  - Not yet much structural change in the way government money flows to university research
    - How "competitive" are competitive funds?
    - Most of professors' research budgets still not from competitive sources
  - Risk capital must demand greater growth
    - More hands-on governance
    - More focus on disruptive ideas
  - Big companies must learn new patterns of open innovation
    - Different from outsourcing
  - More exit by M&A, bigger IPOs

Other critical issues for improving the Japanese innovation system

- Big companies have become largely reactive (controlled by sales division knowledge and experience in current markets)
  - Must return to taking lead in delivering new product categories, not just incremental new products
- In order to solve above problem, industry must build up its capabilities for open innovation
  - Hear new voices from outside: younger researchers, universities, start-up companies
  - Build up capabilities for joint brainstorming, exploratory R&D with universities – U.S. university models fit U.S. labor market needs
- Government funding must not be "easy money," but it must provide a stable platform
- System elements exist, but need motivation to increase flow of people, ideas, capital

On the role of an “innovation hub”

- Critically important to innovation process
  - Place for human networking, idea exchange, introductions for capital flow
  - Incubation is a critical need for knowledge-intensive industries
- “Soft” infrastructure (mentoring, introductions, brainstorming) is as important as “hard” infrastructure (funding mechanisms, etc.)
- Implementation / execution is as important (or more so) as the organizational framework