Emerging Roles of Public and Private Agricultural Research in the United States

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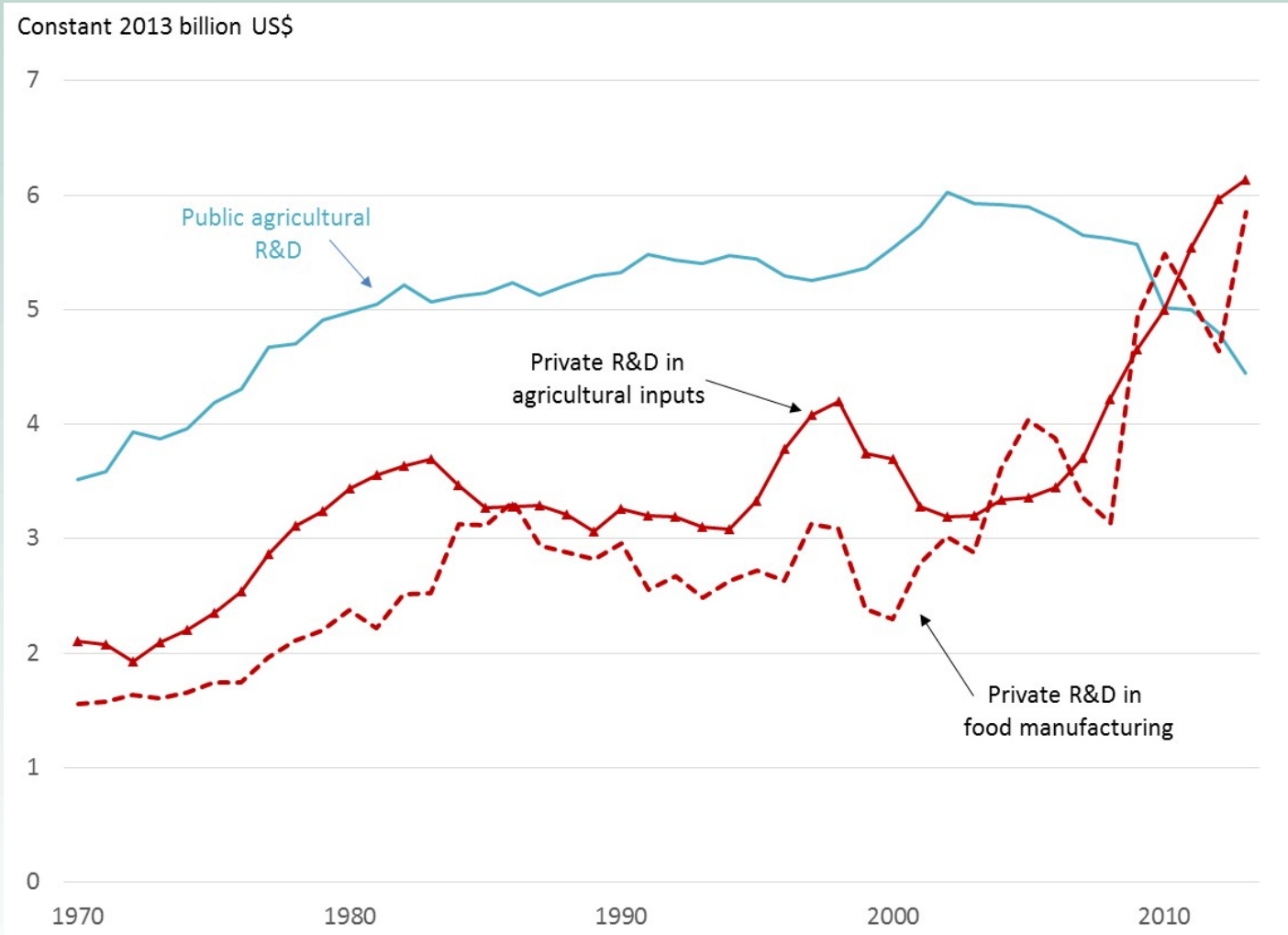
USDA
United States Department of Agriculture, Economic Research Service

Innovation in U.S. food and agriculture: Private R&D is rising while public is R&D falling



R&D spending adjusted for inflation by cost-of-research price index.

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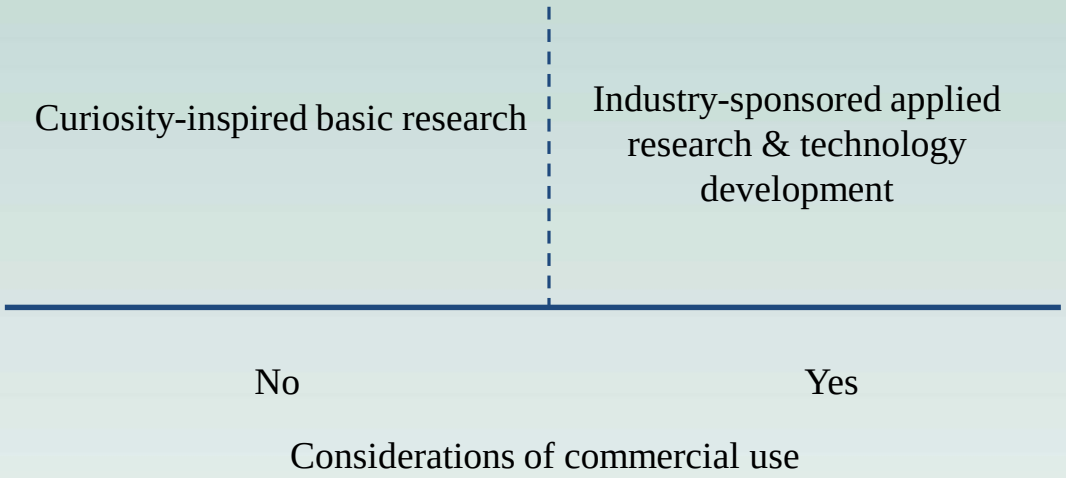
Clarifying the roles of public and private R&D

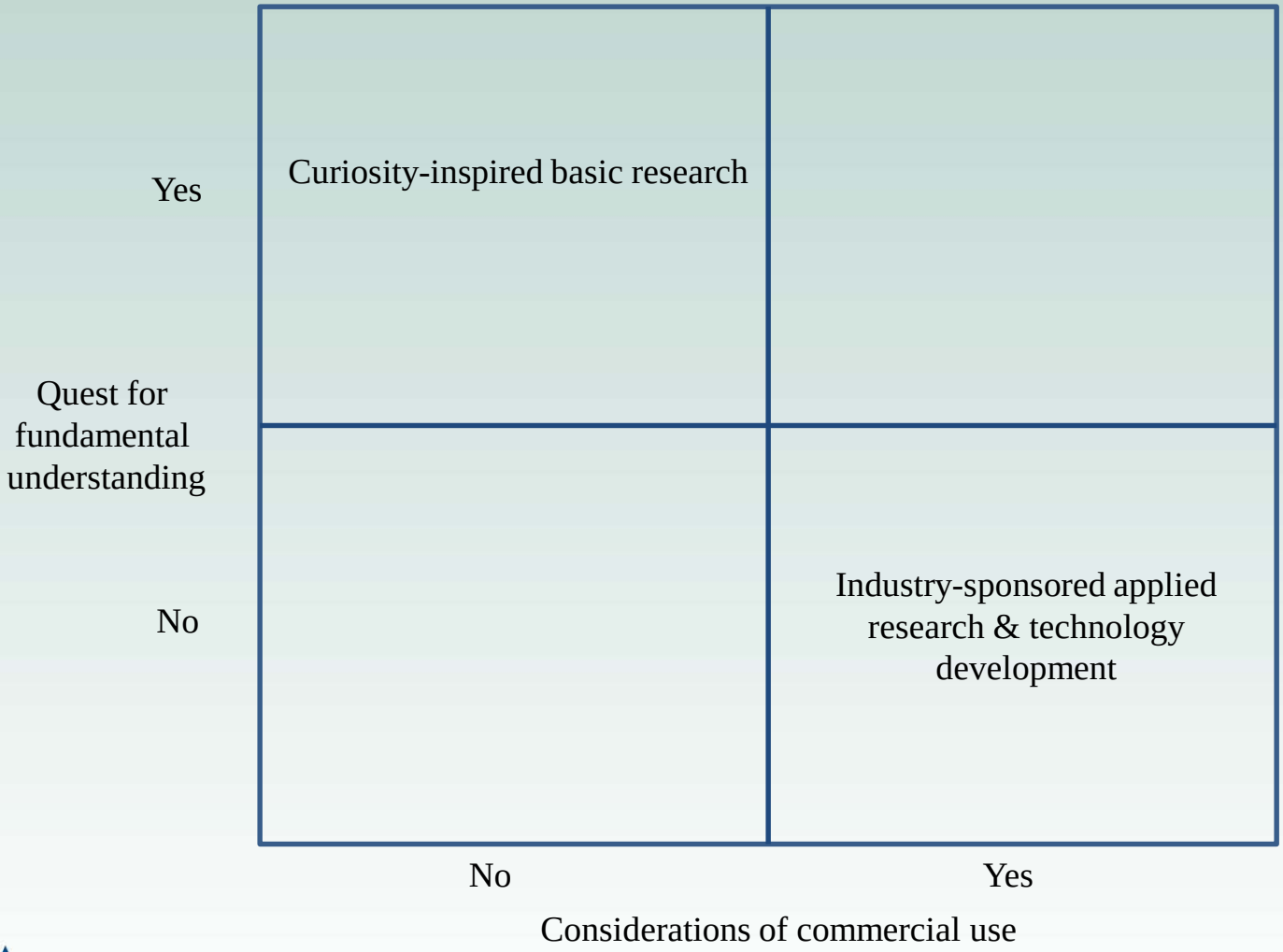
- Framework for distinguishing public and private roles in an R&D system
- Evidence on how this system works in agriculture
- Challenges facing this system and evaluating its performance

Traditional Framework for Public and Private R&D

Vannevar Bush (1945) *Science: The Endless Frontier*



Stokes (1997) *Pasteur's Quadrant: Basic Science and Technological Innovation*



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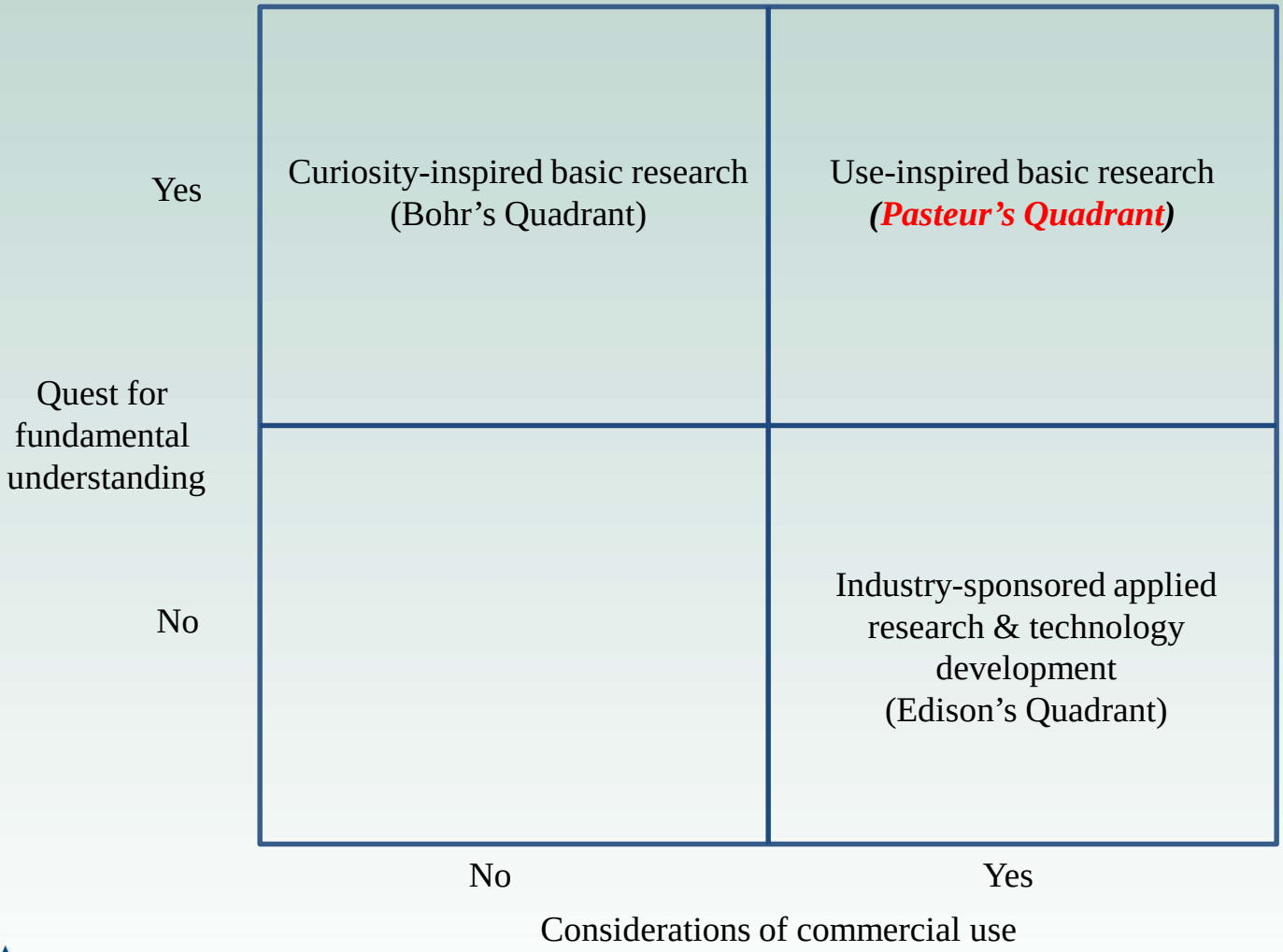
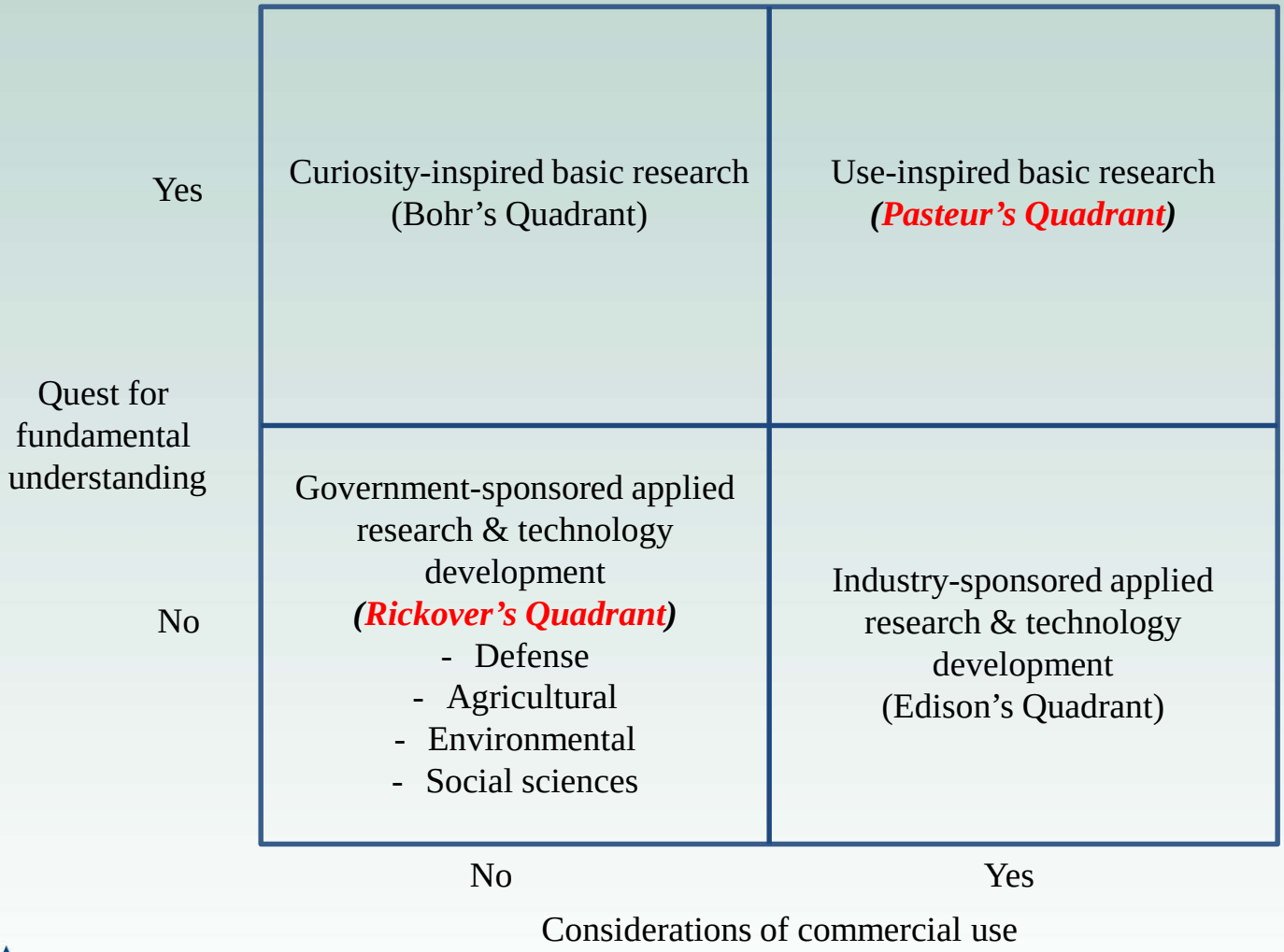


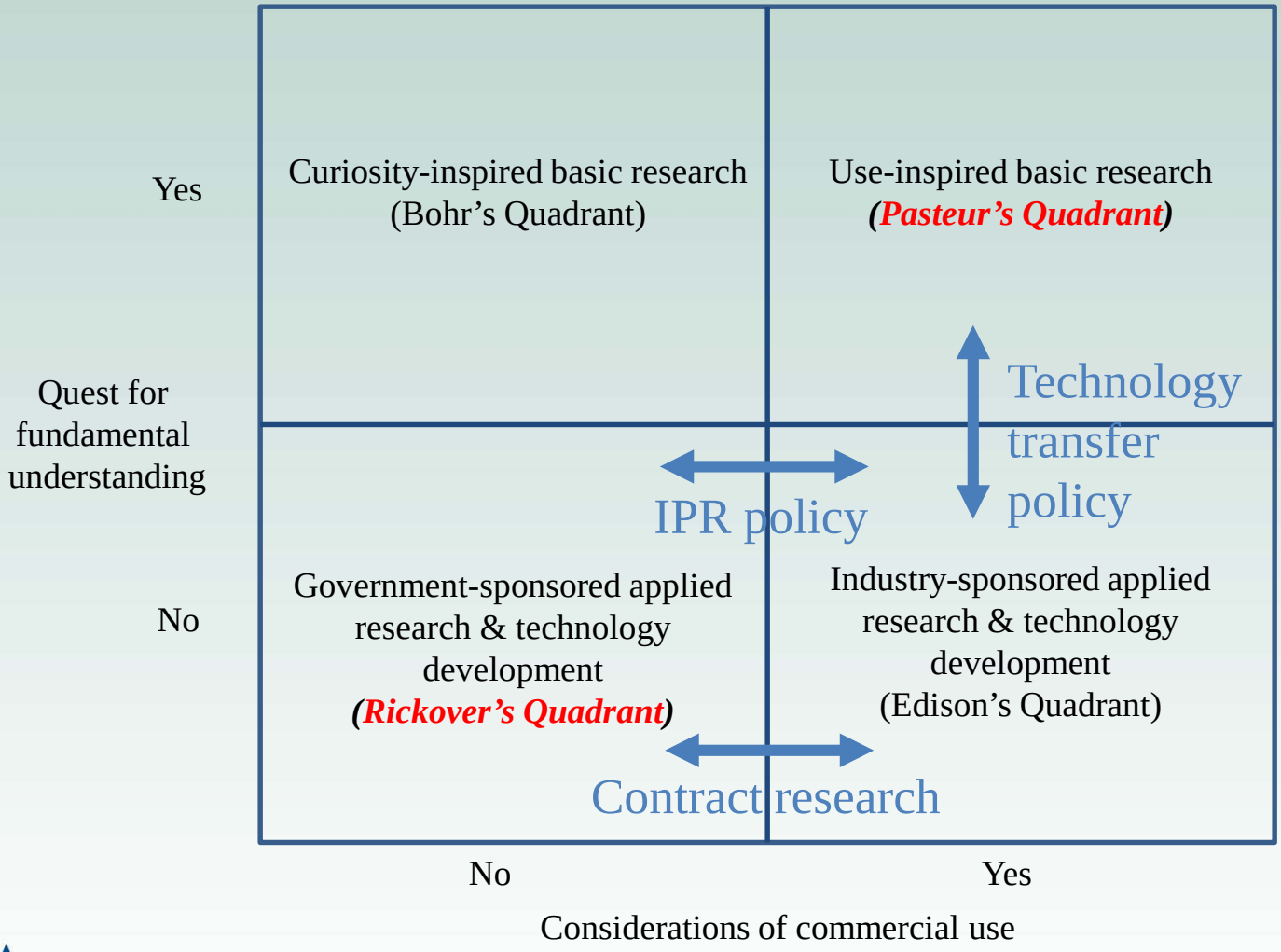
Ruttan (2001) *Technology, Growth and Development: An Induced Innovation Perspective*



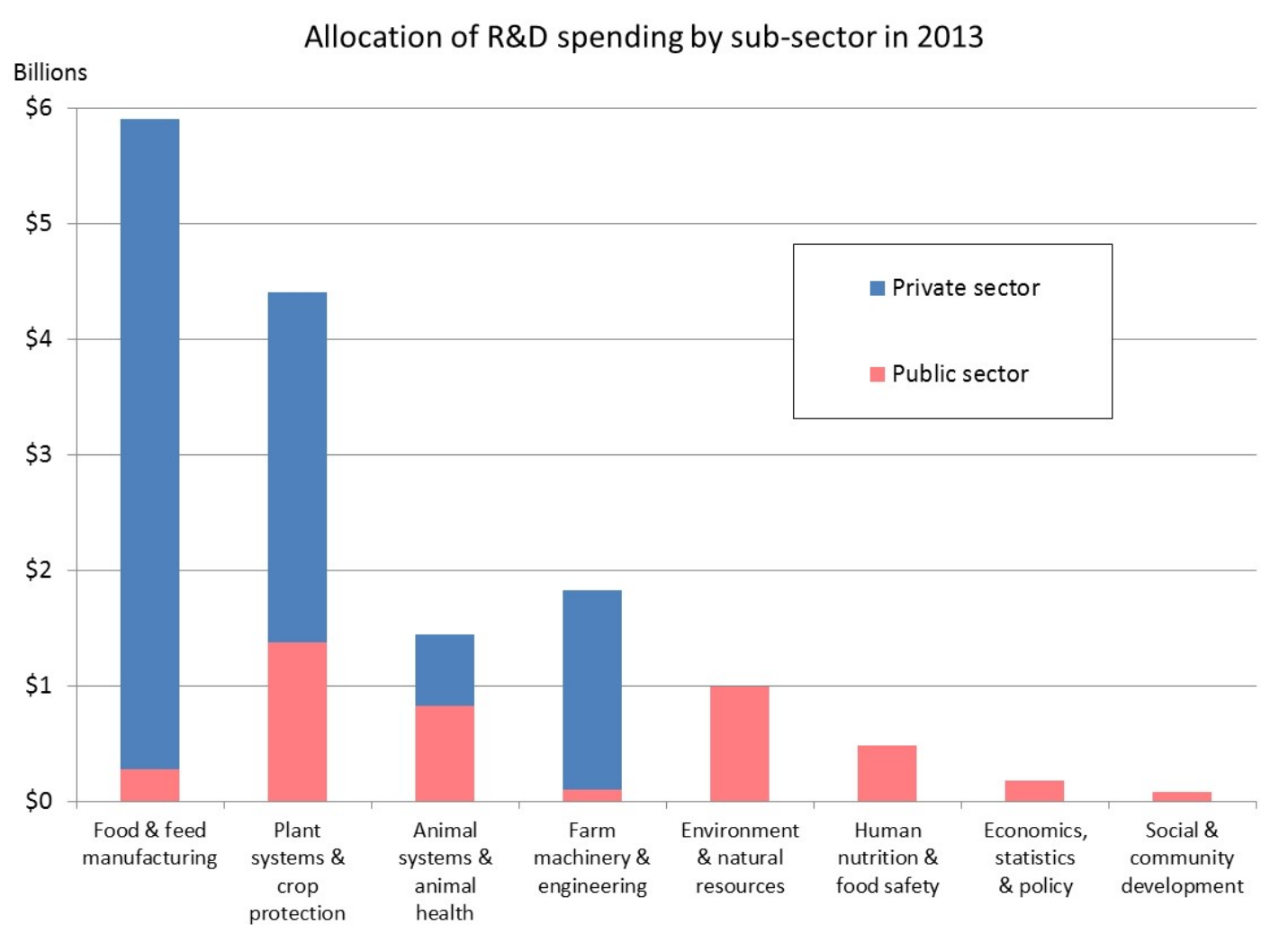
Where does science policies fit in?
USA Science & Technology Policies Initiatives

IPR for biological innovations	Technology transfer
Trade secrecy protection - Grew out of common law - Important for hybrid seed	Bayh-Dole Act (1980) - Encouraged public institutions to patent and license inventions
Plant Patent Act (1930) - Established patents for ornamentals	Small Business Innovation Devel. Act (1982) - Designated federal extramural R&D to Small Businesses Innovation Research (SBIR)
Plant Variety Protection Act (1970, 1994) - Established plant breeders' rights with saved seed & research exemptions	National Cooperative Research Act (1984) - Loosened antitrust rules to encourage research consortia
Diamond v. Chakrabarty (1980) - Supreme Court ruled that biotech inventions are patentable	Federal Technology Transfer Act (1986) - Established the public-private Cooperative Research & Development Agreement (CRADA)

Science policy within the Stokes-Ruttan Framework

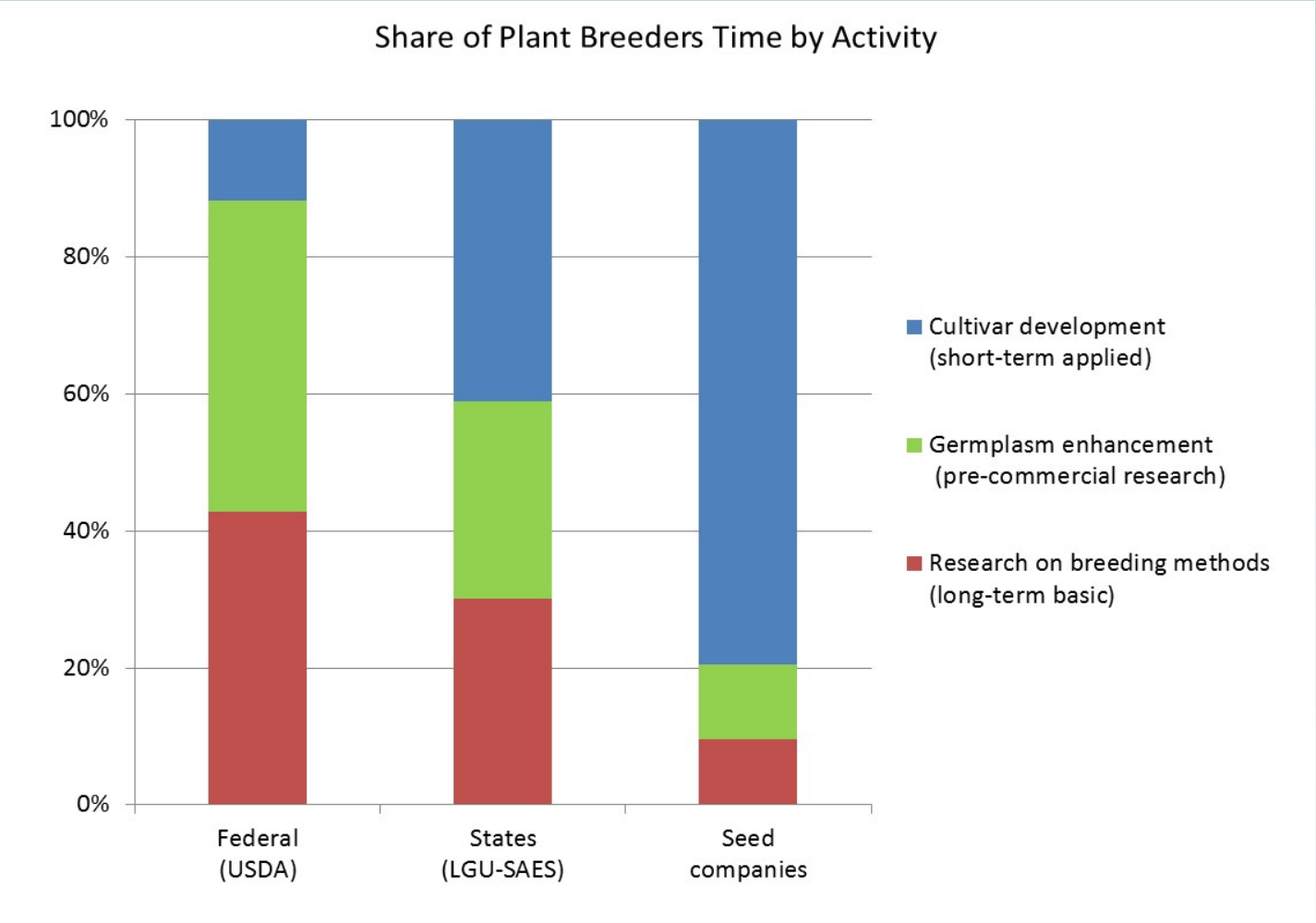


Public and private R&D have different roles in an innovation system



Source: ERS (2016)

Within sub-sectors, public and private R&D focus on different parts of the innovation process

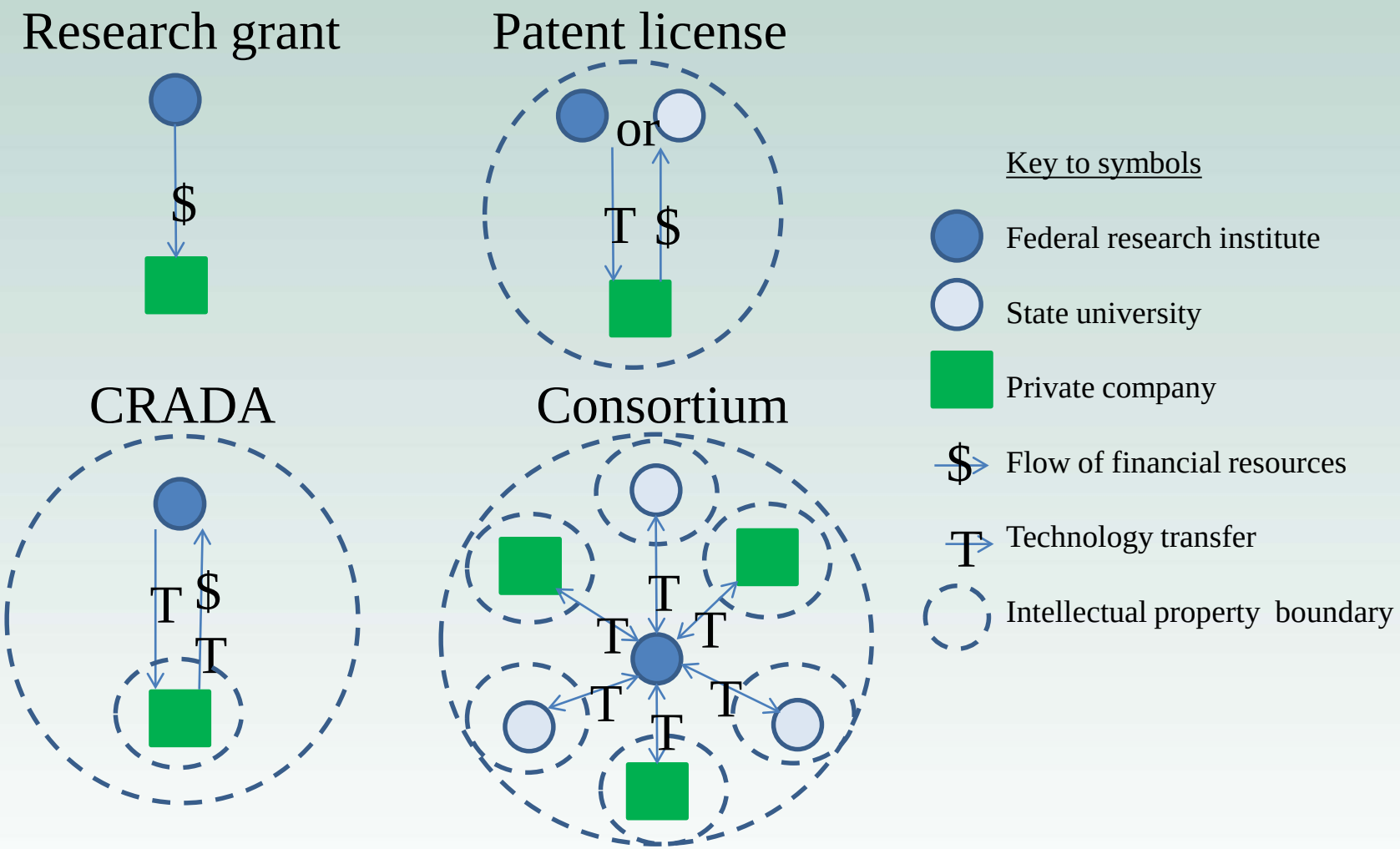


Source: Frey (2000)

Are public & private R&D complements or substitutes? Findings from empirical studies

- Studies may distinguish between “basic” and “applied” agricultural or life science R&D
- Most studies find public and private agricultural R&D to be complements
- Public “basic” R&D stimulates more private R&D
  - multiplier of 0.6 to 0.9 in case of agriculture R&D

Models of technology transfer



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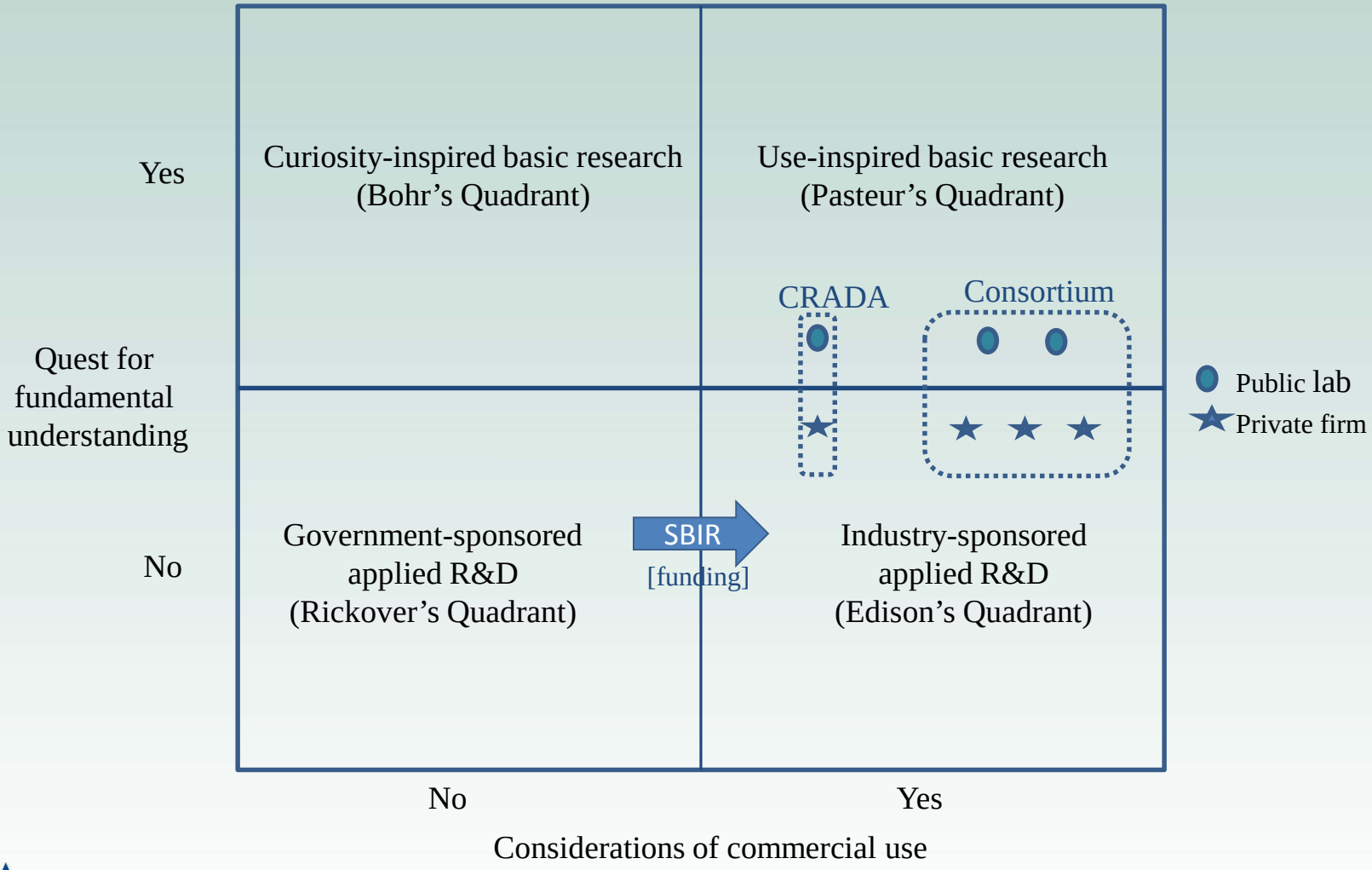
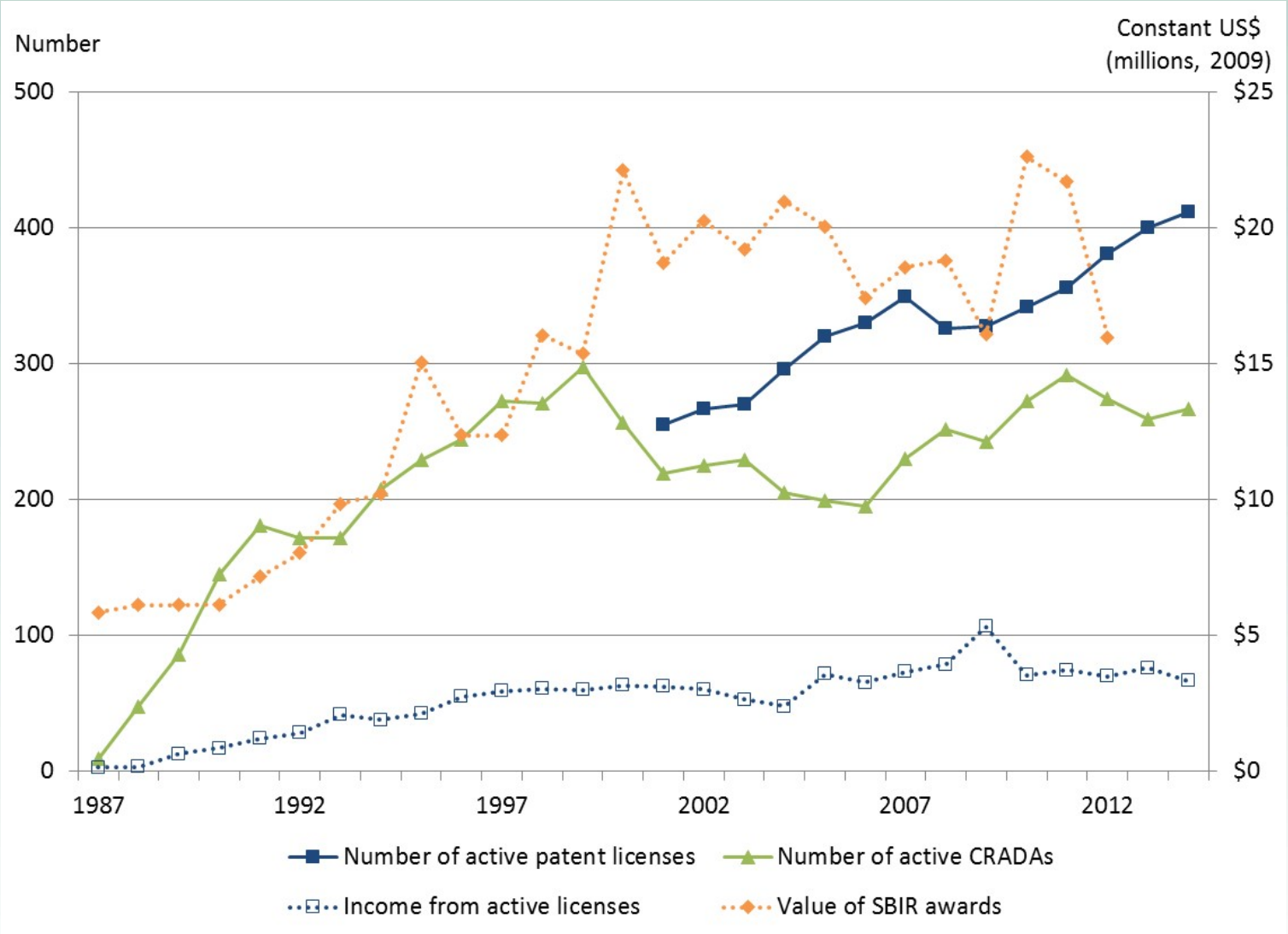
Technology Transfer Within Stokes-Ruttan Framework



USDA Technology Transfer Activity Since 1987



Impact of new technology transfer mechanisms? -empirical evidence is thin

- Private “capture” of public goods?
  - Taxol (anticancer drug)
- Public “capture” of private goods?
  - Public R&D may duplicate industry research to capture patent royalties
- Does public-private R&D collaboration increase rate of productivity growth?
  - Little direct evidence, but collaboration does appear to raise *research* productivity (number of publications)
- Few examples of successful research consortia

Concluding comments

- Growth of private agricultural R&D
  - challenges some areas where public R&D has led
  - Increases potential for public-private collaboration
- Need new models for clarifying public and private roles in R&D
  - e.g. Stokes-Ruttan framework, but boundaries between quadrants are fuzzy
- Need new approaches for evaluating impact of public R&D and science policies on private R&D behavior
  - difficult because information is often proprietary