Encouraging Innovation and Entrepreneurship through University - Industry - Government Collaboration

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Outline

- Traditional functions and interactions between university, industry, and government
- The need for better innovation systems and entrepreneurship requires new university-industry collaboration
- Implementing new patterns of collaboration
- Opportunities and challenges for Japan

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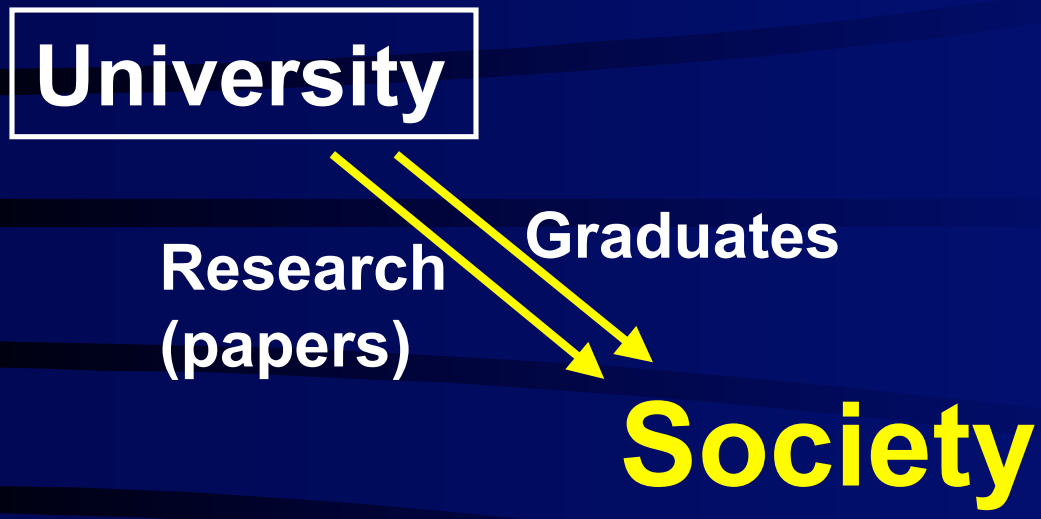
Traditional functions of university, industry, and government: how each sector benefits society



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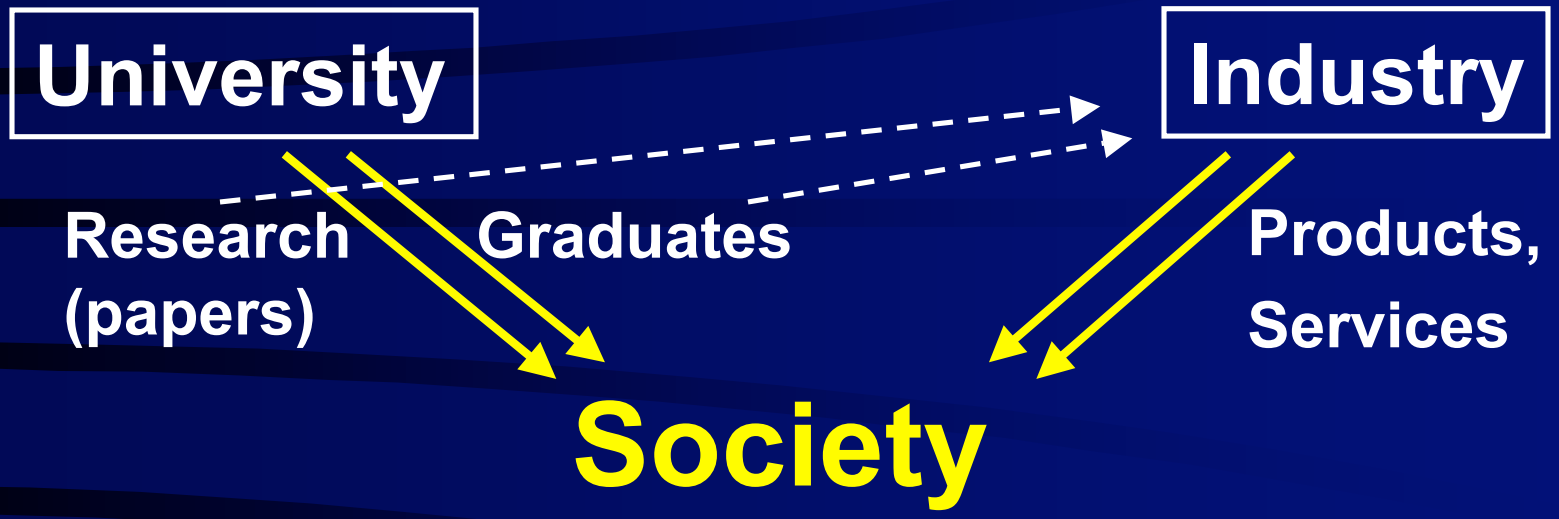

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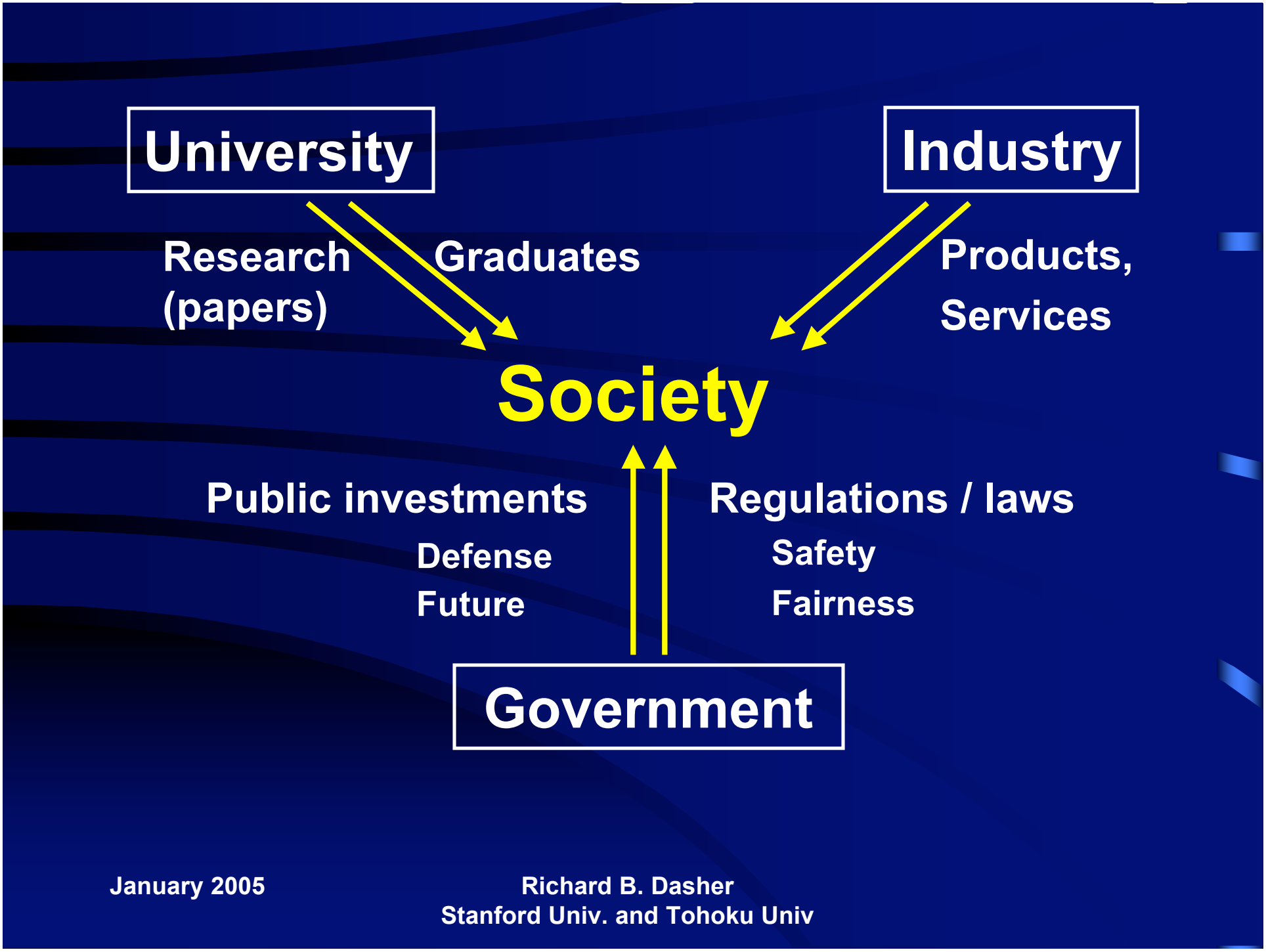

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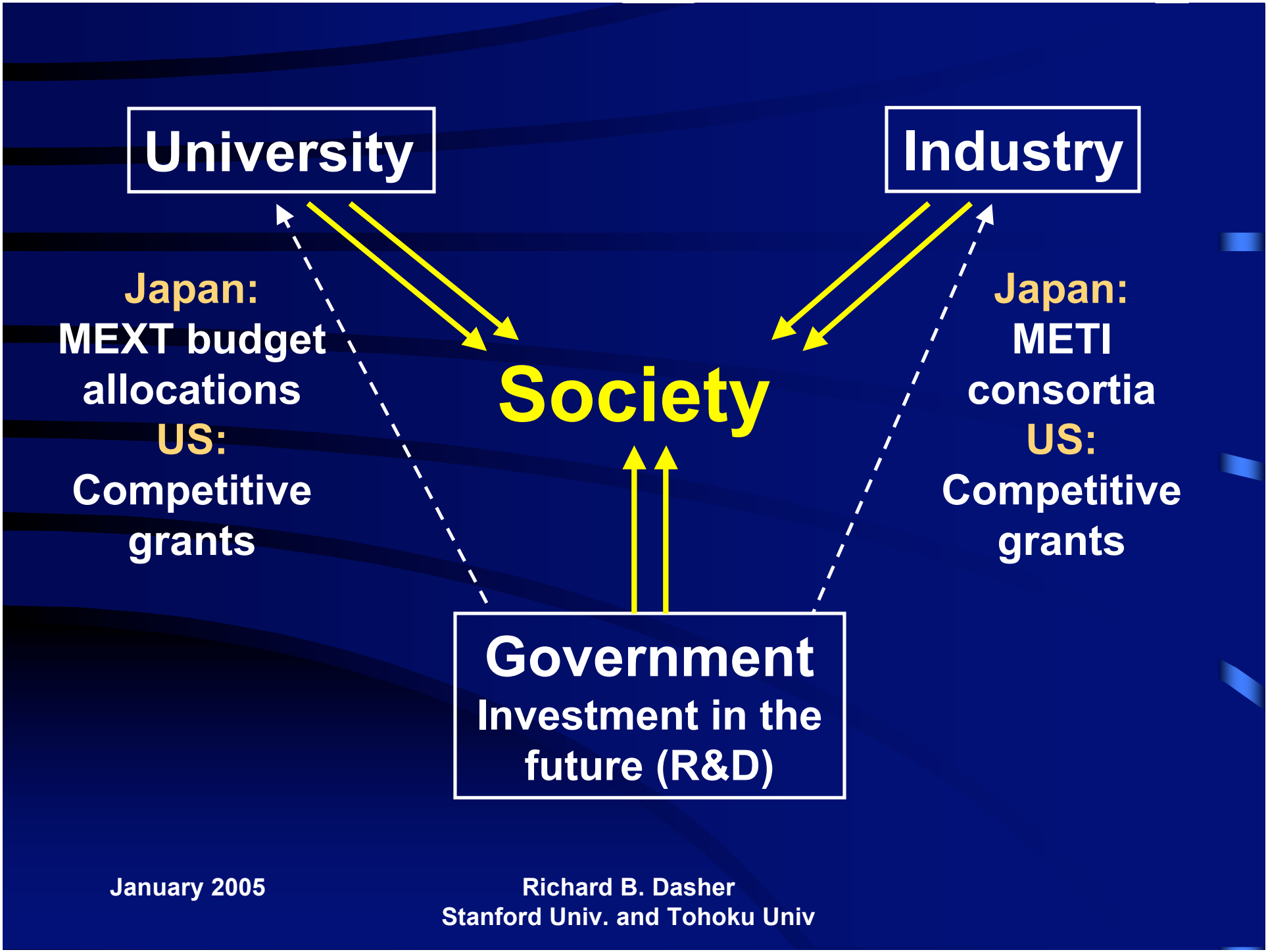

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Main points so far: Traditional functions and interactions

- University, industry, and government activities have been mostly independent of each other
  - But communications through hiring and research funding relationships, individual professional contacts
- Knowledge transfer between sectors is typically one-way and not real-time
  - Students graduate and then go to work in companies
  - Government issues request for proposals (RFP), universities and industry compete for funds, do research, send reports back to government

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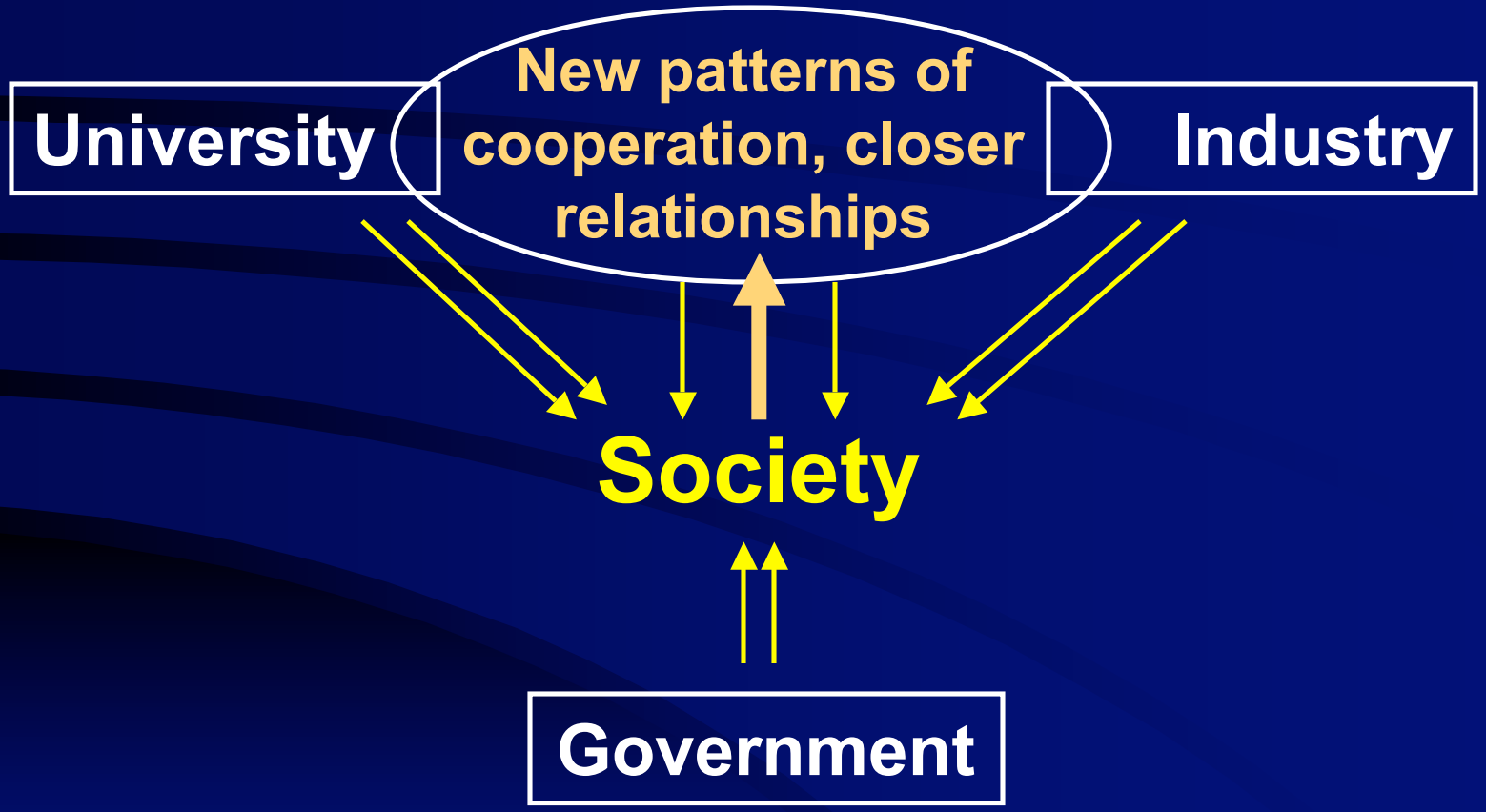
New needs of society require closer university-industry relationships



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(Explanation of previous slide) Demands for new collaboration

- All sectors are expected to continue their traditional functions (benefits to society)
- Society has new needs that require greater cooperation between university and industry
  - We will discuss these needs in the next section
  - The new relationships focus on substantive, real-time, two-way cooperation
- Government acts as catalyst for all sectors to meet the new needs of society
  - Through regulation and investment

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The demands for greater university-industry collaboration are driven by a need for

Better early-stage innovation

Innovation

- The process leading from discovery (invention) of a new idea or technology to its practical implementation (often via commercialization)
  - Early stage (basic research): typically without a practical implementation (product) in mind
  - Late stage (development): driven by technology and cost demands of a real-world application
- Usually, different people are involved at the different stages

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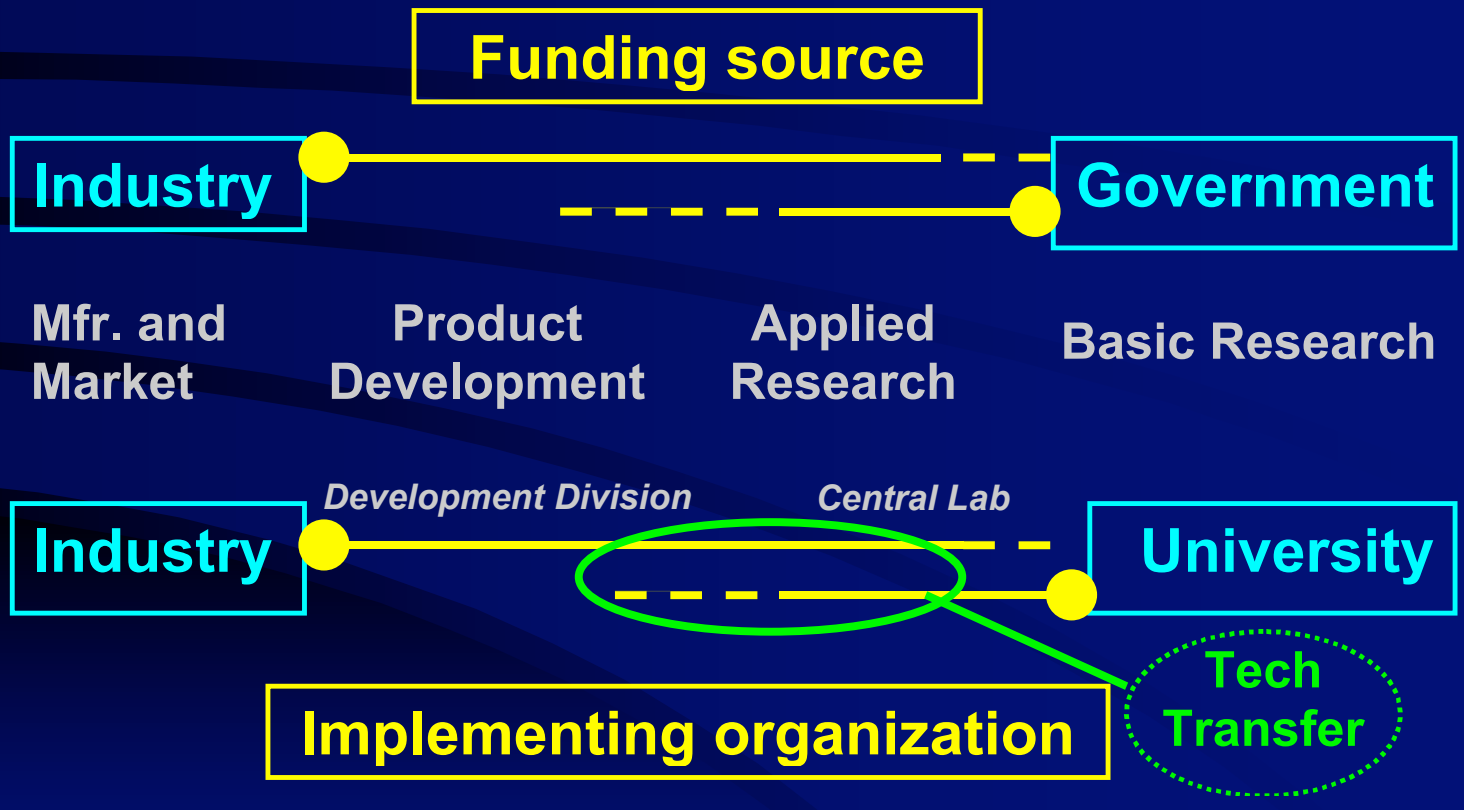
University, industry, government roles in an innovation system



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(Explanation of previous slide)

- Natural division of labor
  - Basic research: government funds, university conducts
  - Product development: industry funds, industry conducts
- Transition at "Applied Research"
  - Both industry and government fund applied research
  - Both industry and university conduct applied research
- Technology (knowledge) transfer
  - Internal to industry: central lab to product division
  - From university to industry

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Why are there new demands for better innovation systems?

- Innovation is critically important for any advanced economy
- Now: an era of rapid, revolutionary technology progress and sudden new markets
- Industry faces ever more severe economic conditions
  - New worldwide competition, more knowledgeable customers require efficiency, sophisticated planning
  - High land and labor prices in comparison with Asian countries

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Demands for new innovation systems in Japan: Economic restructuring

- Shift from production-based to knowledge-based competitiveness
- Ending protection of inefficient industries
- Shift away from lifetime employment
- Rising government deficits
- Population getting older

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New demands: shift of focus to earlier stages of innovation

- Japan has already led the world in best practices of late-stage innovation (product development and commercialization)
- The transition from basic research to applied research is at the heart of competitiveness for advanced economies
  - Earlier identification of (high value-added) new market opportunities
  - Better allocation of limited research funds to multiple possible directions of technology development (especially about five years from commercialization)

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Entrepreneurs: very important for early-stage innovation

(Christensen 1997)

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Start-up companies in university-industry collaboration

- Start-up companies are often important licensees for university technologies
  - See early market opportunities better than do big companies
  - Buy-back of rights by university inventors
- Start-up companies may bring university and industry together as investors
- Start-up companies may pay to use university lab facilities (for prototype development)
- But, typically only big companies can sponsor university research

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Implementing new patterns of university-industry collaboration

Patterns of university-industry technology transfer (U.S.)

- Linear hand-off (traditional path)
  - Students graduate and transfer knowledge to companies
  - Public domain academic papers transfer knowledge from university researchers to industry R&D community
- Spillover (since 1980's)
  - Real-time knowledge-sharing between university and industry
  - Channels: visitors, joint R&D projects, open university labs…
- Technology marketplace (growing since 1990's)
  - Technology licensing, start-up company creation

Rosenberg and Nelson (1996)

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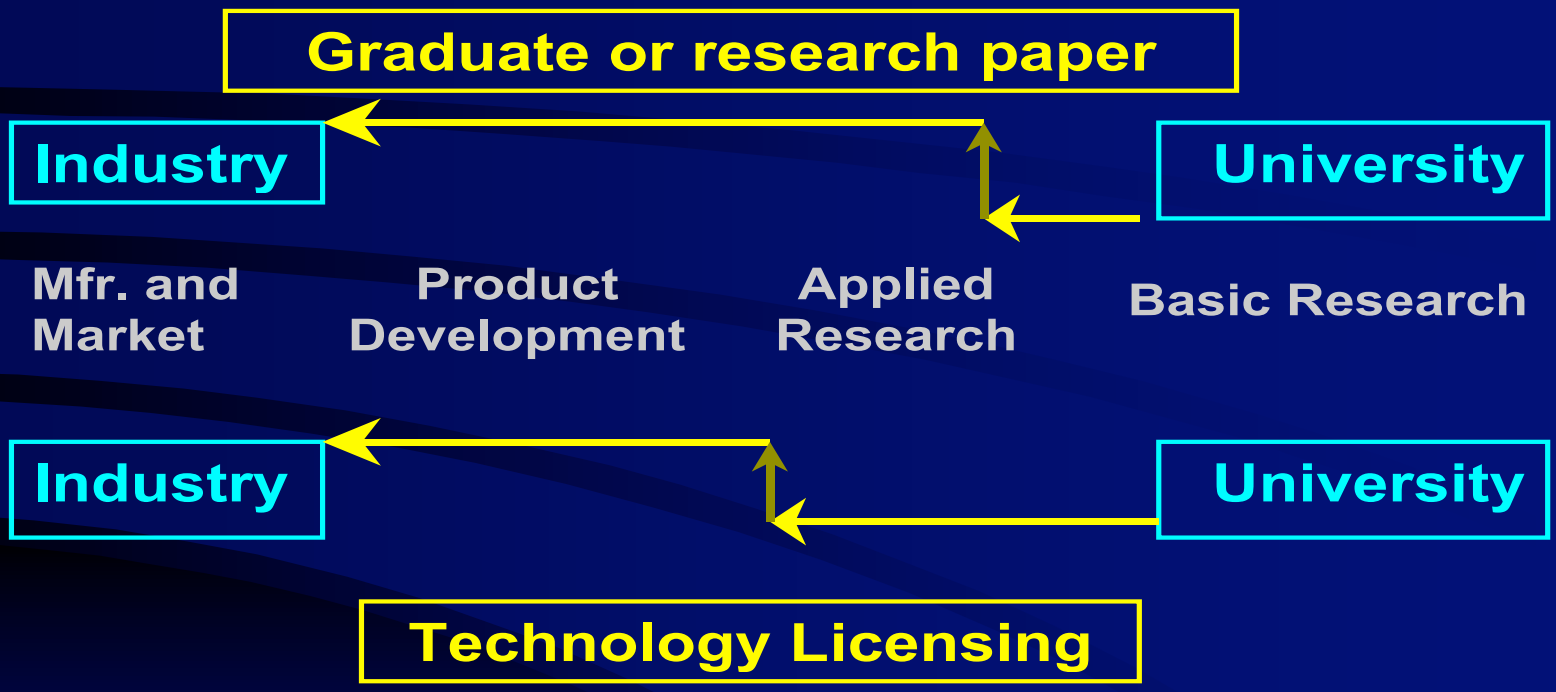
Technology licensing is a type of linear hand-off (at a later stage)



Transfer is relatively instant, one-way

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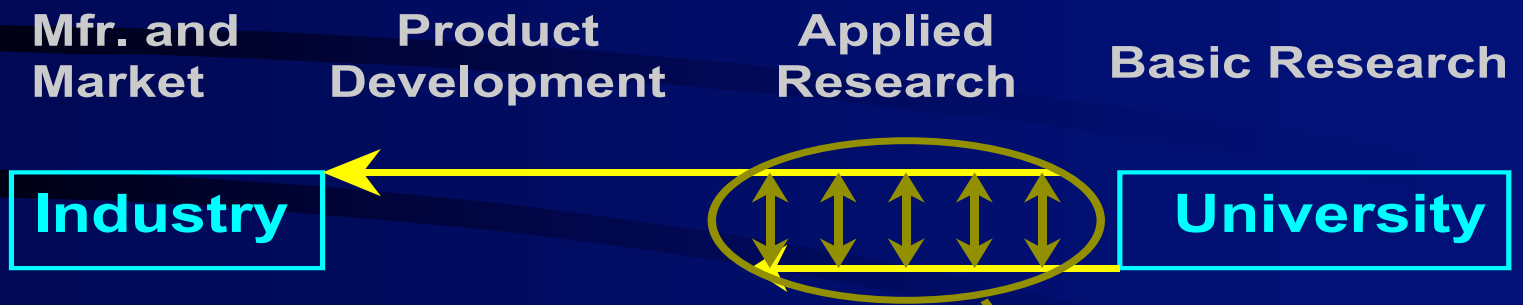
Technology spillover is different



Technology Spillover

Real-time, two –way knowledge exchange
Industry visitors, student internships at company labs, joint-research projects, professors as consultants, etc.

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Technology spillover is important to meet new innovation demands

- Real-time, two way knowledge exchange
- Spillover relationships focus on the transition between basic and applied research
  - Exploratory research about 5 - 10 years in the future
  - At later stages, spillover does not work well:
    - Corporate concerns for IP rights, secrecy
    - University concerns about academic freedom, open publication
    - Ph.D. project timelines not suitable for project development deadlines

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Case Study: External funding in Stanford's School of Engineering

2002-03 Sources of Funds

$161.8 M (of which, about $93.1 M was used for research)

- University funds 22.0%
- Endowment income 12.0%
- Sponsored projects 42.0%
  - About 3/4 sponsored by U.S. government
- Other (gifts, affiliate fees, licensing, etc.) 24.0%

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Stanford Engineering funding shows that industry pays mostly for spillover

- Very little contracted research (sponsored projects) from companies
  - Less than 10% of all sponsored projects (~ 4% of total budget)
- Similarly, licensing revenues are small percentage of budget
  - In 2002-03, about $900,000 to School of Engineering and the engineering departments: about 1% of all research
  - Most royalties are received only after commercialization, or typically 5 - 10 years after the research is over

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What industry pays for at Stanford Engineering

- Industry affiliate program fees: ~ $20 - 25M / year
- Expendable gifts by companies for "unrestricted" support of research by individual professors: typically $11 - 15M each year
- Benefits to companies
  - Preferential (but not exclusive) access to professors, students, IP
  - Visiting researchers from industry in the university
  - Influence in directions of exploratory research
- User fees by company researchers in open university labs: ~ $ 2M / year

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Entrepreneurship at Stanford University

- Driven by individual goals, not the university
  - (Graduate) students even more than professors
- The university concentrates on teaching best practices in new company creation and growth
  - Stanford people provide rich access to possible investors, managers, and experts in Silicon Valley
  - Limited funding by venture funds under Stanford control
  - No incubator at Stanford (plenty in Silicon Valley)
- Stanford also pays close attention to conflict-of-interest policies

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Opportunities and challenges for Japan in implementing new patterns of university-industry collaboration

University-industry cooperation in Japan will change, because of…

- Competitive pressures on companies
  - Reduce cost overhead
  - Less in-house basic research
  - More M&A of start-up companies
- Gradual disappearance of lifetime employment
  - Companies will spend less on employee training
- Changes in government funding patterns
  - Reductions of allocated budgets: unavoidable
  - Greater emphasis on competitive grants

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Best opportunities - (1): Joint research

- Technologies just ahead of what industry can do in-house: 5 - 10 years in the future
- Sufficiently exploratory frameworks to allow professors to try out new things
  - Fuzzy partnerships are better than complete control by either side
  - Flexible goals (not fixed deliverables)
- True "joint research" is rare:
  - Companies must keep their best people in-house most of the time

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Best opportunities - (2): Joint research pricing

- Joint research should be less costly to the company than doing it in-house
  - Industry affiliate programs: pool funds from multiple member companies
  - Even in the U.S., full recovery of indirect costs is difficult in company contracts
- Cost effectiveness best if research support improves access to other research at university as well
  - From government grants, etc.
- But, university must not lose money by accepting an external project

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Best opportunities - (3): Licensing

- Great improvement in recent years (Japan): clarity of IP rights ownership
- TLO must work closely with faculty, so that they see TLO as helping their research programs
  - They may have best contacts in companies
- Send information about IP to strategic R&D executives, not just company licensing offices
- Best business model: friendly negotiation of lower fees to supporters of research programs

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Challenges - (1): University spin-off ventures

- Require expert input from business world
  - Examples: company valuation, refinements of business plan, access to employees outside university
  - University should not become an amateur general partner (investor) or manager
- Most difficult aspect in Japan: getting first customers
  - "Technology evaluation hell"
  - Will the university buy the product?
- Will improve as more success stories appear

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Challenges - (2): Conflict-of-interest and secrecy policies

- Japan is now more relaxed than most U.S. universities
- Protecting rights of professors and students
  - If company demands secrecy or exclusive IP rights, the project is probably not right for a university
  - Universities should prevent any actions that slow down the progress of students toward their degrees
- Preserving the core mission of the university: research should not be aimed at commercial gain, but rather the progress of knowledge
  - But, seize commercial opportunities that may appear

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Challenges - (3): Realistic expectations

- University-industry relations are naturally closest in engineering, medicine
  - Universities need to include many other fields, as well
  - Creativity often involves ideas jumping from field to field
  - Other external sources of funding are more important in humanities, basic sciences (government, private foundations)
- Closer university-industry relations will not solve all of the problems with Japan's innovation system
  - Standard of living requires a much larger shift to knowledge-based economy

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Summary

- Society has new needs that require real-time, two-way university-industry cooperation
  - In order to improve early-stage innovation system
- New patterns of university-industry collaboration:
  - Must build on the natural strengths of each party
  - Be priced right
- University-industry relations are only part of the solution to early-stage innovation
- University-industry relations involve much more than just a funding relationship

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