

Measuring Innovation Investment in the Service Sector and Policy Implications

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Technology and Innovation Policy in the U.S.

President Clinton was one of the first to articulate an innovation and technology policy in the U.S.:

“The goal of technology policy is not to substitute the government’s judgment for that of private industry in deciding which potential ‘winners’ to back. Rather, the point is to correct market failures.” (1994 Economic Report of the President)

Overview of Presentation

- Technology and innovation policy in the U.S.
- Defining innovation and R&D
- Measurement issues
- US R&E tax credit
- Summary remarks

Technology and Innovation Policy in the U.S. (cont.)

Market failure, in particular technological or innovation market failure, results from conditions that prevent organizations from fully realizing or appropriating the benefits created by their investments.

R&D and innovation policy in the U.S. has historically leveraged three major categories of policy instruments:

- Market structure policies (such as patents) that affect firms' abilities to appropriate returns
- Government support for basic R&D and infratechnologies that increase the efficiency of private-sector R&D
- Direct funding to firms to lower the cost of private cost of R&D in the form of grants, R&D tax credits, or other incentives

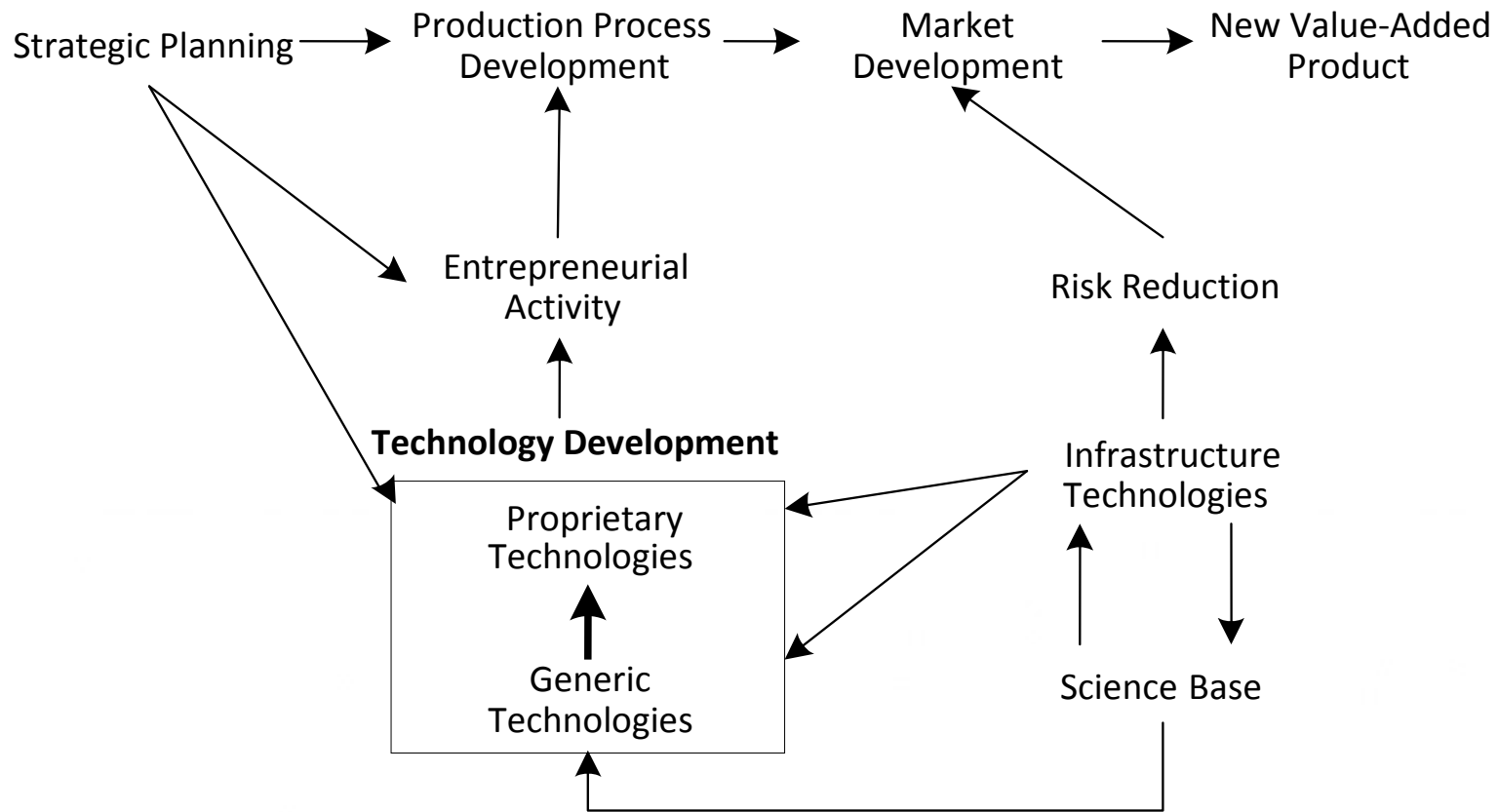
Technology and Innovation Policy Related to the Service Sector

I will focus on two issues that are of particular relevance for service-sector innovation policy:

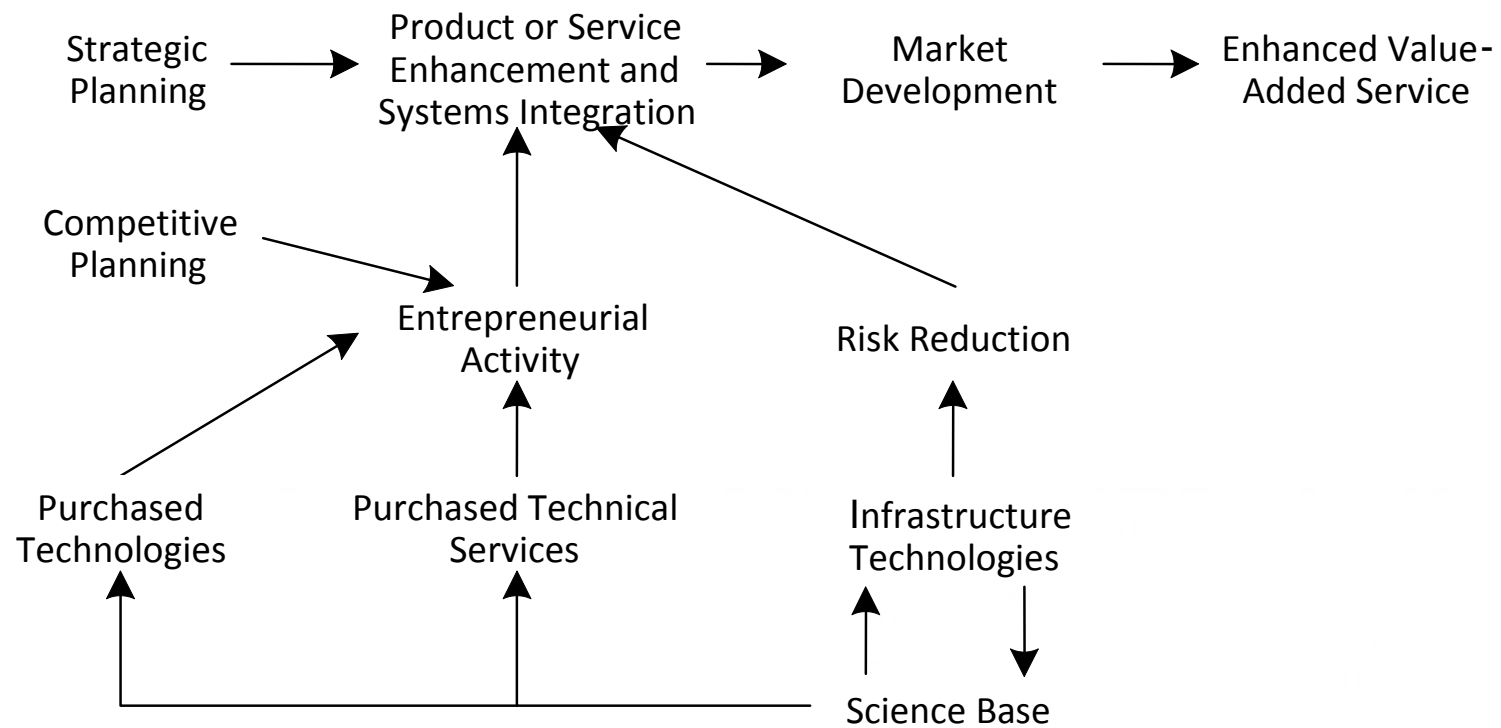
- Defining and measuring R&D and innovation in the service sector
- The U.S. R&E tax credit and its effectiveness for the service sector

Begin by comparing basic models of innovation in the manufacturing and service sectors

Model of Innovation Relevant to the Manufacturing Sector



Model of Innovation Relevant to the Service Sector



Manufacturing and Service Sectors — Blurring the Distinction

- The largest contribution to growth in the service sector is from a small subset of all services known as knowledge-intensive business services (KIBSs) (e.g., telecommunications, information technology, networking, and organizational consultancy).
- Over time the once sizeable distinction between manufacturing industries and service-producing industries is narrowing.
- This broadening of scope is referred to as servicisation, or the trend in manufacturing to encapsulate the physical product in a shell of services (i.e., finance, monitoring, maintenance, and repurchase).
- However, a growing number of authors point to such firms as IBM and/or Siemens (both large mass-production service firms) as examples of traditional manufacturers who now have a dominant share of their business activities associated with the sale of services.

Innovation and R&D—What Is Included and What Is Not

- The term “innovation” has frequently been used to encompass a wide range of processes that include both R&D- and non-R&D-related activities.
- In a broad sense, innovation may be new products, new processes, or new organizational methods that are novel and add value to economic activity.
- Historically, innovation and technology policy has focused on R&D or, more specifically in the U.S., on R&E (experimentation).
- R&D is distinguished from the broader category of innovative activities in that R&D is defined to include activities that systematically use research findings and expand the frontier of knowledge.
- Based on this definition, many activities frequently included as innovation are excluded from R&D, such as market research and technology adoption/or imitation.

How R&D Is Defined in Important in Existing Policy (from US Industrial R&D Survey)

<i>The following are included in the definition of R&D</i>	<i>The following are NOT included in the definition of R&D</i>
<p><i>Basic research:</i> Pursue new knowledge whether or not the search has reference to a specific application. Limited to federal, university, and nonprofit organizations.</p>	<p>Test and evaluation once a prototype becomes a production model.</p>
<p><i>Applied research:</i> Apply existing knowledge to problems involved in creating a new product or process.</p>	<p>Routine product testing or troubleshooting for breakdowns in production.</p>
<p><i>Development:</i> Apply existing knowledge to problems involved in improving an existing product or process.</p>	<p>Consumer, market, and opinion R&D; advertising new products or processes.</p>
	<p>Management and organization R&D.</p>
	<p>Social sciences, etc.: any research in the social sciences, arts, or humanities.</p>

R&D versus Innovation—Gray Areas

- Customization is a gray area for distinguishing between R&D and non-R&D innovation activities.
 - Service-producing industries commonly take products developed in the manufacturing sector and add value to them by assembling customized systems or networks.
 - Frequently, a system is specifically tailored to an individual client and its assembly represents a unique product.
- Acquisition and integration of technology may also be an important component of innovation that is frequently not included as R&D.
 - These activities are of particular importance to service-sector firms because much of the R&D associated with services is embodied in products acquired from outside of the service sector.
 - The issue becomes what share of acquisition and integration activities is R&D and what share is simply technology adoption or imitation that is not classified as R&D.
- Business interactions and joint product development between the service-producing industries and manufacturing industries represent an increasing trend in product and service innovation.
 - For example, American Airlines (AA) played a significant role in developing the design specifications for Boeing's 777 series.
 - However, much of AA's activities were likely conducted by staff in market research divisions, and it is unclear what share of this work was or should have been counted as R&D expenditures.

Difficult to Measure R&D in the Service Sector

- Activities that are of an R&D nature are often decentralized through different business units of a firm, making them difficult to measure.
- Often these activities occur in very small groups that reasonable cannot segment their time between traditionally defined R&D and other technical areas.
- Product/service development process in the service sector does not fit well with fundamental manufacturing concepts of engineering design, prototype testing, and manufacturing process design leading to mass production.

Inconsistent Reporting— Systems Integration R&D

Company	Systems Integration Revenues (\$ millions)	Percentage Systems Integration R&D
Services-Only Firms		
Accenture Consulting	8,307	0
American Management Systems	1,058	77
Computer Sciences Corporation	7,660	0
Electronic Data Services	16,891	0
Keane	1,076	3.5
Diversified Firms		
IBM	28,916	25
Hewlett Packard	6,956	50
Lockheed Martin	5,212	36

Source: Computer Science and Technology Board, 2000

U.S. Redesign of R&D and Innovation Survey

- National Academies report *Measuring Research and Development Expenditures in the U.S. Economy* was published in 2005.
- Recommended redesign the U.S. Survey of Industrial Research and Development to benchmark it against best practices in other countries (Frascati Manual).
- Innovation measures covering activities were to be included (patterned after the European Community Innovation Survey):
 - The introduction of new products to the market
 - The development of new processes to produce, or deliver of new products for the market
 - The development of new markets
 - The finding of new sources of supply or raw materials
 - Changes in the organization of the firms (CMSTAT, 2005; 91)

New U.S. Business R&D and Innovation Survey

- U.S. National Science Foundation (NSF) and U.S. Census Bureau have developed the new Business R&D and Innovation Survey (BRDIS).
- BRDIS expands the range of data collection topic areas to include
 - Measures related to R&D management strategy
 - Share of R&D devoted to social science, new business areas
 - Measures related to intellectual property, technology transfer, and innovation

Research and Experimentation (R&E) Tax Credit in U.S.

U.S uses an incremental tax credit of 20% (as opposed to flat credit used in countries such as Japan and Canada).

Designed to stimulate **significant** advances in technology, as opposed to **incremental** improvements in products or processes.

- Must be attempting to obtain knowledge that exceeds, expands, or refines the common knowledge of skilled professionals and the process must rely on principles of the physical or biological sciences, engineering, or computer science.
- 80% of research must be of an experimental nature: developing hypotheses, designing and conducting experiments, and refining and discarding hypotheses.

Shortcomings of U.S. R&E Tax Credit

- U.S. R&E tax credit has been “temporary” for 25 years. It was recently renewed as part of the U.S. stimulus package.
- The incremental nature of the tax credit results in limited impact on long term business investment decisions and strategic planning.
- The “experimentation” focus of the tax credit (targeted as shifting the composition) excludes many important aspects of R&D – including much of innovation.
- Because credits cannot be banked, start-up companies (with negative profits) are not able to take advantage of the program.

U.S. Government's Role Beyond R&D Tax Credits and Impact on Service-Sector Innovation

- Market structure: patents—marginally effective because of the high visibility nature or the inexcludability of the product or process
- Government research: Infratechnologies—very important to service sector
 - Organizations such as National Institute of Standards and Technology are active in developing standards and protocols essential for “integration” activities
 - Government lead consortiums
 - Test beds for interoperability
 - Certification and conformance testing

Summary Remarks

- The ability to accurately identify and measure R&D expenditures and innovation activities is key to the success of public policies targeted at stimulating research.
- Tax credits and other incentives rely on strict definitions of R&D to determine which activities are eligible.
- The applicability of definitions and difficulties in identifying and measuring service-sector R&D and innovation has implications for the effectiveness of current policies.