

Macro View Of U.S. R&D, Licensing

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Statistics show R&D activity licensing has strong correlation with innovation, property

According to a recent report published by the National Academy of Engineering (NAE), within the United States there are currently 41,888 corporations, 730 federal labs, 879 colleges, and 2,380 nonprofit organizations performing R&D research. Their collective R&D budgets for 1985 were \$71 billion, which represents approximately 2.5% of America's Gross Domestic Product (GDP). Approximately 99% of this \$71 billion was paid for by industry while the remainder came from public agencies (the United States government) and nonprofit funds. This private-public split is a substantial change from what was true when the U.S. government alone funded approximately 80% of all R&D expenditures within the U.S. (NAE 1987). The decline in the amount of federal government R&D funds and offsetting factors have led to the amount of R&D expenditures in the United States declining slightly over the past five years both in real dollar terms, as well as, a percent of U.S. GDP.

As America has diversified its defense budget, the U.S. federal government has concomitantly diversified its funding of basic R&D research. U.S. business has almost proportionally increased its developmental R&D spending. The net result, along with other factors like the breakup of AT&T, has been an overall change in research activities within the U.S. resulting in less basic and applied research and more developmental research.

As Table 1 shows, U.S. industry spends heavily on the development and commercialization of technol-

U.S. R&D EXPENDITURES BY SECTOR AND CHARACTER OF WORK—1985
(in billions of dollars)

	Industry	Public & Nonprofit	Total
Development	\$57.6	7.1	\$64.7
Applied Research	16.7	1.8	18.5
Basic Research	7.7	22.4	30.1
	\$82.0	31.3	\$113.3

Table 1

government, academic and other non-profit organizations, spend heavily on basic research. As Table 1 shows, the U.S. public and nonprofit sectors performed more than 75% of America's basic research in 1985.

One question frequently asked is: Are the American people and businesses getting a fair return on their R&D investment? Although there are no generally accepted measures of the value or success of innovative activities resulting from R&D efforts within America, a proxy may be the amount of royalty revenues from technology licensing received by American organizations (Lair 1985).

roy managers (AUTM), and data collected by the National Academy of Sciences (NAS) and the U.S. Department of Commerce. The figures in Table 2 are estimates and encompass all forms of U.S. royalty income from intellectual property licensing excluding agricultural and mineral rights for 1986.

This \$28.5 billion in royalty income comes from numerous domestic and international sources including licensing of industrial products and processes, royalties from books, software, sound and tape publishing, and franchise and broadcasting fees. The data clearly indicate that 89% of the royalty in-

ESTIMATED U.S. ROYALTY RECEIPTS BY RECEIVING ENTITY — 1986
(in billions of dollars)

Receiving Entity	Affiliated Entities	Unaffiliated Entities	Total
Government			
Domestic (Frost)	556.6	556.2	1,112.8
Foreign (Frost)	24.3	8.5	32.8
Total (Frost)	580.9	564.7	1,145.6
Individual U.S.			
Citizens	5.6	5.6	11.2
Universities & Colleges	0	0	0
Government & Nonprofits	1	1	2
	\$65.5	\$71.8	\$137.3

Table 2

U.S. ROYALTY REVENUES — ALL SOURCES

To determine a reasonable approximation of the total royalty income received by U.S. entities, data was obtained from various sources including federal tax returns filed with the Internal Revenue Service (IRS), surveys performed by the Association of University Technol-

ogy received by corporations is from affiliated entities including subsidiaries and joint-venture arrangements. This means that around half of all business licensing is with related parties rather than with independent outsiders. This tendency is primarily the result of

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low U.S. corporations (most) international commerce (Table 3).

Table 3 also highlights that individual inventors in the United States receive significant amounts of royalty income. This is to be expected since individual entrepreneurs and inventors within the United States personally hold significant intellectual property assets, for example, 10% of the patents issued by the U.S. Patent and Trademark Office (PTO) in 1997 went directly to U.S. citizens.

Another interesting fact is that while universities and colleges performed 12.8% of all U.S. R&D research (Table II) they received only .4% of the total U.S. royalty income (Table 2). Of course, the .4% does not measure the complete contribution to innovation and progress that U.S. universities and colleges make. Universities and colleges perform a significant amount of America's basic research and retain the lion's share of the scientists and research engineers for industry. Additionally, a respectable share of America's high-tech entrepreneurs in science-based industries comes directly from university-based researchers (NAM, 1997).

The amount for the lowest investment return in terms of royalty income has to be given to America's government, which invested over \$68 billion in 1995 in R&D and received approximately \$60 million in return. This stems in part, from what the government spends its R&D funds on.

The United States government in 1996 spent 30% of its R&D funds for development, testing, and evaluation of systems for military use; 10% for civilian space exploration, and 17% for basic health correlated research (OAE 1997). Much of the technology developed in other military activities and therefore not licensable or basic research

U.S. CORPORATE ROYALTIES AND LICENSE FEES FROM FOREIGN UNAFFILIATED ENTITIES — 1996

(in Millions of Dollars)

Type of Intellectual Property	Exports (Receipts)	Imports (Payments)
Industrial Processes and Products	\$2,079	\$1,161
Computer Software Licenses	2,179	562
Trademarks and Brand Names	500	128
Patent Fees	420	
Broadcast and Recording Rights	183	124
Books, Records and Tapes	174	120
Other Intellectual Property	100	208
	\$6,563	\$2,303

Table 4

and therefore a long way from commercialization and royalties.

U.S. ROYALTY RECEIPTS AND PAYMENTS TO/FROM FOREIGN ENTITIES

U.S. corporations license-in and license-out significant amounts of technology both domestically and internationally to related and unrelated entities. Table 3 shows the amount of license and royalty fees U.S. corporations receive from or pay to foreign entities.

U.S. businesses received \$2.8 billion in royalty income during 1996 from foreign enterprises of which 70% was from affiliated companies, while paying \$7.9 billion of which 72% was from affiliates. From this Bureau of Economic Analysis (BEA) data, one can infer two things: first, American businesses which transacting business internationally generally expand using joint ventures or through affiliates, rather than directly licensing to or from foreign third parties, and second, American businesses license-out significantly more technology than they license-in.

U. S. UNAFFILIATED FOREIGN ROYALTIES BY AREA

Based on BEA data the receipts by U.S. corporations of royalties

and licensing fees from foreign unaffiliated entities have grown steadily over the past few years at 12% per annum. On the other hand, royalty and licensing payments to foreign unaffiliated entities has remained relatively unchanged during the same period. The fastest growing segment in licensing is the licensing-out of computer software to unaffiliated entities. International unaffiliated computer software royalties to U.S. corporations, has grown over the past few years at 17% per year. This is clearly the result of the explosion of computer and Internet usage worldwide.

Table 4 highlights for foreign unaffiliated entities the types of intellectual property U.S. corporations receive and pay royalties and licensing fees. These intellectual property types can be grouped and include royalties on patents, know-how and computer software; copyrights on books, records and tapes, trade and service mark, fees and broadcasting and franchising fees.

The \$24 million in payments for broadcast and recording rights includes about \$80 million in recovering fees from the broadcast of the Olympic Games in 1996. The BEA data in Table 3 and Table 4 shows the U.S. has close to a 2 to 1 edge in licensing-out technology to the world.

U.S. UNAFFILIATED ROYALTY INCOME — BY INDUSTRY

Using data available from the Internal Revenue Service, it was determined which individual U.S. industries received the \$66.5 billion (Table 2) in corporate royalty income from unaffiliated entities, the

U.S. CORPORATE LICENSE AND ROYALTY FEES FROM TECHNOLOGY — EXPORTS AND IMPORTS — 1996

(in Billions of Dollars)

	Exports (Receipts)	Imports (Payments)
Affiliated Entity	\$28.5	\$27.7
Unaffiliated Entity	3.1	2.2
	\$31.6	\$30.0

Table 3

U.S. CORPORATE ROYALTY INCOME FROM UNAFFILIATED ENTITIES BY INDUSTRY — EARLY 1990s

(Percent of Total Royalty Income)

Machinery	20%
Chemical & Pharmaceutical Products	13%
Food & Allied	7%
Oil and Gas	6%
Printing & Publishing	6%
Electronics & Coal Products	4%
Business & Retail	3%
Transportation	3%
Tobacco Products	2%
Other Manufacturing	1%
Total Manufacturing	76%
Business and Other Services	10%
Retail & Wholesale Trade	7%
Finance, Insurance & Real Estate	7%
Other Nonmanufacturing	7%
Total	100%

Table 3

example, Table 3 shows that the U.S. Chemical and Pharmaceutical industries received approximately 13% (\$6.6 billion) of royalty income from licensing out of technology to unaffiliated entities.

Manufacturing is by far and away the largest recipient of royalty income, receiving 76% of the total unaffiliated royalty income. This seems reasonable considering manufacturing businesses performed approximately 77% of all U.S. R&D. This proportion has not always been the same; before 1980, manufacturing businesses performed over 95% of industry-related R&D in the U.S. The other 4% of R&D research, before 1980, was performed by nonmanufacturing (predominantly service) businesses.

Nonmanufacturing royalty income has risen rapidly, from 3% in 1983 to 14% in 1993. This change roughly parallels the shift in the U.S. economy from manufacturing to service and information technologies over the past several decades. These service industries (communication services, computer programming and related businesses, and testing services) account for the vast majority of the new manufacturing licensing and R&D (N&E 1993).

U.S. FOREIGN ROYALTIES AND LICENSING BY COUNTRY

The U.S. licenses technology to and from most countries in the world. Table 4 ranks America's top

10 technology trading partners in 1996 based on their payments and receipts of licensing and royalty fees with the United States. The receipts and payments include both transactions with affiliated and unaffiliated entities and are based on Bureau of Economic Analysis data collected in their annual and biennial surveys of U.S. businesses.

U.S. FOREIGN LICENSE AND ROYALTY FEES BY COUNTRY — 1996

(In Millions of Dollars)

Country	Payments To the U.S.	Payments By the U.S.
Japan	\$ 3,664	\$1,390
UK	2,665	1,872
Germany	2,400	774
France	1,762	811
Netherlands	1,382	488
Canada	1,416	73
Singapore	1,408	12
Italy	1,055	129
Spain	688	43
China	672	13
Other Countries	11,892	2,774
	\$23,822	\$7,654

Table 4

Six of the U.S.'s top technology trading partners are in the European Union (EU). The EU members collectively pay the U.S. about \$13 billion in royalty and licensing fees each year while receiving \$6 billion from the U.S. This clearly makes the EU America's number-one technology trading region. Another interesting fact is that Japan is the U.S.'s number-one technology trading partner; the United States appears to get more of its technology imports from the United Kingdom-UK. This disparity in Japan's technology exports tends to sup-

port the old argument that Japan may intentionally license more than it imports (National Historical Academy of Sciences 1995).

THE MACRO VIEW

Is there a correlation between R&D expenditures and innovation and economic prosperity? It is hard to tell from the above data. Wyns and Mansfield, along with others, have estimated that over 40% of the world's economic growth since World War II is a direct result of advances in technology (Wyns 1980 and Mansfield 1975). The National Academy of Engineering estimated that the U-S nations historically spend between 3% and 3% of their gross domestic products on research and development (N&E 1992). This 2-3% investment appears to have yielded a 4% annual return. This seems to indicate, from both a U.S. and a worldwide perspective, that R&D research and licensing may have a strong positive correlation with innovation and economic prosperity.

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