Employment and Gross Output of Intellectual Property Companies in the United States

ndp|consulting

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ABSTRACT

Innovation is a key determinant of the global competitiveness of American businesses. IP companies are those who produce intellectual property (IP) or who apply IP in producing their goods and services. IP companies contribute substantially to U.S. output and employment and generate a large number of well-paying jobs for both white- and blue-collar workers. Based on the latest U.S. official data, we estimate that, in 2008, IP companies in manufacturing and non-manufacturing sectors employed more than 19 million workers and accounted for 16.3 percent of U.S. employment. In the same year, IP companies generated about $7.7 trillion in gross output, accounting for 33.1 percent of U.S. gross output. The innovation emanating from these companies is a key driver of sustained long-term economic growth and productivity, which are especially important in light of the current sluggish economic recovery and high unemployment. Given their important role in generating jobs and output, U.S. policymakers should give top priority to protecting and nurturing companies and their intellectual property.

[1]The author would like to acknowledge the invaluable research and analytic support of Mark Schmidt, Principal at ndp|consulting. This research was supported by the U.S. Chamber of Commerce. The analysis and views expressed here are solely those of the author.

Introduction and Summary of Key Findings

Investment in innovation is critical for the competitiveness of U.S. companies in global markets. Studies show that intellectual property (IP) contributes to economic growth in both developed and developing countries by encouraging investments in new ideas and methods. It also strengthens competitiveness and productivity, which in turn promotes exports, boosts sales and revenues, creates jobs, and pays higher wages for both white- and blue-collar workers. [2]

IP generally takes three tangible and legally recognized forms: patents, trademarks, and copyrights.

- A *patent* is the property right of inventors to exclude others from producing, using, or selling the invention or the designed process.
- A *trademark* is a word, phrase, symbol, logo, or design that distinguishes a product or service.
- A *copyright* is a protection for original authored works, mostly of a literary, dramatic, musical, architectural, pictorial, graphic, sculptural, and audiovisual nature.

Patent and copyrights are authorized by the U.S. Constitution, which grants the U.S. Congress the power to promote the progress of science and the useful arts. The U.S. Patent and Trademark Office grants patents and registers trademarks while the U.S. Copyright Office administers the national copyright system. U.S. intellectual property law is a mix of common law and federal and state statutes. At the federal level, the Constitution and legislation cover patents, trademarks, and copyrights[3] while state laws differ from one another and cover a broad range of IP areas.

In this report, we define IP companies as businesses that produce intellectual property and/or apply intellectual property in their production of goods and services. IP companies span both manufacturing and non-manufacturing sectors, as well as IP-intensive and non-IP-intensive industries. An IP company may belong to an IP-intensive industry (one that allocates above-the-national-average R&D expenditure per employee) or to a non-IP-intensive industry (one that allocates below-the-national-average R&D spending per employee).[4] IP companies in the manufacturing sector (e.g., pharmaceutical and textile manufacturers) typically undertake research and development to produce their own intellectual property. IP companies in the non-manufacturing sector (e.g., software publishers and motion picture companies) either conduct their own IP or apply IP from other sources—including software programmers, writers, and artists–to generate their business revenues.

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[2] Pham, Nam D. 2010. "The Impact of Innovation and the Role of Intellectual Property Rights on U.S. Productivity, Competitiveness, Jobs, Wages and Exports," NDP Consulting Research Paper; Lederman, Daniel and William F. Maloney. 2003. "R&D and Development" Policy Research Working Paper, World Bank; Bresnahan, Timothy and Manuel Trajtenberg. 2001. "General Purpose Technologies 'Engines of Growth?'" NBER Working Papers No. 4148.

[3] United States Patent and Trademark Office; U.S. Copyright Office.

[4] Our previous report identified 15 IP-intensive industries that have higher-than-average annual R&D expenditure per employee and 12 non-IP-intensive industries that have lower-than-average annual R&D expenditure per employee. Pham, Nam D. 2010. "The Impact of Innovation and the Role of Intellectual Property Rights on U.S. Productivity, Competitiveness, Jobs, Wages and Exports," NDP Consulting Research Paper.

Based on the latest U.S. official data, we estimate that, in 2008, IP companies in manufacturing and non-manufacturing sectors employed more than 19 million full- and part-time (headcounts) workers and accounted for 16.3 percent of U.S. full- and part-time employment. Nearly 70 percent of U.S. manufacturing jobs and 9.3 million workers (full- and part-time) were in IP companies and less than 10 percent of U.S. non-manufacturing jobs and 9.8 million workers (full- and part-time) were in IP companies.

Since worker headcounts include all full- and part-time jobs, national statistics often estimate the full-time-equivalent (FTE) employment for comparison purposes. We use the Bureau of Economic Analysis (BEA) estimated ratio of headcounts to FTE figures for 2008 to convert the IP headcounts to full-time-equivalent IP employment. We estimate nearly 9.1 million FTE IP employees in the manufacturing sector in 2008 and nearly 8.9 million in the non-manufacturing sector. Altogether, IP companies employed nearly 18 million FTE workers, accounting for 16.8 percent of 107 million U.S. FTE jobs.

While IP jobs include all employees in IP companies in manufacturing and non-manufacturing sectors, direct IP jobs refer to those workers who directly create intellectual property. Direct IP workers include R&D scientists, engineers, and technicians who produce outputs that are patented and trademarked, and writers/authors, software programmers, musicians, and producers who produce copyright-able outputs. We estimate nearly 1.7 million full- and part-time workers (the equivalent of nearly 1.6 million FTE) direct IP jobs in the United States in 2008. Among 1.655 million direct IP jobs, 836,000 were in the manufacturing sector and 819,000 in the non-manufacturing sector.

IP companies in the manufacturing and non-manufacturing sectors generated more than $7.6 trillion in gross output in 2008, accounting for 33.1 percent of total U.S. gross output. IP companies in the manufacturing sector alone generated $3.9 trillion in output, constituting 75.2 percent of total U.S. manufacturing output. IP companies in the non-manufacturing sector generated $3.7 trillion in output, accounting for 20.8 percent of U.S. non-manufacturing gross output.

Table 1. Employment and Gross Output of IP Companies in the United States, 2008

	Manufacturing	Non-Manufacturing	All Industries
All IP Employment (millions)			
Headcounts (full- and part-time)	9.294	9.824	19.118
% of U.S. Employment	69.2%	9.5%	16.8%
Full-time-equivalent (FTE)	9.098	8.883	17.981
Direct IP Employment (millions)			
Headcounts (full- and part-time)	0.836	0.819	1.655
% of All IP Employment	9.0%	8.3%	8.7%
% of U.S. Employment	6.2%	0.8%	1.4%
Full-time-equivalent (FTE)	0.818	0.741	1.559
Gross Output (billions of dollars)	$3,927.8	$3,718.0	$7,645.8
% of U.S. Gross Output	75.2%	20.8%	33.1%
U.S. Headcounts (millions)	13.437	103.751	117.188
U.S. FTE (millions)	13.154	93.809	106.963
U.S. Gross Output (billions of dollars)	$5,226.4	$17,859.2	$23,085.6

IP Inputs: Research and Development Expenditures

Research and development (R&D) expenditures are direct inputs for the development of intellectual property and are widely used to measure the intensity of IP across industries. Studies show that R&D spending is highly correlated with the number of patents in both large and small firms.[5] Empirical evidence shows that R&D is a reliable indicator of innovative capacity and is one of six key factors determining companies' innovation success and financial performance.[6] Furthermore, R&D expenditures are positively correlated with all measures of innovation outputs.[7]

R&D spending in the United States (adjusted for inflation in 2000 dollars) grew by an annual average of 4.7 percent from 1953 to 2008–from $28 billion to $325 billion. The source of R&D funding in the United States has shifted from public to private, owing to the exponential growth of privately-funded R&D projects beginning in the early 1950s. Publicly-funded R&D accounted for almost 60 percent of total U.S. R&D spending during 1953-1983; it averaged $48.5 billion a year, versus $35 billion in privately-funded R&D. But the share of publicly-funded R&D then dropped to 35 percent during 1984-2008. And in 2008, federally-funded R&D accounted for only about 27 percent of total R&D. In contrast, privately-funded R&D spending has grown at an annual average of 5.5 percent in the past 55 years, from $12.3 billion in 1953 to $218.8 billion in 2008 (Figure 1). During 1984-2008,

[5] For example, Chakrabarti, Alok K. and Michael R. Halperin (1990). "Technical Performance and Firm Size: Analysis of Patents and Publications of U.S. Firms," Small Business Economics, Vol. 2, No. 3, pp. 183-190.

[6] Steinberg, Rolf and Olaf Arndt. 2001. "What Determines the Innovation Behavior of European Firms?" Economic Geography.

[7] Mairesse, Jacques and Pierre Mohnen. 2004. "The Importance of R&D for Innovation: A Reassessment Using French Survey Data." NBER Working Paper No. 10897.

Figure 1. Annual Public and Private R&D Expenditures, 1953-2008[8]

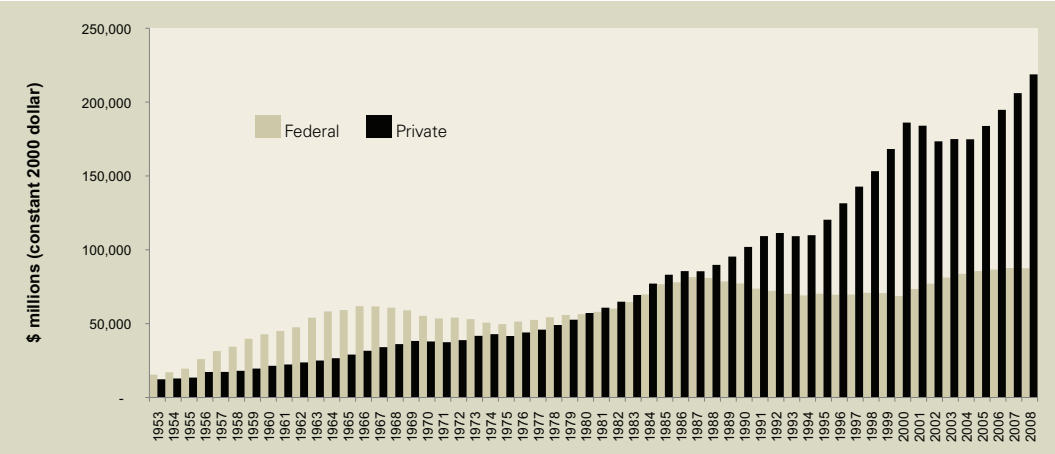


Table 2. Average Annual R&D Spending and Annual Growth Rates, 1953-2008[9]

	All Periods 1953-2008	Period 1: 1953-1983	Period 2: 1984-2008
	Annual average; in millions current dollars		
Total	$114,201	$30,026	$218,578
Federal	$41,086	$16,243	$71,892
Private/Industry	$68,109	$13,040	$136,395
Others	$5,005	$743	$10,291
	Annual average; in millions 2000 dollars		
Total	$147,987	$85,402	$225,592
Federal	$60,961	$48,494	$76,420
Private/Industry	$81,340	$34,960	$138,852
Others	$5,685	$1,948	$10,319
	Average shares (%)		
Total	100.0%	100.0%	100.0%
Federal	47.8%	57.9%	35.3%
Private/Industry	49.0%	39.9%	60.3%
Others	3.1%	2.1%	4.4%
	Annual growth rates (%)		
Total	4.7%	5.6%	3.5%
Federal	3.4%	5.2%	1.3%
Private/Industry	5.5%	6.1%	4.8%
Others	6.8%	7.2%	6.4%

[8] Bureau of Economic Analysis.

[9] Bureau of Economic Analysis.

[10] Mairesse, Jacques and Pierre Mohnen. 2004. "The Importance of R&D for Innovation: A Reassessment Using French Survey Data." NBER Working Paper No. 10897; Chakrabarti, Alok K. and Michael R. Halperin (1990). "Technical Performance and Firm Size: Analysis of Patents and Publications of U.S. Firms," Small Business Economics, Vol. 2, No. 3, pp. 183-90.

[11] Wilson, Daniel J. 2001. "Is Embodied Technological Change the Result of Upstream R&D? Industry-Level Evidence." Federal Reserve Bank of San Francisco.

privately-funded R&D expenditures averaged $138.9 billion a year, almost twice the $72 billion in federally-funded annual R&D (Table 2). Privately-funded R&D now accounts for nearly 70 percent of total R&D spending in the United States.

IP Outputs: Patents, Trademarks, and Copyrights

As noted earlier, the three common, tangible IP products are patents, trademarks, and copyrights.

Patents. Research and development expenditures, direct inputs for IP, are positively correlated with the number of patents in both large and small firms.[10] Evidence from patent literature also suggests that R&D spending directed at a product is the main input into the innovation production function and is proportional to the value of innovations in that product.[11] In the United States, R&D expenditure and IP outputs are clearly related. The number of patent applications filed with the U.S. Patent and Trademark Office (USPTO) increased from an annual average of 129,700 during 1980-89 (when real total R&D expenditure averaged $152 billion a year) to 216,300 a year during 1990-99 (when real R&D spending was $205.9 billion) and further to 402,300 a year during 2000-08 (when R&D spending reached $285 billion) (Table 3).

Despite the sharp rise in patent applications, however, the percentage of actual patents issued has fallen over the past thirty years. More than 59 percent of patent applications were issued

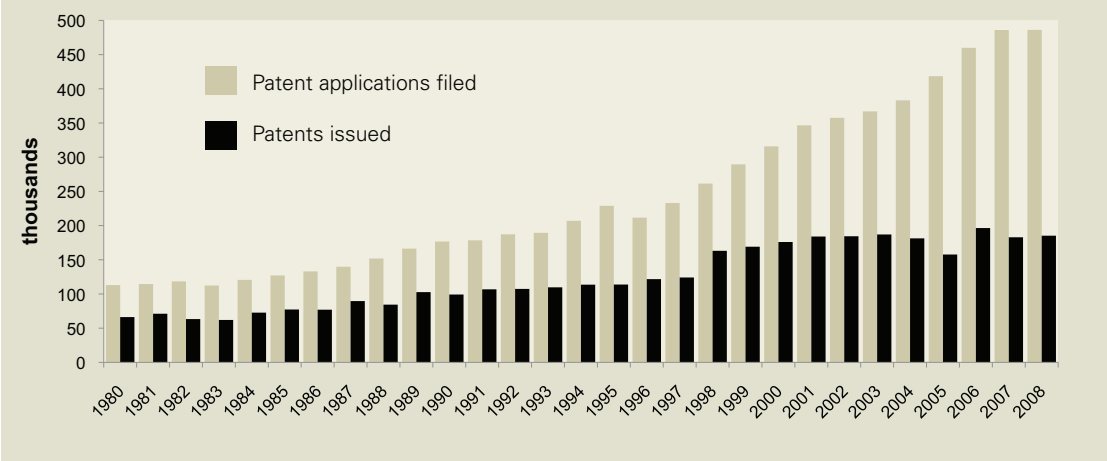
Table 3. Annual Average of Patents Filed and Issued in the United States, 1980-2008 (in thousands) [12]

	1980-89	1990-99	2000-08
Patent Applications Filed	129.7	216.3	402.3
Inventions	119.5	200.3	376.8
Designs	9.5	14.9	23.4
Botanical Plants	0.3	0.5	1.0
Reissues	0.4	0.6	0.9
Patent Applications Issued	76.6	122.9	181.7
Inventions	70.9	110.8	161.9
Designs	5.1	11.3	18.4
Botanical Plants	0.3	0.4	0.9
Reissues	0.3	0.3	0.4
Filed as % of Issued Patents	59.1%	56.8%	45.2%
Inventions	59.3%	55.3%	43.0%
Designs	54.2%	75.6%	78.7%
Botanical Plants	86.2%	75.1%	87.8%
Reissues	75.0%	55.0%	47.3%
Annual R&D Spending (in billions $2000)	$152.0	$205.9	$285.1

[12] U.S. Patent and Trademark Office.

during 1980-89 but only 45.2 percent were issued during 2000-08. Inventions issued declined from 59.3 percent of applications during 1980-89 to 43 percent during 2000-08. In contrast, issuances of designed patents grew from 54.2 percent of applications during 1980-89 to 78.7 percent during 2000-08 (Figure 2).

Figure 2. Number of Patents Filed and Issued Annually, 1980-2008[13]



The top 10 classes of issued patents in the United States during 1990-2009 totaled nearly 480,000 and accounted for more than 16 percent of all U.S. patents. The patents for drug inventions, the highest number, totaled 133,748 in this period, accounting for 3.7 percent of total U.S. patents. Patents related to semiconductor device manufacturing totaled 68,955, nearly half the number of patents in the drug class, and accounted for 1.9 percent all U.S. patents (Table 4).

Table 4. Top 10 Patent Counts Based on Original Classification, By U.S. Patent Classification System, 1990-2009[14]

Class	Number of Patents	% of U.S. Total
Drug, Bio-Affecting and Body Treating Compositions	133,748	3.7%
Semiconductor Device Manufacturing	68,955	1.9%
Stock Material or Miscellaneous Articles	61,534	1.7%
Active Solid-State Devices	59,971	1.6%
Molecular Biology and Microbiology	57,381	1.6%
Measuring and Testing	44,448	1.2%
Multiplex Communications	42,044	1.2%
Internal-Combustion Engines	39,451	1.1%
Electrical Connectors	38,192	1.1%
Radiation Imagery Chemistry: Process, Composition, Product	37,879	1.0%

[13] U.S. Patent and Trademark Office.

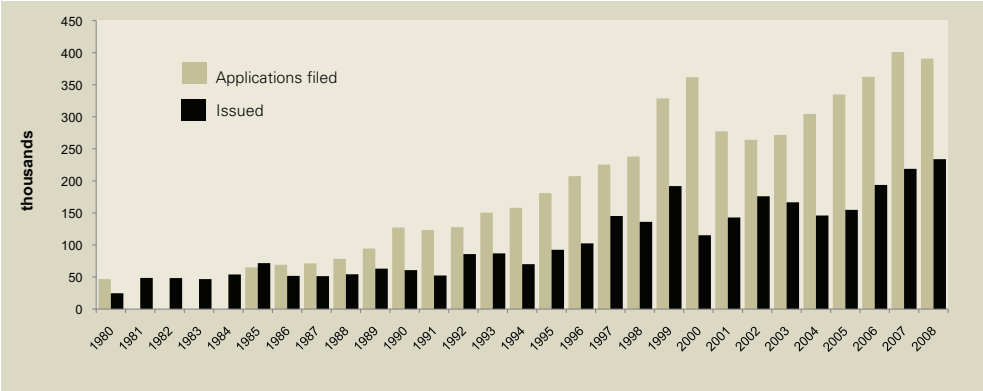
[14] U.S. Patent and Trademark Office.

Table 5. Number of Trademarks Filed and Issued in the United States, 1980-2008 (in thousands) [15]

	1980-89	1990-99	2000-08
Trademark Applications Filed	70.8	186.7	329.8
Trademarks Issued	51.5	102.4	172.0
New	45.6	95.7	138.6
Renewals	5.9	6.7	33.4
Filed as % of Issued Patents	74.6%	54.8%	52.1%
Annual R&D Spending (in billions of 2000 dollars)	$152.0	$205.9	$285.1

Trademarks. Trademarks have also paralleled the increase in R&D spending and have grown substantially in the last 30 years. During the 1980s, trademark applications filed with the U.S. Patent and Trademark Office averaged 70,800 annually and R&D expenditure averaged $152 billion. The number of trademark applications rose to 186,700 a year during the 1990s, when annual R&D spending was $205.9 billion, and 329,800 a year during 2000-08, when annual R&D spending reached $281.5 billion (Table 5).

Figure 3. Number of Trademarks Filed and Issued Per Year, 1980-2008 [16]



The number of trademark applications grew nearly five times between the periods 1980-89 and 2000-08–from an annual average of 70,800 during 1980-89 to 329,800 during 2000-08. But the number of trademarks issued grew only 3.3 times–from an annual average of 51,500 during 1980-89 to 172,000 during 2000-08. As a result, the percentage of trademarks issued declined from 74.6 percent of total trademark applications in the 1980s to only 52.1 percent during 2000-08 (Figure 3).

Companies that apply for trademarks also tend to be patent recipients, according to USPTO data. For example, Mattel Inc. and Disney Enterprises Inc., the top two trademark applicants in 2009, both produced and sold their products using their trademarks, copyrights, and patented devices or designs. In their annual reports, these companies acknowledged that trade names and trademarks were important assets.[17] Similarly, Johnson & Johnson, Novartis, and Bristol-Myers Squibb were among the top 10 trademark applicants in 2009 and also belong to the drug group receiving the highest number of patents during 1990-2009 (Table 6).

[15] U.S. Patent and Trademark Office.

[16] U.S. Patent and Trademark Office.

[17] Mattel's annual reports; Walt Disney's annual reports.

Table 6. Top 10 Trademark Applicants, 2009 [18]

Applicant	Industry	NAICS*
Mattel, Inc.	Doll, toy, game manufacturing	3399
Disney Enterprises, Inc.	Television, radio broadcasting; amuse. parks	5151, 7131
Johnson & Johnson	Pharmaceutical, medicine manufacturing	3254
Novartis	Pharmaceutical, medicine manufacturing	3254
Bristol-Myers Squibb	Pharmaceutical, medicine manufacturing	3254
LG Electronics Inc.	Computer, electronic product manufacturing	334
IGT	All other miscellaneous manufacturing	3399
FPL Group, Inc.	Electric power gen., transmission, distrib.	2211
Lidl Stiftung & Co.	Grocery stores	4451
Harvey Ball Smile Limited	Lessors of nonfinancial intangible assets	5331

*North American Industry Classification System

Copyrights. While patents are typically IP rights for inventions, copyrights are protections for the authorship of various types of subject matter. Unlike trademark owners, who are most likely also patent owners, copyright owners are not likely to be patent owners. For example, writers and artists copyright their monographs, sound recordings, and visual arts; similarly, software programmers copyright their software and machine readable works. Although these writers, artists, and software programmers do not own patents, their original works are protected like all other intellectual property products.

Copyright claims are concentrated in six industries: motion pictures, newspapers, the performing arts, broadcasting, independent artists, and software. In the past 25 years, the U.S. Copyright Office has issued an average 500,000 copyrights a year. During 1985-2008, the three subject areas receiving the largest numbers of copyrights were monographs (34.8 percent), musical works (27.5 percent), and visual arts (16 percent). Monographs include computer software and machine readable works; musical works include dramatic works, music, choreography, pantomimes, motion pictures, and filmstrips; and visual arts are two-dimensional works of fine and graphic art, including prints, sculptures, technical drawings, photographs, commercial prints, applied arts, and cartographic and multimedia works[19] (Table 7).

Economic Contribution of IP Companies: Employment and Gross Output

In this report, direct IP employees are those workers who produce tangible intellectual property; they include R&D scientists, engineers, and technicians producing patent-able and trademark-able products. In the information and performing arts industries, direct IP employees include performing and non-performing artists, writers/authors, and software programmers whose works lead to patents, trademarks, and copyrights.

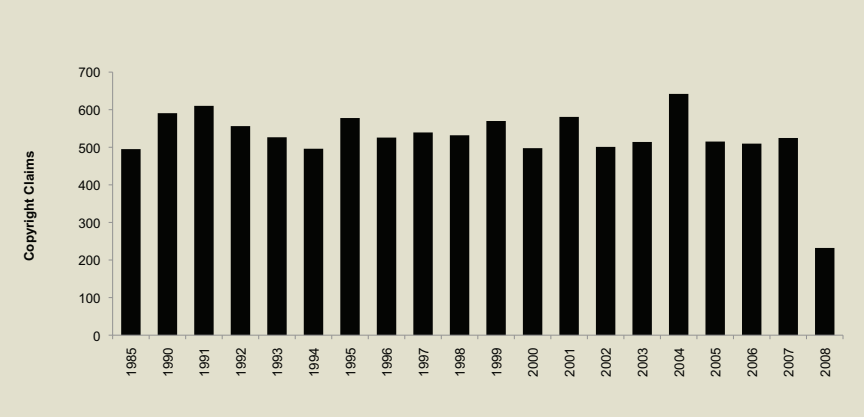
[18] U.S. Patent and Trademark Office.

[19] The Library of Congress, Copyright Office, Annual Report.

Table 7. Number of Copyright Registration by Subject Area, 1985-2008 (in thousands) [20]

	1985-1989	1990-99	2000-08
Total Copyright Claims	495.1	552.5	501.9
Monographs	154.5	186.9	183.1
Musical Works	147.9	157.6	130.3
Works of the Visual Arts	50.0	86.0	85.7
Serials	120.0	87.5	56.7
Sound Recordings	22.7	34.5	46.1
Semiconductor Chip Products	0.9	0.9	0.4
Renewals	43.8	35.6	13.6

Figure 4. Number of Copyright Issued Annually, 1985-2008 [21]



IP companies employ other workers who apply IP to produce goods and services for sale in domestic and foreign markets. Indirect IP employees refer to those workers employed in IP companies but do not create intellectual property. They include both white-collar and blue-collar workers such as managers, lawyers, doctors, nurses, salespeople, educators, production workers, editors, and support staff who work in companies that spend on R&D and companies in the information and performing arts industries.

We use data published by the National Science Foundation (NSF), U.S. Census Bureau, U.S. Bureau of Labor Statistics (BLS), and U.S. Bureau of Economic Analysis (BEA) to estimate direct and indirect IP employment in the Unites States. The NSF and the Census Bureau jointly developed the Business R&D and Innovation Survey statistics of direct R&D full-time and part-time employment (headcounts), total employment in companies having R&D expenditure, and sales

[20] The Library of Congress, Copyright Office, Annual Report.

[21] The Library of Congress, Copyright Office, Annual Report.

by industry. Preliminary statistics were released in July 2010 and the revised and detailed data are expected in early 2011.[22] The BLS publishes the number and distribution of 800 occupational employment statistics across industries.[23] And the BEA publishes the national full-time, part-time, and full-time-equivalent employment and gross output by industry.[24]

Direct IP Employment

We use the NSF full- and part-time headcounts for R&D employment to estimate direct IP employees for patents and trademarks. The NSF's direct R&D employment includes all engineers and scientists, managers, technicians, and administrators providing direct support to either R&D paid for by the company or R&D paid for by others not in the company.[25] Studies show that the direct outputs of R&D efforts are typically patents and trademarks.

We use the BLS full-time and part-time occupational employment to estimate direct IP employees for copyrights by industry. Unlike patents and trademarks, copyright claims are concentrated in monographs, musical works, and visual arts in six industries (motion pictures, newspapers, the performing arts, broadcasting, independent artists, and software). Among 800 occupations in 22 BLS major occupational groups, we identified 13 occupations with high direct IP employment in six copyright-concentrated industries (Table 8).

Table 8. Direct Copyright Employment [26]

	Newspaper	Software	Motion Picture	Broadcast	Performing Arts	Independent Artists
Art directors	5,330		1,750			
Craft artists						1,980
Fine artists	440		560			2,850
Multi-media artists		2,710	7,720			
Other artists			390			600
Graphic designers	25,670		4,840			
Actors			9,720		10,370	3,910
Producers/directors			23,490	21,420	5,260	
Dancers					4,760	
Music directors/composers			240			
Musicians/singers			190		28,420	1,570
Writers/authors			2,040	3,090		2,550
Photographers			300	4,330		
Total	45,010	5,580	51,240	28,840	48,810	13,460

[22] National Science Foundation (2010). "New Employment Statistics From the 2008 Business R&D and Innovation Survey," Info Brief, NSF.

[23] U.S. Bureau of Labor Statistics, National Industry-Specific Occupational Employment and Wage Estimates.

[24] U.S. Bureau of Economic Analysis, Industry Economic Accounts.

[25] National Science Foundation.

[26] Bureau of Labor Statistics' Occupational Employment Statistics.

Table 9. Direct IP Employment in Copyright-Concentrated Industries, 2008 [27]

	R&D-Employment (Patents, Trademarks)	Copyright-Employment	Total Direct IP-Employment
Information	221,000	130,670	351,670
Publishing	--	50,590	50,590
Newspaper, periodical, book	--	45,010	45,010
Software	147,000	5,580	152,580
Motion picture	--	51,240	51,240
Telecommunications	66,000	--	66,000
Broadcasting	--	28,840	28,840
Others	8,000	--	8,000
Performing Arts	--	62,250	62,250
Performing art companies	--	48,810	48,810
Independent artists	--	13,460	13,460

We estimate 192,940 full- and part-time direct copyright employees in six copyright-concentrated industries in 2008: 51,240 in motion pictures; 45,010 in newspapers, periodicals and books; 28,840 in broadcasting; 48,810 in the performing arts; 13,460 independent artists; and 5,580 in software (Table 8).

We estimate the direct IP employment in copyright-concentrated industries by combining the above direct copyright employment and the R&D employment published by the NSF. In 2008, the information industry employed an estimated 351,670 direct IP workers (221,000 R&D employees and 130,670 copyright employees). The performing arts industry employed another estimated 62,250 direct IP employees. Since the NSF preliminary statistics combined R&D employment data of the performing arts industry with 14 other non-manufacturing industries, R&D employment data for the performing arts industry are not yet available (Table 9).[28]

For manufacturing and other non-manufacturing industries, we use R&D employment to estimate direct IP employment. In 2008, nearly 1.7 million full- and part-time direct IP employees were working in U.S. manufacturing and non-manufacturing sectors, accounting for 1.4 percent of total U.S. manufacturing and non-manufacturing employment. In the same year, the number of full- and part-time direct IP employees in manufacturing industries was 836,000, 6.2 percent of total U.S. manufacturing employment. In 2008, full-time and part-time direct IP employees in non-

[27] Bureau of Labor Statistics; National Science Foundation.
[28] Disaggregated R&D employment for these services industries are expected to be available in early 2011.

Table 10. Direct IP Jobs in U.S. Manufacturing and Non-Manufacturing Industries, 2008 (in thousands) [29]

	Direct IP Employment	
	Headcounts	**% of U.S. Jobs**
Manufacturing	836.0	6.2%
Food, beverage, tobacco	20.0	1.2%
Textile, wood, furniture	15.0	1.0%
Chemicals, plastics, nonmetallic	184.0	9.0%
Primary, fabricated metals	36.0	1.9%
Machinery, computer, electrical	348.0	12.2%
Other manufacturing	233.0	6.8%
Non-manufacturing	818.9	0.8%
Information	351.7	11.7%
Finance, real estate	12.0	0.1%
Professional	302.0	3.8%
Healthcare	12.0	0.1%
Other non-manufacturing	141.3	0.2%
All Industries	1,654.9	1.4%

manufacturing industries were 818,900, 0.8 percent of total U.S. non-manufacturing employment. In the manufacturing sector, machinery and computer and electrical industries employed 348,000 full- and part-time direct IP workers, 12.2 percent of total employment in those industries. In the non-manufacturing sector, direct IP-jobs in the information industry in 2008 were 351,700 full- and part-time, accounting for 11.7 percent of total U.S. jobs in the information industry (Table 10).

Total IP Employment

While direct IP employees produce tangible IP outputs, indirect IP employees rely on innovation outputs to produce goods and services to sell in domestic markets and overseas. IP employment thus refers to both direct IP employees who produce IP and indirect IP employees who apply IP in their production.

For six copyright-concentrated non-manufacturing industries, we include all full- and part-time employees in our copyright and R&D employment estimates since most of these companies use copyrighted, patented, or trademarked goods and services. For all manufacturing and other non-manufacturing industries (excluding copyright-concentrated industries), we include only full- and part-time employees in companies that conducted R&D in our IP employment estimates.

In 2008, U.S. manufacturing and non-manufacturing industries employed more than 19.1 million full- and part-time IP workers (headcounts), accounting for 16.3 percent of total U.S. headcounts. IP employment in the manufacturing industry was nearly 9.3 million headcounts, accounting for 69.2 percent of total U.S. manufacturing employment. The non-manufacturing industry employed

[29] Bureau of Labor Statistics; National Science Foundation.

Table 11. Full-Time & Part-Time IP Employment in U.S. Manufacturing and Non-Manufacturing Sectors, 2008 (in thousands) [30]

	All IP Jobs	
	Headcounts	% of U.S. Jobs
Manufacturing	9,294.0	69.2%
Food, beverage, tobacco	1,343.0	80.0%
Textile, wood, furniture	669.0	45.3%
Chemicals, plastics, nonmetallic	1,548.0	75.9%
Primary, fabricated metals	844.0	43.6%
Machinery, computer, electrical	2,338.0	81.8%
Other manufacturing	2,552.0	74.0%
Non-manufacturing	9,824.0	9.5%
Information	3,004.0	100.0%
Finance, real estate	1,420.0	17.3%
Professional	1,234.0	15.5%
Healthcare	203.0	1.5%
Other non-manufacturing	3,963.0	5.6%
All Industries	19,118.0	16.3%

more than 9.8 million headcounts in 2008, accounting for 9.5 percent of total non-manufacturing employment (Table 11).

Full-Time-Equivalent Employment

The R&D employment data surveyed by the NSF and U.S. Census Bureau are headcounts that

Table 12. Full-Time Equivalent IP Employment in U.S. Manufacturing and Non-Manufacturing Sectors, 2008 [31]

	Manufacturing	Non-Manufacturing	Total
	Full-Time-Equivalent Employment		
IP companies	9,098,257	8,882,899	17,981,156
United States	13,154,000	93,809,000	106,963,000
	Headcounts (full-time & part-time)		
IP companies	9,294,000	9,824,300	19,118,300
United States	13,437,000	103,751,000	117,188,000
U.S. Headcounts, as % of U.S. FTE	1.0215	1.1060	

[30] Bureau of Labor Statistics' Occupational Employment Statistics.
[31] Bureau of Labor Statistics' Occupational Employment Statistics.

include all full- and part-time positions. We use data published by the U.S. Bureau of Economic Analysis to convert the U.S. headcounts to full-time-equivalent (FTE) jobs. In 2008, headcounts were 2.15 percent higher than FTE jobs in the manufacturing sector and 10.6 percent higher than FTE jobs in the non-manufacturing sector. Using headcount/FTE ratios, we estimate nearly 9.1 million FTE IP employees in the manufacturing sector and nearly 8.9 million FTE IP employees in the non-manufacturing sector. In total, there were 17,981,156 FTE IP jobs in the U.S. manufacturing and non-manufacturing sectors in 2008 (Table 12).

Gross Output of IP Companies in the United States

We use the NSF and BEA's gross outputs for manufacturing and non-manufacturing companies to estimate gross output of IP companies. As noted earlier, all companies in the information industry are considered as IP companies, so we include all revenues of information companies.

IP companies contribute substantially to total U.S. output. We estimate that IP companies in the manufacturing and non-manufacturing sectors generated $7.65 trillion in gross outputs in 2008, accounting for 33.1 percent of the $23.1 trillion in gross outputs of all U.S. companies in the manufacturing and non-manufacturing sectors.

IP companies in the manufacturing sector made the far larger contribution. Their 2008 gross output of $3.9 trillion accounted for 75.2 percent of U.S. gross output in 2008. In the chemicals, plastics, and nonmetallic category, IP companies, with revenues of $906. 9 billion, accounted for

Table 13. Gross Output of IP Companies in the United States, 2008 (million U.S. dollars) [32]

	Gross Output of IP Companies	U.S. Gross Output	Output of IP Companies as % of U.S. Outputs
Manufacturing	$3,927,834	$5,226,366	75.2%
Food, beverage, tobacco	496,959	746,544	66.6%
Textile, wood, furniture	163,344	263,504	62.0%
Chemicals, plastics, nonmetallic	906,943	949,558	95.5%
Primary, fabricated metals	301,870	587,837	51.4%
Machinery, computer, electrical	778,165	860,118	90.5%
Other manufacturing	1,280,553	1,818,805	70.4%
Non-manufacturing	3,717,962	17,859,193	20.8%
Information	1,224,009	1,224,009	100.0%
Finance, real estate	435,850	4,845,785	9.0%
Professional	467,509	1,588,231	29.4%
Healthcare	27,928	1,508,835	1.9%
Other non-manufacturing	1,562,666	8,692,333	18.0%
All Industries	$7,645,796	$23,085,559	33.1%

[32] Bureau of Labor Statistics' Occupational Employment Statistics.

95.5 percent of total U.S. output; and in the machinery, computer, and electrical area, IP-company earnings of $778.2 billion accounted for 90.5 percent of U.S. output. IP companies in the non-manufacturing sector were also important contributors to U.S. gross output; their gross output of $3.7 trillion accounted for 20.8 percent of U.S. non-manufacturing gross output. Here the major categories were information companies, which accounted for 100 percent (as noted above) and professional companies, which earned $467.5 billion or 29.4 percent of all U.S. professional company output (Table 13).

Conclusions

Innovation is imperative for U.S. economic competitiveness and sustained long-term growth. In this report, and in our earlier report on the impact of innovation on U.S. productivity, jobs, and exports, we find that those industries that allocate above-average R&D expenditure per employee (IP-intensive industries) are more competitive in global markets, generate higher output per employee, create more jobs, pay higher wages for both white- and blue-collar workers, and export more than industries that invest below-average R&D expenditure per employee (non-IP-intensive industries).

IP companies in both IP-intensive and non-IP-intensive industries are more innovative relative to their peer groups in their own industry. In 2008, these companies employed more than 19 million full- and part-time employees (the equivalent of nearly 18 million full-time jobs), and generated more than $7.6 trillion gross outputs in the United States. Innovation contributes substantially to both U.S. manufacturing and non-manufacturing sectors. Indeed, IP companies in the manufacturing sector generated nearly 9.3 million American jobs, accounting for nearly 70 percent of U.S. manufacturing jobs, and generated nearly $4 trillion gross output, accounting for 75 percent of total gross output in the U.S. manufacturing sector. Similarly, IP companies in non-manufacturing sectors employed another 9.8 million American workers and generated another $3.7 trillion in gross output. All told, in 2008, IP companies generated 16.3 percent of all U.S. employment and 33.1 percent of total U.S. gross output.

Given the importance of innovation for sustainable long-term growth, U.S. policymakers should give high priority to protecting and promoting innovation and new intellectual property. Promoting and protecting innovation are doubly important in light of the current weak economic recovery and persistence of high unemployment since IP companies are best able to boost U.S. productivity and output and generate more and better-paying jobs for both blue- and white-collar workers.

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References

Bresnahan, Timothy and Manuel Trajtenberg. (2001). "General Purpose Technologies 'Engines of Growth?'" NBER Working Papers No. 4148.

Chakrabarti, Alok K. and Michael R. Halperin. (1990). "Technical Performance and Firm Size: Analysis of Patents and Publications of U.S. Firms," Small Business Economics, Vol. 2, No. 3, pp. 183-190.

Lederman, Daniel and William F. Maloney. (2003). "R&D and Development" Policy Research Working Paper, World Bank.

Mairesse, Jacques and Pierre Mohnen. (2004). "The Importance of R&D for Innovation: A Reassessment Using French Survey Data." NBER Working Paper No. 10897.

Mattel's annual reports.

National Science Foundation. (2010). "New Employment Statistics From the 2008 Business R&D and Innovation Survey," Info Brief, NSF.

Pham, Nam D. (2010). "The Impact of Innovation and the Role of Intellectual Property Rights on U.S. Productivity, Competitiveness, Jobs, Wages and Exports," NDP Consulting Research Paper.

Steinberg, Rolf and Olaf Arndt. (2001). "What Determines the Innovation Behavior of European Firms?" Economic Geography.

U.S. Bureau of Economic Analysis, Industry Economic Accounts.

U.S. Bureau of Labor Statistics, National Industry-Specific Occupational Employment and Wage Estimates.

U.S. Copyright Office.

U.S. Patent and Trademark Office.

Walt Disney's annual reports.

Wilson, Daniel J. 2001. "Is Embodied Technological Change the Result of Upstream R&D? Industry-Level Evidence." Federal Reserve Bank of San Francisco.