

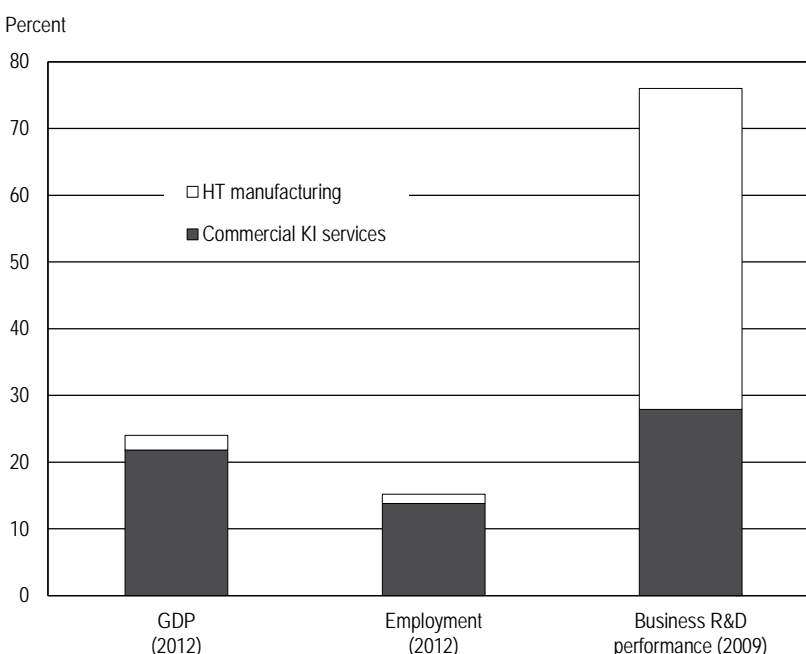
U.S. Knowledge-Intensive Services Industries Employ 18 Million and Pay High Wages

by Derek Hill¹

The commercial knowledge and technology-intensive (KTI) industries play a big role in the U.S. economy. The larger component of KTI industries—the knowledge-intensive (KI) services industries—employed 18 million workers and produced 22% of U.S. gross domestic product (GDP) in 2012. The smaller component—the high technology (HT) manufacturing industries—employed 2 million workers and produced 2% of GDP in 2012. Although smaller than KI services industries, HT manufacturing industries have a greater concentration of workers in S&E occupations and perform a larger proportion of U.S. research and development. Both KI services industries and HT manufacturing industries pay substantially higher wages than the private-sector average.

Three KI services industries (business, finance, and information) and six HT manufacturing industries (aircraft; communications; computers and office machinery; pharmaceuticals; semiconductors; and testing, measuring, and control instruments) classified by the Organisation for Economic and Cooperation and Development are discussed in this report.² (Note: Because various data sources used in this report classify industries differently, different numbers may be reported for KI and HT industries.)

FIGURE 1. Share of U.S. GDP, employment, and business R&D performance, by selected industry : 2009 and 2012



GDP = gross domestic product; HT = high technology; KI = knowledge intensive.

NOTES: Employment consists of the nonagricultural workforce. Business R&D performance consists of domestic funding by companies' own internal funds and funds from other sources. HT manufacturing and commercial KI services industries are classified by the Organisation for Economic Co-operation and Development. HT manufacturing industries include computers and office machinery; communications; semiconductors; testing, measuring, and control instruments; aircraft; and pharmaceuticals. Commercial KI services industries include business, information, and financial services. Business R&D performance of commercial KI services industries consists of professional and technical services and information.

SOURCES: Bureau of Economic Analysis, Annual Industry Accounts, <http://www.bea.gov/industry/index.htm#annual>; Bureau of Labor Statistics, Current Employment Survey, <https://www.bls.gov/ces/> and National Center for Science and Engineering Statistics, Business Research and Development and Innovation Survey, <http://www.nsf.gov/statistics/srvyindustry/>.

TABLE 1. Value-added output of selected U.S. industries and sectors: Selected years, 2000–12
(Billions of current U.S. dollars)

Industry or sector	2000	2003	2005	2007	2008	2009	2010	2011	2012
All sectors and industries	9,952	11,142	12,623	14,029	14,292	13,974	14,499	15,076	15,685
All private services	6,475	7,374	8,330	9,269	9,458	9,345	9,684	10,059	10,474
Commercial KI services	2,013	2,346	2,695	2,998	3,042	2,992	3,116	3,241	3,421
Business	834	937	1,089	1,282	1,363	1,294	1,347	1,435	1,488
Professional, scientific, and technical services	662	745	870	1,025	1,100	1,046	1,084	1,152	1,192
Management of companies and enterprises	171	192	218	258	263	248	263	284	296
Finance	762	902	1,019	1,080	1,042	1,094	1,157	1,159	1,242
Information	418	507	587	636	637	605	612	647	691
Other services	4,462	5,028	5,635	6,271	6,417	6,353	6,568	6,818	7,053
Education	86	106	120	138	148	163	166	174	180
Health care and social assistance	592	741	833	939	1,006	1,062	1,103	1,137	1,165
All others	3,784	4,181	4,682	5,195	5,263	5,127	5,299	5,507	5,709
Manufacturing	1,416	1,374	1,569	1,698	1,629	1,540	1,631	1,732	1,867
HT manufacturing	300	272	301	330	320	332	333	328	342
Aircraft	49	48	57	70	68	70	68	72	79
Communications	49	28	29	30	27	23	25	21	21
Computers and office machinery	40	28	30	30	31	28	20	20	18
Pharmaceuticals	34	52	50	52	44	56	50	47	47
Semiconductors	63	46	52	51	51	46	58	59	53
Testing, measuring, and control instruments	66	71	84	97	100	109	112	109	123
Other manufacturing	1,116	1,102	1,268	1,368	1,309	1,208	1,297	1,404	1,525
Other industries	846	958	1,138	1,302	1,350	1,172	1,217	1,291	1,318
Government	1,215	1,435	1,586	1,760	1,854	1,917	1,967	1,994	2,026

HT = high technology; KI = knowledge intensive.

NOTES: Reporting categories follow the data source. Value-added output is the amount contributed by the industry to the value of a good or service. HT manufacturing and KI services industries are classified by the Organisation for Economic Co-operation and Development. Data for HT manufacturing industries are from IHS Global Insight; data for all other industries are from the Bureau of Economic Analysis.

SOURCES: Bureau of Economic Analysis, GDP by Industry, <http://www.bea.gov/industry/index.htm#annual>, accessed 28 June 2013; IHS Global Insight, World Industry Service.

KTI Industries in the U.S. Economy

In 2012, KTI industries produced \$3.8 trillion in value-added output, nearly one-fourth of the U.S. GDP (figure 1, table 1). The three KI services industries contributed the largest part by far, producing 22% of the GDP. KTI industries perform three-fourths of U.S. business R&D, an important source of innovation and economic growth.³ The six HT manufacturing industries alone performed nearly one-half of U.S. business R&D.

KTI industries are major exporters. In 2011, commercial KI services exported nearly one-half of the \$587 billion total in U.S. cross-border exports for all services, and in 2012, HT manufacturing industries exported nearly one-fourth of the \$1,422 billion total in exports of nonpetroleum goods.⁴

KTI industries tend to be leaders in productivity growth. This is important because productivity—the ratio of production outputs to resource inputs—is a key source of economic growth and

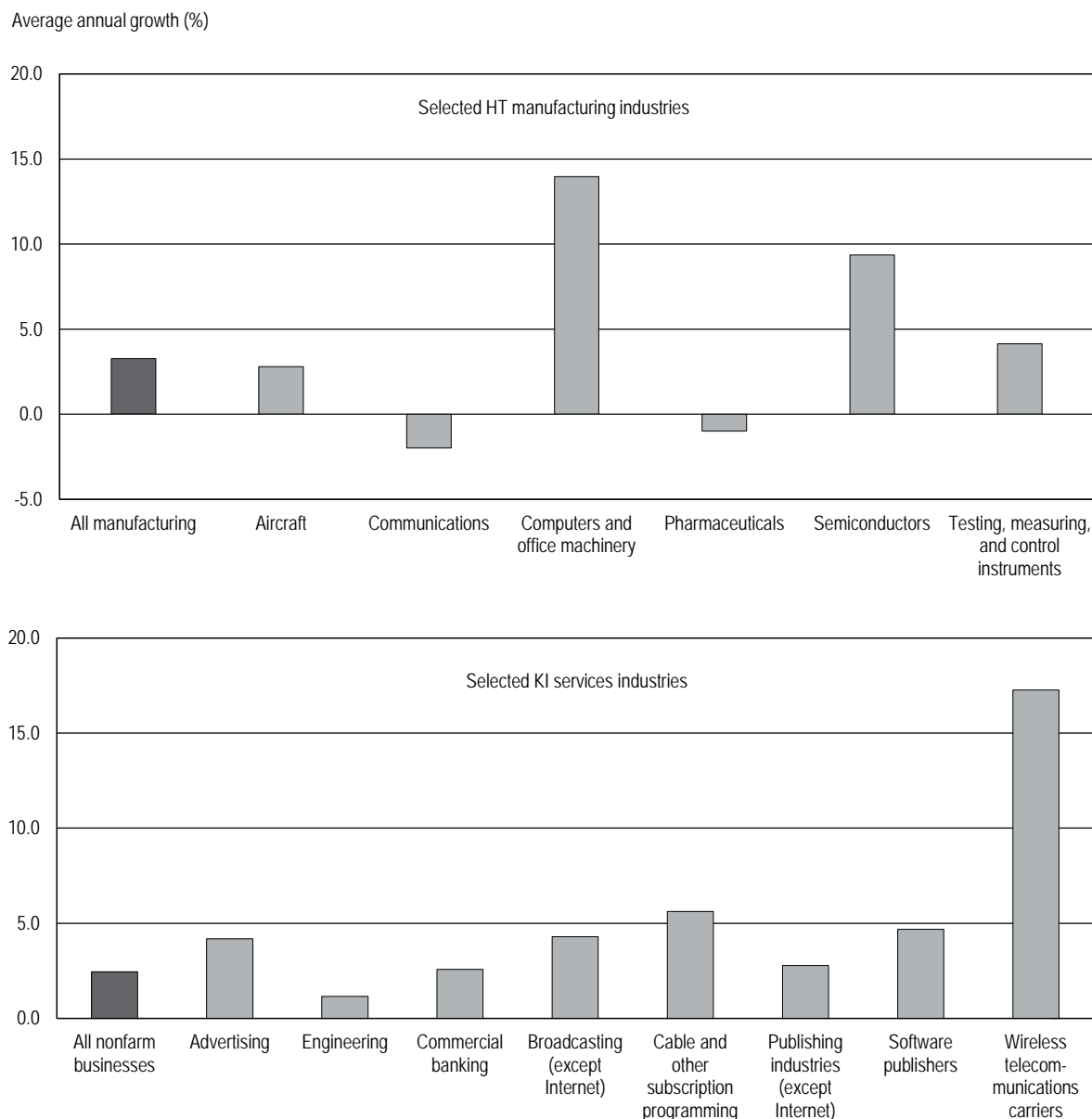
an indicator of development.⁵ In most of the KI services industries for which data are available, labor productivity has grown considerably faster than in nonfarm business. Similarly, in several HT manufacturing industries, labor productivity has grown considerably faster than productivity in the manufacturing sector (figure 2).⁶

Employment Characteristics

Employment

Employment in KTI industries represented 15% of the U.S. workforce in

FIGURE 2. Labor productivity growth of selected U.S. HT manufacturing and KI services industries: 2000–11



SOURCE: Bureau of Labor Statistics, Labor Productivity and Costs, September 2012, <http://www.bls.gov/lpc/>.

2012 (figure 1). KI services employ far more workers (18.4 million) than are employed in the HT manufacturing industries (1.8 million) (table 2). Employment in each of the three KI services industries is much bigger than in HT manufacturing industries as a whole. Business services has the largest workforce (9.9 million), with nearly one-half employed in four advanced-technology

industries: architectural and engineering, computer systems design, management and technical consulting, and scientific R&D. Financial services has the next-largest workforce (5.8 million), with over 80% employed in the credit intermediation and insurance industries. Information services has the smallest labor force (2.7 million), with 0.9 million collectively employed in four advanced technology

industries: data processing, hosting, and related services; radio and television broadcasting; software publishers; and wireless telecommunications carriers. In contrast, the largest HT manufacturing industry employer in 2012 was aircraft (0.5 million), followed by the semiconductors and the testing, measuring, and control instruments industries, which employ about 0.4 million each.

TABLE 2. Employment of selected U.S. industries and sectors: Selected years, 2000–12

(Thousands of persons)

Industry or sector	2000	2003	2005	2007	2008	2009	2010	2011	2012
Total (nonfarm) businesses	131,881	130,100	133,747	137,645	136,852	130,876	129,917	131,497	133,739
All private industries	111,091	108,517	111,943	115,427	114,343	108,321	107,427	109,411	111,822
All private services	86,442	86,701	89,753	93,194	93,008	89,764	89,676	91,363	93,411
Commercial KI services	17,901	17,498	17,907	18,737	18,764	18,023	17,782	18,042	18,413
Business	8,498	8,290	8,784	9,526	9,704	9,376	9,314	9,600	9,901
Professional, scientific, and technical services	6,702	6,603	7,025	7,659	7,800	7,509	7,441	7,666	7,892
Accounting and bookkeeping	866	815	849	936	951	914	887	899	913
Advertising and related services	497	430	446	471	462	422	408	422	430
Architectural and engineering services	1,238	1,227	1,311	1,432	1,439	1,325	1,275	1,294	1,323
Computer systems design services	1,254	1,117	1,195	1,372	1,440	1,423	1,449	1,536	1,620
Legal services	1,066	1,142	1,168	1,175	1,162	1,125	1,114	1,116	1,122
Management and technical consulting services	673	718	824	953	1,002	995	999	1,065	1,121
Other professional and business services	462	494	524	574	584	566	576	592	609
Scientific R&D services	515	539	577	602	620	616	621	628	638
Specialized design services	132	121	131	143	141	124	113	114	116
Management of companies and enterprises	1,796	1,687	1,759	1,866	1,905	1,867	1,872	1,934	2,008
Finance	5,773	6,021	6,063	6,179	6,077	5,844	5,761	5,769	5,835
Credit intermediation	2,548	2,792	2,869	2,866	2,733	2,590	2,550	2,554	2,579
Securities, commodity contracts, investments	805	758	786	849	864	811	801	811	814
Insurance carriers	2,317	2,367	2,303	2,354	2,367	2,333	2,304	2,300	2,337
All others	104	103	105	110	113	109	107	104	104
Information	3,631	3,188	3,061	3,032	2,984	2,804	2,707	2,673	2,678
Data processing, hosting, and related services	316	280	263	268	260	249	243	246	250
Motion picture and sound recording	383	376	378	381	371	358	370	362	372
Publishing (except Internet)	1,035	925	904	901	880	796	759	749	738
Software publishers	261	239	238	255	264	258	261	271	286
Radio and television broadcasting	253	238	239	237	233	215	210	210	211
Cable and other subscription programming	91	86	89	89	86	85	80	74	74
Wired telecommunications carriers	922	762	690	665	666	635	603	585	581
Wireless telecommunications carriers	186	190	191	203	201	187	170	166	159
All others	446	331	308	289	286	279	272	283	292
Other services	68,541	69,203	71,846	74,458	74,244	71,741	71,894	73,321	74,998
Education	2,390	2,695	2,836	2,941	3,040	3,090	3,155	3,250	3,347
Health	10,858	11,817	12,314	12,947	13,290	13,543	13,777	14,026	14,302
All others	55,293	54,691	56,696	58,569	57,914	55,108	54,962	56,045	57,349
Manufacturing	17,263	14,509	14,227	13,879	13,406	11,847	11,528	11,726	11,919
HT manufacturing	2,496	2,004	1,983	1,989	1,981	1,863	1,805	1,817	1,821
Aircraft	517	442	455	489	507	492	478	487	497
Communications	239	149	141	128	127	121	117	115	110
Computers and office machinery	302	224	205	186	183	166	158	157	159
Pharmaceuticals	274	292	288	295	291	284	277	270	271
Semiconductors	676	461	452	448	432	378	369	383	384
Testing, measuring, and control instruments	488	435	441	443	441	422	406	404	400
Other manufacturing	14,767	12,505	12,244	11,890	11,425	9,984	9,723	9,910	10,098
Other industries	7,386	7,307	7,963	8,354	7,929	6,710	6,223	6,322	6,492
Government	20,790	21,583	21,804	22,218	22,509	22,555	22,490	22,086	21,917

HT = high technology; KI = knowledge intensive.

NOTES: Reporting categories follow the data source. HT manufacturing and commercial KI services industries are classified by the Organisation for Economic Co-operation and Development.

SOURCE: Bureau of Labor Statistics, Current Employment Statistics, <http://www.bls.gov/ces/>, accessed 15 July 2013.

S&E workforce intensity

KTI industries have a highly skilled workforce as measured by S&E workforce intensity—defined as the percentage of the workforce in S&E occupations. The S&E workforce intensities of HT manufacturing industries (26%) and commercial KI services industries (16%) are significantly higher than the average S&E workforce intensity of private industries (4%) (table 3).

S&E workforce intensity varies widely among individual KI services and HT manufacturing industries. Business services has the highest S&E workforce intensity among the KI services industries, with about one in five employees working in an S&E occupation in 2012 (table 3). Within business services, S&E workforce intensity is highest in computer systems design (53%), scientific R&D (44%), and architectural and engineering (33%) (table 4). Information

services has the next highest S&E intensity (17%). Software publishers (46%) and data processing, hosting, and related services (38%) have the highest S&E intensities within this industry sector.

Computers and office machinery manufacturing has the highest S&E workforce intensity among the HT manufacturing industries (43%) (table 3), followed by communications (31%). Pharmaceuticals ranks the lowest at 20%.

Wages

U.S. commercial KTI industries pay much higher wages than other industries (figure 3, table 3). The average salaries of KI services industries and HT manufacturing industries in 2011 were similar and were more than \$20,000 higher than the private-sector average. However, average salaries vary widely among individual HT manufacturing and commercial KI services industries (tables 3, 4).

The wage premium in commercial KTI industries is due, in part, to the high concentration of workers in S&E occupations. In the private sector, S&E workers earn an average of \$83,000, close to double the salary of non-S&E workers (figure 3, table 3). However, this is not the whole story. Non-S&E workers in commercial KTI industries earn at least \$18,000 more than those in other industries.

Business services pays the highest average salary (\$73,000) among commercial KI services industries (table 4). Within this category, average salaries are highest in computer systems design and related services and in scientific R&D (\$85,000). The average salary in information services is \$64,000, with the software publishers industry commanding the highest salary (\$91,000) in this category. Among the HT manufacturing industries, computers and office machinery

TABLE 3. Average salaries and S&E workforce intensity, by selected industry and broad occupation category: 2004 and 2012 (Dollars)

Industry	All occupations		S&E occupations		Non-S&E occupations		S&E workforce intensity (%) ^a	
	2004	2012	2004	2012	2004	2012	2004	2012
All private industries	37,000	45,000	68,000	83,000	35,000	43,000	3.9	4.4
Commercial KI services	53,000	68,000	70,000	86,000	50,000	65,000	12.8	15.8
Business	57,000	73,000	71,000	87,000	54,000	69,000	18.7	21.4
Finance	48,000	62,000	66,000	83,000	47,000	60,000	4.7	5.4
Information	49,000	64,000	70,000	84,000	46,000	60,000	11.8	16.6
HT manufacturing	56,000	70,000	79,000	95,000	48,000	61,000	25.8	26.4
Aircraft	56,000	71,000	77,000	96,000	49,000	62,000	25.8	24.4
Communications	55,000	75,000	77,000	98,000	48,000	64,000	25.2	30.9
Computers and office machinery	69,000	90,000	87,000	98,000	57,000	83,000	38.5	43.1
Pharmaceuticals	54,000	64,000	72,000	84,000	49,000	59,000	20.0	20.4
Semiconductors	51,000	64,000	80,000	97,000	43,000	55,000	22.1	23.4
Testing, measuring, and control instruments	56,000	71,000	79,000	94,000	48,000	62,000	27.6	28.0
All other industries	37,000	41,000	63,000	78,000	33,000	40,000	1.9	2.5

HT = high technology; KI = knowledge intensive; S&E = science and engineering.

^a Percentage of workforce in S&E occupations.

NOTES: HT manufacturing and commercial KI services industries are classified by the Organisation for Economic Co-operation and Development. S&E occupations include biological, agricultural, and environmental scientists; computer scientists; life scientists; mathematicians; physical scientists; social scientists; engineers; and S&E postsecondary teachers. Salary estimates are in current dollars and are rounded to the nearest thousand.

SOURCE: Bureau of Labor Statistics, Occupational Employment Survey, special tabulations, July 2013.

TABLE 4. Average salaries and S&E workforce intensity for selected U.S. commercial KI services industries, by broad occupation: 2004 and 2012 (Dollars)

Service industry	All occupations		S&E occupations		Non-S&E occupations		S&E workforce intensity ^a	
	2004	2012	2004	2012	2004	2012	2004	2012
Business services	57,000	73,000	71,000	87,000	54,000	69,000	18.7	21.4
Accounting, tax preparation, bookkeeping, and payroll services	49,000	60,000	66,000	71,000	48,000	60,000	3.8	2.7
Advertising, public relations, and related services	51,000	65,000	61,000	74,000	50,000	64,000	3.5	3.6
Architectural, engineering, and related services	56,000	73,000	71,000	88,000	50,000	65,000	29.5	33.3
Computer systems design and related services	70,000	85,000	72,000	86,000	68,000	83,000	48.3	52.5
Legal services	61,000	77,000	58,000	70,000	61,000	77,000	1.2	1.4
Management of companies and enterprises	55,000	73,000	69,000	83,000	53,000	72,000	11.7	12.9
Management, scientific, and technical consulting services	59,000	74,000	69,000	86,000	57,000	72,000	18.4	17.9
Other professional, scientific, and technical services	34,000	46,000	48,000	69,000	33,000	45,000	5.9	4.2
Scientific R&D services	67,000	85,000	77,000	93,000	60,000	78,000	40.0	44.1
Specialized design services	48,000	59,000	61,000	74,000	48,000	58,000	3.6	4.7
Financial services	48,000	62,000	66,000	83,000	47,000	60,000	4.8	5.4
Activities related to credit intermediation	44,000	52,000	61,000	85,000	43,000	50,000	3.4	6.0
Agencies, brokerages, and other insurance-related activities	46,000	56,000	60,000	73,000	45,000	55,000	2.3	2.7
Depository credit intermediation	38,000	50,000	60,000	78,000	37,000	49,000	3.2	3.4
Insurance and employee benefit funds	50,000	69,000	69,000	89,000	na	68,000	na	7.8
Insurance carriers	49,000	64,000	64,000	80,000	48,000	62,000	7.7	9.5
Monetary authorities—central bank	50,000	81,000	70,000	90,000	46,000	79,000	14.7	21.5
Nondepository credit intermediation	48,000	58,000	67,000	86,000	47,000	56,000	4.6	5.2
Other financial investment activities	71,000	95,000	75,000	93,000	71,000	95,000	7.1	5.3
Other investment pools and funds	58,000	79,000	na	91,000	na	77,000	na	8.9
Securities and commodity contracts intermediation and brokerage	74,000	95,000	77,000	99,000	73,000	94,000	6.9	6.8
Securities and commodity exchanges	76,000	99,000	74,000	na	77,000	na	16.2	na
Information services	49,000	64,000	70,000	84,000	46,000	60,000	11.8	16.6
Cable and other program distribution	41,000	na	57,000	na	40,000	na	6.5	na
Cable and other subscription programming	46,000	56,000	58,000	77,000	45,000	55,000	7.8	4.7
Data processing, hosting, and related services	53,000	68,000	na	79,000	75,000	61,000	29.0	38.0
Internet publishing and broadcasting	63,000	na	67,000	na	61,000	na	29.2	na
Internet service providers and Web search portals	61,000	na	65,000	na	59,000	na	36.9	na
Motion picture and video industries	40,000	61,000	69,000	86,000	39,000	61,000	1.7	2.3
Newspaper, periodical, book, and directory publishers	41,000	52,000	62,000	72,000	40,000	51,000	4.4	3.9
Other information services	38,000	72,000	64,000	88,000	37,000	68,000	5.2	23.7
Other telecommunications	50,000	65,000	61,000	79,000	48,000	61,000	14.7	20.2
Radio and television broadcasting	46,000	57,000	62,000	72,000	45,000	56,000	2.8	3.1
Satellite telecommunications	53,000	57,000	73,000	90,000	50,000	53,000	11.6	12.8
Software publishers	75,000	91,000	77,000	91,000	72,000	91,000	48.3	45.9
Sound recording industries	45,000	61,000	56,000	73,000	45,000	60,000	3.8	3.2
Telecommunications resellers	52,000	na	68,000	na	49,000	na	16.1	na
Wired telecommunications carriers	54,000	63,000	71,000	81,000	51,000	59,000	16.3	16.5
Wireless telecommunications carriers (except satellite)	47,000	60,000	68,000	86,000	43,000	56,000	13.7	15.4

na = not available.

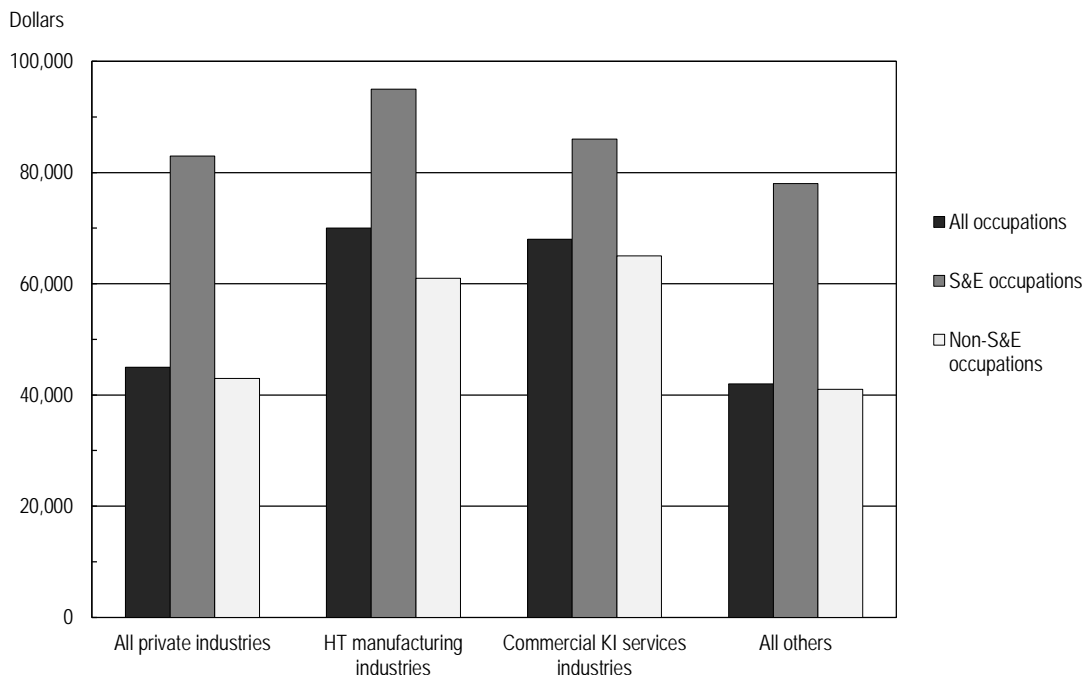
KI = knowledge intensive; S&E = science and engineering.

^a Percentage of workforce in S&E occupations.

NOTES: Reporting categories follow the data source. Commercial KI services industries are classified by the Organisation for Economic Co-operation and Development and include health, education, business, information, and financial services. S&E occupations include biological, agricultural, and environmental scientists; computer scientists; life scientists; mathematicians; physical scientists; social scientists; engineers; and S&E postsecondary teachers. Salary estimates are in current dollars and are rounded to the nearest thousand.

SOURCE: Bureau of Labor Statistics, special tabulations, July 2013, of the Occupational Employment Survey.

FIGURE 3. Average annual salaries for selected U.S. industries and broad occupations: 2012



HT = high technology; KI = knowledge intensive; S&E = science and engineering.

NOTES: As classified by the Organisation for Economic Co-operation and Development, HT manufacturing industries include computers and office machinery; communications; semiconductors; testing, measuring, and control instruments; aircraft; and pharmaceuticals. Commercial KI services industries include business, information, and financial services. S&E occupations include biological, agricultural, and environmental scientists; computer scientists; life scientists; mathematicians; physical scientists; social scientists; engineers; and S&E postsecondary teachers. Salary estimates are in current dollars and are rounded to the nearest thousand.

SOURCE: Bureau of Labor Statistics, Occupational Employment Survey, special tabulations, July 2013.

pay by far the highest salary (\$90,000) (table 3).

Employment and Output Trends

KTI industries tended to have faster growth in output per unit of labor (labor productivity) than other industries between 2000 and 2011. In general, higher labor productivity growth is consistent with more modest or negative job growth. KTI industries exhibited more modest or negative job growth compared with other industries between 2000 and 2012. The value-added output of commercial KI services industries grew 70% in this period and employment expanded by 3% (500,000 jobs) (tables 1, 2). Employment in business services grew 17% (1.4 million jobs), coinciding with the

move by U.S. companies to reduce costs and leverage the expertise of specialized companies by contracting out many of their services. Employment in information services contracted by 26% (-950,000 jobs), coinciding with rapid technological progress and increased international competition that affected both traditional industries (e.g., publishing) and HT industries (e.g., broadband and cellular phone service).

In the HT manufacturing industries, the three ICT industries—communications, semiconductors, and computers and office machinery—had collective steep declines in output and employment with a loss of 600,000 jobs (tables 1, 2). The sharp fall in employment and output in the ICT manufacturing industries coincided with U.S.-based multi-

national corporations moving their production facilities to China and other countries. In the three other HT manufacturing industries—aircraft, pharmaceuticals, and testing, measuring, and control instruments—combined value-added output grew 67%. Employment trends varied, with stable employment in aircraft and pharmaceuticals and a loss of 90,000 jobs in testing, measuring, and control instruments.

Data Sources and Availability

Data presented here are from the Bureau of Economic Analysis's (BEA's) *GDP by Industry Data* and from the Bureau of Labor Statistics' (BLS's) Current Employment Statistics (CES) and Occupational Employment Survey (OES). Data from BEA and CES are

publicly available at http://www.bea.gov/industry/gdpbyind_data.htm and <http://www.bls.gov/ces/>, respectively. Data from the OES are special tabulations provided to the National Center for Science and Engineering Statistics by BLS, and publicly available data from the May 2004 survey can be found at <http://www.bls.gov/oes/tables.htm>. Data on U.S. business R&D are from *Business Research and Development and Innovation: 2008–10* (available at <http://www.nsf.gov/statistics/nsf13332/>).

Average salaries are rounded to the nearest \$1,000. Average salaries for all occupations for individual industries are from OES special tabulations and the May 2004 survey. To calculate average salaries for categories of industries, such as commercial KI services industries, total wages were divided by employment. Salaries of S&E occupations for individual industries are from OES special tabulations. Salaries of S&E occupations for industry categories were calculated by total wages divided by employment. Average salaries or employment for a few individual industries in these categories were not available and were excluded from the calculations of average salaries of these industry categories.

Definitions

High-technology (HT) manufacturing industries: Manufacturing industries identified by the Organisation for Economic Cooperation and Development (OECD) that spend a large proportion of their revenues on R&D and make products that contain or embody technologies developed from R&D. These are aircraft; communications (including semiconductors); computers and office machinery; pharmaceuticals; and testing, measuring, and control instruments. This report separately examines communications and semiconductors.

Knowledge-intensive (KI) services industries: Service industries identified by OECD that incorporate advanced technology, either in their services or in the delivery of their services. Three of these—business, finance, and information services (including computer software and R&D)—are generally commercially traded. The others—education and health services—are publicly regulated or provided and remain relatively more location bound. Each KI services industry is a collection of specific industries. Examples of business service industries are accounting, architecture and engineering, scientific R&D, computer systems design, and legal services.

S&E occupations: Occupations include biological, agricultural, and environmental scientists; computer scientists; life scientists; mathematicians; physical scientists; social scientists; engineers; and S&E postsecondary teachers.

Value added: The amount contributed by the industry to the value of a good or service. It excludes purchases of domestic and imported supplies and inputs from other industries or countries. Value-added output is expressed in current dollars unless otherwise noted.

Notes

1. Derek Hill, National Center for Science and Engineering Statistics, National Science Foundation, 4201 Wilson Boulevard, Suite 965, Arlington, VA 22230 (dhill@nsf.gov; 703-292-7805).
2. National Science Board (NSB). 2014. *Science and Engineering Indicators 2014*. NSB 14-01. Arlington, VA: National Science Foundation. Available at <http://www.nsf.gov/statistics/seind14/>.
3. National Science Foundation, National Center for Science and Engineering Statistics (NSF/NCSES).

2013. *Business Research and Development and Innovation: 2008–10*. Detailed Statistical Tables NSF 13-332. Arlington, VA. Available at <http://www.nsf.gov/statistics/nsf13332/>.

4. Data on cross-border exports of U.S. service industries are from Bureau of Economic Analysis, U.S. international services statistics, http://www.bea.gov/international/international_services.htm. In these data, U.S. cross-border exports of commercial KI services industries are the sum of the finance; insurance; telecommunications; and business, professional, and technical services categories. Data on U.S. exports of nonpetroleum exports are from the Census Bureau, Foreign Trade, U.S. International Trade in Goods and Services—Annual Revision for 2012, http://www.census.gov/foreign-trade/Press-Release/2012pr/final_revisions/#notice_goods. Data on U.S. HT exports are from IHS Global Insight World Trade Service, <http://www.ihs.com/products/global-insight/industry-analysis/commerce-transport/world-trade.aspx>. The value of exports (and imports) is measured on a gross basis, which is not compatible with the value-added measure of industry output. Trade data are based on a classification of goods or services themselves, not the industry that produces them.

5. Organisation for Economic Cooperation and Development (OECD). 2001. *Measuring Productivity: Measurement of Aggregate and Industry-Level Productivity*. OECD Manual. Paris: OECD Publications. Available at <http://www.oecd.org/std/productivity-stats/>.
6. For more information on Bureau of Labor Statistics measures of industry-level labor productivity, see <http://www.bls.gov/lpc/iprhours11.htm> and <http://www.bls.gov/Spotlight/2013/productivity/>.

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