The Contribution of Private Sector Colleges and Universities to IP-Intensive Industries in the United States

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Abstract

Private sector colleges and universities play a vital role in the labor market, global competitiveness, and ultimately growth of the U.S. economy. These educational institutions provide valuable skillsets and practical training for individuals, including nontraditional and underserved student groups, to enter the labor force or to advance their careers. By providing applicable, market-based skills and education, private sector schools enable their graduates to find better jobs and earn higher incomes in strong growth industries.

While accounting for 13% of total postsecondary enrollment, awards conferred by private sector schools in 2012 represented 23% of all the postsecondary awards earned for jobs requiring postsecondary education in IP-intensive industries. Three-quarters of these jobs are technologists, technicians, and production workers that support scientists, engineers, and managers who research, develop, and manufacture innovative products and services. A more educated and skilled workforce fuels the U.S. economy by helping America innovate, produce, and compete in the global marketplace.

Key Findings of the Report

Innovation is fundamental to economic growth and the basis of the United States industrial competitiveness. The U.S. economy is at the world's technological frontier, dependent on a highly-skilled labor force and flow of innovation to fuel its economic growth. The U.S. currently accounts for more than one-third of global research and development (R&D), most of which is contributed by private companies. In 2011, private R&D totaled $238.8 billion in all industries and $163.3 billion in the manufacturing sector alone, accounting for nearly 4% of its total sales. Total R&D personnel consisted of more than 1.4 million people; two-thirds scientists and engineers and one-third technicians, technologists and support staff.

Empirical studies have shown that innovation — the process of turning an idea into a final product or service — is a key driver of economic expansion in both developed and developing countries, accounting for 80% of U.S. economic growth. R&D investment and human capital are two critical components of innovation. Both the research phase and the development phase require a combination of skillsets that are first acquired from postsecondary education and later refined on the job.

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- The U.S. postsecondary education system has doubled in the last 40 years, as non-traditional, minority, and economically-disadvantaged students have taken advantage of expanded opportunities to enroll in postsecondary educational institutions. The percentage of graduating high school students who enroll in postsecondary schools increased from 50.7% in 1975 to 68.2% in 2011.
- The number of institutions, student enrollment, and degrees conferred by private sector schools has grown exponentially over the past decades in response to higher demand for the skills needed to enter the 21st century labor market or career advancement. About 13% of postsecondary enrollment is in private sector schools, which in 2012 conferred 32.5% of all postsecondary credentials and associate's degrees, 7.4% of all bachelor's degrees, and 9.5% of master's or other advanced degrees.
- Different occupations require different skillsets. Legal, life science, and social science jobs usually require a master's degree or higher. Other occupations such as healthcare, computer science, engineering, and management require a mix of skill sets that include postsecondary credentials and associate's, bachelor's, master's, and doctoral degrees.
- Evidence shows a highly positive correlation between education, employment and earnings. In 2012, when the national unemployment rate reached a high of 8.1%, the unemployment rates for no high school diploma and high school diploma groups were 12.4% and 8.3%, respectively. For those with some college and an associate's degree, the unemployment rates were 7.7% and 6.2%, respectively. The unemployment rates were lower for those people who had earned a bachelor's degree (4.5%), a master's degree (3.5%), and a doctor's degree (2.5%).
- While the private sector accounts for 13% of total postsecondary enrollment, awards conferred by private sector schools represent 23% of the awards conferred in fields for jobs in IP-intensive industries requiring a postsecondary education. Of those jobs, nearly three-quarters are held by individuals with postsecondary credentials and associate's degrees.

Private sector educational institutions have made significant contributions to individuals' educational achievement and to the U.S. economy as a whole. These institutions provide required practical skillsets and education for their graduates to get better jobs and higher earnings. Although private sector schools offer all levels and fields of study, the majority of awards conferred by private sector schools are postsecondary credentials and associate's degrees in health, business, homeland security, computer, and engineering technologies.

Graduates from private sector colleges and universities apply their practical skillsets and education to both the research and development phases for innovative industries that are the backbone of the U.S. economy. Some graduates support research scientists and engineers to create intellectual property while others work in the development and production phases to produce innovative products and services. Supported by these technologists and technicians, American companies are the largest source of innovation in the world. These graduates provide their skillsets to produce innovative products at home and to strengthen the competitiveness of American companies globally.

Development of Postsecondary Education over the Past Four Decades

Access to the U.S. postsecondary educational system has been expanding significantly since President Lyndon Johnson signed the Higher Education Act of 1965 as part of his Great Society domestic agenda. The rising demand for skilled workers requiring postsecondary education across the spectrum of industries is largely the result of structural changes in the U.S. economy. Enrollment in postsecondary educational institutions has doubled in the past four decades — enrollment in traditional public and private educational institutions has increased by 70% while enrollment in private sector institutions has jumped 50-fold. The share of non-traditional, minority, and economically-disadvantaged students in postsecondary schools has expanded noticeably.

Over the past 40 years, more U.S. high school completers, including those from minority and economically-disadvantaged groups, have had the opportunity to pursue postsecondary education. Indeed, the share of high school completers who enrolled in 2-year and 4-year schools jumped from 50.7% in 1975 to 68.2% in 2011, an increase of 17.5 percentage points. In 2011, a quarter of 3 million high school completers enrolled in 2-year institutions and 42.3% enrolled in 4-year institutions.

Between 1975 and 2011, enrollments of African-American and Hispanic students increased by 25.4 percentage points and 8.6 percentage points, respectively, compared to 17.2 percentage points for white students. Enrollment by the lowest 20th percentile income group increased by 22.3 percentage points compared to 20.0 percentage points and 17.9 percentage points for those from middle-income and higher-income families, respectively (Table 1). In addition, the College Board reported that 75% of students enrolled in private sector schools are financially independent, twice the percentage of those enrolled in public and private colleges, who are 24 or older, married or have dependents, in the military or veterans, or orphans. Among those dependent students in the private sector schools, 54% came from families with incomes below $40,000, also twice the percentage of those enrolled in public and private colleges.[2]

Female high school completers enrolled in postsecondary schools now surpass their male counterparts. In 1975, less than half of females who completed high school enrolled in postsecondary schools, but by 2011, more than 72% of female high school graduates enrolled in 2-year or 4-year institutions. During the same period, the share of male high school completers who enrolled in postsecondary schools rose from 52.6% to 64.7% (Table 1).

[2] Baum, Sandy and Kathleen Payea. 2011. "Trends in For-Profit Postsecondary Education: Enrollment, Prices, Student Aid and Outcomes." College Bards Advocacy & Policy Center.

Table 1. High School Completers and Their Enrollment in Postsecondary Institutions, 1975-2011[3]

	1975	1980	1990	2000	2011
All completers	3,185,000	3,088,000	2,362,000	2,756,000	3,079,000
% enrolled in colleges	50.7	49.3	60.1	63.3	68.2
2-year	18.2	19.4	20.1	21.4	25.9
4-year	32.6	29.9	40.0	41.9	42.3
By race (% enrolled in colleges)					
White	51.1	49.8	63.0	65.7	68.3
Black	41.7	42.7	46.8	54.9	67.1
Hispanic	58.0	52.3	42.7	52.9	66.6
Asian	--	--	--	84.1 /1	86.1
By income (% enrolled in colleges)					
Lowest 20% income	31.2	32.5	46.7	49.7	53.5
Middle income	46.2	42.5	54.4	59.5	66.2
Top 20% income	64.5	65.2	76.6	76.9	82.4
By gender					
Male completers	1,513,000	1,498,000	1,173,000	1,251,000	1,611,000
% enrolled in colleges	52.6	46.7	58.0	59.9	64.7
2-year	19.0	17.1	19.6	23.1	24.7
4-year	33.6	29.7	38.4	36.8	40.0
Female completers	1,672,000	1,589,000	1,189,000	1,505,000	1,468,000
% enrolled in colleges	49.0	51.8	62.2	66.2	72.2
2-year	17.4	21.6	20.6	20.0	27.3
4-year	31.6	30.2	41.6	46.2	44.9

1/ 2003 data; 2000 data not available.

Total fall enrollments in degree-granting institutions have almost doubled in the past 40 years, from 11.2 million students in 1975 to 21.0 million students in 2011. While part-time enrollments have hovered around 40% of all students during the past 40 years, female enrollment has reported strong gains, climbing from 45% to 57%. During the same period, enrollment in both public and private institutions increased by some 70%. Enrollment in private sector institutions, however, increased by a factor of 49, from 38,903 students in the fall of 1975 to more than 1.9 million students in fall 2011. During the same period, the growth in enrollments in four-year and above institutions, which confer the full gamut of awards from postsecondary credentials to doctorate degrees, increased by nearly 85 fold from 18,147 students to nearly 1.6 million students (Table 2).

[3] Institute of Education Science, U.S. Department of Education.

Table 2. Fall Enrollments in Degree-granting Institutions, 1975-2011[4]

	1975	1991	2011	Growth 1975-2011
Total enrollment	11,184,859	14,358,953	20,994,113	1.9
Part-time	38.8%	43.5%	38.1%	--
Female	45.0%	54.7%	57.0%	--
Public	8,834,508	11,309,563	15,110,196	0.7
4-year	4,998,142	5,904,748	8,047,729	0.6
2-year	3,836,366	5,404,815	7,062,467	0.8
Private Nonprofit	2,311,448	2,819,041	3,927,186	0.7
4-year	2,198,451	2,729,752	3,887,322	0.8
2-year	112,997	89,289	39,864	-0.6
Private Sector	38,903	230,349	1,956,731	49.3
4-year	18,147	72,553	1,559,080	84.9
2-year	20,756	157,796	397,651	18.2

Fall enrollment is used because data for each sector – public, private non-profit and private sector - go back nearly 40 years. However, 12-month enrollments provide a more complete representation of enrollment patterns at private sector colleges and universities that have multiple starts throughout the year. During academic year 2011-12, postsecondary educational institutions had 29 million 12-month unduplicated headcount enrollments. Among those 29 million students, nearly 3.8 million students enrolled in private sector schools, accounting for 13% of total postsecondary enrollments. More than 4.8 million students (16.6% of total) enrolled in private (non-profit) schools and over 20.4 million students (70.4%) enrolled in public schools. Nearly 17 million students (58.5% of total) enrolled in 4-year institutions, 11.4 million students (39.4%) enrolled in 2-year schools, and 629,256 (2.2%) enrolled in less-than-2-year schools (Table 3).

[4] Institute of Education Science, U.S. Department of Education.

Table 3. 12-month Enrollment, by Level and Type of Institution, 2011-12[5]

	Public	Private (non-profit)	Private Sector	Total
Total U.S. Institutions	20,449,384	4,830,271	3,761,878	29,041,533
Less than 2-year	91,041	20,769	517,446	629,256
2-year	10,626,384	71,279	734,955	11,432,618
4-year or more	9,731,959	4,738,223	2,509,477	16,979,659
By level of education				
Total U.S. Institutions	100.0%	100.0%	100.0%	100.0%
Less than 2-year	0.4%	0.4%	13.8%	2.2%
2-year	52.0%	1.5%	19.5%	39.4%
4-year or more	47.6%	98.1%	66.7%	58.5%
By Type of Institution				
Total U.S. Institutions	70.4%	16.6%	13.0%	100.0%
Less than 2-year	14.5%	3.3%	82.2%	100.0%
2-year	92.9%	0.6%	6.4%	100.0%
4-year or more	57.3%	27.9%	14.8%	100.0%

Those 29 million students enrolled in 7,253 institutions operated by public, private (non-profit), or private sector colleges and universities. Although all three types of institutions offer postsecondary credentials (also referred to as certificates) and degrees,[6] each type of institution tends to dominate a certain market segment. Currently, more than half of public educational institutions (1,035 institutions) are 2-year community colleges, 86% of private educational institutions (1,566 institutions) are 4-year or above schools, and nearly half of private sector educational institutions (1,640 institutions) are less-than-2-year schools (Table 4).

[5] Ginder, Scott A. and Janice E. Kelly-Reid. 2013. "Postsecondary Institutions and Cost of Attendance in 2012-13; Degrees and Other Awards Conferred, 2011-12; and 12-Month Enrollment, 2011-12." National Center for Education Statistics, U.S. Department of Education.

[6] The U.S. Department of Education uses the term "certificate" and the Bureau of Labor Statistics uses the term "postsecondary credential" to refer to a sub-baccalaureate award. "Awards" in this report refer to either degrees or postsecondary credentials. Degrees include associate's degrees, bachelor's degrees, master's degrees, doctor's degrees, and professional degrees. Postsecondary credentials can be conferred at any level of institution, but less-than-two year institutions can only confer postsecondary credentials.

Table 4. Number of Education Institutions, by Level and Type of Institution, 2012-13[7]

	Public	Private (not-for-profit)	Private Sector	Total
Total U.S. Institutions	1,981	1,820	3,452	7,253
Less than 2-year	256	78	1,640	1,974
2-year	1,035	176	1,030	2,241
4-year or more	690	1,566	782	3,038

In 2011-12, nearly 3.7 million students earned degrees in public, private, and private sector educational institutions. Among those students, 423,738 students earned degrees from private sector schools compared to 978,577 who earned degrees from private schools and nearly 2.3 million who earned degrees from public schools (Table 5).

Table 5. Number of Students Receiving Degrees by Level and Type of Institution, 2011-12[8]

	Public	Private	Private Sector	Total
Total	2,268,277	978,577	423,738	3,670,592
2-year	592,245	7,570	71,437	671,252
4-year or more	1,676,032	971,007	352,301	2,999,340
Associate's degrees	130,787	46,181	134,617	311,585
Bachelor's degrees	1,113,213	521,902	132,559	1,767,674
Master's degrees	347,449	323,557	79,274	750,280
Doctoral degrees	84,583	79,367	5,851	169,801

The characteristics of students who earn awards from private sector postsecondary institutions are much different than those who graduated from public and private postsecondary institutions. Overall, students who earned a degree from private sector institutions are older and are ethnic minorities. Nearly 46% of students in 2-year private sector schools are between 25 and 39 years old while 45.3% of students in 2-year public schools and 41.2% of students in 2-year private schools are between 18 and 24 years old. Similarly, 54.6% of students in 4-year private sector schools are between 25 and 39 years old compared to 54.0% of students in 4-year public schools and 43.9% of students in 4-year private schools who are between 18 and 24 years old (Table 6).

[7] Ginder, Scott A. and Janice E. Kelly-Reid. 2013. "Postsecondary Institutions and Cost of Attendance in 2012-13; Degrees and Other Awards Conferred, 2011-12; and 12-Month Enrollment, 2011-12." National Center for Education Statistics, U.S. Department of Education.

[8] Ginder, Scott A. and Janice E. Kelly-Reid. 2013. "Postsecondary Institutions and Cost of Attendance in 2012-13; Degrees and Other Awards Conferred, 2011-12; and 12-Month Enrollment, 2011-12." National Center for Education Statistics, U.S. Department of Education.

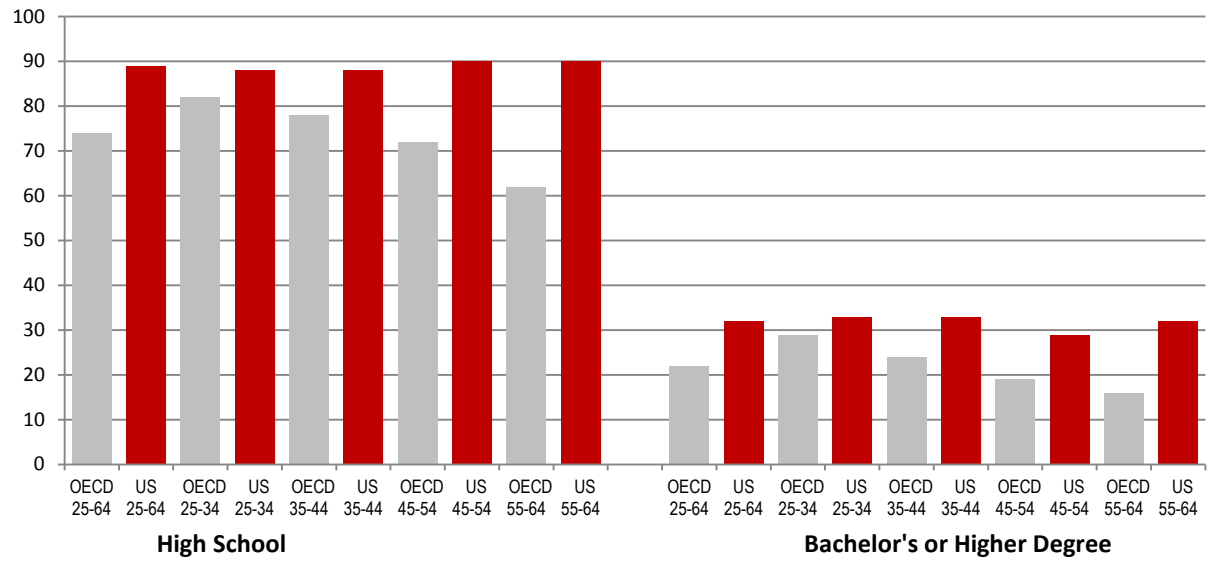
Table 6. Characteristics of Students Receiving Degrees by Type of Institution, 2011-12[9]

	Public	Private	Private Sector	Total
% of women				
2-year	61.1%	62.6%	62.4%	61.2%
4-year or more	56.8%	58.8%	62.7%	58.2%
Age group (%)				
2-year	100.0%	100.0%	100.0%	100.0%
18-24	45.3%	41.2%	35.4%	44.2%
25-39	37.0%	35.8%	45.7%	37.9%
40+	14.3%	12.4%	17.3%	14.6%
4-year				
18-24	54.0%	43.9%	14.8%	46.2%
25-39	37.2%	41.0%	54.6%	40.5%
40+	7.9%	12.5%	30.1%	12.0%
Race (%)				
2-year	100.0%	100.0%	100.0%	100.0%
Asian	4.6%	4.8%	4.3%	4.6%
Black	11.0%	22.2%	19.7%	12.1%
Hispanic	12.9%	10.6%	19.1%	13.5%
White	62.6%	55.3%	45.2%	60.6%
4-year	100.0%	100.0%	100.0%	100.0%
Asian	6.4%	5.8%	3.0%	5.8%
Black	8.9%	9.2%	19.2%	10.2%
Hispanic	9.3%	6.5%	9.5%	8.4%
White	63.0%	60.7%	43.2%	59.9%

Lastly, we compare educational attainment by age group in the U.S. to their counterparts in other OECD countries. About 90% of the population in the United States across all age groups completed their high school education compared to a range of between 60% and 80% of high school completers in other OECD countries. About 30% of the population between 25 and 64 years old earned at least a bachelor's degree compared to between 15% and 30% of the population in the same age group in other OECD countries (Figure 1).

[9] Ginder, Scott A. and Janice E. Kelly-Reid. 2013. "Postsecondary Institutions and Cost of Attendance in 2012-13; Degrees and Other Awards Conferred, 2011-12; and 12-Month Enrollment, 2011-12." National Center for Education Statistics, U.S. Department of Education.

Figure 1. International Comparisons -- Educational Attainment, by Age Group, 2010[10]



As reported in an OECD study, the United States and Japan together employ nearly half of all workers with postsecondary education in the OECD countries. The study finds that the highly educated workforce in these two countries has been the crucial contributing factor to their innovation and global competitiveness. However, the study shows that the gap of educated workforce is narrowing. Indeed, the postsecondary educational attainment in other countries has expanded to catch up with the United States and Japan. For example, China is currently ranked second, behind the United States but already ahead of Japan, in the percentage of OECD and G20 population with postsecondary education attainment.[11]

Distribution of Educational Attainment by Occupation

Each profession requires a particular skillset, training, and experience. A typical requirement of educational attainment varies across occupations, from many years in the legal field to as little as a few months in healthcare support services and protective services occupations. According to the 2010 Bureau of Labor Statistics (BLS) occupational profile, 31% of the U.S. workforce has some college or associate's degree, while 19% and 10% of the workforce has bachelor's and master's degree or above, respectively.[12]

We categorized the educational attainment distribution of BLS 22 major occupational groups into four categories: high school or below, associate's degree and some college (which includes persons who have

[10] Aud, Susan. 2013. "The Condition of Education 2013." National Center for Education Statistics, U.S. Department of Education.
[11] OECD. 2011. "Education at a Glance 2011: OECD Indicators." OECD Publishing.
[12] U.S. Department of Labor, Bureau of Labor Statistics. Standard Occupational Classification.

earned a postsecondary credential), bachelor's degree, and master's degree and above.[13] We identify ten BLS occupational groups where more than 50% of workers have at least a bachelor's degree. The majority of workers in four out of those ten occupational groups have earned a master's degree or above (legal; life physical and social science; education, training, and library; and community and social service). In five other BLS occupational groups, the majority of workers have bachelor's degrees (computer and mathematical; arts, design, entertainment, sports, and media; business and financial operations; architecture and engineering; and management).

There are five BLS occupational groups where the majority of workers have postsecondary awards, mostly associate's degree or some college education (protective service; office and administrative support; healthcare practitioners and technical; healthcare support; personal care and service; and sales). The highest education achievement of the majority of workers in the seven remaining occupations is a high school diploma (Table 7).

Table 7. Educational Attainment by BLS Major Occupation, 2010[14]

Occupation	High School	Associate's degree, Some College	Bachelor's degree	Master's degree, Doctorate's degree
Legal	6%	15%	12%	67%
Life Physical and Social Science	7%	13%	31%	49%
Education, Training, and Library	9%	17%	32%	42%
Community and Social Service	11%	20%	34%	35%
Computer and Mathematical	7%	29%	44%	20%
Arts, Design, Entertainment, Sports, and Media	13%	28%	43%	16%
Business and Financial Operations	13%	27%	42%	18%
Architecture and Engineering	10%	29%	41%	20%
Management	22%	28%	32%	18%
Healthcare Practitioners and Technical	9%	38%	27%	26%
Protective Service	32%	45%	18%	4%
Office and Administrative Support	39%	43%	15%	3%
Healthcare Support	47%	43%	8%	2%
Personal Care and Service	47%	35%	14%	4%
Sales	39%	33%	23%	5%
Farming, Fishing, and Forestry	81%	13%	5%	1%
Building, Grounds Cleaning and Maintenance	74%	20%	5%	1%
Construction and Extraction	69%	25%	5%	1%

[13] The U.S. Bureau of Labor Statistics (BLS) classifies U.S. jobs into 22 major groups, 97 minor groups, 461 broad occupations, and 840 detailed occupations published in its Standard Occupational Classification (SOC).
[14] Employment Projections Program, Bureau of Labor Statistics, U.S. Department of Labor.

Production	67%	26%	6%	1%
Transportation and Material Moving	67%	26%	6%	1%
Food Preparation and Serving	66%	26%	8%	1%
Installation, Maintenance, and Repair	55%	38%	6%	1%
Total	**40%**	**31%**	**19%**	**10%**

We use the distribution of postsecondary awards conferred by three types of educational institutions to estimate the share of private sector students in BLS major occupations. In 2012, private sector schools accounted for 32.5% of all associate's degrees and certificates conferred by all public, private, and private sector schools. While granting a large number of associate's degrees and certificates, private sector schools also accounted for 7.4% of all bachelor's degrees and 9.5% of all master's degrees or higher conferred by all three types of educational institutions to train and educate American workers (Table 8).

Table 8. Shares of Postsecondary Awards Conferred by Private Sector Schools, 2012[15]

Occupation	Associate's degree, Certificates	Bachelor's degree	Master's degree, Doctorate's degree
Architecture and Engineering	29.8%	2.0%	1.1%
Arts, Design, Entertainment, Sports, and Media	33.0%	5.9%	5.0%
Business, Management, Marketing	23.1%	14.1%	19.2%
Community and Social Service	9.2%	5.4%	4.6%
Computer and Mathematical	35.9%	19.6%	7.8%
Construction and Extraction	23.1%	0.3%	--
Education, Training, and Library	15.6%	3.0%	9.0%
Food Preparation and Serving	79.4%	50.3%	--
Healthcare Practitioners, Technical, and Support	46.9%	12.1%	7.9%
Installation, Maintenance, and Repair	32.5%	38.2%	30.8%
Legal	37.6%	22.2%	3.3%
Life Physical and Social Science	6.7%	1.0%	10.2%
Protective Service	27.1%	21.8%	29.2%
Transportation and Material Moving	31.8%	2.4%	3.2%
Total	**32.5%**	**7.4%**	**9.5%**

Public, private, and private sector educational institutions granted nearly 3.7 million postsecondary credentials and degrees in 2012. The top three fields of study across public, private, and private sector institutions in which students earn bachelor's degrees or above were business, health professions, and education. Degrees in social sciences, engineering, and psychology ranked fourth and fifth most popular

[15] Employment Projections Program, Bureau of Labor Statistics, U.S. Department of Labor.

degrees in public and private educational institutions. However, the fourth and fifth most popular degrees in private sector institutions were computer support services and homeland security protective services (Table 9).

Health professions, business, and homeland security protective services are also among the top five associate's degrees conferred in 2012 in public, private, and private sector institutions. Liberal arts, engineering technologies, and personal/culinary services are the fourth and fifth most widely-conferred degrees from public and private institutions. The fourth and fifth most popular associate's degrees in all private sector institutions in 2012 were computer supports services and engineering technologies. In addition to degrees, we also include certificates conferred by all postsecondary institutions. The health professions field of study ranks first in the number of awards earned across public, private, and private sector educational institutions in 2012 (Table 9).

Table 9. Top 5 Fields of Study, by Type of Institution and Level of Degree, 2012[16]

Public	Private	Private Sector
Bachelor's degrees, Master's degrees, and Doctor's degrees		
Business, management, marketing	Business, management, marketing	Business, management, marketing
Health professions	Health professions	Health professions
Education	Education	Education
Social sciences	Social sciences	Computer & support srvc
Engineering	Psychology	Homeland security & protective srvc
Associate's degrees		
Liberal arts & general studies	Health professions	Health professions
Health professions	Liberal arts & general studies	Business, management, marketing
Business, management, & marketing	Business, management, & marketing	Homeland security & protective srvc
Homeland security & protective srvc	Personal & culinary srvc	Computer & support srvc
Engineering technologies	Homeland security & protective srvc	Engineering technologies
Postsecondary Credentials		
Health professions	Health professions	Health professions
Business, management, marketing	Business, management, marketing	Personal & culinary srvc
Mechanic & repair technologies	Personal & culinary srvc	Mechanics & repair technologies
Liberal arts & general studies	Mechanics & repair technologies	Engineering technologies
Homeland security & protective srvc	Visual & performing arts	Transportation & materials moving

Impacts of Education on Employment and Earnings in the United States

Education helps people find and maintain jobs and earn higher wages. Evidence has shown that educational attainment is positively correlated with earnings and employment and negatively correlated with the unemployment rate. When national unemployment rates are high, workers with a postsecondary

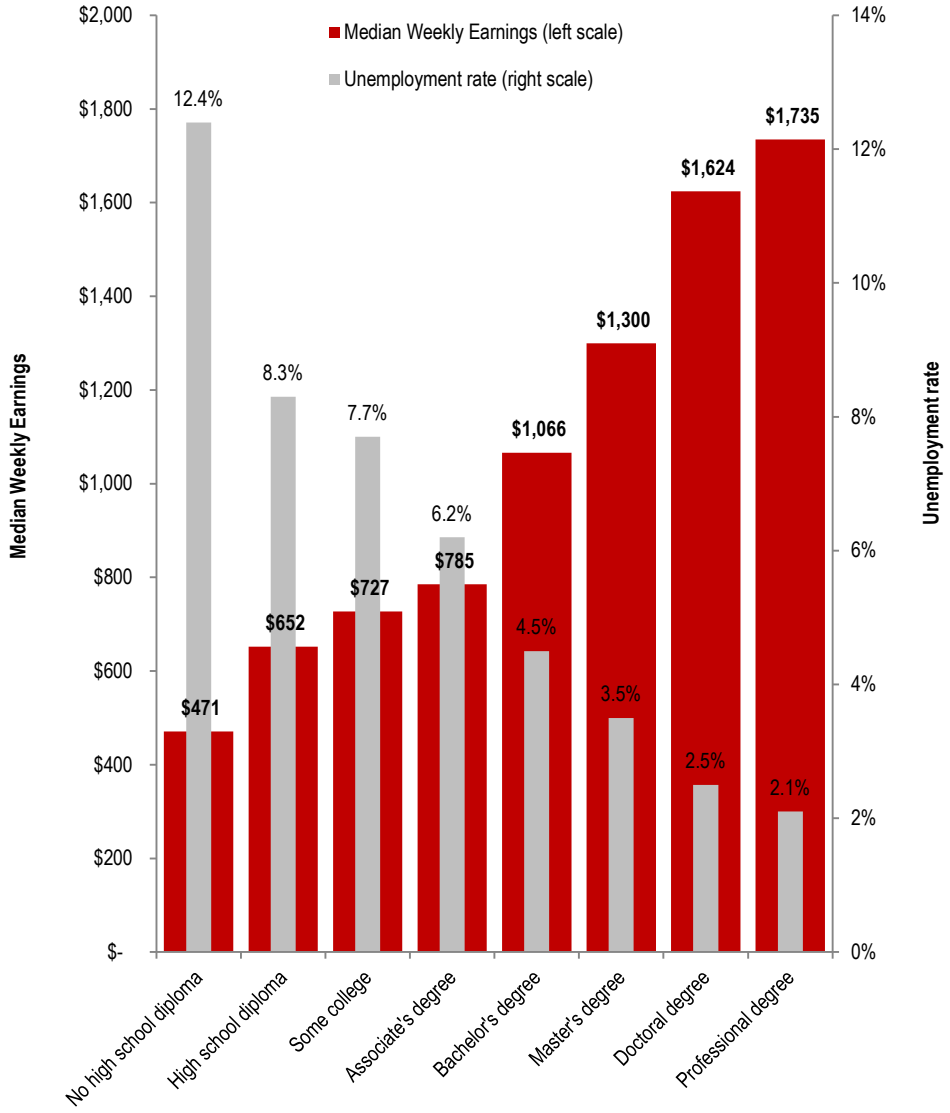
[16] National Center for Education Statistics, U.S. Department of Education.

education are more likely to keep their jobs. In 2012, when the national unemployment rate climbed above the natural rate of unemployment to an average of 8.1%[17], 12% of people with no high school diploma and 8.3% of people with only a high school diploma were unemployed. By comparison, the unemployment rate for people with some college education and associate's degrees dropped to 7.7% and 6.2%, respectively. The unemployment rate for those workers who had at least a bachelor's degree remained low, 2.1% for professional degree holders, 3.5% for master's degree holders, and 4.5% for bachelor's degree holders (Figure 2).

Recent 2012 data reconfirmed the positive relationship between education and earnings. Typical weekly median earnings were $471 for the no high school diploma group and $652 for the high school diploma group. Weekly median earnings increased by more than 11% for those with some college study and more than 20% for associate's degree holders. For those with professional degrees, weekly median earnings were $1,735 in 2012 (Figure 2).

[17] The natural rate of unemployment, which is unemployment that might be needed for a healthy economy, was 5.94 in 2012. Source: U.S. Congressional Budget Office.

Figure 2. Earnings and Unemployment Rates by Educational Attainment, 2012[18]



The positive economic contributions of education on employment and earnings hold true for gender and race. Postsecondary education, in fact, creates opportunities for minorities to be employed and maintain their jobs. Unemployment rates are lower for both men and women who have some college or an associate's degrees and much lower for those who earned bachelor's degrees or higher compared to individuals who only completed high school or less (Table 10 and Table 11).

[18] Current Population Survey, Bureau of Labor Statistics, U.S. Department of Labor.

Table 10. Unemployment Rates by Educational Attainment, Sex and Race, 2012[19]

	Less than a high school diploma	High school graduate	Some college, or Associate's degree	Bachelor's degree, or higher
Total	12.4	8.3	7.7	4.0
Male	11.6	8.5	7.5	3.8
Female	13.9	8.1	8.0	4.3
Asian	6.8	6.1	7.0	4.3
Black	20.4	13.4	11.6	6.3
Hispanic	11.0	9.0	8.0	5.1
White	11.4	7.5	6.9	3.7

Table 11. Weekly Median Earnings by Educational Attainment, Sex and Race, 2012[20]

	Less than a high school diploma	High school graduate	Some college, or Associate's degree	Bachelor's degree, or higher
Total	$474	$652	$749	$1,165
Male	$508	$735	$857	$1,371
Black	$446	$604	$694	$1,086
Hispanic	$486	$624	$758	$1,103
White	$515	$760	$894	$1,399
Female	$386	$561	$659	$1,001
Black	$377	$499	$595	$913
Hispanic	$369	$501	$611	$902
White	$389	$581	$678	$1,012
Asian (all)	$446	$589	$715	$1,290

The median annual earnings for all occupations were $32,530 in 2012. Five occupations with the highest median annual earnings in 2012 were management ($95,230), computer and mathematical ($77,830), legal ($75,030), architecture and engineering ($73,270), and business and financial operations ($62,210). We rank 22 major BLS occupations by the highest educational attainment of the majority of workers. The median annual earnings of all ten major occupations where the majority of workers have bachelor's degrees or above are all higher than the median earnings for all occupations. With the exception of the construction occupation and installation, maintenance, and repair occupation categories, the ten occupations where the majority of workers have associate's degrees or below have lower annual earnings than the national median annual earnings (Table 12).

[19] 25 years and older; Current Population Survey, Bureau of Labor Statistics, U.S. Department of Labor.
[20] 25 years and older; Current Population Survey, Bureau of Labor Statistics, U.S. Department of Labor.

Table 12. Median Annual Earnings by Major Occupation and Educational Attainment, 2012[21]

Occupation	High School	Associate's degree, Some College	Bachelor's degree	Master's degree, Doctorate's degree
Legal				$75,030
Life Physical and Social Science				$61,260
Education, Training, and Library				$38,350
Community and Social Service				$35,970
Computer and Mathematical			$77,830	
Arts, Design, Entertainment, Sports, and Media			$43,950	
Business and Financial Operations			$62,210	
Architecture and Engineering			$73,270	
Management			$95,230	
Healthcare Practitioners and Technical			$60,620	
Protective Service		$24,030		
Office and Administrative Support		$30,540		
Healthcare Support		$25,290		
Personal Care and Service		$20,600		
Sales		$25,090		
Farming, Fishing, and Forestry	$19,210			
Building, Grounds Cleaning and Maintenance	$21,940			
Construction and Extraction	$39,850			
Production	$30,670			
Transportation and Material Moving	$28,620			
Food Preparation and Serving	$18,880			
Installation, Maintenance, and Repair	$40,320			

Impact of Education on Innovation and Economic Growth in the United States

Innovation contributes directly and indirectly to a large share of U.S. economic growth and competitiveness through an array of economic activities, including employment, wages, investment, and output across all sectors in the economy. Our previous empirical studies used historical research and development (R&D) activities conducted by private companies to assess the impacts of innovation. More than two-thirds of R&D expenditures of U.S. companies go towards human capital — mostly in salaries and wages for scientists, engineers, technologists, technicians and support staff — to develop intellectual property. Once the

[21] Employment Projections Program, Bureau of Labor Statistics, U.S. Department of Labor.

intellectual property is created, companies then employ highly-skilled workers and production workers to develop and manufacture innovative products and services.

Using 2000-2007 R&D data published by the National Science Foundation, we calculated the R&D expenditure per employee to measure the intensity of innovation in each industry in the U.S. economy. We identified six "IP-intensive" industries (petroleum and coal products, chemicals, computer and electronic products, transportation equipment, medical equipment, and software) that invest more on R&D per employee than the national average. "Non-IP-intensive" industries are defined as those industries whose R&D expenditures per employee are less than the national average.[22]

Our previous studies estimate that innovation creates and supports 55.7 million direct, indirect, and induced jobs of all occupations along the supply chain of economic activity. Our empirical research shows that these IP-intensive industries outperform non-IP-intensive industries in many economic measures including job creation, wages, output and sale per employee, and export per employee. Furthermore, we find IP-intensive industries employ both high- and low-skilled jobs and provide nearly 60% greater wages to their workers than non-IP-intensive industries. Both output and sales per employee in IP-intensive manufacturing industries are more than double those of non-IP-intensive manufacturing industries.

The output of IP-intensive manufacturing industries accounts for nearly half the output of all manufacturing sectors in the United States. Workers in IP-intensive industries are also more productive, reflecting the required labor skills and relative capital intensity.[23] Our findings support the body of economic literature that shows that human capital plays critically important roles in advancing innovation, adding value to the economy, and contributing disproportionately to job and wage growth.[24]

Education plays a significant role in innovation and ultimately the performance and growth of the U.S. economy. The success of innovation is a combination of large-scale investments and a skilled labor force across all occupations during both the research and development phases. Education contributes to the research phase by providing R&D scientists and engineers, managers, and skilled supporting staff. Education continues contributing to the development phase, once research is completed, by providing skilled workers to produce the innovative products and services. Without a skilled labor force, companies cannot apply innovation to produce those goods and services at home. Growth accounting suggests that rising educational attainment and research intensity contribute to 80% of U.S. growth.[25]

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[22] Pham, Nam. 2012. "IP Creates Jobs for America." NDP Consulting; Pham, Nam. 2010. "The Impact of Innovation and the Role of Intellectual Property on U.S. Productivity, Competitiveness, Jobs, Wages, and Exports." NDP Consulting; [22] IP-intensive industries include petroleum and coal product manufacturing (NAICS 324), chemicals (NAICS 325), computer and electronic products (NAICS 334), transportation equipment (NAICS 336), medical equipment (NAICS 3391), and software (NAIC 5112).
[23] Pham, Nam. 2012. "IP Creates Jobs for America." NDP Consulting; Pham, Nam. 2010. "The Impact of Innovation and the Role of Intellectual Property on U.S. Productivity, Competitiveness, Jobs, Wages, and Exports." NDP Consulting.
[24] Chen, Derek H.C., and Carl Dahlman. 2004. "Knowledge and Development: A Cross-Section Approach." World Bank Policy Research Working Paper No. 3366; Ginarte, J.C., Park, W.G., 1997. "Determinants of Patent Rights: A Cross-National Study." *Research Policy*, 26, pp. 283–301.
[25] Jones, Charles. 2002. "Sources of U.S. Economic Growth in a World of Ideas. American Economic Review.

Building upon our previous research on the IP topic, this report examines the direct contribution of postsecondary education on IP-intensive industries and therefore, by extension, on economic growth. The report focuses on career-oriented, private sector educational institutions that for the most part educate technologists, technicians, and supporting personnel for jobs in the research phase to create IP, and also in the development phase to produce innovative products and services.

Contribution of Education on R&D Personnel across All Industries

The increased importance of the innovation and knowledge industries has changed the structure of U.S. labor markets noticeably over the past several decades. The number of research scientists and engineers employed in science, engineering, and health has been growing steadily over the years. Depending on the nature and the scope of the research project, scientists and engineers assemble teams of laboratory technicians, technologists, statisticians, and supporting staff. Research projects could take years and millions of dollars. For example, research for a new therapeutic drug often lasts more than a decade and costs more than $1.2 billion to meet the pre-approval U.S. Food and Drug Administration (FDA) standards.[26]

The National Science Foundation (NSF) estimates that there were more than 1.4 million jobs directly related to R&D activities in all industries in the U.S. in 2011.[27] Manufacturing sectors accounted for more than 60% of total R&D jobs in the U.S. economy, of which three-quarters were made up of IP-intensive industries. The software industry alone accounts for more than one-quarter of R&D jobs in non-manufacturing sectors. The NSF disaggregates R&D personnel as research scientists and engineers, technicians and technologists, and support staff. As shown in the detailed NSF data, R&D technicians and technologists and other support staff accounted for over one-third of total R&D personnel in both the manufacturing and non-manufacturing sectors. The data demonstrate that innovation requires a combination of different education, skillsets, and worker occupations (Table 13).

Table 13. R&D Personnel in the United States, 2011[28]

	Total R&D Personnel	Scientists & engineers	Technicians & technologists	Support staff
All industries	1,412,000	950,000	292,000	170,000
Manufacturing (31-33)	849,000	584,000	160,000	105,000
Petroleum & coal (324)	4,000	3,000	1,000	---
Chemicals (325)	169,000	109,000	35,000	25,000

[26] DiMasi, Joseph and Henry Grabowski. 2007. "The Cost of Biopharmaceutical R&D: Is Biotech Different?" *Managerial and Decision Economics,* 28, pp. 469-479.
[27] National Science Foundation. 2013. "National Center for Science and Engineering Statistics, Business R&D and Innovation Survey." National Center for Science and Engineering Statistics.
[28] National Science Foundation. 2011. "National Center for Science and Engineering Statistics, Business R&D and Innovation Survey." National Center for Science and Engineering Statistics.

Computer & electronic (334)	266,000	207,000	40,000	19,000
Transportation equipment (336)	155,000	113,000	20,000	22,000
Medical equipment (3391)	33,000	22,000	6,000	5,000
Non-manufacturing (21-23, 42-81)	563,000	366,000	132,000	65,000
Software (5112)	141,000	116,000	15,000	10,000

The Bureau of Labor Statistics (BLS) surveys and compiles a dataset to characterize the typical education requirements for 750 detailed occupations. The BLS statistics show that R&D scientists and engineers, such as computer and research scientists, biological scientists, and medical scientists typically have doctoral and professional degrees. Other scientists, such as epidemiologists, food scientists, soil and plant scientists, and microbiologists require a master's and bachelor's degree to enter the workforce. The majority of technicians and technologists — including medical technicians, clinical laboratory technicians, surgical technologists, computer specialists, and nuclear medicine technologists — have associate's degrees and certificates.[29]

The skillset of R&D scientists and engineers, technologists, technicians, and support staff are obtained from schools and enhanced at their workplace. As shown above, all three - public, private, and private sector - postsecondary institutions educate students in a wide variety of fields of study and confer an array of postsecondary awards from certificates to doctorate degrees. Based on all the awards conferred in 2012, private sector educational institutions are responsible for one-third of technologists, technicians, and support staff who earned postsecondary credentials and associate's degrees. The data underscore the educational designs of private sector educational institutions to focus on the vocational and career-oriented programs to provide their students the requisite skillsets to enter the labor force.

Contribution of Education on Production in IP-intensive Industries

Once the research phase is completed, innovation is transformed into the development and production phases. Companies employ workers with different skillsets in different occupations to work innovatively to produce goods and services to bring to the market for end users. Workers in IP-intensive industries are expected to be better educated and better trained in order to use advanced technology to produce innovative products.

In 2012, more than 4 million American workers were directly employed in the six IP-intensive industries identified above and more than 2.3 million workers (58% of all workers) have postsecondary education.[30] The occupational mix of IP-intensive industries includes higher-skilled and lower-skilled labor. Production workers have the largest percentage of total workers (39.2%) in IP-intensive industries followed by architecture and engineering (12.2%), computer and mathematical (9.0%), office and administrative support (8.6%), management (7.9%), and business and financial operations (6.6%) (Table 14).

[29] Occupational Employment Statistics, Bureau of Labor Statistics, U.S. Department of Labor.
[30] Occupational Employment Statistics, Bureau of Labor Statistics, U.S. Department of Labor.

Table 14. IP-intensive Industries -- Employment by BLS Standard Occupational Classification, 2012[31]

Occupation	Share of Total Jobs in IP-intensive Industries	Jobs in IP-intensive Industries	% of Jobs Have Postsecondary Education
Production	39.2%	1,577,320	32.5%
Architecture and Engineering	12.2%	490,460	90.1%
Computer and Mathematical	9.0%	360,170	93.1%
Office and Administrative Support	8.6%	346,790	61.1%
Management	7.9%	317,880	77.5%
Business and Financial Operations	6.6%	264,460	87.3%
Installation, Maintenance, and Repair	4.5%	180,690	44.7%
Transportation and Material Moving	3.8%	151,640	32.7%
Sales	2.8%	113,680	60.8%
Life Physical and Social Science	2.1%	85,390	92.9%
Construction and Extraction	1.4%	57,850	30.9%
Arts, Design, Entertainment, Sports, and Media	0.8%	31,930	86.6%
Healthcare Practitioners and Technical	0.3%	12,750	91.5%
Building, Grounds Cleaning, and Maintenance	0.3%	13,240	25.8%
Protective Service	0.2%	7,690	68.1%
Legal	0.1%	5,740	94.2%
Others /1	0.1%	2,810	57.3%
Total	100.0%	4,020,490	58.0%

/1 Include food preparation and serving; healthcare support; personal care and service; education, training, and library; community and social service; and farming, fishing, and forestry.

Using the BLS's education and training measurement of 750 detailed occupations, we estimate the distribution of postsecondary educational attainment of workers in IP-intensive industries. In 2012, nearly half of all workers with postsecondary education have earned either postsecondary credentials or associate's degrees. More than one-third have received bachelor's degrees and nearly 16% have earned master's degrees or higher (Table 15).

As shown above, about 40% of workers in IP-intensive industries are production workers. Among those production workers, less than one-third have a postsecondary education. The BLS detailed occupation data shows that among the group with the postsecondary education, nearly 80% have received postsecondary credentials or associate's degrees. Healthcare support, office and administrative support, installation and repairs, and construction are other occupations in the IP-intensive industries that have large shares of workers with postsecondary credentials or associate's degrees (Table 15).

[31] Bureau of Labor Statistics, U.S. Department of Labor.

Table 15. IP-intensive Industries – Distribution of Educational Attainment by Occupation, 2012[32]

Occupation	Workers who have Post-secondary Education	Associate's degree and Post-secondary Credentials	Bachelor's degree	Master's degree and above
Production	512,302	79.6%	16.9%	3.5%
Architecture and Engineering	441,856	32.2%	45.5%	22.3%
Computer and Mathematical	335,408	30.7%	47.2%	22.1%
Office and Administrative Support	211,948	71.3%	23.9%	4.8%
Management	246,518	36.5%	40.7%	22.8%
Business and Financial Operations	230,870	31.4%	47.5%	21.1%
Installation, Maintenance, and Repair	80,733	83.9%	13.6%	2.5%
Transportation and Material Moving	49,552	77.7%	18.8%	3.6%
Sales	69,193	54.7%	37.3%	8.0%
Life Physical and Social Science	79,326	14.6%	33.0%	52.4%
Construction and Extraction	17,894	80.6%	16.3%	3.1%
Arts, Design, Entertainment, Sports, Media	27,648	32.0%	50.1%	18.0%
Healthcare Practitioners and Technical	11,656	42.4%	29.2%	28.4%
Building, Grounds Cleaning, Maintenance	3,417	76.7%	19.5%	3.8%
Protective Service	5,128	67.7%	26.6%	5.7%
Legal	5,405	16.0%	12.3%	71.8%
Others /1	1,610	46.8%	27.1%	26.1%
Total	**2,330,464**	**49.7%**	**34.4%**	**15.9%**

/1 Include food preparation and serving; healthcare support; personal care and service; education, training, and library; community and social service; and farming, fishing, and forestry.

We use the profile of 2012 graduates by field of study to estimate the contribution of private sector schools to IP-intensive industries by major occupation. Based on the profile of awards conferred in 2012, those conferred by private sector schools represent 23.1% of the total awards conferred in the fields for jobs in IP-intensive industries requiring a postsecondary education and more than one-third of the associate's degrees and certificates (Table 16).

[32] Bureau of Labor Statistics, U.S. Department of Labor.

Table 16. Contribution of Private Sector Schools to IP-intensive Industries

	IP-Intensive Industries	Conferred by Private Sector Schools	% of IP-intensive Industries
Postsecondary awards	2,330,464	537,345	23.1%
Associate's degrees or below	1,158,064	396,470	34.2%
Bachelor's degrees	802,551	103,336	12.9%
Master's degrees or above	369,850	37,538	10.1%

Conclusions

The nation's 3,452 private sector postsecondary institutions and nearly 3.7 million students in 2012 provide an outsized boost to the U.S. economy. Though accounting for just 13% of total postsecondary enrollment in 2012, private sector schools conferred awards for 23% of all jobs that required a postsecondary education in the country's IP-intensive industries. The statistics reflect educational training in the private sector schools to provide practical skillsets for students to enter the growing industries.

Enrollment in postsecondary educational institutions has doubled in the past four decades. While enrollment in traditional public and private educational institutions has increased by 70%, enrollment in private sector institutions has jumped 50-fold. The data underscore the development of private sector schools in response to higher demand for the relevant skills needed for the 21st century labor market.

Research scientists and engineers with doctoral and professional degrees work closely with technologists, technicians, and support staff, who have certificates and associate's degrees, in order to create innovative products and services.

It is these IP-intensive industries — coal and petroleum manufacturing, chemicals, computer and electronic products, transportation equipment, medical equipment, and software — that fuel the process of innovation, when an idea becomes a final product or service, and which is a crucial driver of economic growth, both in the United States and across the world, in developed and developing economies alike.

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