

CONEXUS INDIANA

About Conexus Indiana

Conexus Indiana is a private sector-led initiative focused on the advanced manufacturing and logistics sectors—two industries that combined employ more than one of every five Hoosiers. Conexus Indiana is focused on making Indiana a global manufacturing and logistics leader by strengthening the state's human capital, building industry partnerships to capitalize on new opportunities and address key challenges, and promoting a better understanding of the importance of these industries to our economic future.

Conexus Indiana's most urgent mission is building tomorrow's manufacturing and logistics workforce, preparing Hoosiers to take advantage of high-tech careers in these exciting fields. Conexus Indiana is also focused on developing a unified strategy to enhance logistics capabilities, linking manufacturers with in-state suppliers to streamline supply chains and spur investment in Indiana, and undertaking other strategic projects that will help the manufacturing and logistics sectors thrive here at the Crossroads of America.

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Advanced Manufacturing in the United States

THE SHIFT TOWARD DIVERSIFIED INDUSTRIES & AN EDUCATED WORKFORCE



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Introduction

Advanced manufacturing is characterized by a close relationship between technology research and development and to the production of goods. Advanced manufacturing has long emerged as an area of special interest for policymakers concerned with the future of US manufacturing strength. A number of educational and workforce training goals, changes to the regulation of licensing and patents, protection of intellectual property and public investment in R&D are all policies focusing on continued success of advanced manufacturing.

In this analysis we examine 35 advanced manufacturing sectors identified by The Brookings Institution in a recent study (Muro, et al, 2015). We define them and evaluate the connection between advanced manufacturing and educational attainment at the state level. We follow this with an evaluation of the diversity of advanced manufacturing sectors within each state in the most recent year. This provides insight into the breadth of advanced manufacturing sectors across the nation.

We then disaggregate employment in these 50 industrial sectors into three large occupational groups: STEM, white-collar, and blue-collar occupations. We then track employment changes in these sectors across different occupation types in the most recent decade in which we have data. This work is performed at the national level. To focus this analysis, we examine employment within these occupation groups in Indiana.

We conclude with a brief discussion of the current state of manufacturing employment and the role of state and local public policy on this sector.

Advanced Manufacturing Sectors

A recent report published by The Brookings Institution, *America’s Advanced Industries* (Muro et al., 2015) classifies 35 industries as advanced manufacturing. These industries were selected based on the post-recession rebound, impact to US economic activity (value added and GDP), employment share in occupations with large numbers of engineers, increased contributions to private sector R&D, patents, and to exports. This is the most comprehensive definition of advanced manufacturing now in use, and very relevant to our discussion of industry and occupational composition.

These sectors contribute significantly to employment in most states, and are especially important to Midwestern states, comprising a significant share of overall manufacturing. *Table 1* lists the industries that are classified by The Brookings Institution as advanced manufacturing sectors.

Table 1. Classification of Advanced Manufacturing Sectors

Source: The Brookings Institution

NAICS	Sector Name	NAICS	Sector Name	NAICS	Sector Name
3240	Petroleum and coal products manufacturing	3332	Industrial machinery manufacturing	3351	Electric lighting equipment manufacturing
3251	Basic chemical manufacturing	3333	Commercial and service industry machinery manufacturing	3352	Household appliance manufacturing
3252	Resin, synthetic rubber, and artificial synthetic fibers and filaments manufacturing	3336	Engine, turbine, and power transmission equipment manufacturing	3353	Electrical equipment manufacturing
3253	Pesticide, fertilizer, and other agricultural chemical manufacturing	3339	Other general purpose machinery manufacturing	3359	Other electrical equipment and component manufacturing
3254	Pharmaceutical and medicine manufacturing	3341	Computer and peripheral equipment manufacturing	3361	Motor vehicle manufacturing
3259	Other chemical product and preparation manufacturing	3342	Communications equipment manufacturing	3362	Motor vehicle body and trailer manufacturing
3271	Clay product and refractory manufacturing	3343	Audio and video equipment manufacturing	3363	Motor vehicle parts manufacturing
3279	Other nonmetallic mineral product manufacturing	3344	Semiconductor and other electronic component manufacturing	3364	Aerospace product and parts manufacturing
3311	Iron and steel mills and ferroalloy manufacturing	3345	Navigational, measuring, electromedical, and control instruments manufacturing	3365	Railroad rolling stock manufacturing
3313	Alumina and aluminum production and processing	3346	Manufacturing and reproducing magnetic and optical media	3366	Ship and boat building
3315	Foundries			3369	Other transportation equipment manufacturing
3331	Agriculture, construction, and mining machinery manufacturing			3391	Medical equipment and supplies manufacturing
				3399	Other miscellaneous manufacturing

Sector Share of Advanced Manufacturing

Figure 1 shows each state's advanced manufacturing employment as a share of total manufacturing employment in 2013. Indiana's share was 52.6 percent, which was the third highest after New Mexico (54.5 percent) and Wyoming (52.9 percent). Because Indiana has the largest manufacturing sector in the United States, it is also true that Indiana has the largest state share of advanced manufacturing in the nation.

Indiana's large advanced manufacturing share is also growing. Indiana experienced a 1.8 percentage point growth in advanced manufacturing employment share between 2010 and 2013. This places the state in the top quarter of all manufacturing growth rates. During the same period, the median growth across the nation was only 0.5 percent.

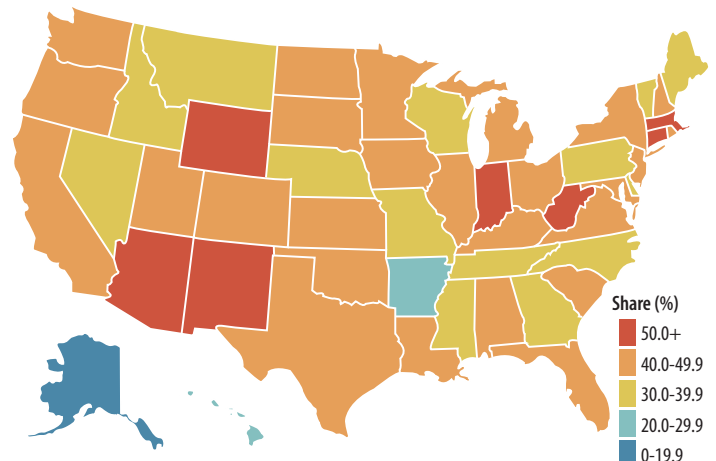
Advanced manufacturing is an important share of Indiana's economy, with 8.4 percent, or one out of every 12 workers, employed in this sector. Among the issues facing advanced manufacturing, the level of educational attainment within labor markets is crucial. To better understand this, we evaluate the role of educational attainment and advanced manufacturing nationwide.

Advanced Manufacturing and Education

To test whether education attainment could drive relative growth in the advanced manufacturing sector, we plot the relationship between changes in share of employment (and establishment) and changes in share of adult population with associates degree or higher between years 2010 and 2013. Figure 2 plots these relationships. We find that changes in education are positively related to changes in share of advanced manufacturing sectoral employment and establishments. This is yet another clear piece of evidence pointing to the important role that an educated workforce plays in long-term prospects for advanced manufacturing.

Figure 1. State-Level Advanced Manufacturing Share of All Manufacturing Employment, 2013

Source: Occupational Employment Statistics, Bureau of Labor Statistics



Diversification in Advanced Manufacturing

Diversity within an industry can be an indicator of the overall stability and resilience of the sector. States or regions with advanced manufacturing presence in only one sector may be far more vulnerable to cyclical downturns, changes in consumer demand, workplace automation, or exposure to competition from imports than regions with a broader distribution of manufactured goods.

To examine the concentration of advanced manufacturing at the state level, we use the Herfindahl-Hirschman Index (HHI) scaled by a factor of 10,000 to determine the relative diversity within 35 advanced manufacturing sectors among all 50 states. The higher the index, the more concentrated the advanced manufacturing sectors are within a state relative to other states. The lower the index, the more diverse the manufacturing sector within a given state.

Next, we analyze the measures of employment and number of establishments within the advanced manufacturing sector.

Figure 2. Relationship Between Educational Attainment of the Worker Population and Manufacturing Growth, 2010-2013

Source: Occupational Employment Statistics, Bureau of Labor Statistics • Panel A: $y = 0.0111x - 0.0116$, $R^2 = 0.0189$ • Panel B: $y = 0.011x - 0.0118$, $R^2 = 0.19834$

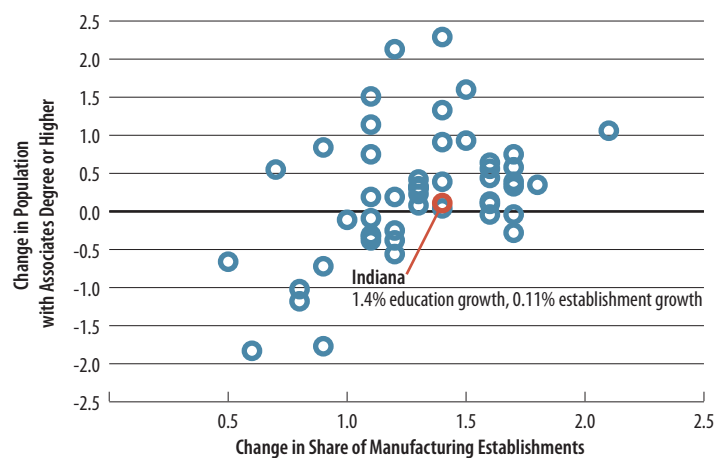
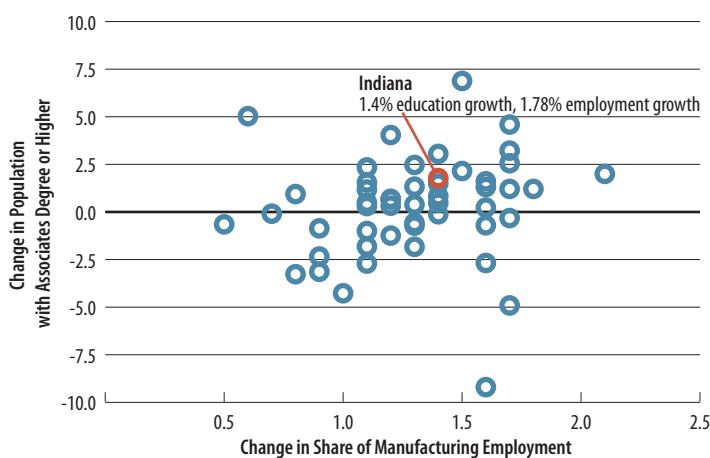
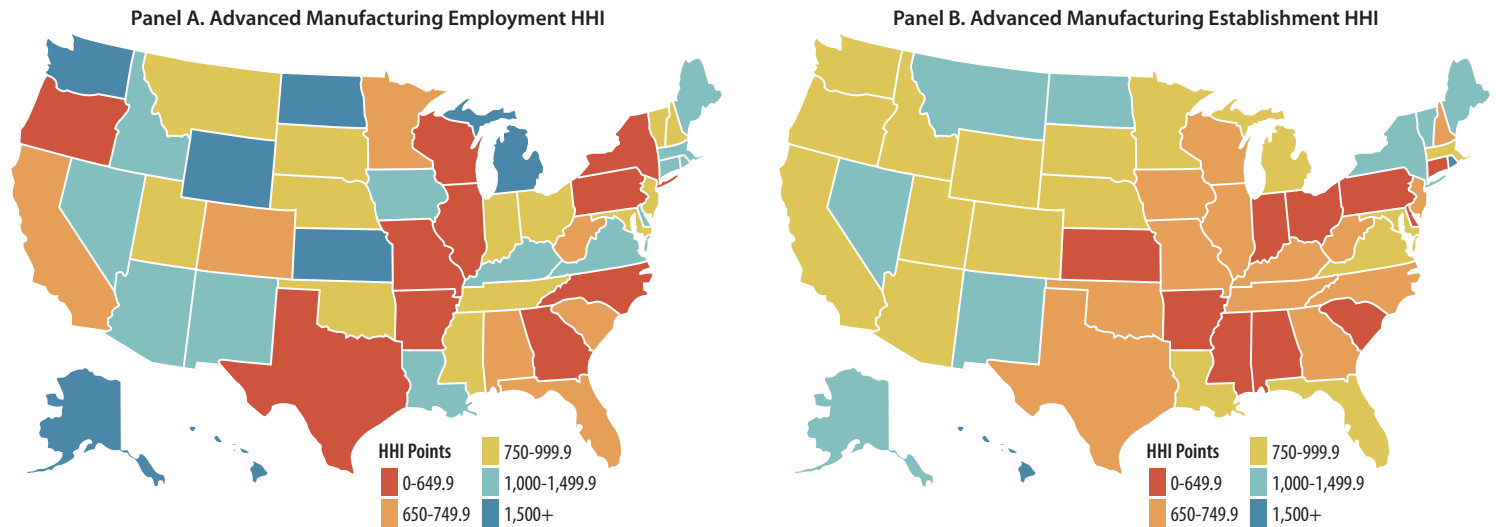


Figure 3. Advanced Manufacturing Performance Using the Herfindahl-Hirschman Index

Source: Occupational Employment Statistics, Bureau of Labor Statistics



As is clear from *Figure 3*, **Indiana enjoys a diverse advanced manufacturing sector**. Indiana's diversification index for advanced manufacturing employment was 891.2 and establishments was 640.6 in 2013. The diversification in Indiana's advanced manufacturing employment was close to average relative to other states, **whereas establishment diversification in Indiana was in the Top 10**.

Table 2 shows the size of advanced manufacturing employment and establishments in Indiana during 2013 (sorted by employment share in *Panel A* and by establishment share in *Panel B*).

Indiana had 243,597 jobs and 2,548 establishments in advanced manufacturing sectors in 2013. *Motor vehicle parts* (NAICS 3363) had the highest share of advanced manufacturing employment (20.5 percent), followed by *Motor vehicle body and trailer* (NAICS 3362) with 14.7 percent, *Iron and steel mills and ferroalloy* (NAICS 3311) with 8.5 percent, and *Medical equipment and supplies* (NAICS 3391) with a share of 7.0 percent.

In terms of establishment size, the *Other miscellaneous manufacturing* (NAICS 3399) had the highest establishment share of 13.4 percent, followed by *Motor vehicle parts* (NAICS 3363) with 11.9 percent share and *Medical equipment and supplies* (NAICS 3391) with a share of 9.5 percent.

We now turn to an evaluation of the employment and occupations within advanced manufacturing, with an emphasis on their dynamics over the last decade.

Table 2. Top 10 Advanced Manufacturing Sectors in Indiana by Employment Share and by Establishment Share, 2013

Source: Occupational Employment Statistics, Bureau of Labor Statistics

Note: See *Appendix Table A1* for all 35 sectors.

Panel A. By Employment Share

Industry	Employees	Employment Share ▼	Total Establishments	Establishment Share
<i>Total, all advanced manufacturing</i>	243,597	100%	2,548	100%
Motor vehicle parts	49,964	20.51	303	11.89
Motor vehicle body and trailer	35,849	14.72	200	7.85
Iron and steel mills and ferroalloy	20,634	8.47	43	1.69
Medical equipment and supplies	17,011	6.98	241	9.46
Motor vehicle	13,533	5.56	19	0.75
Foundries	9,329	3.83	83	3.26
Engine, turbine, and power transmission equipment	8,291	3.4	54	2.12
Other miscellaneous	8,248	3.39	342	13.42
Pharmaceutical and medicine	8,073	3.31	33	1.3
Other general purpose machinery	8,059	3.31	172	6.75

Panel B. By Establishment Share

Industry	Employees	Employment Share	Total Establishments	Establishment Share ▼
<i>Total, all advanced manufacturing</i>	243,597	100%	2,548	100%
Other miscellaneous	8,248	3.39	342	13.42
Motor vehicle parts	49,964	20.51	303	11.89
Medical equipment and supplies	17,011	6.98	241	9.46
Motor vehicle body and trailer	35,849	14.72	200	7.85
Other general purpose machinery	8,059	3.31	172	6.75
Industrial machinery	2,427	1.00	101	3.96
Other nonmetallic mineral product	2,820	1.16	95	3.73
Navigational, measuring, electromedical, and control instruments	7,239	2.97	90	3.53
Foundries	9,329	3.83	83	3.26
Agriculture, construction, and mining machinery	3,540	1.45	78	3.06

Occupations in Advanced Manufacturing

In this section, we analyze the trends in the occupation mix of advanced manufacturing sectors. To do so, we first classify the occupations into three broad groups: STEM, white collar, and blue collar and others. We do this to offer a sense of the educational requirements of each sector, and to better understand how the mix of employment in advanced manufacturing is maturing. We then consolidate occupation employment for each of the 35 advanced manufacturing sectors in the United States for three years (2004, 2010, and 2014).

Table 3 shows the 2014 summary and the 2004-2014 trend of advanced manufacturing sectoral employment by occupation for the entire nation. We do this at the national level because more recent data for states is not yet available, and the likelihood of overall trends at the national level also impacting occupations in states is very high.

Table 3. Advanced Manufacturing Employment by Occupation in the US, 2004-2014

Source: Occupational Employment Statistics, Bureau of Labor Statistics

Occupation	US Employment Share			2014 US Employment
	2004	2010	2014 ▼	
<i>Total, all occupations</i>	100.00%	100.00%	100.00%	5,528,400
STEM-RELATED OCCUPATIONS				
Architecture and engineering occupations	10.84%	↗ 11.52%	↘ 11.51%	636,100
Computer and mathematical occupations	3.79%	↗ 4.50%	↘ 4.36%	240,800
Life, physical, and social science occupations	1.90%	↘ 1.69%	↘ 1.51%	83,300
WHITE COLLAR-RELATED OCCUPATIONS				
Office and administrative support occupations	9.56%	↘ 9.38%	↘ 8.75%	483,900
Management occupations	6.37%	↗ 6.99%	↘ 6.96%	384,800
Business and financial operations occupations	4.51%	↗ 5.11%	↗ 5.45%	301,500
Sales and related occupations	2.53%	↗ 2.74%	↘ 2.59%	143,100
Arts, design, entertainment, sports, and media occupations	0.61%	↗ 0.65%	↘ 0.63%	34,700
Health care practitioners and technical occupations	0.18%	↗ 0.24%	↗ 0.27%	14,700
Legal occupations	0.07%	↗ 0.09%	→ 0.09%	5,000
BLUE COLLAR AND OTHER OCCUPATIONS				
Production occupations	46.51%	↘ 45.27%	↗ 46.57%	2,574,400
Installation, maintenance, and repair occupations	5.47%	↘ 5.13%	↗ 5.19%	286,800
Transportation and material moving occupations	5.01%	↘ 4.32%	↘ 4.08%	225,300
Construction and extraction occupations	1.86%	↘ 1.47%	↗ 1.50%	82,900
Building and grounds cleaning and maintenance occupations	0.48%	↘ 0.39%	↘ 0.35%	19,600
Protective service occupations	0.17%	↘ 0.16%	↘ 0.15%	8,300

We see that the shares of most STEM and white-collar occupations have increased 2004-2014. However, the share of blue-collar and other occupations had a declining trend. For detailed occupational trends across individual advanced manufacturing sectors, refer to *Appendix Tables A2, A3, and A4*.

These trends offer strong support for the argument that automation has contributed to the shift in occupational mix over time. This was detailed in the 2015 companion report, *The Myth and Reality of Manufacturing in America* (June 2015). In that study, we calculated that 88 percent of job changes in manufacturing were due to automation, with only 13 percent due to trade imbalances. Because these jobs in particular are highly susceptible to automation, this examination of advanced manufacturing echoes our discussion from last year.

We apply the nation's share of advanced manufacturing by occupations to estimate Indiana's advanced manufacturing employment levels. Table 4 and Figure 4 show the distribution of advanced manufacturing jobs across occupations.

Table 4. Advanced Manufacturing Employment Estimates by Occupation in Indiana, 2013

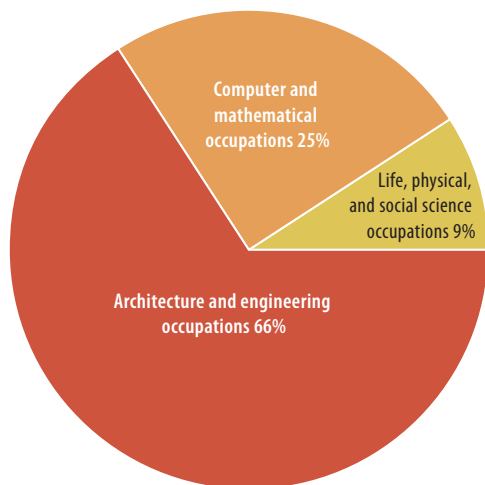
Source: Occupational Employment Statistics, Bureau of Labor Statistics

Occupation	2013 Indiana Employment Share ▼	2013 Indiana Employment
<i>Total, all occupations</i>	100.0%	243,597
STEM-RELATED OCCUPATIONS		
Architecture and engineering occupations	11.5%	28,028
Computer and mathematical occupations	4.4%	10,610
Life, physical, and social science occupations	1.5%	3,670
WHITE COLLAR-RELATED OCCUPATIONS		
Office and administrative support occupations	8.8%	21,322
Management occupations	7.0%	16,955
Business and financial operations occupations	5.5%	13,285
Sales and related occupations	2.6%	6,305
Arts, design, entertainment, sports, and media occupations	0.6%	1,529
Health care practitioners and technical occupations	0.3%	648
Legal occupations	0.1%	220
BLUE COLLAR AND OTHER OCCUPATIONS		
Production occupations	46.6%	113,435
Installation, maintenance, and repair occupations	5.2%	12,637
Transportation and material moving occupations	4.1%	9,927
Construction and extraction occupations	1.5%	3,653
Building and grounds cleaning and maintenance occupations	0.4%	864
Protective service occupations	0.2%	366

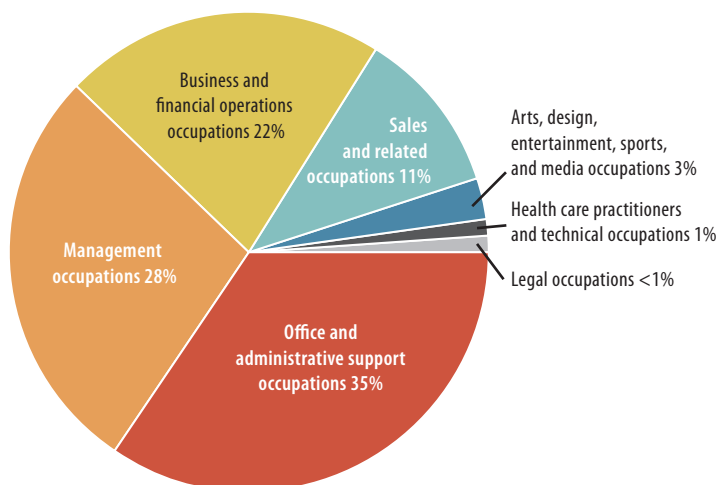
We see that the shares of most STEM and white-collar occupations have increased between 2004 and 2014. However, the share of blue-collar and other occupations had a declining trend.

Figure 4. Distribution of Employment in Indiana, 2013
Source: Occupational Employment Statistics, Bureau of Labor Statistics

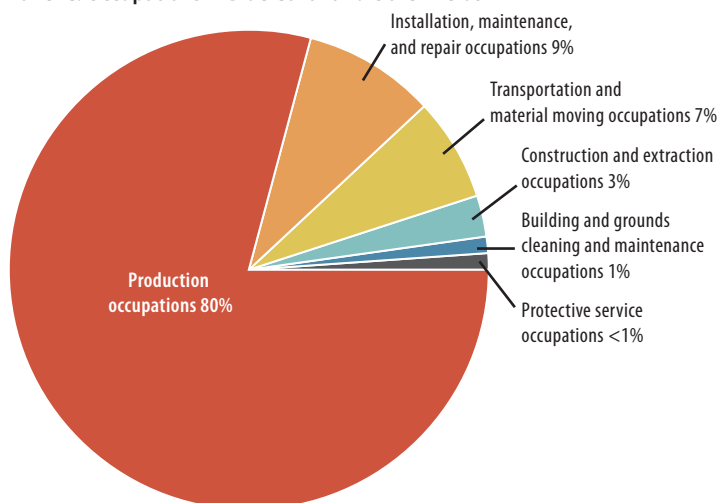
Panel A. Occupations in STEM-Related Fields



Panel B. Occupations in White Collar-Related Fields



Panel C. Occupations in Blue Collar and Other Fields



We find that out of 243,597 estimated advanced manufacturing employment, 17.4 percent (42,309 jobs) are STEM-related occupations, 24.7 percent (60,265 jobs) are white collar-related occupations and 57.8 percent (140,882 jobs) are blue-collar and other occupations.

Discussion

This study has evaluated the size, growth, and composition of advanced manufacturing in the United States over the past decade. We find that advanced manufacturing employment has grown, but that employment growth has been clustered in STEM and white-collar employment. Blue-collar employment in advanced manufacturing has either declined or remained unchanged since 2004.

Examining the correlates of this growth, we find, as virtually every study before has found, that growth in advanced manufacturing is highly correlated with levels of educational attainment. While other factors such as tax and regulatory climate, availability of research universities surely matter; over the long run, a well-educated and ready workforce matters more than any other single factor in the health of advanced manufacturing firms.

Examining Indiana, we find that the state leads the nation in the share of employment in advanced manufacturing with at least one out of every 12 workers employed in this area. The growth in this cluster has likely provided the bulk of manufacturing employment growth in Indiana over the past decade. Importantly in terms of the industrial mix, Indiana enjoys strong diversification, suggesting that advanced manufacturing will be less sensitive to cyclical changes than most states.

There is one concern about advanced manufacturing in Indiana. Indiana's educational attainment ranks no better than average for the skill areas in which advanced manufacturing depends. Continued growth and strength in advanced manufacturing will depend on how effectively the K-12 and higher education systems perform in transitioning students into potential employees for these sectors.

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Appendix A. Additional Data

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Table A1. Size of Industrial Sectors in Indiana in Advanced Manufacturing, 2013

Source: Occupational Employment Statistics, Bureau of Labor Statistics, US Department of Labor,
<http://www.bls.gov/oes/>

NAICS-4	Industry	Employees	Employment Share	Establishments	Establishment Share
<i>Total, all advanced manufacturing</i>		243,597	100%	2,548	100%
3241	Petroleum and coal products	3,428	1.41	59	2.32
3251	Basic chemical	2,513	1.03	70	2.75
3252	Resin, synthetic rubber, and artificial synthetic fibers and filaments	3,334	1.37	47	1.84
3253	Pesticide, fertilizer, and other agricultural chemical	272	0.11	15	0.59
3254	Pharmaceutical and medicine	8,073	3.31	33	1.30
3259	Other chemical product and preparation	2,969	1.22	58	2.28
3271	Clay product and refractory	655	0.27	33	1.30
3279	Other nonmetallic mineral product	2,820	1.16	95	3.73
3311	Iron and steel mills and ferroalloy	20,634	8.47	43	1.69
3313	Alumina and aluminum production and processing	5,822	2.39	45	1.77
3315	Foundries	9,329	3.83	83	3.26
3331	Agriculture, construction, and mining machinery	3,540	1.45	78	3.06
3332	Industrial machinery	2,427	1.00	101	3.96
3333	Commercial and service industry machinery	2,152	0.88	35	1.37
3336	Engine, turbine, and power transmission equipment	8,291	3.40	54	2.12
3339	Other general purpose machinery	8,059	3.31	172	6.75
3341	Computer and peripheral equipment	999	0.41	11	0.43
3342	Communications equipment	1,020	0.42	15	0.59
3343	Audio and video equipment	126	0.05	6	0.24
3344	Semiconductor and other electronic component	3,719	1.53	72	2.83
3345	Navigational, measuring, electromedical, and control instruments	7,239	2.97	90	3.53
3346	Manufacturing and reproducing magnetic and optical media	2,500	1.03	14	0.55
3351	Electric lighting equipment	770	0.32	16	0.63
3352	Household appliance	779	0.32	4	0.16
3353	Electrical equipment	2,859	1.17	66	2.59
3359	Other electrical equipment and component	2,773	1.14	41	1.61
3361	Motor vehicle	13,533	5.56	19	0.75
3362	Motor vehicle body and trailer	35,849	14.72	200	7.85
3363	Motor vehicle parts	49,964	20.51	303	11.89
3364	Aerospace product and parts	6,889	2.83	26	1.02
3365	Railroad rolling stock	1,079	0.44	8	0.31
3366	Ship and boat building	3,288	1.35	17	0.67
3369	Other transportation equipment	634	0.26	36	1.41
3391	Medical equipment and supplies	17,011	6.98	241	9.46
3399	Other miscellaneous	8,248	3.39	342	13.42



Over the long run,
a well-educated and ready workforce
matters more than any other
single factor in the health
of advanced manufacturing firms.

Table A2. Occupations in STEM-Related Fields Using NAICS CodesSource: Occupational Employment Statistics, Bureau of Labor Statistics, US Department of Labor, <http://www.bls.gov/oes/>

Note: For each occupation, "2014 Level" is employment in thousands of workers

STEM-Related Fields	Architecture and Engineering Occupations				Computer and Mathematical Occupations				Life, Physical, and Social Science Occupations			
	2004 Share	2010 Share	2014 Share	2014 Level	2004 Share	2010 Share	2014 Share	2014 Level	2004 Share	2010 Share	2014 Share	2014 Level
31-330 manufacturing	5.69	6.4	6.4	785.9	1.95	2.3	2.3	282.9	1.08	1.0	1.0	115.8
Overall advanced manufacturing	10.84	11.52	11.51	636.1	3.79	4.50	4.36	240.8	1.90	1.69	1.51	83.30
Petroleum and coal products mfg	6.22	8.2	10.0	11.1	1.53	2.3	1.7	1.8	3.55	3.2	3.7	4.1
Basic chemical mfg	6.6	8.6	8.4	12.3	1.49	1.2	1.1	1.7	7.82	7.0	8.1	11.9
Resin, synthetic rubber, and artificial synthetic fibers and filaments mfg	5.77	7.6	8.1	7.6	0.95	1.5	1.7	1.6	6.42	5.0	5.8	5.4
Pesticide, fertilizer, and other agricultural chemical mfg	3.24	3.5	4.0	1.5	1.19	0.6	0.6	0.2	7.22	4.1	5.6	2.0
Pharmaceutical and medicine mfg	4.49	4.5	6.3	17.5	4.07	4.5	3.6	10.0	18.62	19.5	16.1	44.9
Other chemical product and preparation mfg	5.57	4.2	4.1	3.4	1.31	1	0.8	0.7	4.91	4.1	3.9	3.2
Clay product and refractory mfg	2.38	3.2	3.4	1.4	0.38	0.7	0.4	0.2	0.32	0.3		
Other nonmetallic mineral product mfg		2.3	3.3	2.4		0.3	0.4	0.3		0.4	0.3	0.3
Iron and steel mills and ferroalloy mfg	4.01	4.6	3.6	3.3	0.81	0.8	0.9	0.8	0.47	0.3	0.4	0.4
Alumina and aluminum production and processing	3.32	3.5	3.4	2.0	0.76	0.7	0.5	0.3	0.44	0.4	0.3	0.2
Foundries	3.17	3.8	3.6	4.6	0.29	0.5	0.4	0.5	0.16	0.1	0.2	0.2
Agriculture, construction, and mining machinery mfg	7.55	7.9	7.9	20.3	0.87	1.2	1.7	4.4	0.26	0.3	0.3	0.7
Industrial machinery mfg	13.44	13.9	14.4	15.5	2.39	3.2	2.8	3.0	0.5	0.1	0.2	0.2
Commercial and service industry machinery mfg	11.75	12.1	10.9	9.6	5.11	4.9	5.3	4.7	0.71	0.1	0.2	0.2
Engine, turbine, and power transmission equipment mfg	9.1	12.2	15.1	15.6	1.11	1.5	1.5	1.6			0.1	0.1
Other general purpose machinery mfg	10.33	10.1	10.5	27.8	1.4	1.5	1.6	4.3	0.26	0.1	0.1	0.4
Computer and peripheral equipment mfg	17.73	14.9	18.6	30.3	23.62	33.2	32.9	53.5	2.3	0.2	0.1	0.1
Communications equipment mfg	21.83	24.6	22.0	20.5	10.02	12	13.9	13.0	0.75	0.1		
Audio and video equipment mfg	14.74	14.4	17.0	3.2	4.91	6.7	5.2	1.0	0.4			
Semiconductor and other electronic component mfg	21.72	22.2	26.8	98.5	6.72	6.0	6.5	24.0	1.21	0.3	0.2	0.9
Navigational, measuring, electromedical, and control instruments mfg	23.58	23.4	20.7	80.6	9.03	10.4	11.0	42.8	1.39	0.6	0.8	3.1
Mfg and reproducing magnetic and optical media	5.93	2.4	14.0	2.6	15.92	13.3	8.7	1.6	0.67			
Electric lighting equipment mfg	4.32	5.2	7.0	3.2	0.76	1.3	1.5	0.7	0.22			
Household appliance mfg	5.48	5.8	6.3	3.7	1.34	0.9	0.6	0.4	0.43			
Electrical equipment mfg	11.33	12.4	13.7	19.7	1.66	1.9	2	2.9	0.39			
Other electrical equipment and component mfg	7.11	9.4	9.4	11.8	1.29	1.8	1.9	2.4	0.35	0.3	0.2	0.2
Motor vehicle mfg	5.62	8.8	4.6	9.1	0.67	1.2	0.5	0.9	0.07			
Motor vehicle body and trailer mfg	3.81	2.7	2.6	3.7	0.39	0.4	0.4	0.6	0.06			
Motor vehicle parts mfg	7.47	7.6	7.8	42.0	0.66	0.9	1.1	6.0	0.16	0	0.1	0.7
Aerospace product and parts mfg	24.29	21.3	21.0	102.7	7.16	7.7	8.7	42.3	0.67	0.1	0.2	0.9
Railroad rolling stock mfg	7.96	13.6	6.0	1.6	0.86	0.9	1.0	0.2				
Ship and boat building	8.88	10.9	9.9	13.7	0.37	0.5	1.1	1.5	0.29			
Other transportation equipment mfg	9.38	8.4	6.4	2.1	1.92	1.9	1.4	0.4				
Medical equipment and supplies mfg	5.01	6.6	7.8	24.1	1.46	1.7	1.9	5.9	0.9	1.0	0.9	2.7
Other miscellaneous mfg	2.09	2.3	2.6	7.1	1.21	1.6	1.7	4.6	0.29	0.1	0.2	0.5

Table A3. Occupations in White Collar-Related Fields Using NAICS CodesSource: Occupational Employment Statistics, Bureau of Labor Statistics, US Department of Labor, <http://www.bls.gov/oes/>

Note: For each occupation, "2014 Level" is employment in thousands of workers

Other White Collar-Related Fields	Office and Administrative Support Occupations				Management Occupations				Business and Financial Operations Occupations			
	2004 Share	2010 Share	2014 Share	2014 Level	2004 Share	2010 Share	2014 Share	2014 Level	2004 Share	2010 Share	2014 Share	2014 Level
31-330 manufacturing	9.84	9.2	9.2	1126.9	5.19	5.7	5.7	696.4	2.99	3.8	3.8	461.2
Overall advanced manufacturing	9.56	9.38	8.75	483.9	6.37	6.99	6.96	384.8	4.51	5.11	5.45	301.5
Petroleum and coal products mfg	8.73	7.4	7	7.8	5.22	6.6	5.6	6.2	5.11	6.6	5.3	5.8
Basic chemical mfg	9.29	8.2	7.6	11.2	6.49	6.9	7	10.2	3.28	3.9	4.3	6.3
Resin, synthetic rubber, and artificial synthetic fibers and filaments mfg	8.35	8.5	6.8	6.3	6.66	5.5	6.7	6.3	2.77	3.9	4.2	3.9
Pesticide, fertilizer, and other agricultural chemical mfg	10.97	9.5	9.6	3.5	6.91	5.4	7.3	2.7	2.55	3	3.2	1.2
Pharmaceutical and medicine mfg	11.62	9.9	9.1	25.4	10.9	11.1	11.2	31.3	7.3	8.4	8.5	23.7
Other chemical product and preparation mfg	12.03	11.3	10.7	9.0	6.95	6.4	6.7	5.6	2.79	2.6	2.9	2.4
Clay product and refractory mfg	8.42	9	8.6	3.4	4.59	5.3	5.3	2.1	1.33	2.2	2	0.8
Other nonmetallic mineral product mfg		10.3	9.7	7.0		4.4	5.1	3.7		2.1	2.2	1.6
Iron and steel mills and ferroalloy mfg	8.44	5.7	5.8	5.3	3.02	3.4	3.1	2.8	1.59	1.8	1.8	1.7
Alumina and aluminum production and processing	6.4	6.6	6.4	3.8	3.49	3.8	4	2.4	1.93	2.4	2.2	1.3
Foundries	6.05	6.4	6.2	7.9	3.58	4.2	4	5.1	1.39	1.5	1.8	2.3
Agriculture, construction, and mining machinery mfg	10.47	9.6	8.8	22.5	5.49	5.2	5.1	13.1	2.97	3.8	4.4	11.1
Industrial machinery mfg	12.91	12	11.7	12.7	8.72	9.3	9.4	10.2	4.56	4.9	5.2	5.6
Commercial and service industry machinery mfg	13.63	13.8	11.6	10.2	7.86	8.8	8.6	7.5	4.56	5.8	6.4	5.6
Engine, turbine, and power transmission equipment mfg	8.33	8	8.2	8.4	5.53	6.6	7.8	8.1	2.83	3.7	5.8	5.9
Other general purpose machinery mfg	12.43	12.3	11.7	31.0	7.34	6.7	6.7	17.7	3.95	4	4.5	12.0
Computer and peripheral equipment mfg	9.59	7.1	7.5	12.2	10.42	15.2	12.1	19.8	8.83	10.4	10.4	16.9
Communications equipment mfg	12.17	10.2	10.4	9.7	10.22	11.1	10.8	10.1	5.67	6.9	8.1	7.5
Audio and video equipment mfg	10.57	13.8	13	2.5	7.45	8.6	10	1.9	4.28	7	8.1	1.5
Semiconductor and other electronic component mfg	8.56	8.1	7.5	27.7	8.35	8.6	8.9	32.7	4.49	5.6	5.7	21.1
Navigational, measuring, electromedical, and control instruments mfg	11.5	11	10.2	39.7	9.79	10.3	11.3	44.0	7.16	7.8	8.7	33.9
Mfg and reproducing magnetic and optical media	14.43	15.3	13.6	2.6	7.47	8	8.1	1.5	4.41	5.8	5.9	1.1
Electric lighting equipment mfg	12.48	14.8	14.7	6.8	5.02	6.2	7.6	3.5	2.45	3.9	4.9	2.3
Household appliance mfg	8.5	6.2	7.8	4.7	3.71	4.7	5.1	3.1	2.58	3.3	4.3	2.6
Electrical equipment mfg	9.48	9.9	8.5	12.2	5.94	5.9	7	10.0	3.31	4	4.8	6.9
Other electrical equipment and component mfg	10.16	10	9.7	12.2	5.77	6.9	6.6	8.2	2.67	4	4.1	5.1
Motor vehicle mfg	2.5	2.5	1.7	3.4	2.27	3.3	2.3	4.7	4.53		2.1	4.1
Motor vehicle body and trailer mfg	7.37	7.7	6.8	9.6	3.73	3.7	3.5	5.0	2.13	2.1	2	2.9
Motor vehicle parts mfg	5.54	7.1	6.5	34.9	3.24	4.1	4.7	25.2	3.03	2.8	3.1	16.6
Aerospace product and parts mfg	8.01	7.4	6.8	33.3	6.64	6.5	6.3	30.6	10.94	10.5	11.1	54.4
Railroad rolling stock mfg	11.08	8.4	7.1	1.8	4.41	5.5	3.9	1.0	2.56		3.2	0.8
Ship and boat building	7.76	7.3	7.5	10.4	3.81	4	4.2	5.8	2.73	3.1	3.7	5.2
Other transportation equipment mfg	9.66	8.1	9.4	3.1	4.47	5.3	6.3	2.1	3.52	3.9	5.4	1.8
Medical equipment and supplies mfg	14.29	13.7	13.4	41.2	6.41	6.7	7.6	23.3	3.22	4	5.1	15.8
Other miscellaneous mfg	14.78	15	14.7	40.5	6.01	6	6.3	17.3	2.65	3.1	3.6	9.8

(Continued) Table A3. Occupations in White Collar-Related Fields Using NAICS Codes

Other White Collar-Related Fields	Sales and Related Occupations				Arts, Design, Entertainment, Sports, and Media Occupations				Legal Occupations			
	2004 Share	2010 Share	2014 Share	2014 Level	2004 Share	2010 Share	2014 Share	2014 Level	2004 Share	2010 Share	2014 Share	2014 Level
31-330 manufacturing	2.91	3.1	3.1	377.2	0.54	0.6	0.6	77.0	0.04	0.1	0.1	6.2
Overall advanced manufacturing	2.53	2.74	2.59	143.1	0.61	0.65	0.63	34.7	0.07	0.09	0.09	5.0
Petroleum and coal products mfg	1.95	1.7	1.9	2.1	0.1	0.1	0.1	0.1	0.34	0.3	0.1	0.1
Basic chemical mfg	2.02	2.1	1.8	2.6		0.1			0.12	0	0.1	0.1
Resin, synthetic rubber, and artificial synthetic fibers and filaments mfg	2.22	1.5	1.7	1.5		0.1	0.2	0.2		0.1	0.1	0.1
Pesticide, fertilizer, and other agricultural chemical mfg	3.83	4.5	4	1.5								
Pharmaceutical and medicine mfg	3.03	2.3	1.5	4.2	0.46	0.8	0.6	1.7	0.38	0.3	0.3	0.8
Other chemical product and preparation mfg	4.06	4.1	4.2	3.5	0.1	0.1	0.1	0.1				
Clay product and refractory mfg	3.78	4.3	4.2	1.6	1.49	2	1.3	0.5				
Other nonmetallic mineral product mfg		4.3	4.9	3.6		0.3	0.2	0.1				
Iron and steel mills and ferroalloy mfg	0.94	1.2	1	0.9								
Alumina and aluminum production and processing	1.13	1.1	1.2	0.7								
Foundries	0.83	1.3	1.1	1.4		0.1	0.1	0.1				
Agriculture, construction, and mining machinery mfg	3.06	3.1	3.1	7.8	0.31	0.3	0.4	1.0			0.1	0.3
Industrial machinery mfg	5.23	5.2	5	5.4	0.63	0.6	0.6	0.7		0.1	0.1	0.1
Commercial and service industry machinery mfg	4.28	4.5	4.4	3.8	0.56	0.7	0.6	0.6		0.1		
Engine, turbine, and power transmission equipment mfg	2	2.3	2.1	2.1	0.33	0.6	0.4	0.4		0.1	0.1	0.1
Other general purpose machinery mfg	4.36	4.7	4.6	12.1	0.48	0.5	0.4	1.2		0	0	0.1
Computer and peripheral equipment mfg	3.63	5	4.4	7.1	1.1	1	1	1.6	0.23	0.3	0.3	0.5
Communications equipment mfg	3.91	4.1	4.4	4.1	0.78	0.8	0.8	0.7	0.13	0.1	0.2	0.2
Audio and video equipment mfg	3.33	3.9	4.1	0.8	1.03	1.4	0.9	0.2			0.3	0.1
Semiconductor and other electronic component mfg	2.26	2.3	2.4	8.9	0.36	0.3	0.4	1.4	0.12	0.1	0.1	0.5
Navigational, measuring, electromedical, and control instruments mfg	3.11	3.9	3.7	14.3	0.75	0.8	0.8	3.1	0.09	0.1	0.2	0.8
Mfg and reproducing magnetic and optical media	5.69	5.5	4.4	0.8	4.81	5.8	4.6	0.9				
Electric lighting equipment mfg	2.88	3.8	5.2	2.4	0.42	0.9	1.2	0.5				
Household appliance mfg	1.57	1	2.2	1.3	0.5	0.7	0.8	0.5		0.1		
Electrical equipment mfg	2.54	3.1	3.4	4.9	0.25	0.2	0.3	0.4				
Other electrical equipment and component mfg	2.79	2.9	3	3.7	0.2	0.2	0.3	0.3		0.1	0	0.1
Motor vehicle mfg	0.33	0.4	0.2	0.4	0.14		0.1	0.1	0.05			
Motor vehicle body and trailer mfg	2.27	2.9	2.6	3.7	0.16	0.3	0.2	0.3				
Motor vehicle parts mfg	0.76	1.3	1.2	6.2	0.2	0.2	0.4	2.0	0.02		0	0.1
Aerospace product and parts mfg	1.23	0.7	0.7	3.5	1.32	0.7	0.6	2.9	0.06	0.1	0.1	0.5
Railroad rolling stock mfg	0.84	2.1	1.1	0.3		0.5						
Ship and boat building	0.76	0.6	0.6	0.8	0.36	0.4	0.3	0.4				
Other transportation equipment mfg	2.11	1.9	2.3	0.8	1.21	0.7	0.7	0.2				
Medical equipment and supplies mfg	3.47	2.8	3.1	9.6	0.54	0.5	0.5	1.5	0.08	0.1	0.1	0.4
Other miscellaneous mfg	5.09	5.7	5.3	14.7	2.46	3.7	4	11.0	0.03	0.1	0.1	0.1

Table A4. Occupations in Blue Collar and Other Fields Using NAICS CodesSource: Occupational Employment Statistics, Bureau of Labor Statistics, US Department of Labor, <http://www.bls.gov/oes/>

Note: For each occupation, "2014 Level" is employment in thousands of workers

Blue Collar and Other Fields	Production Occupations				Transportation and Material Moving Occupations				Installation, Maintenance, and Repair Occupations				Construction and Extraction Occupations			
	2004 Share	2010 Share	2014 Share	2014 Level	2004 Share	2010 Share	2014 Share	2014 Level	2004 Share	2010 Share	2014 Share	2014 Level	2004 Share	2010 Share	2014 Share	2014 Level
31-330 manufacturing	51.58	51.6	51.6	6292.8	9.62	8	8	972.8	5.08	5	5	614.2	1.9	1.6	1.6	193.2
Overall advanced manufacturing	46.51	45.27	46.57	2574.4	5.01	4.32	4.08	225.3	5.47	5.13	5.19	286.8	1.86	1.47	1.5	82.9
Petroleum and coal products mfg	38.81	40.8	42.4	47.0	11.27	8.2	6.7	7.4	9.72	7.9	8.4	9.3	6.78	5.8	6.3	6.9
Basic chemical mfg	41.55	42.3	42	61.8	7.5	7.2	7.1	10.4	10.99	10.2	10.4	15.3	1.73	1.3	1	1.5
Resin, synthetic rubber, and artificial synthetic fibers and filaments mfg	47.97	48.9	49.2	45.8	5.94	5.3	3.7	3.4	10.09	10.1	9.5	8.9	1.53	0.9	1.1	1.0
Pesticide, fertilizer, and other agricultural chemical mfg	35.34	41	41.5	15.1	12.68	13.5	12.1	4.4	12.23	11.8	9	3.3	2.14	1.2	0.9	0.3
Pharmaceutical and medicine mfg	26.98	28.4	32.2	90.0	4.44	3.4	3.4	9.6	4.48	4.3	4.8	13.3	0.34	0.3	0.3	0.9
Other chemical product and preparation mfg	47.43	50.8	53.1	44.3	6.72	8.4	6.6	5.5	6.44	5.2	5.4	4.5	0.83	1.2	0.6	0.5
Clay product and refractory mfg	55.74	53.2	55.4	21.9	13.54	10.9	10.8	4.3	5.65	5.7	6.4	2.5	1.35	2.4	1.1	0.4
Other nonmetallic mineral product mfg		52.8	51.8	37.5		9.8	8.5	6.2		5.2	4.8	3.5		7.5	8	5.8
Iron and steel mills and ferroalloy mfg	42.25	48	50	45.7	15.3	12	8.5	7.8	15.19	17.8	18.1	16.6	7.15	3.3	5.8	5.3
Alumina and aluminum production and processing	57.62	55.4	53.3	31.9	10.3	11.4	14.2	8.5	11.33	11.8	10.6	6.3	2.39	2	2.4	1.4
Foundries	67.54	68	68.4	86.9	6.45	5.1	4.1	5.2	7.98	7.1	8.1	10.3	1.53	1	1.1	1.4
Agriculture, construction, and mining machinery mfg	56.63	56.8	55.3	141.0	4.8	5	5.2	13.4	4.86	5.1	5.4	13.7	1.93	1	1.5	3.8
Industrial machinery mfg	41.7	43.6	42.8	46.3	2.54	1.6	2.2	2.4	5.11	4.5	4.3	4.6	1.44	0.6	1.1	1.2
Commercial and service industry machinery mfg	42.53	41.2	43.2	37.8	2.75	2.4	3.2	2.8	4.28	3.9	3.6	3.2	0.9	1	1.2	1.0
Engine, turbine, and power transmission equipment mfg	58.82	53.6	50	51.4	3.27	3.8	2.9	2.9	5.98	6.2	5.1	5.2	1.58	0.8	0.6	0.6
Other general purpose machinery mfg	49.15	50.3	49.7	131.6	3.91	3.9	3.5	9.1	4.08	4.2	5	13.3	1.52	1	1.1	2.8
Computer and peripheral equipment mfg	18.52	10.3	10.8	17.6	1.3	0.8	0.8	1.4	2.35	1.5	1	1.7	0.07			
Communications equipment mfg	29.34	25.4	25	23.4	1.62	1.6	1.4	1.3	2.72	2.4	2.4	2.2	0.28	0.2	0.1	0.1
Audio and video equipment mfg	45.8	37.9	35.6	6.7	3.15	2.8	3	0.6	3.47	3.1	2	0.4				
Semiconductor and other electronic component mfg	40.79	41.9	36.7	135.0	1.5	1.5	1.6	5.8	3.07	2.6	2.6	9.5	0.14	0.1	0.1	0.3
Navigational, measuring, electromedical, and control instruments mfg	28.06	26.7	27.5	106.9	1.2	1.4	1.3	5.0	2.86	2.8	2.8	10.9	0.44	0.1	0.2	0.6
Mfg and reproducing magnetic and optical media	21.85	23	24.8	4.7	15.45	16.6	12	2.3	2.44	3	3.6	0.7				
Electric lighting equipment mfg	57.92	50.1	44.9	20.8	7.83	6.6	5.1	2.4	4.37	5.7	6.5	3.0	0.68	0.7	0.8	0.4
Household appliance mfg	58.52	63.7	58.2	34.7	12.4	8.4	9.1	5.4	3.36	4.3	4	2.4	0.77	0.4	1.2	0.7
Electrical equipment mfg	57.03	54.5	52.1	74.9	2.82	2.9	3.3	4.8	3.79	4	3.7	5.4	0.83	0.6	0.7	1.0
Other electrical equipment and component mfg	57.54	54	53.6	67.0	6	5.3	5.7	7.1	4.78	4.3	4.5	5.6	0.46	0.3	0.4	0.5
Motor vehicle mfg	64.64	65.4	76.4	152.3	5.18	4.8	3.2	6.4	8.77	4.9	5.6	11.1	4.61		3.2	6.5
Motor vehicle body and trailer mfg	66.43	66.1	68.1	95.9	4.93	4.9	5.5	7.8	4.64	4.4	5.3	7.4	3.27	4.2	2.1	3.0
Motor vehicle parts mfg	62.45	62.2	62.9	337.6	6.9	6	5.7	30.4	6.42	5.8	5	26.7	2.35	1.5	1.1	5.9
Aerospace product and parts mfg	27.2	32.8	32.9	160.6	1.57	1.7	1.8	9.0	7.96	7.8	7.6	37.2	1.69	1.4	1	4.7
Railroad rolling stock mfg	48.46	47.3	63.9	16.6	6.44	4	3.9	1.0	14.02	10.3	7.7	2.0	2.34		0.9	0.2
Ship and boat building	47.55	43.2	46.8	64.8	3.85	4.2	3.5	4.8	6.75	6	6.1	8.5	15.49	18.3	14.9	20.6
Other transportation equipment mfg	55.2	56.4	55.4	18.3	5.66	5.7	7.1	2.3	4.27	4.8	3.8	1.3	1.57	1.9	1.1	0.4
Medical equipment and supplies mfg	54.89	54.6	51.6	158.6	5.7	4	3.7	11.3	2.1	2.4	2.3	7.2	0.07	0.1	0.1	0.2
Other miscellaneous mfg	52.47	51.5	51.6	142.0	7.44	5.7	4.7	12.9	3.1	3.2	3.6	9.8	1.43	1.2	1.1	3.0

(Continued) Table A4. Occupations in Blue Collar and Other Fields Using NAICS Codes

Blue Collar and Other Fields	Building and Grounds Cleaning and Maintenance Occupations				Health Care Practitioners and Technical Occupations				Protective Service Occupations			
	2004 Share	2010 Share	2014 Share	2014 Level	2004 Share	2010 Share	2014 Share	2014 Level	2004 Share	2010 Share	2014 Share	2014 Level
31-330 manufacturing	0.69	0.6	0.6	69.0	0.12	0.2	0.2	21.9	0.14	0.1	0.1	15.5
Overall advanced manufacturing	0.48	0.39	0.35	19.6	0.18	0.24	0.27	14.7	0.17	0.16	0.15	8.3
Petroleum and coal products mfg		0	0.1	0.1	0.27	0.6	0.6	0.6	0.18	0.2	0.2	0.2
Basic chemical mfg	0.34	0.3	0.3	0.4	0.34	0.6	0.7	1.1	0.27	0.2	0.2	0.2
Resin, synthetic rubber, and artificial synthetic fibers and filaments mfg	0.43	0.2	0.2	0.1	0.43	0.6	0.8	0.7	0.21	0.2	0.2	0.2
Pesticide, fertilizer, and other agricultural chemical mfg	0.58	0.5	0.5	0.2		0.5	0.7	0.3				
Pharmaceutical and medicine mfg	0.93	0.7	0.7	2.1	1.07	0.9	1	2.7	0.24	0.3	0.2	0.6
Other chemical product and preparation mfg	0.51	0.4	0.4	0.4	0.13	0.2	0.3	0.3		0.1	0.1	0.1
Clay product and refractory mfg	0.69	0.5	0.6	0.3			0.1	0.1		0.1	0.2	0.1
Other nonmetallic mineral product mfg		0.4	0.4	0.3		0.1	0.2	0.2				
Iron and steel mills and ferroalloy mfg	0.4	0.2	0.1	0.1		0.4	0.4	0.3	0.19	0.3	0.5	0.5
Alumina and aluminum production and processing	0.43	0.4	0.5	0.3	0.18	0.4	0.9	0.5		0.1	0.2	0.1
Foundries	0.7	0.6	0.6	0.7	0.09	0.2	0.3	0.3	0.11	0.1	0.1	0.1
Agriculture, construction, and mining machinery mfg	0.48	0.4	0.5	1.2	0.08	0.1	0.2	0.5	0.1	0.1	0.1	0.2
Industrial machinery mfg	0.61	0.5	0.4	0.4								
Commercial and service industry machinery mfg	0.63	0.6	0.4	0.4							0.1	0.1
Engine, turbine, and power transmission equipment mfg	0.7	0.4	0.3	0.3		0.1	0.1	0.1			0.1	0.1
Other general purpose machinery mfg	0.56	0.4	0.4	1.1		0.1	0.1	0.2		0.1	0	0.1
Computer and peripheral equipment mfg	0.11	0.1	0.1	0.1					0.07	0		
Communications equipment mfg	0.3	0.3	0.3	0.2					0.14	0.2	0.2	0.2
Audio and video equipment mfg			0.3	0.1								
Semiconductor and other electronic component mfg	0.38	0.4	0.3	1.0	0.07	0	0.1	0.2	0.13	0.1	0.1	0.2
Navigational, measuring, electromedical, and control instruments mfg	0.43	0.3	0.3	1.1	0.12	0.1	0.2	0.7	0.35	0.2	0.2	0.7
Mfg and reproducing magnetic and optical media	0.34								0.27	1.1		
Electric lighting equipment mfg	0.42	0.4	0.5	0.2								
Household appliance mfg	0.41	0.3	0.2	0.1		0.1	0.1	0.1				
Electrical equipment mfg	0.4	0.4	0.3	0.4		0	0.1	0.1				
Other electrical equipment and component mfg	0.6	0.4	0.4	0.5		0.1	0.1	0.1	0.1			
Motor vehicle mfg	0.31	0.1	0	0.1	0.14		0.1	0.2	0.11			
Motor vehicle body and trailer mfg	0.55	0.5	0.4	0.6		0.1	0.1	0.1	0.11	0.1	0	0.1
Motor vehicle parts mfg	0.55	0.4	0.3	1.6	0.1	0.1	0.1	0.5	0.08	0	0	0.2
Aerospace product and parts mfg	0.3	0.4	0.4	1.8	0.22	0.2	0.2	0.9	0.61	0.6	0.6	2.8
Railroad rolling stock mfg			0.4	0.1						0.5	0.6	0.2
Ship and boat building	0.53	0.5	0.4	0.5	0.18	0.2	0.3	0.4	0.54	0.5	0.6	0.8
Other transportation equipment mfg	0.61	0.3	0.3	0.1								
Medical equipment and supplies mfg	0.58	0.5	0.5	1.4	0.92	1.1	1.1	3.4	0.06	0.1	0.1	0.2
Other miscellaneous mfg	0.63	0.5	0.5	1.3		0	0	0.1	0.14	0.1	0.1	0.3