

## U.S. Manufacturing Employment Report

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**Keywords:** *President Trump, Trump Administration, Obama Administration, 25 Million New Jobs, U.S. Manufacturing, Tariffs, Reshoring, Gross Domestic Product, GDP, GDP Growth, Department of Labor, Bureau of Labor Statistics, Service-Providing, Goods-Producing, Employment Situation Summary, ADP National Employment Report, U.S. Labor Force, Employment, Job Openings, Employment Report, Workforce Development, Economic Development, Business Development, Private Sector Jobs, Federal Reserve, Consensus Bureau, National Association of Manufacturers, Pew Research Center, Industrial Revolution, Digital Economy, Apparel Industry, Automotive Industry, Motor Vehicles and Parts Industry, Urban Agriculture, Jobenomics*

**Short Caption:** Jobenomics analysis of the U.S. manufacturing employment situation.

**Caption:** The U.S. Manufacturing supersector is an anchor tenant of the U.S. economy, and its preservation is a national priority. On the other hand, Americans should not be encouraged to perceive manufacturing as the principal source of future U.S. employment or high-paying jobs.

**Executive Summary.** The U.S. Manufacturing supersector is vitally important to national sovereignty and an anchor tenant of the U.S. economy. Reshoring and keeping American factories in America is a worthy goal. Even if America reshores manufacturing jobs from foreign countries, manufacturing has limited upside employment potential due automation across the entire manufacturing value chain. From a wage perspective, manufacturing is no longer the high-paying industry sector that it used to be, nor will it be in the future. As opposed to looking to manufacturers as a principal supplier of “good” jobs, manufacturing focus should be on protecting the current set of U.S. manufacturers, focusing on next-generation manufacturing technology and processes, and recapitalization of the American industrial base and retooling its workforce.

**Manufacturing Supersector.** According to the National Association of Manufacturers, in 2016 (most recent data), U.S. manufacturers contributed \$2.25 trillion to the U.S. economy or 11.7% of U.S. GDP.<sup>1</sup> Consequently, maintaining and nourishing the U.S. Manufacturing supersector as an anchor tenant of the U.S. economy is a national priority. On the other hand, Americans should not be encouraged to perceive manufacturing as a major source of employment or high-paying jobs.

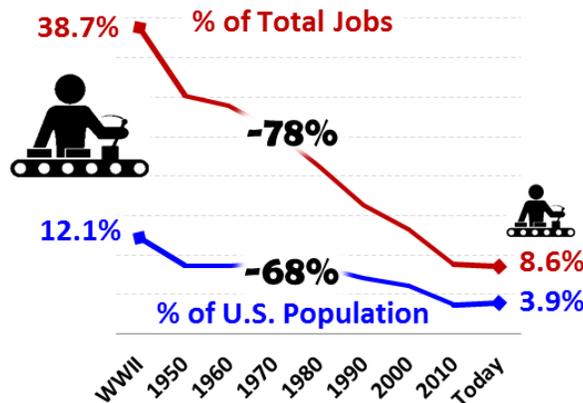
The industrial age is following the same path as the agricultural age. Several centuries ago, the vast majority of Americans worked on a farm or ranch. Today, Department of Agriculture estimates that there are 2.6 million direct on-farm employees, which equates to 0.8% of the U.S. population of 327 million Americans.

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<sup>1</sup> National Association of Manufacturers, Top 20 Facts About Manufacturing, <http://www.nam.org/Newsroom/Top-20-Facts-About-Manufacturing/>

## U.S. Manufacturing Decline As A Percent Of Population & Total Jobs

Source: Bureau of Labor Statistics



Today, manufacturing employs 12.8 million workers or 8.6% of all American workers (nonfarm), down from a peak of 38.7% in WWII and down from 16.3% in 1960. At the peak of WWII, when the U.S. population was 137 million citizens, manufacturing employed 16.5 million or 12.1% of all Americans. In 1960, when the U.S. population was 181 million citizens, manufacturing employed 15.7 million or 8.7% of all Americans. As shown below, the U.S. Manufacturing supersector produced 1,276,000 new jobs since 1 January 2010. 1,276,000 new jobs equate to 6.5% of all the new jobs created by the U.S. private sector during this post-Great Recession recovery period.

## U.S. Manufacturing Employment Growth This Decade (the 2010s)

Source: Bureau of Labor Statistics

Thousands of Jobs (000s)

1 January 2010 to 1 August 2018

**Total Private Sector Gains = 19,495,000**



Reshoring and keeping American factories in America is a worthy goal from economic and security standpoints. Even if America reshores manufacturing jobs from foreign countries, manufacturing has limited upside employment potential due to automation (robotics and artificial intelligent agents) across the entire manufacturing value chain. From a wage perspective, **manufacturing is no longer the high-paying industry sector that it used to be**, nor will it be in the future. According to the U.S. Berkeley Labor Center and the National Employment Law Project, contrary to public perception that manufacturing jobs are “good jobs,” manufacturing wages now rank in the bottom half of all jobs in the United States and are not even keeping up with inflation. In the largest segment of the American

manufacturing base, automotive manufacturing, wages have declined further, falling three times faster than manufacturing as a whole and **nine times faster** than all occupations.<sup>2 3</sup>

### Manufacturing Earnings #7 Out Of 10 (July 2018)

Rank	All Employees		Production and Nonsupervisory Employees	
	Industry	Earnings	Industry	Earnings
1	Information	\$39.39	Information	\$31.53
2	Financial activities	\$34.85	Mining and logging	\$28.46
3	Mining and logging	\$33.01	Construction	\$27.69
4	Professional and business services	\$32.48	Financial activities	\$26.91
5	Construction	\$29.86	Professional and business services	\$26.74
6	Education and health services	\$27.04	Education and health services	\$23.66
7	Manufacturing	\$27.01	Manufacturing	\$21.44
8	Other services	\$24.39	Other services	\$20.68
9	Trade, transportation, and utilities	\$23.27	Trade, transportation, and utilities	\$19.84
10	Leisure and hospitality	\$15.99	Leisure and hospitality	\$13.87

Source: BLS, Industries At A Glance, Earnings

According to the Bureau of Labor Statistics (BLS), the Manufacturing Supersector (NAICS 31-33) ranks seventh out of ten. The average manufacturing production and nonsupervisory employees earned only \$21.44 per hour in July 2018, not including benefits. All manufacturing employees (including supervisory officials) only average \$27.01 per hour.<sup>4</sup>

These figures compare unfavorably with the other two sectors in the Goods-Producing Industries supersector group: Construction and Mining and Logging supersectors. The Construction supersector pays all employees \$29.86/hour and production and nonsupervisory workers \$27.69/hour. The Mining and Logging supersector pays all employees \$33.01/hour and production and nonsupervisory workers \$28.46/hour.<sup>5</sup>

Four of the seven supersectors in Service-Providing Industries make more than manufacturing. The Information supersector is the highest performer at \$39.39/hour for all employees and \$31.53/hour for nonsupervisory workers. The three Service-Providing supersectors that earn less than Manufacturing are Other Services; Trade, Transportation, and Utilities; and Leisure and Hospitality (\$15.99/hour and \$13.87/hour).<sup>6</sup>

Per BLS historical data, the average hourly earnings of manufacturing production and nonsupervisory employees have zoomed from \$2.50/hour in 1965 to \$21.44/hour today, an 8.6-fold increase that

<sup>2</sup> UC Berkeley Labor Center, Producing Poverty: The Public Cost of Low-Wage Production Jobs in Manufacturing, May 2016, <http://laborcenter.berkeley.edu/pdf/2016/Producing-Poverty.pdf>

<sup>3</sup> National Employment Law Project, Manufacturing Low Pay: Declining Wages in the Jobs That Built America's Middle Class, November 2014, <http://www.nelp.org/content/uploads/2015/03/Manufacturing-Low-Pay-Declining-Wages-Jobs-Built-Middle-Class.pdf>

<sup>4</sup> BLS, Industry at a Glance, Manufacturing: NAICS 31-33, <https://www.bls.gov/iag/tgs/iag31-33.htm>

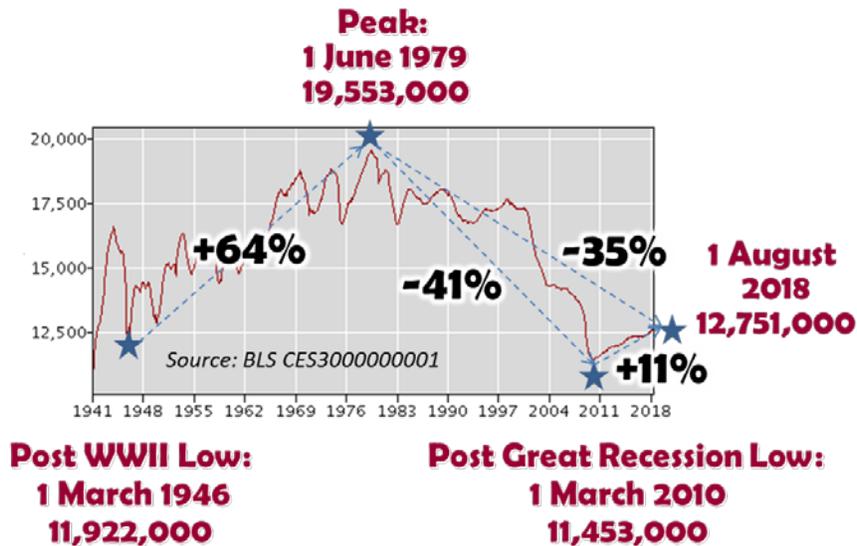
<sup>5</sup> BLS, Industry at a Glance, Goods-Producing Industries, <https://www.bls.gov/iag/tgs/iag06.htm>

<sup>6</sup> BLS, Industry at a Glance, Service-Providing Industries, <https://www.bls.gov/iag/tgs/iag07.htm>

appears to be extremely impressive.<sup>7</sup> However, adjusted for inflation yesteryear’s \$2.50 now equates to \$22.65 in purchasing power. In other words, manufacturing production and nonsupervisory employees are worse off by \$1.21 per hour (\$22.65 minus \$21.44). A 2018 Pew Research Center analysis on inflation-adjusted wages supports the assertion that American wage growth has approximately the same purchasing power during the golden years of the 1960s.

Quoting the Pew Research Center analysis, “On the face of it, these should be heady times for American workers. U.S. unemployment is as low as it’s been in nearly two decades (3.9% as of July) and the nation’s private-sector employers have been adding jobs for 101 straight months – 19.5 million since the Great Recession-related cuts finally abated in early 2010, and 1.5 million just since the beginning of the year. But despite the strong labor market, **wage growth has lagged economists’ expectations**. In fact, despite some ups and downs over the past several decades, today’s real average wage (that is, the wage after accounting for inflation) has about the same purchasing power it did 40 years ago. And what wage gains there have been have mostly flowed to the highest-paid tier of workers.”<sup>8</sup>

## U.S. Manufacturing Supersector Employment since WWII



While U.S. manufacturing employment increased from its post-Great Recession low of 11,453,000 to 12,751,000 today (11% growth), it has a long way to go to achieve its peak level of 19,553,000 in June 1979. Since the peak, manufacturing is still down by 35%.

As of the most recent BLS Job Openings and Labor Survey<sup>9</sup>, U.S. manufacturers have 441,000 open jobs (6.6% out of a total of 6,671,000 unfilled U.S. jobs)—primarily due to a lack of job skills.

<sup>7</sup> BLS, Industry at a Glance, Manufacturing: NAICS 31-33, Average hourly earnings of production and nonsupervisory employees, manufacturing, Series Id: CES3000000008, Back Data, <https://www.bls.gov/iag/tgs/iag31-33.htm>

<sup>8</sup> Pew Research Center, For most U.S. workers, real wages have barely budged in decades, 7 August 2018,

<sup>9</sup> BLS, Table 7. Job openings levels and rates by industry and region, not seasonally adjusted, <http://www.bls.gov/news.release/jolts.t07.htm>

According to a 2015 study by the Manufacturing Institute and Deloitte, over the next decade, 3.4 million manufacturing jobs are projected to become available, but up to 60% (2 million) of these jobs will remain unfilled due to a lack of manufacturing skills. 84% of manufacturing executives agree that there is a “talent shortage” and the “skills gap is expected to grow substantially over the next decade.”<sup>10</sup>

## Manufacturing Employment Situation This Decade

Source: BLS CES3000000001, Seasonally Adjusted

	1-Jan-10	1-Aug-18	New Jobs (000s)	% Growth	% Growth Per Year
	Jobs (000s)				
<b>Manufacturing</b>	<b>11,475</b>	<b>12,751</b>	<b>1,276</b>	<b>11%</b>	<b>1.3%</b>
<b>Durable Goods</b>	<b>6,999</b>	<b>7,981</b>	<b>982</b>	<b>14%</b>	<b>1.6%</b>
Wood Products	346	407	61	18%	2.1%
Nonmetallic Mineral Products	376	419	42	11%	1.3%
Primary Metals	347	382	35	10%	1.2%
Fabricated Metal Products	1,259	1,495	236	19%	2.2%
Machinery	977	1,131	155	16%	1.8%
Computer and Electronic Products	1,095	1,070	-24	-2%	-0.3%
<i>Computer and Peripheral Equipment</i>	159	170	11	7%	0.8%
<i>Communications Equipment</i>	117	86	-31	-26%	-3.1%
<i>Semiconductors and Electronic Components</i>	363	371	8	2%	0.3%
<i>Electronic Instruments</i>	410	411	2	0%	0.1%
<i>Miscellaneous Computer and Electronic Products</i>	47	32	-15	-32%	-3.7%
Electrical Equipment and Appliances	354	406	51	14%	1.7%
Transportation Equipment	1,314	1,680	366	28%	3.2%
<i>Motor Vehicles and Parts</i>	653	972	319	49%	5.7%
Furniture and Related Products	363	391	28	8%	0.9%
Miscellaneous Durable Goods Manufacturing	570	600	31	5%	0.6%
<b>Nondurable Goods</b>	<b>4,476</b>	<b>4,770</b>	<b>294</b>	<b>7%</b>	<b>0.8%</b>
Food Manufacturing	1,453	1,642	189	13%	1.5%
Textile Mills	121	112	-9	-8%	-0.9%
Textile Product Mills	120	111	-9	-8%	-0.9%
Apparel	160	116	-44	-28%	-3.2%
Paper and Paper Products	397	375	-22	-5%	-0.6%
Printing and Related Support Activities	497	433	-64	-13%	-1.5%
Petroleum and Coal Products	112	117	6	5%	0.6%
Chemicals	794	832	37	5%	0.5%
Plastics and Rubber Products	611	729	118	19%	2.2%
Miscellaneous Nondurable Goods Manufacturing	210	303	93	44%	5.1%
	<b>Lost Jobs</b>	<b>Below GDP Annual 2.4% Growth Rate</b>		<b>Above GDP</b>	

This color-coded table is a snapshot of this decade’s manufacturing employment situation. Red indicates job losses. White represents growth rates below this decade’s average annual 2.4% GDP growth rate. Green signifies above annual GDP growth rates.

<sup>10</sup> Manufacturing Institute, [http://www.themanufacturinginstitute.org/Research/Skills-Gap-in-Manufacturing/~/\\_media/FF00360FC3344AD9B62F600B9FDEBD5B.ashx](http://www.themanufacturinginstitute.org/Research/Skills-Gap-in-Manufacturing/~/_media/FF00360FC3344AD9B62F600B9FDEBD5B.ashx)

During the post-recession recovery period from 1 January 2010 to 1 August 2018, the Manufacturing supersector produced 1,276,000 new jobs at a paltry rate of 11.1%, which equates to 1.3% per year, well below the annual 2.4% rate of GDP growth. Compared to other supersectors, manufacturing employment is not keeping pace. Over the same period, the Construction supersector (the other player in the Goods-Producing supersector group) generated 28.1% job growth; Professional and Business Services 27.6%; Leisure and Hospitality 26.5%; Education and Health Services 19.5%; and Trade, Transportation, and Utilities 13.6%.

Manufacturing supersector employment includes 7,981,000 durable and 4,770,000 nondurable goods jobs. The Durable Goods sector (goods not for immediate consumption and able to be kept for a period) posted a gain of 982,000 new jobs and grew at a lukewarm rate of 14% or 1.6% per annum. The Nondurable Goods sector (products consumers purchase for a short period) suffered anemic growth of 7% (0.8% per annum) and added only 294,000 new jobs.

Of the twenty Manufacturing subsectors, The Transportation Equipment was the only subsector that produced a significant expansion of 28%, or one-quarter of all new jobs in the entire Manufacturing supersector. Of the remaining Manufacturing subsectors, only Plastics and Rubber Products (19%), Fabricated Metal Products (19%) and Wood Products (18%) posted subpar but reasonable rates of growth.

The biggest losers were: Apparel (-28%), Printing and Related Support Activities (-13%), Textile Mills (-8%), Textile Product Mills (-8%), Paper and Paper Products (-5%), and Computer and Electronic Products (-2%). Within the Computer and Electronic Products subsector, U.S. Communications Equipment (-26%) and Miscellaneous Computer and Electronic Products (-32%) downsized due to foreign competition.

## Manufacturing Industry Trends This Decade

### Obama Era (84 Months)



**Manufacturing**  
**Durable Goods**  
**Nondurable Goods**

1-Jan-10	1-Jan-17	New Jobs	% Growth
Jobs (000s)		(000s)	Per Year
11,475	12,351	876	1.0%
6,999	7,691	692	1.2%
4,476	4,770	294	0.8%

### Trump Era (19 Months)



**Manufacturing**  
**Durable Goods**  
**Nondurable Goods**

1-Jan-17	1-Aug-18	New Jobs	% Growth
Jobs (000s)		(000s)	Per Year
12,351	12,751	400	2.0%
7,691	7,981	290	2.4%
4,660	4,770	110	1.5%

Since the beginning of this decade, President Obama increased manufacturing jobs 1.0% per year compared to President Trump's 2.0% during his 19-month tenure. Both Presidents produced manufacturing jobs below the annual 2.4% rate of GDP growth over the decade.

If President Trump can maintain the recent 4.1% rate of GDP growth in Q2 2018 and if the Administration's concentration on manufacturing jobs takes root, manufacturing jobs are likely to

soar in the future. This optimistic opinion assumes an absence of any major domestic or international disruptions, and that recapitalization (building of new manufacturing plants) of U.S. manufacturing infrastructure occurs as opposed to investing profits in secondary markets, merging, acquiring, or engaging in stock buy-back schemes. It also assumes that manufacturing executives will invest in retooling the U.S. workforce in balance with automating labor. In today's strong economy, many manufacturing executives seem to be willing to recapitalize as well as reshoring jobs due to recent policy changes (tax, regulatory and trade reforms).

### Mixed Manufacturing Outlook.

So far this decade, the growth rate in manufacturing job growth averaged 11.1% or a tepid 1.1% per year. The good news is that 11.1% is a welcome change from the previous three decades. The bad news is that this tepid rate of growth falls below the rate of U.S. economic (GDP) growth during the post-Great Recession period. It also falls short of the golden years of the post-WWII era.

The outlook for U.S. manufacturing's future is mixed. On the one hand, American manufacturing is becoming more competitive due to technology and rising labor costs in foreign countries. On the other hand, to remain competitive machines and algorithms are replacing the human element across the entire manufacturing value chain. Centaurs (a mix of humans and machines) will dominate tomorrow's manufacturing ecosystem both here and abroad. Skilled human labor is already in short supply. Automated labor (robots and artificially intelligent agents) are getting smarter and cheaper.

Borrowing the words of the legendary Yogi Berra, manufacturing's "future ain't what it used to be." Consequently, it is safe to assume that tomorrow's U.S. manufacturing supersector will be much different than its 20<sup>th</sup> Century predecessor. To forecast the future is often best to start by examining the past.

### U.S. Manufacturing Employment Gains/Losses History

Source: BLS (Nonfarm Employment), BEA (GDP, Year over Year Change) As of 1 August 2018

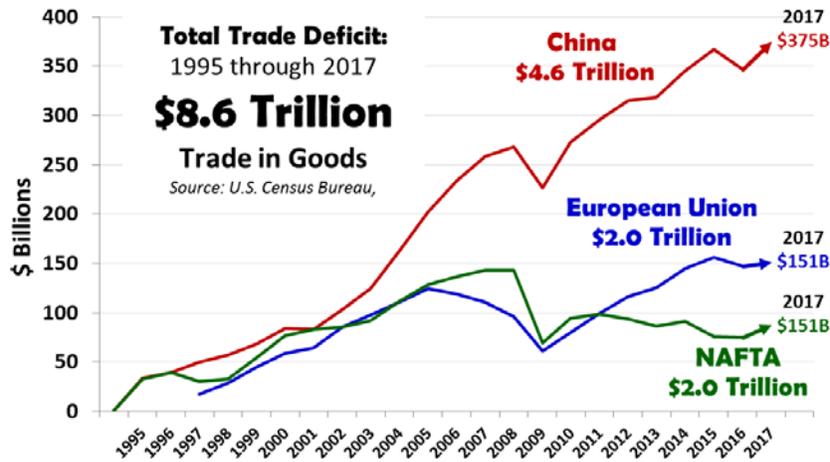
	WWII	1950s	1960s	1970s	1980s	1990s	2000s	2010-18
New Jobs (000s)	3,113	2,511	2,912	816	-1,420	-601	-5,805	1,276
Average Annual Growth	3.1%	1.9%	1.9%	0.4%	-0.7%	-0.3%	-3.4%	1.1%
Average GDP YoY Growth	6.0%	4.3%	4.5%	3.2%	3.2%	3.2%	1.8%	2.5%
Difference	-2.9%	-2.4%	-2.6%	-2.8%	-3.9%	-3.5%	-5.2%	-1.4%

In regard to job creation, the U.S. Manufacturing supersector lagged the rate of GDP growth per annum over the last 8-decades.<sup>11</sup> The highly manufacturing-intensive WWII decade set an employment growth high-water mark of 3.1% per annum (31.3% per decade) that added 3,113,000 new American jobs. Surprisingly, even with the addition of 3 million new jobs, the manufacturing rate of growth fell behind the rate of overall GDP growth by 2.9%. The 1950s and 1960s generated a modest peacetime expansion of U.S. manufacturing jobs with growth rates of 1.9% that were well below the average year-over-year GDP growth of 4.3% and 4.5% respectively. In the 1970s, the

<sup>11</sup> U.S. Bureau of Economic Analysis, GDP, Table 1.1.1.Percent Change From Preceding Year, <https://www.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey>

United States began outsourcing U.S. manufacturing jobs overseas in earnest. The 1980s and 1990s accelerated this outsourcing as well as building plants in countries with low-cost labor. However, the outsourcing zenith occurred in the 2000s causing U.S. manufacturing to lose 33.6% of its workforce in a single decade. The hemorrhaging of manufacturing jobs in the 2000s was not limited to China but also to the advent of NAFTA (founded in 1994) and the new European Union (founded in 1993). Not only did these foreign countries welcome U.S. corporate largess but they instituted aggressive tariffs and trade barriers on U.S. manufactured goods.

## U.S. Trade Deficit in Goods Since 1995



Since 1995, the U.S. goods trade deficit amounted to \$8.6 trillion with China, EU, and NAFTA or \$4.6T, \$2.0T and \$2.0T respectively. As of 1 August 2018, trade with these three trading entities are trending higher to the dismay of the current Administration. From a Jobenomics perspective, the Trump Administration’s aggressive approach to achieving balanced trade via tariffs is not only warranted but an economic and national security necessity.

## Manufacturing Job Growth during the Trump Administration



As shown, the Trump Administration got off to a slow start but is building steam over the last year. 400,000 new manufacturing jobs equates to 10.8% of the 3,691,000 new jobs produced during the Trump Administration. Barring any major disruptions, Jobenomics expects this upward trend to continue. The main reason for this optimistic statement is due to the President’s pro-business policies including corporate tax cuts, reduced regulations and trade reform. In other words, the Administration laid the groundwork for a healthy manufacturing base and improved manufacturing workforce development. Notwithstanding, the American public should not expect manufacturing job growth to return to the heydays of the 1950s and 1960s as many believe.

The outlook for the next decade ranges from very optimistic to very pessimistic.

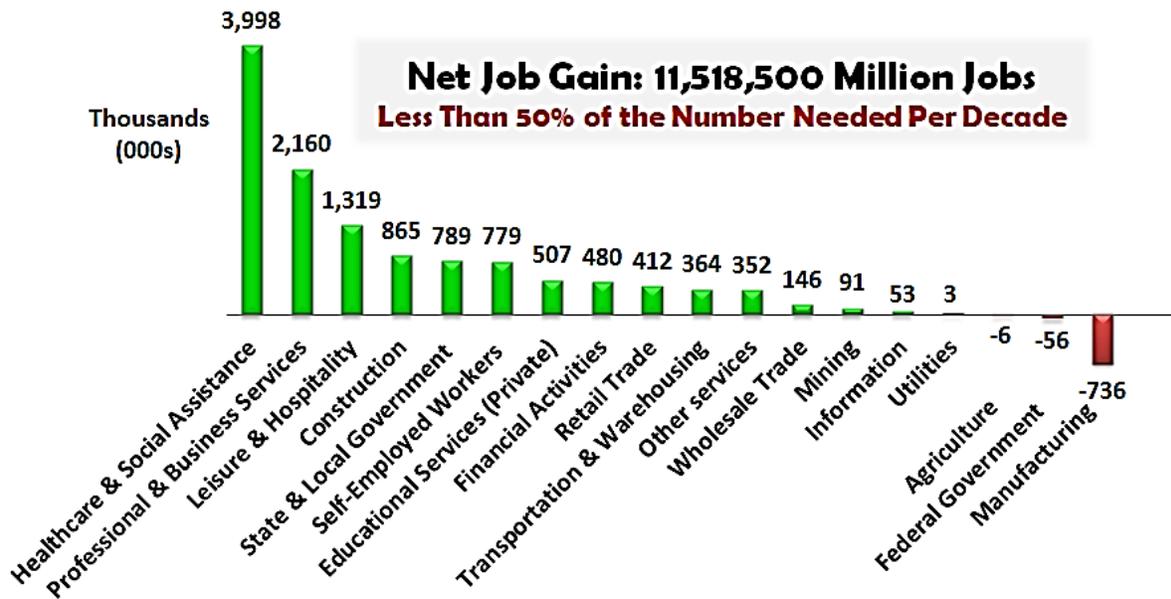
The most optimistic outlook resides in the White House. Over the next decade, President Trump’s stated objective is to create a sustained rate of GDP growth of 4% and 25 million new jobs. Based on the President’s campaign plan and ongoing efforts, he plans to achieve this objective mainly on regenerating the U.S. Manufacturing supersector.

For the sake of argument, let’s assume that the Administration can double their annual rate of growth from 1.4% to 2.8%—a very Trumpian type of deal. At 2.8% growth per year for each of the next ten years, manufacturing employment would swell from 12,632,000 today to 16,650,000 in 2028, for a net increase of 4,018,000 new manufacturing jobs. Since every direct manufacturing job supports three additional indirect jobs (mainly service-providing industries jobs), the Administration could potentially add 16 million manufacturing-related jobs that will go a long way to fulfilling the President’s 25 million new jobs goal.

The most pessimistic outlook also resides in the Executive Branch. In stark contrast to the Administration, the U.S. Department of Labor’s Bureau of Labor Statistics Employment Projections 2016-2026 Report, published on 24 October 2017—ten months into the Trump Administration—predicts that the U.S. Manufacturing supersector will lose 726,400 jobs (a decline of approximately 6%) during this 10-year period.<sup>12</sup> Moreover, the BLS forecasts a net job gain of only 11.5 million workers, which is about half the number needed to grow the U.S. economy effectively.

### Fastest Growing Occupational Groups: 2016 to 2026

Source: BLS Employment Projections 2016-26 Summary



<sup>12</sup> BLS, Employment Projections 2016-2026 Summary, <https://www.bls.gov/news.release/ecopro.nr0.htm>, and [https://www.bls.gov/emp/ep\\_table\\_201.htm](https://www.bls.gov/emp/ep_table_201.htm)

BLS sites the following reasons for their pessimistic outlook: an aging population, moderate GDP growth of 2.0% annually over the decade, productivity growth of 1.6% annually over the decade, a 2026 unemployment rate essentially the same as today, and moderate economic growth.<sup>13</sup> If this forecast is correct, the United States is in significant trouble. 11.5 million new workers are not enough to grow the economy. Such a low number indicates that the BLS foresees either a period of stalled growth or a recessionary period that would reverse labor gains.

Fortunately, BLS' negative employment projections have not materialized since the U.S. manufacturing workforce is stronger by 400,000 jobs today than it was before President Trump took office in 2017 and 391,000 jobs stronger than 1 January 2016, the start date of the BLS Employment Projections 2016-2026 Report. Moreover, President Trump's recent manufacturing initiatives have not had enough time to materialize. Being the dogged dealmaker that he is, the President is spending countless hours promoting, cajoling and enlisting manufacturing executives to help America achieve a manufacturing resurgence that will provide millions of new high-paying jobs.

President Trump's pledge to reduce corporate taxes and regulations will make American manufacturing more competitive, but advances in technology and automation are likely to inhibit employment growth. To achieve the Administration's GDP and employment objectives, manufacturing companies must aggressively deploy new-found tax savings and repatriated profits for recapitalizing American manufacturing facilities, implementing a massive workforce skills-based training program, and supporting mass-expansion of manufacturing's subcontractor supplier base.

To create 25 million new jobs, the Administration must also place greater emphasis on the emerging digital economy, network technology revolution and small/startup businesses.

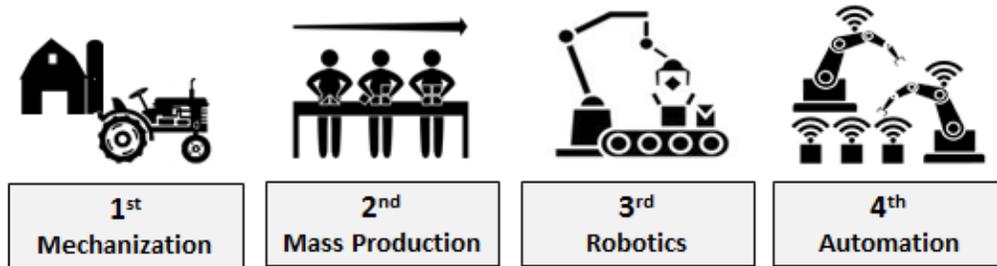
- The digital economy (also known as the web economy, internet economy, network-centric economy, or the new economy) is an economy based on digital and networked technologies, which is increasingly intertwining and preempting today's traditional economy. The digital economy is growing at 15% per year compared to current growth of 2%.
- Jobenomics defines today's network technology revolution as a "perfect storm" of next-generation network and digital technologies that will transform economies, and revamp existing institutions, businesses, labor forces and governments, According to the McKinsey Global Institute, the total economic impact of a dozen disruptive network and digital technologies would be \$124 trillion by 2025.<sup>14</sup>
- The digital economy and network technology revolution are already having a transformative effect on manufacturing and the traditional industrial base. This transformation is known as Smart Factories, Manufacturing of the Future, Fourth Industrial Revolution, or simply Industry 4.0.

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<sup>13</sup> BLS, Employment Projections: 2016-26 Summary, <http://www.bls.gov/news.release/ecopro.toc.htm>

<sup>14</sup> McKinsey Global Institute, Disruptive Technologies: Advances That Will Transform Life, Business and the Global Economy, May 2013, file:///C:/Users/CHUCK/Downloads/MGI\_Disruptive\_technologies\_Full\_report\_May2013.pdf

## Industrial Revolutions



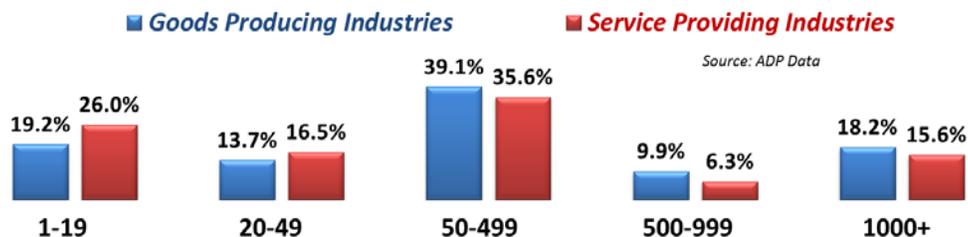
The 1<sup>st</sup> Industrial Revolution occurred in the 18<sup>th</sup> Century with the mechanization of agriculture. The 2<sup>nd</sup> Industrial Revolution transpired in the 19<sup>th</sup> Century with assembly lines and mass production. The 3<sup>rd</sup> Industrial Revolution transpired in the 20<sup>th</sup> Century with robotics on the factory floor. The 4<sup>th</sup> Industrial Revolution involves automation (robotics, software applications, and artificially-intelligent agents) that will transform the manufacturing industry and the entire production value chain by vastly reducing the cost of labor. Advances in digital and network technologies now enable artificially intelligent agents and robots to work alongside humans during the entire production process.

The tech-titans (Apple, Alphabet, Microsoft, Amazon, Facebook, etc.) dominate the emerging digital economy and related network technology revolution. The combined market valuation of these Big-5 technology titans is \$4.1 trillion, an amount greater than Germany’s \$3.5 trillion GDP. Unfortunately, Washington and the Big-5 and many other tech-giants are not on the same song sheet with the Administration regarding economic, community, business or workforce development. As evidenced by President Trump’s disbanding of his Manufacturing Jobs Initiative and its Strategy & Policy Forum after a walk-out of many of the tech-titans, the Administration has a very steep hill to climb with the Big-5 if they hope to maximize the emerging digital economy and network technology revolution as a source for mass-producing small/startup businesses and jobs.

Small/startup business development is also not part of Washington’s lexicon that focuses mainly on big business and massive projects. From a Jobenomics perspective, mass-producing highly-scalable small companies should be center stage on the Administration’s job creation efforts. Enabled by new digital and network technologies, digital business startups are an order of magnitude quicker and cheaper to launch and support than traditional startups.

### Industry Employment by Company Size

as of 1 August 2018

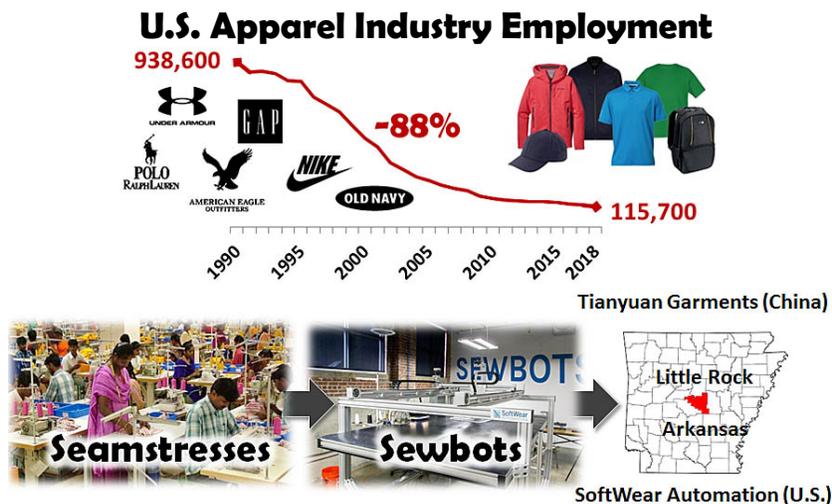


It is a common misconception that small businesses are only involved in service-providing industries whereas large major corporations dominate goods-producing industries. ADP data, a monthly survey of workers in 400,000 U.S. private sector businesses by the ADP Research Institute in collaboration with Moody’s Analytics, indicates that small business has a major role in both the Goods-Producing

and Service-Providing Industries supersector groups. According to the July 2018 ADP National Employment Report, the three goods-producing industries employ 20,545,000 workers, of which small businesses employ 72% (14,777,000) of all American workers.<sup>15</sup> Since manufacturing represents around 62% of the Goods-Producing Industries supersector group total employment (12.8 million out of 20.5 million), it is reasonable to assume that manufacturing companies have a very large small business supplier base that is likely to grow as Industry 4.0 takes root across the entire manufacturing value chain. U.S. manufacturers are already outsourcing increasing amounts of labor to the contingent workforce that includes independent contractors, freelancers, self-employed workers and part-timers.

As reported by The Economist, from 2000 to 2010, 88% of all U.S. manufacturing job losses were due to increased productivity and automation.<sup>16</sup> While productivity and automation have decimated the manufacturing labor force, they have paid handsomely regarding manufacturing output. American manufacturing has “more than doubled output in real terms since the Reagan era, to over \$2 trillion today.” Also, “output per labor-hour rose by 47% between 2002 and 2015, outpacing gains in Britain, France, and Germany.” Notwithstanding, The Economist projects that “a widening skills gap means that over half of new manufacturing jobs in the decade to 2025 may go unfilled.”<sup>17</sup>

Increased automation and productivity are not the only factors depressing the manufacturing labor force expansion. Other factors include competitive and predatory foreign labor rates that undercut U.S. workforce wages, dumping of imported below-cost products, tariffs on American made goods, a lack of high-tech manufacturing skills in the civilian labor force, outsourcing U.S. full-time work to American task-oriented workers and independent contractors, and burdensome government regulations and taxation on industries critical to U.S. sovereignty and prosperity. After decades of ambivalence, Washington is now addressing many of these factors.



<sup>15</sup> ADP Research Institute, April 2018: ADP Employment Reports, <https://www.adpemploymentreport.com/>

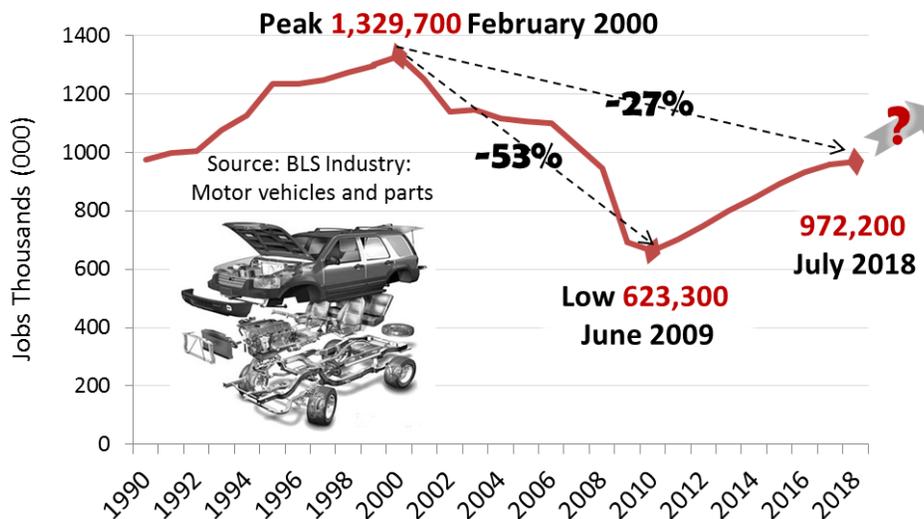
<sup>16</sup> The Economist, Companies/Industries, Training Day, 20-26 March 2017, Page 19

<sup>17</sup> The Economist, Manufacturing, Making it in America, American factories could prosper if they find enough skilled workers, 12 October 2017, <https://www.economist.com/news/business/21730188-widening-skills-gap-means-over-half-new-manufacturing-jobs-decade-2025-may>

The U.S. Apparel industry has been one of the hardest hit American industries. In 1990, this industry employed 938,600 Americans. Today, only 115,700 Americans are employed. While the number of workers is not likely to increase significantly, apparel manufacturing is rebounding due to the use of next-generation technology. One of China’s leading garment manufacturers, Tianyuan Garments Company, is scheduled to begin production by the end of 2018 in a modern \$20 million Arkansas factory. This factory is unique since it can manufacture T-shirts for a paltry 33 cents (\$0.33) each, which is well below the costs of similar manufactured Tianyuan products in China.<sup>18</sup> The primary reason why this Tianyuan Garments-owned Arkansas factory can manufacture so cost-effectively involves 330 American-made “sewbots” from Atlanta-based SoftWear Automation Inc. Another reason is that Arkansas’ relatively high-skilled labor force is competitive against China’s aging, shrinking, and less cost-effective workforce and lower-automated garment factories.

First Solar, an Arizona manufacturer of solar panels, not only uses second-generation solar technologies (highly efficient cadmium telluride thin-film photovoltaics<sup>19</sup>) that makes the manufacturing process easier but is almost fully automating their production facility in Ohio. Compared to the leading Chinese solar companies that make similar-size silicon panels, First Solar panels take 3½ hours to manufacture. According to a Bloomberg report, First Solar panels “produce 244 percent more power at a manufacturing cost of as little as 20¢ per watt, about 30 percent less than the cheapest Chinese equivalent.” From a labor force perspective, what took First Solar hundreds of workers to run the Ohio plant now takes only several dozens of workers to supervise hundreds of robots that tirelessly toil over three miles of production lines.<sup>20 21</sup>

## Transportation Jobs Could Be Much Higher



<sup>18</sup> Bloomberg Businessweek, China Snaps Up America’s Cheap Robot Labor, A Chinese T-shirt company is setting up shop in Arkansas, lured by U.S. sewbots and lower production costs, 30 August 2017,.

<https://www.bloomberg.com/news/articles/2017-08-30/china-snaps-up-america-s-cheap-robot-labor>

<sup>19</sup> Energy.Gov, Cadmium Telluride, <https://www.energy.gov/eere/solar/cadmium-telluride>

<sup>20</sup> First Solar, Modules, Our Technology, <http://www.firstsolar.com/Modules/Our-Technology>

<sup>21</sup> Bloomberg Businessweek, First Solar Is Using Robots to Better Tap the Sun, 24 January 2018,

<https://www.bloomberg.com/news/articles/2018-01-24/first-solar-is-using-robots-to-better-tap-the-sun>

Within the Transportation Equipment sector, Motor Vehicles and Parts (NAICS 3361 Motor vehicle manufacturing, NAICS 3362 Motor vehicle body and trailer manufacturing and NAICS 3363 Motor vehicle parts manufacturing) grew at an astounding rate of **49%** generating 319,000 new jobs since this decade and 348,900 new jobs since its Great Recession low of 623,000 in June 2009. However, this rate of growth could and should be much higher since this industry is still down 27% from its February 2000 peak of 1,329,700 jobs.

The lookout for motor vehicle manufacturing-related jobs could be exceedingly bright if U.S. companies (like Tesla, GM, and Ford) can capture the lion’s share of the emerging electric vehicle market. Also, recent trade negotiations could boost U.S. manufacturing substantially further.

### **USA Sales: New Passenger Vehicles and Light Trucks**

*Source: Statista,  
Made in America Movement (2017)*

	<b>Number (Millions)</b>	<b>Percentage</b>	
<b>U.S. Owned &amp; Made In USA</b>	<b>8.1</b>	<b>47%</b>	
<b>Foreign Imports</b>	<b>6.0</b>	<b>35%</b>	<b>53% Foreign</b>
<b>Foreign Owned Assembled In USA</b>	<b>3.1</b>	<b>18%</b>	
<b>17.2</b>			

Of the 17.2 million passenger vehicles and light trucks sold last year in the United States, only 43% were by U.S. automakers. Foreign-owned manufacturers from Europe and Asia garnished 53% of U.S. vehicle sales. 35% (6.0 million) of the foreign sales total was from imported vehicles. 18% (3.1 million) were by foreign vehicles assembled in the United States. Jobenomics expects that U.S. assembly operations by brands will increase to mitigate growing Made In America sentiment.

While 17.2 million U.S. passenger vehicle and light truck sales seem like a huge number, it is only 18% of global sales of 96.8 million vehicles. Compared to other countries, the American automotive market is subject to foreign penetration at the expense of the U.S. economy and labor force.

America’s taste for foreign vehicles cost the U.S. economy and labor force dearly. Imports not only deprive American workers of manufacturing jobs but funnel revenue and profits away from domestic use. From a Jobenomics standpoint, American policy-makers could incentivize Americans to buy vehicles made in America with high American content via tax deductions or low-cost loans. The U.S. Government underwrites home ownership (through GSE’s like Fannie Mae and Freddie Mac). After home ownership, automobile ownership is the largest expense for the average American.

In 2017, global production of passenger vehicles and light trucks was 97.3 million vehicles. After a decade of breakneck growth, China produces 29.0 million vehicles (30% of global auto sales, up from 4% in 2000) compared to 11.2 million in the United States (12% of global auto sales, down from 22% in 2000). Other major foreign producers include Japan (9.6 million vehicles or 10% of global total),

Germany (5.6 million vehicles or 6%), India (4.8 million vehicles or 5%), South Korea (4.1 million vehicles or 4%) and Mexico (4.1 million vehicles or 4%).<sup>22</sup>

### Trade Deficit: New Passenger Vehicles and Light Trucks

Source: U.S. Department of Commerce, Office of Transportation and Machinery (2017)

	Exports (\$ Billions)	Imports (\$ Billions)	Trade Imbalance (\$ Billions)
Asia/Pacific (TTP)	\$30	\$129	\$100
NAFTA	\$27	\$89	\$63
European Union (27)	\$9	\$43	\$34
	<b>\$65</b>	<b>\$262</b>	<b>\$196 Deficit</b>

Asia and Europe put high tariffs and trade barriers on U.S. automotive vehicles and parts. According to the U.S. Department of Commerce, the trade deficit for new U.S. passenger vehicles and light trucks was \$196 billion in 2017. If half this amount was retained in the USA for America automotive workers who would earn \$100,000 per year worth of wages and benefits (a very high number— the average salary for Production and Nonsupervisory Employees is roughly \$40,000 per year), creating over 1 million new U.S. jobs.

Fortunately, President Trump’s tough stand on trade imbalances and tariffs are producing results. The President of the European Commission, Jean-Claude Juncker, recently agreed to work together toward “zero tariffs, zero non-tariff barriers and zero subsidies on non-auto industrial goods.” In July 2018, Germany’s chancellor, Angela Merkel, said that Germany is willing to back lower tariffs on U.S. auto imports. The CEOs of Germany’s biggest carmakers reportedly voiced support for eliminating such tariffs entirely.

During President Trump’s first 19-months in office, the Administration has helped the Motor Vehicle and Parts industry create 19,000 new jobs. If he can get foreign countries to agree to balanced/reciprocal trade agreements, it is not unreasonable to assume that U.S. automakers and their suppliers could reach the previous peak set in February 2000, adding 357,500 new American jobs as well as another 1 million indirect jobs. Jobenomics believes that this is an achievable goal. On the other hand, automation will likely limit job growth to peak and not much higher. While 1,357,000 new jobs would be a significant addition, it will not be enough to fulfill President Trump’s objective of generating 25 million new jobs over the next decade.

Since nondurable goods are less visible and sexy than durable goods, like automobiles, tough trade talks are likely to have much effect. Consequently, America will have to take advantage of our technological prowess and entrepreneurial spirit to turn around many nondurable industries that are losing jobs, like the Apparel industry, or growing at paltry rates well below the rate of GDP growth.

<sup>22</sup> Wikipedia, List of countries by motor vehicle production, [https://en.wikipedia.org/wiki/List\\_of\\_countries\\_by\\_motor\\_vehicle\\_production](https://en.wikipedia.org/wiki/List_of_countries_by_motor_vehicle_production)

## Food Manufacturing Jobs Could Be Much Higher

Source: Bureau of Labor Statistics

	1-Jan-10	1-Aug-18	New Jobs (000s)	% Growth Per Year
<b>Food Manufacturing</b>	<b>1,453</b>	<b>1,642</b>	<b>189</b>	<b>1.5%</b>

Unemployment Rate: 7.3%

### Urban Agriculture



Indoor Vertical Farming, Hydroponics, Aquaponics

One of the most overlooked nondurable industries is Food Manufacturing. Industries in Food Manufacturing transform livestock, seafood and agricultural products into products for intermediate or final consumption.

So far this decade, Food Manufacturing is growing a meager rate of 1.5% per year. On the flip side, Food Manufacturing added 189,000 new jobs and employed 1,642,000 people, which is 69% more than the 972,000 employed by the Motor Vehicles and Parts industry.

Worldwide food shortages will drive explosive growth for the global food manufacturing industry.

Today, there is more than enough food produced in the world to feed everyone, yet 815 million people go hungry according to the U.N. By 2050, with the global population expected to reach 9.8 billion, food supplies will be under extreme stress. Demand will be 60% higher than it is today, but climate change, urbanization, and soil degradation are minimizing availability and productivity of arable land, according to the World Economic Forum. Per the World Food Program's 2018 Global Report on Food Crises, in 2017, almost 124 million people across 51 countries and territories faced shortages from "Crisis" levels of acute food insecurity to "Catastrophe/ Famine" conditions requiring urgent humanitarian action.<sup>23</sup>

Many areas in the United States are also suffering from severe food and nutrition shortages. Almost every major city and many rural areas have "food deserts" with limited access to convenience and dollar stores. Food-insecure and low-income people with limited access to full-service grocery stores and farmer's markets tend to have unhealthy diets, increased risk for obesity, higher levels of stress and anxiety, and susceptibility to poor mental health and abnormal behavior.<sup>24</sup>

<sup>23</sup> World Food Program, 2018 Global Report on Food Crises, <https://www.wfp.org/content/global-report-food-crises-2018>

<sup>24</sup> Food Research & Action Center, Why Low-Income and Food-Insecure People are Vulnerable to Poor Nutrition and Obesity, <http://frac.org/obesity-health/low-income-food-insecure-people-vulnerable-poor-nutrition-obesity>



One of Jobenomics major areas of focus is Urban Agriculture that entails controlled environment methods, indoor vertical farming, hydroponics, and aquaponics. Indoor agriculture is not only environmentally-friendly (less water and pesticide/herbicide free) but is also largely immune to climate change and extreme climate events. Empty warehouses and vacant lots in depressed inner-city areas are ideal for urban agriculture. Not only would these facilities grow and process food, they would provide jobs in areas that are not only food deserts but job deserts. The positive impact of new jobs in depressed areas benefit micro-farmers but would provide collateral benefits of reducing poverty and crime levels. For more information on Jobenomics Urban Agriculture see the Jobenomics Library at [www.Jobenomics.com](http://www.Jobenomics.com).

Urban agriculture could conceivably help the Food Manufacturing industry reach GDP parity. If Food Manufacturing could produce new jobs at 3% per year (double its current rate), 500,000 direct jobs and potentially 1,500,000 indirect jobs could be added, for a total of 2 million new jobs. Unlike the many other goods-producing industries, Food Manufacturing is unlikely to run out of consumers given the growing state of world hunger and malnutrition.

**In summary**, the U.S. Manufacturing supersector is vitally important to national sovereignty and an anchor tenant of the U.S. economy. Reshoring and keeping American factories in America is a worthy goal. Even if America reshores manufacturing jobs from foreign countries, manufacturing has limited upside employment potential due automation across the entire manufacturing value chain. From a wage perspective, manufacturing is no longer the high-paying industry sector that it used to be, nor will it be in the future. As opposed to looking to manufacturers as a principal supplier of “good” jobs, manufacturing focus should be on protecting the current set of U.S. manufacturers, focusing on next-generation manufacturing technology and processes, and recapitalization of the American industrial base and retooling its workforce.

**About Jobenomics:** *Jobenomics deals with the economics of business and job creation. The non-partisan Jobenomics National Grassroots Movement’s goal is to facilitate an environment that will create 20 million net new middle-class U.S. jobs within a decade. The Movement has reached an estimated audience of 30 million people. The Jobenomics website contains numerous books and material on how to mass-produce small business and jobs as well as valuable content on economic and industry trends. For more information see [Jobenomics.com](http://Jobenomics.com).*