



2019 Indiana Manufacturing Survey:  
**Labor Shortages Hit Home**



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A close-up photograph of a metal gear meshing with a blue fabric. The gear is positioned on the right side of the frame, with its teeth interlocking with the fabric on the left. The background is a mix of blue and orange light, creating a dramatic, industrial atmosphere. The lighting highlights the metallic texture of the gear and the fine ridges of the fabric.

# Foreword

The results of this year’s annual manufacturing survey – now in its 13th year – reflect good news about current performance tempered by uncertainty over trade policy and the realization that major workforce challenges lie just down the road. A record number of survey respondents – more than half – indicate their financial performance is healthy, while less than one in five describe their finances as “challenged.”

A record number of respondents expect their product markets to grow rapidly over the coming years. To satisfy this demand, Hoosier manufacturers are continuing to upgrade their advanced manufacturing processes and technologies, especially with CNC machines, CAD/CAE, CMM, and lasers. These results corroborate the trend first reported in our 2017 survey: Hoosier manufacturers are actively substituting capital investment in technologies for labor to satisfy demand and remain competitive. This trend toward “smart manufacturing,” often referred to as “Industry 4.0,” may displace some unskilled workers, but it will almost certainly increase the demand for skilled workers. When asked about the effects of new technologies and automation on jobs, almost two-thirds of this year’s survey respondents indicate that they expect the number of skilled jobs to increase as a result, and about half of those expect the number of unskilled positions to increase as well, primarily due to improved competitiveness.

For a decade now, respondents to this survey have reported serious worker shortages, not only of skilled production workers but also of unskilled workers capable of being trained to become the skilled workers of the future. The challenge to addressing this shortage is difficulty recruiting young employees capable of replacing retiring baby boomers. This challenge results partly from a lack of interest in manufacturing and partly from a lack of applicants with an adequate education in STEM or employable life skills. Past efforts to address this problem have seemingly made little to no progress, and it has persisted to the point where the growth potential of Hoosier manufacturing is being constrained. Along these lines, the percentage of respondents who now believe they must take responsibility for their own workforce development has risen to a record 66% in 2019, up from 61% in 2018, and 94% offer on-the-job training of some sort.

Because this is the final report of the decade, it is important to address the trends we have seen in Hoosier manufacturing over the previous 10 years, as they are predictive of what’s to come.

In 2010, in the waning years of the Great Recession, most of Indiana’s manufacturers were focused on restoring financial stability and maintaining their market positions. By the middle of this decade there was a surge in capital investments along with rising concerns over growth-limiting regulations, including taxes and healthcare. Worker shortages and the skills gap also started to emerge at that point in time. Near the end of this decade, Hoosier manufacturers were not only enjoying the effects of decreased regulatory burdens, they were also beginning to concentrate their investments on advanced automation.

The stage is now set for what promises to be an exciting new decade for Indiana manufacturing. While labor shortages and advanced technologies will undoubtedly remain dominant themes for many years to come, given the tumultuous decade that manufacturing just withstood, we’re confident the industry will not only overcome whatever challenges arise, but it will remain on top as our state’s most important business sector.



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# **Executive Summary**

The results of the 2019 survey indicate the Hoosier manufacturing sector remains healthy, even in the face of a possible economic slowdown. But the shortage of skilled production workers is more serious than ever, and it is hindering sales and plans for expansion.

Expectations for future growth rates in sales revenues, profit margins, and capital investment remain positive but are at lower levels than projected a year ago. Still, a record number of survey participants expect rapid growth in their product markets over the next three to five years. To meet this demand given the workforce challenges, the emphasis is on capital investment – especially in automation – and improved efficiencies to remain competitive.

As might be expected, opinions on trade policy and tariffs are mixed, and they are evenly split on whether the U.S. federal government is doing a good job supporting the manufacturing industry. At the same time, there is near consensus that corporate tax reform has influenced increasing capital investment and wages.

While the vast majority of respondents believe that Indiana’s state government is supportive of the manufacturing sector, most also think that workforce development programs would be more effective if driven by industry rather than the state. There is also broad support for the state to grant relocation credits as a means of attracting new workers to Indiana. In short, a generally healthy manufacturing sector is grappling with the uncertainty posed by trade and tariffs as well as the continuing challenge of a shortage of skilled production workers.

## **Challenges for 2019: Indiana Manufacturers**

While our 2019 survey suggests that the Hoosier manufacturing sector remains healthy and demand for their products is expected to be strong, the continued shortage of skilled workers presents a serious obstacle to growth, and that means future success is more dependent on improving operational efficiencies than ever before.

- **Investing in technology remains key.** Capital investments in advanced technologies associated with Industry 4.0, such as automation and the internet of things (IOT), can help manufacturers improve operational efficiencies, increase capacity, and stay competitive.
- **Continue to develop the workforce of the future.** With further adoption of advanced manufacturing technologies, manufacturers also need to properly support these capital investments by “upskilling” their workforce through training. And, as one respondent put it, “Manufacturers need to learn how to ‘sell’ their businesses to students given the industry’s lack of glamor versus service industries (tech).”
- **Reassess the supply chain.** There is broad political support in both major parties for rethinking trade policy. Hence, flexibility up and down the supply chain will be a valuable option for the foreseeable future.

## **Challenges for 2019: Government Policy Makers**

To help promote economic growth and foster job creation, government at various levels needs to work with the manufacturing sector to:

- **Develop productive trade policy.** Trade policy that provides more equal reciprocal access and protections for intellectual property, through enforcement of law and by ending forced technology transfers, would go a long way toward benefitting all involved, including U.S. manufacturing.

- **Make progress on healthcare costs.** Healthcare continues to be the top regulatory concern of manufacturers and has been for more than a decade. Given the political climate, it is unrealistic to expect this issue to be solved any time soon, but some modest progress would help.
- **Enlist public secondary schools in addressing the workforce shortage.** As one respondent suggested, “Get back to shop class in lower schools, and promote working with your hands to kids not going to college.”

## Limits to Growth?

Uncertainty about trade policy and healthcare costs remain impediments to growth, but the biggest challenge facing the manufacturing sector today is recruiting and training the next generation of skilled production workers. This challenge is not new, of course. But it takes on added significance now with the resurgence of manufacturing in the U.S. The good news is that this resurgence means abundant opportunities for good paying jobs for young people. The challenge is to get more of them to realize it!

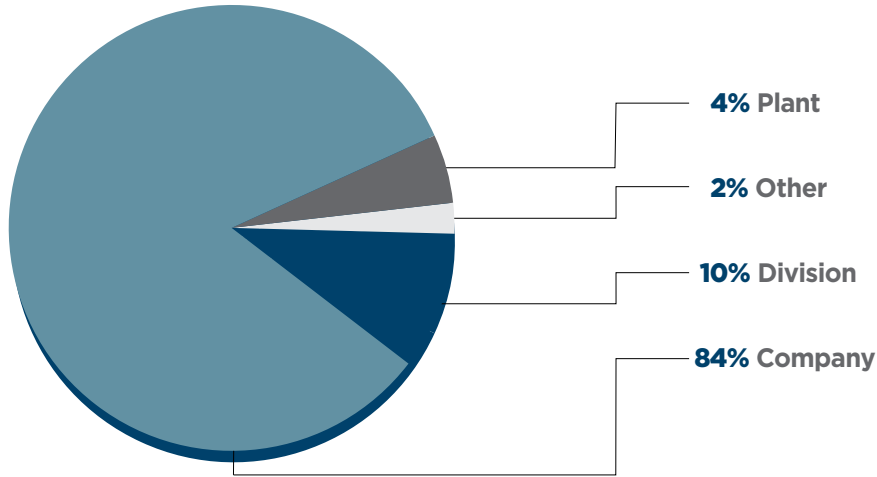




# I. Company Demographics

The majority of participants in the 2019 *Indiana Manufacturing Survey* were reporting for their organizations at the company level (84%), with the rest responding for divisions of larger organizations (10%), individual plants (4%), or other types of organizational units (2%). The average number of direct or full-time employees per respondent is 664, with the largest employing 20,000. Additionally, the average number of contract workers and temporary workers per respondent is 37 and 29, respectively.

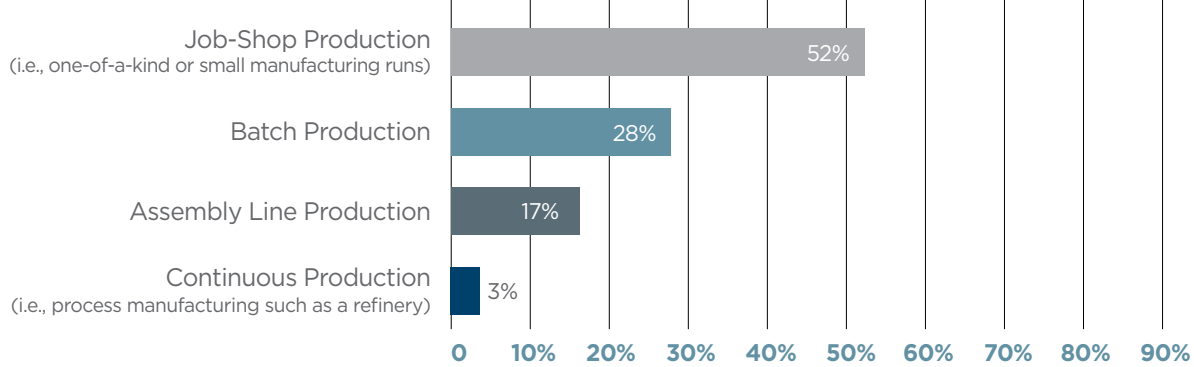
**TYPES OF ORGANIZATIONAL UNITS**



**NUMBER OF EMPLOYEES**

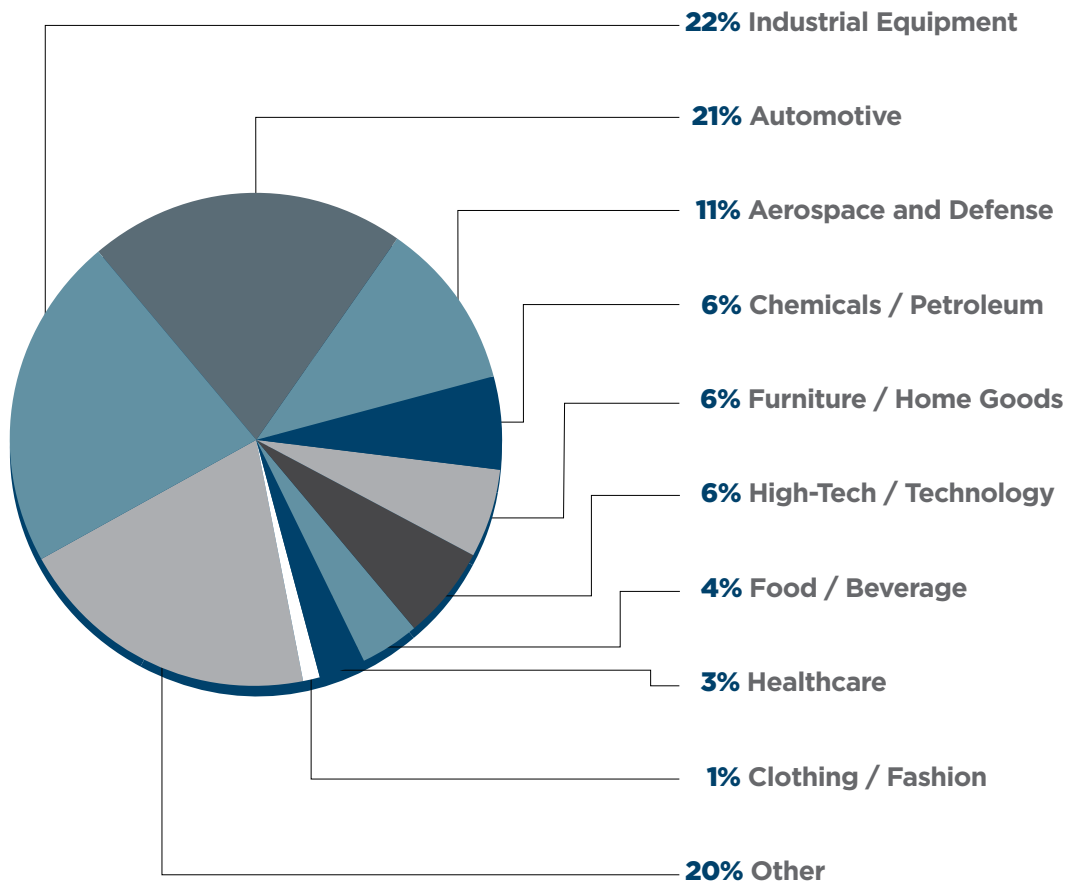
	Direct / Full-Time Workers	Contract Workers	Temporary Workers
Mean	664	37	29
Maximum	20,000	2,000	1,000

**TYPES OF PRODUCTION PROCESSES**



As for the production processes used by the respondents in the 2019 survey, most use either job-shop (52%) or batch production (28%). And consistent with previous years' surveys, a smaller proportion of the respondents use assembly lines (17%) or continuous production (3%).

## INDUSTRY TYPES

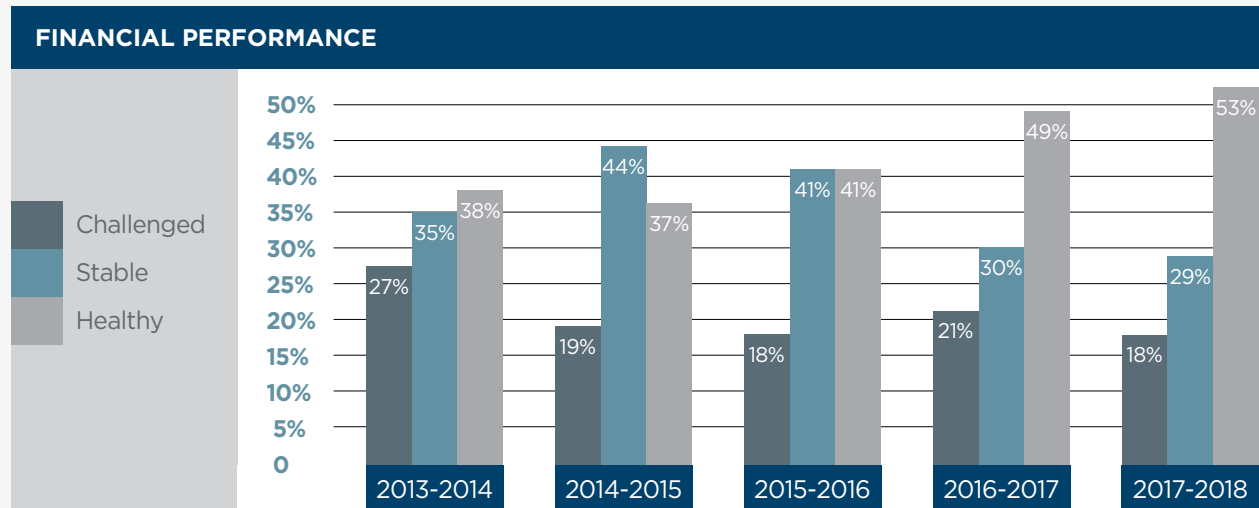


As with our previous studies, the 2019 sample reflects a balanced assortment of Indiana's most significant manufacturing industries. The three largest industry groups, represented by the survey respondents, are industrial equipment (22%), automotive (21%), and aerospace and defense (11%). Another 26% of respondents are distributed between high-tech (6%), chemicals/petroleum (6%), furniture/home goods (6%), food/beverage (4%), healthcare (3%), and clothing/fashion (1%). Companies in the "other" category (20%) include construction materials, home appliances, as well as plastics.

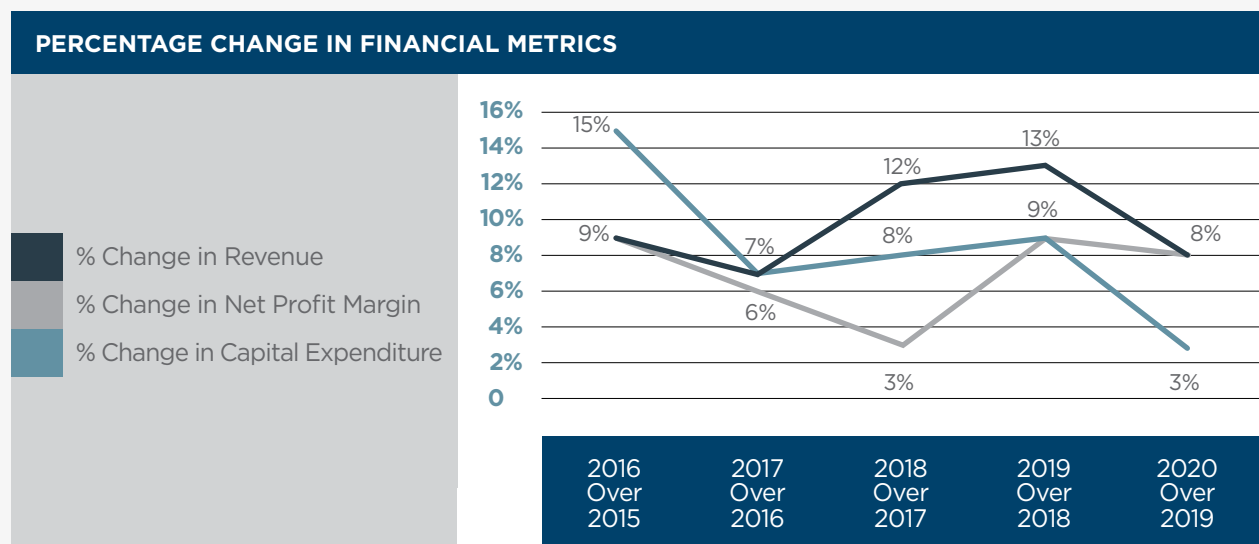


## **II. Overall Economic and Financial Performance**

We asked respondents to rate their overall financial performance over the past two years as either “healthy,” “stable,” or “challenged.” In 2019, a new record high of 53% of the respondents described their organization’s financial performance as “healthy.” These results reflect the overall health of the U.S. economy as well as the continued renaissance underway in U.S. manufacturing. Despite this, almost 20% of respondents continue to report their financial performance is “challenged,” just as in all previous years since the post-recession recovery.



Looking ahead, respondents’ expectations about key financial metrics remain healthy, although slightly less optimistic than last year. The expected percentage growth in profitability is down only from 9% in 2019 to 8% in 2020. Likewise, expected growth in 2020 revenue is 8%, but down from 13% in 2019. More notable is the drop off in the expected growth rate in capital expenditures to 3% in 2020, down from 9% in 2019. This is consistent with the U.S. Department of Commerce’s reported decline in U.S. business investment for the second quarter of 2019, which has been viewed by financial markets as an indication that an economic slowdown may be on the horizon.



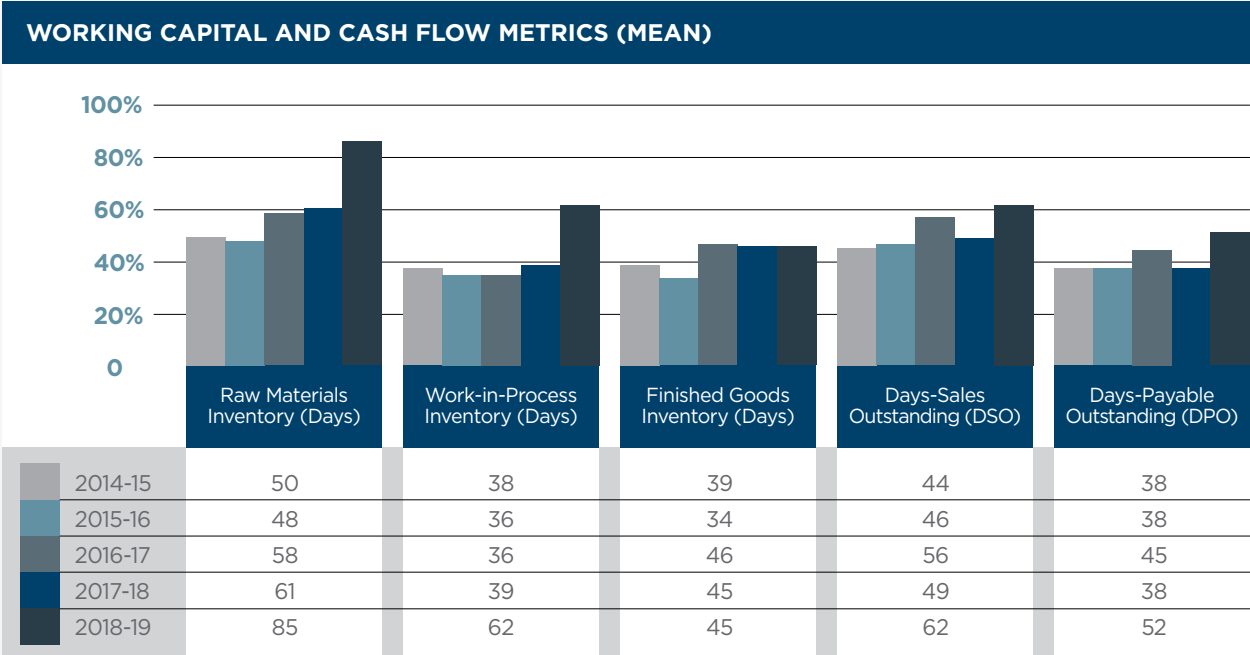
Despite concerns about a possible recession and decline in U.S. manufacturing activity, 81% of the respondents in our survey expect revenues to increase in 2020, and this is encouraging, although down from 91% in last year's survey. And while the percentages of Hoosier manufacturers expecting increases in profit margins (80%) and capital expenditures (76%) in 2020 are lower than in the prior year, the results are encouraging enough to suggest that the economy may only be slowing rather than heading for a recession anytime soon.

<b>FINANCIAL METRICS</b>				
<b>% Change</b>	<b>Min % Value</b>	<b>Max % Value</b>	<b>Avg % Value</b>	<b>% Positive</b>
<b>2019 Survey</b>				
Revenue for 2020 Over 2019	-38	62	8	81
Net Profit Margin for 2020 Over 2019	-21	96	8	80
Capital Expenditures for 2020 Over 2019	-63	58	3	76
<b>2018 Survey</b>				
Revenue for 2019 Over 2018	-31	77	13	91
Net Profit Margin for 2019 Over 2018	-45	57	9	83
Capital Expenditures for 2019 Over 2018	-100	100	9	88
<b>2017 Survey</b>				
Revenue for 2018 Over 2017	-30	77	12	88
Net Profit Margin for 2018 Over 2017	-64	40	3	72
Capital Expenditures for 2018 Over 2017	-92	100	8	75
<b>2016 Survey</b>				
Revenue for 2017 Over 2016	-40	61	7	79
Net Profit Margin for 2017 Over 2016	-83	60	6	76
Capital Expenditures for 2017 Over 2016	-72	100	7	83

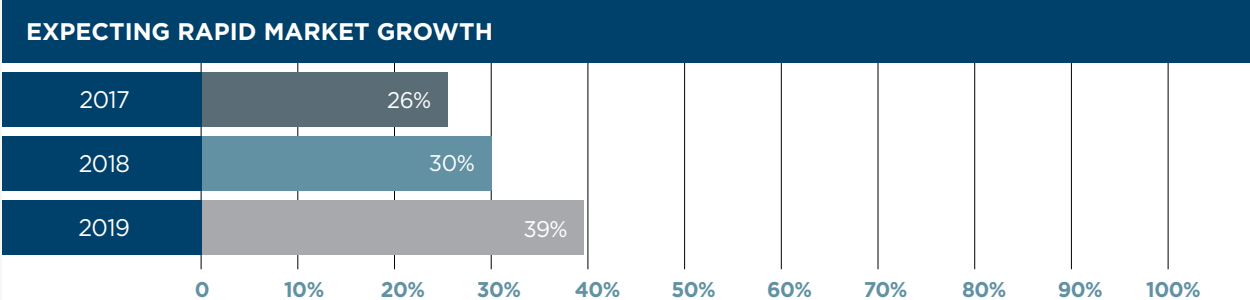
While expectations for 2020 revenues, profits, and capital expenditures are generally still encouraging for Hoosier manufacturers, the environment remains highly competitive with little room for error. Accordingly, we asked survey participants, **“What was your worst manufacturing decision in the past year?”** Interestingly, as the quotes below reflect, more than a handful of respondents indicated that they did not commit enough, or soon enough, to new business investment, perhaps due to concern over an economic slowdown.

- “Delaying delivery of new machines because of the uncertain political climate.”
- “Not placing more processing equipment on lines.”
- “Not automating more of our process. We were afraid of cost. We kept human inspection in the process instead of buying machines to inspect.”
- “Not investing more time and money into new fixtures and technologies to reduce set up times and increase production output.”
- “Increasing sales and production volume before adding more CNC machines.”

In regard to working capital, the mean days of inventory for raw materials and work-in-progress increased markedly in 2019, to 85 and 62 days, respectively. And while large builds in business inventories are often viewed as a sign of looming recession, such an interpretation is inconsistent with the lack of build in finished goods inventories, unchanged at 45 days, and the general optimism about future revenues, reported above. So rather than portend a slowdown, these results more likely reflect the nationwide builds in business inventory reported by the U.S. Department of Commerce earlier in 2019 and are attributed to firms stocking up on inputs to get ahead of tariffs. That said, days-sales outstanding (DSO) and days-payable outstanding (DPO) both increased significantly from last year, by 13 and 14 days, respectively, and such trends usually reflect current and future cash-flow problems somewhere in the supply chains. Thus, like so many other current economic indicators, the story these working capital metrics are telling us about the economy appears to be mixed. Regardless, the mean cash conversion cycle (i.e., average days inventory plus days receivable minus days payable) for this year's sample increased by a very material 15 days in 2018-19, to 74, versus 59 days in 2017-2018.



In terms of product markets, optimism about future growth continues to increase, with 39% of respondents now anticipating rapid growth in their markets over the next three to five years (2021-2023). This is up from 30% in the 2018 survey expecting rapid growth over the subsequent three to five years (2020-2022) and 26% anticipating likewise in the 2017 survey.

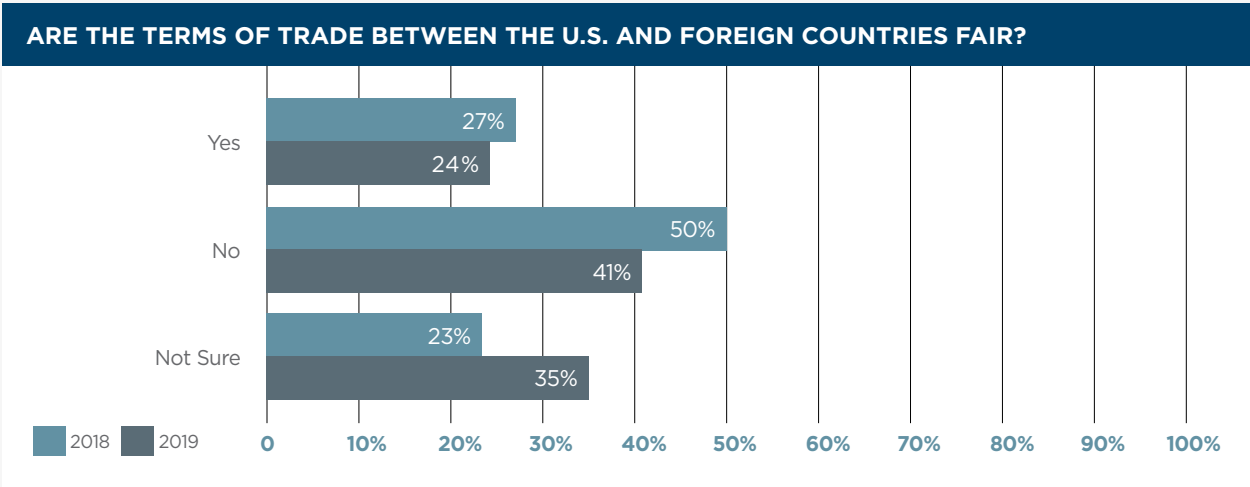






# **III. Trade, Tariffs, and Government Support for Manufacturers**

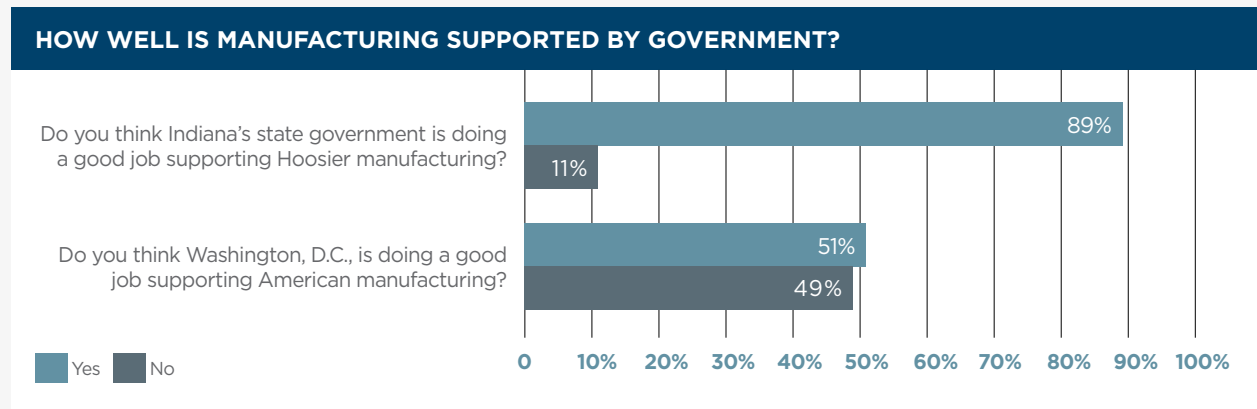
Turning to the hot manufacturing topic of international trade, 50% of respondents in the 2018 survey did not think that the terms of trade were fair between the U.S. and the foreign country/countries where their products are sold. In this year's survey, the percentage of respondents with that view declined to 41%. But the percentage thinking these terms of trade are fair also declined, from 27% to 24%, while those who are not sure increased materially, from 23% to 35%.



When asked to **add any additional comments on U.S. trade and tariff policy and how it is affecting each respondent's business**, illustrative comments included:

- "The tariffs limit our ability to complete long-term planning."
- "We are multinational and have 100% owned entities in Europe and Asia. The uncertainty and the direct and indirect impact on our customers, their markets, and imported goods for our domestic manufacturing is resulting in lost share to foreign countries that are less impacted by the trade threats and actual tariffs. (India is a big winner. Russia too.)"
- "Slowing production and overall sales."
- "The old policies decimated our customers. Hard to say how many employees we lost because at the same time we were moving into CNC and robotics."
- "Keep fighting for level playing field for both tariffs/cost and for the regulation of imported items."
- "It has had a large impact as steel and aluminum are by far our largest costs. It has brought a lot of uncertainty in the market. We have had to be much more thoughtful on our purchasing and there is now a lot more commodity risk than we had before."

As in years past, the 2019 survey asked for opinions on how government – both state and federal – is supporting manufacturing. Similar to past surveys, an overwhelming majority (89%) believes that Indiana’s state government is doing a good job. Conversely, respondents were about evenly split (51% “yes” to 49% “no”) regarding whether the federal government is doing a good job of supporting manufacturers.



When asked to add any other comment(s) they’d like to make regarding **how they think Indiana’s state government is doing in terms of supporting Hoosier manufacturing**, representative comments included:

- “More needs to be done to attract talent to manufacturing jobs. We need to improve the quality of candidates coming through our educational systems, and we need to find ways to incentivize qualified workers to move to Indiana from other states. Most employers are already offering incentives in terms of sign-on bonuses and paying moving expenses. We need assistance from the state.”
- “Being fiscally responsible and holding taxes down while maintaining a good quality of life. Roads, schools, crime, parks, art, etc.”
- “Great workforce development, sound workers compensation insurance management.”
- “Indiana government is making efforts to support manufacturing, but it is proceeding slowly, and with what appears to be some hesitation from the educators, mostly local.”
- “Would be nice to have additional tax cuts for employing local county residents.”
- “Integrity in leadership, politicians with clean records, avoiding corruption and negative publicity.”

Similarly, when asked to add any other comment(s) they'd like to make regarding **how they think the federal government is doing in terms of supporting Hoosier manufacturing**, typical comments included:

- “Trade war is very detrimental to our business. We ship significant amounts of material into China.”
- “Funding, especially in defense, is strong. We are seeing an incredible number of opportunities for new programs and customers that are willing to provide supplier development funds to help us grow. Our constraint will end up being the lack of skilled labor.”
- “Trade and tariff issues are wreaking havoc on our ability to plan and execute.”
- “Volatile discussions regarding tariffs have created a tense international relationship between the U.S. and all other nations. Our economy is dependent upon healthy international relationships, and this hurts businesses in the short and long run.”
- “The tariffs are a start. Some good, some bad. I believe China is a strategic, long-term problem. The tariffs on other countries should be applied with care, if at all. It is good to see some of the apprenticeship issues being addressed.”
- “The unpredictable state of tariffs and economic sanctions has increased our cost of materials and labor and has made quoting jobs much more difficult.”
- “I think the president is doing a good job supporting manufacturing, but Congress is not.”

When asked **“What regulatory issue is having the biggest negative impact on your business,”** illustrative comments included:

- “Steel tariffs have had an impact on our supply side as we grapple with higher input costs, and they have had an impact on our sales side as one of our largest customers is a large agricultural equipment OEM that is seeing sales below forecasts partly due to Chinese soybean retaliatory tariffs.”
- “Enforcement of USFDA regulations while allowing China product to be imported under OBL (own brand labeling).”
- “Taxes and regulations.”
- “The inspections are most burdensome. Fire, boilers, boards of health, back flow preventers, elevators, sprinklers, OSHA. So many inspections and fees.”

- “Air permitting has been rather haphazard and contradictory.”
- “Healthcare system is broken. Out-of-control costs for marginal quality care.”
- “ACA employer-required documentation. If there isn’t a penalty for having the insurance, why are we requiring employers to spend hours preparing useless paperwork?”
- “Just the overall volume of reporting that is required.”

A few years ago, taxes were a top regulatory concern for Hoosier manufacturers. Now that tax reform has been in play for more than a year, we asked in the 2019 survey, “Now that we are one year into tax reform, what is your general sentiment of its impact on your company?” Based on a scale of one to 10 (one being low-impact and 10 being high-impact), the average response was 6.74 with a standard deviation of 1.86. Following up on that question, when directed, **“Please comment on how tax reform has either negatively or positively impacted your company,”** typical replies included:

- “Accelerated depreciation for capital purchases is extremely helpful.”
- “Overall tax burden has been lessened, but the entire process has become much more complicated.”
- “It has positively helped ours and many others ‘share the wealth’ with our employees.”
- “It has been great. It has cut our excise taxes in half at the federal level and cut our income tax bill, too.”
- “We have multiplied our investment in new manufacturing equipment.”
- “Tax reform has allowed us to be more competitive with our foreign competition.”
- “Has allowed us to offer more production incentives to our employees.”
- “Due to how poorly it was implemented and understood, we struggled to get our taxes complete and had to spend a lot of time researching changes. We even had to file an extension.”

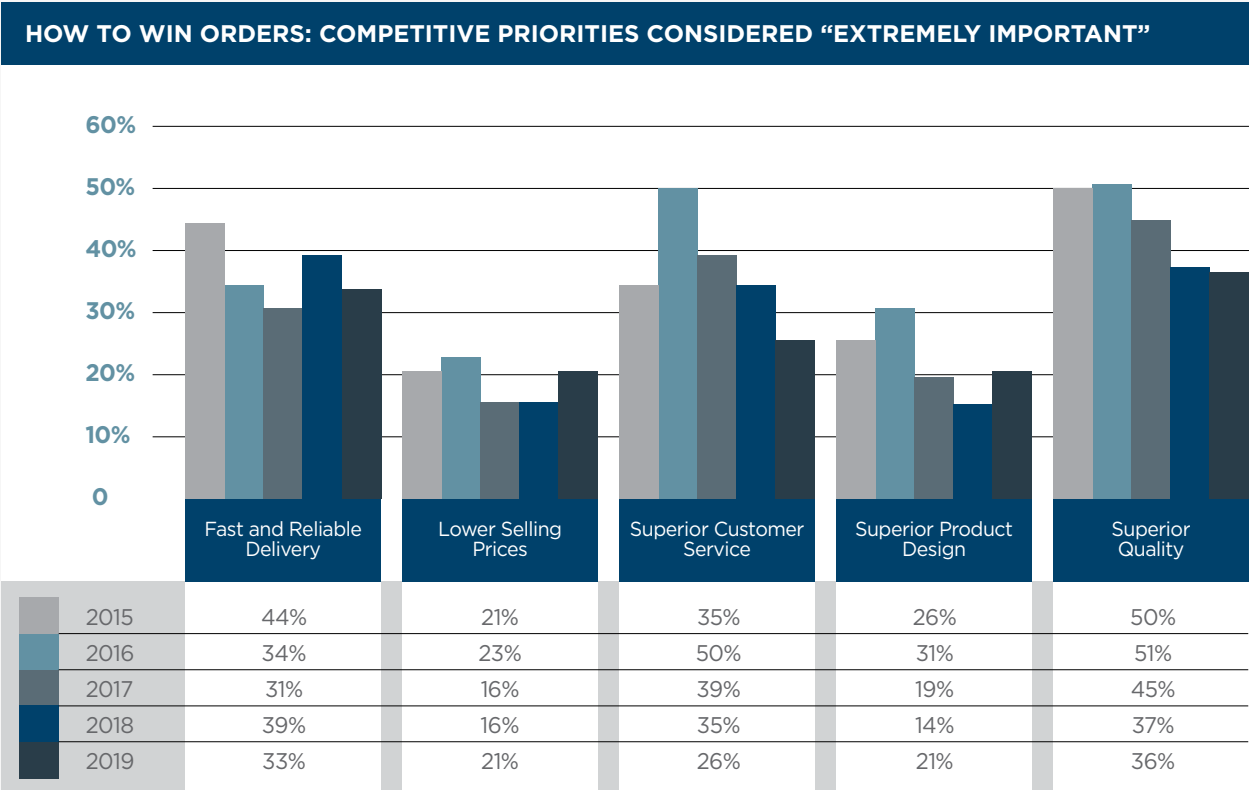
A close-up photograph of a printed circuit board (PCB) with intricate gold-colored traces and several silver-colored components, possibly microchips or connectors, mounted on the board. The lighting is dramatic, with a strong blue and orange color palette, creating a high-tech, industrial feel. The text "IV. Business Strategy and Industry 4.0" is overlaid in the lower-left quadrant in a bold, white, sans-serif font.

## **IV. Business Strategy and Industry 4.0**

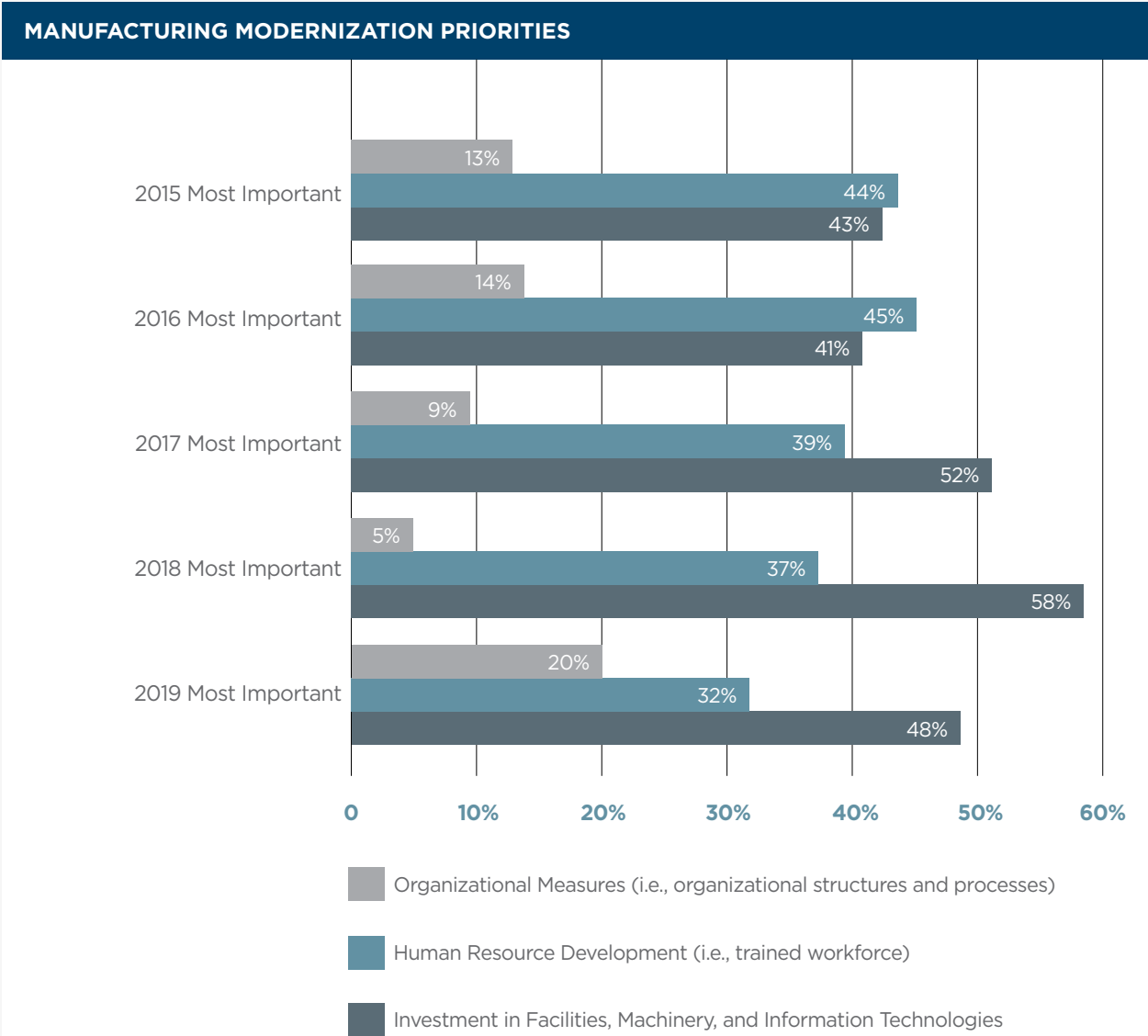
An important strategic business decision every manufacturer makes is how to win customers' orders based upon the traditional competitive priorities of delivery, price, service, design, and quality. The relative importance of these business strategies has remained highly constant from 2016-2019. Overall, superior quality, fast and reliable delivery, and superior customer service rank most important. Similarly, lower selling prices and superior product design have been relatively less-important capabilities.

HOW TO WIN ORDERS: COMPETITIVE PRIORITIES (MEAN)				
	2019 Survey	2018 Survey	2017 Survey	2016 Survey
Fast and Reliable Delivery	3.87	4.09	4.03	4.17
Lower Selling Prices	3.38	3.30	3.50	3.53
Superior Customer Service	3.82	4.05	4.09	4.19
Superior Product Design	3.50	3.47	3.56	3.73
Superior Quality	3.95	4.10	4.16	4.33

“Superior quality” was rated by 36% of Hoosier manufacturers in 2019 as the single most important competitive priority. Along those lines, it is worth pointing out that except for 2018 findings, “superior quality” has always been considered the single most important competitive priority. Similarly, “fast and reliable delivery” (33%) remains a strong dimension in the strategies of many Hoosier manufacturers in 2019.



Since the Great Recession, we have tracked the major areas of concern for manufacturing in terms of modernization. In 2015 (44%) and 2016 (45%), human resource development edged out investment in facilities, machinery, and information technologies as the top priority regarding manufacturing modernization. That all changed in 2017, and facilities, machinery, and information technologies emerged as the top priority in terms of modernization at 52%. In 2019, the trend we first observed in 2017 continued with facilities, machinery, and information technologies rated the top priority at 48%. Correspondingly, human resource development has once again declined in importance to 32%, a new low point. Interestingly, organizational-related activities including modernizing structures and processes jumped from 5% to 20% in 2019. This may be related to new Industry 4.0/advanced automation increasingly installed by many manufacturers in recent years. Socio-technical system theory (STS) has long held that whenever business technologies significantly change, companies must also adapt their systems (i.e., organizational structures, processes, and people) to the new automation in order to fully maximize performance.

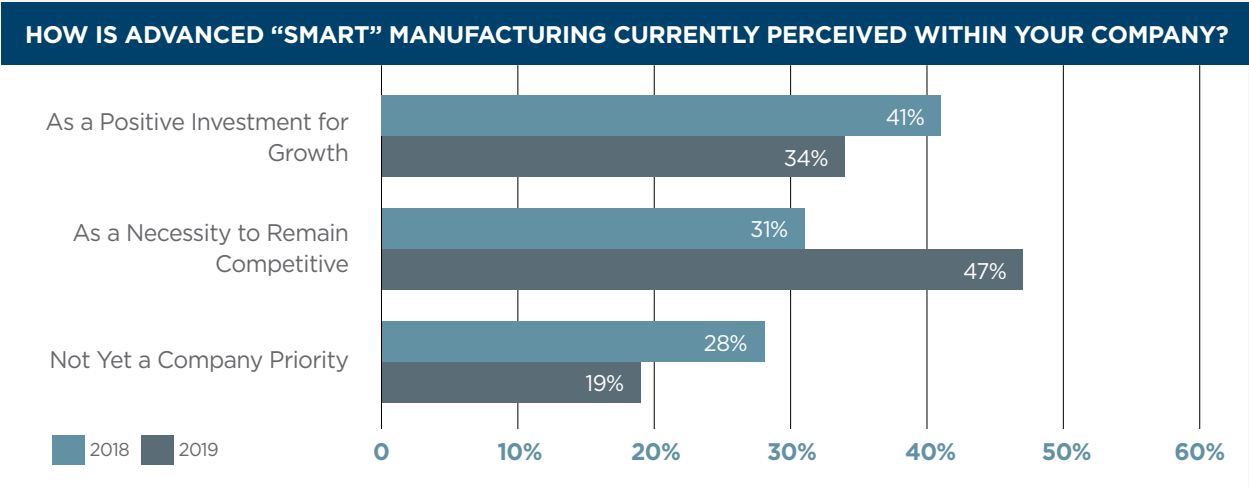




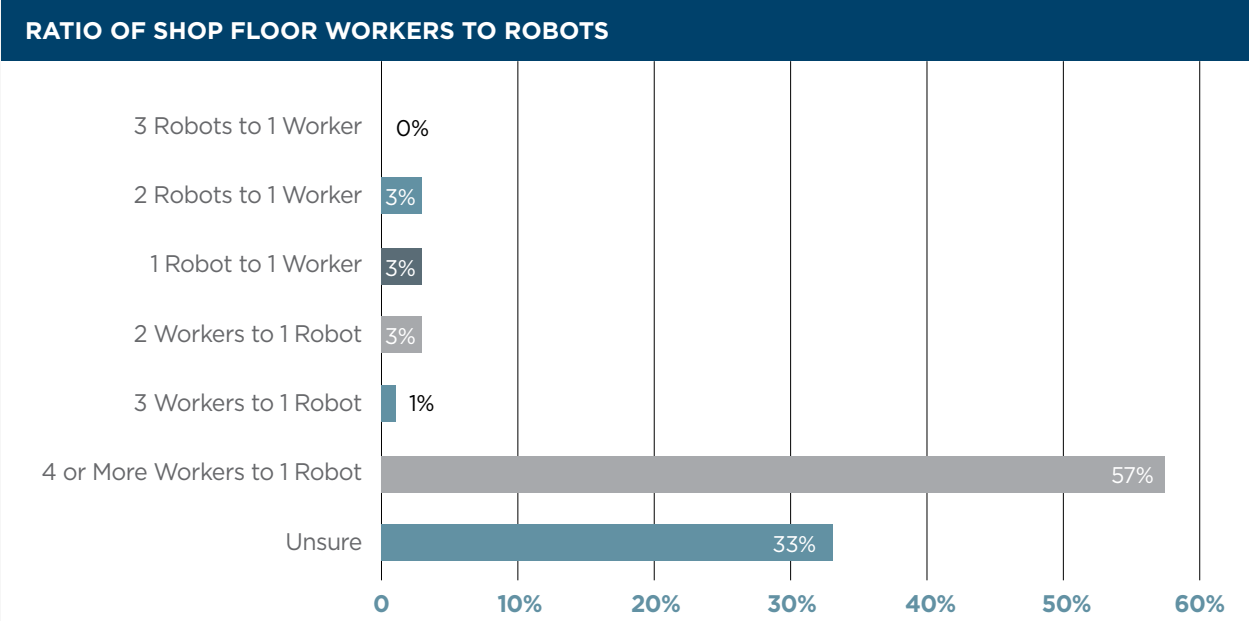
Along those lines, **we asked Indiana manufacturers what they believed to be their best manufacturing decisions in the past year.** A variety of comments related to modernizing manufacturing operations referenced not only technologies, but organizational structures, processes, and human resource issues as well.

- “Networking all 45 CNC machines to our software system.”
- “Add testing equipment to avoid issues within production that cannot be seen during inspection.”
- “Putting in a new, larger AUTOMATED production line that doubled our production, increased quality, and added only three employees in the production process.”
- “Product design decisions to maximize commonality of component use, and reduction in use of unique components and materials.”
- “Purchased and installed another CNC mill and a robot to go with it.”
- “We cut our employees’ portion of healthcare costs and saw immediate increase in retention and new hires.”
- “Brought all machining and laser operations in-house.”
- “Made investments to prepare ourselves for growth within the markets and customers we serve.”

After years of anticipating its arrival, with our 2018 survey we concluded that Industry 4.0 had taken root in Indiana. When asked how “digital technology or advanced ‘smart’ manufacturing is currently perceived within your company,” 41% stated as a positive investment for growth, while another 31% considered it a necessity to remain competitive. Conversely, just 28% of the manufacturers surveyed said it was not yet a company priority. In our 2019 study, approximately one-third (34%) still believed it was a positive investment for growth, while almost half (47%) judged it necessary to remain competitive. Conversely, just 19% of respondents did not yet consider advanced “smart” manufacturing a priority.

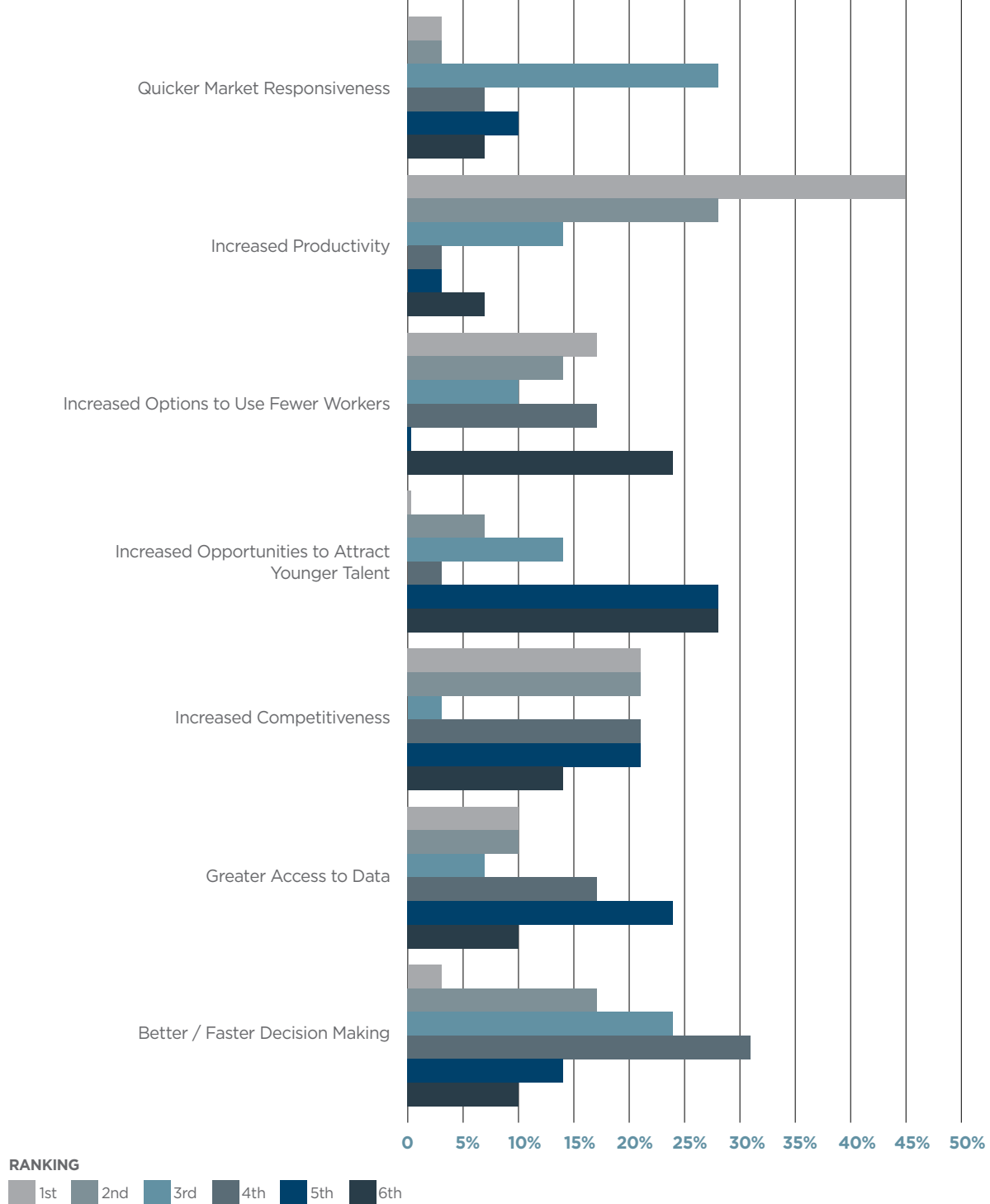


Beginning with this 2019 study, we are tracking a new metric related to Industry 4.0/“smart” manufacturing involving the ratio of shop floor workers to robots, which is expected to change in the coming decade as more processes are automated. Notably, as of 2019, only approximately 3% of Hoosier manufacturers have a ratio of robots to workers greater than one, with another 3% at 1:1 parity.



Drilling down into the topic, we asked respondents, “What do you think are the most powerful benefits that digital technology or advanced ‘smart’ manufacturing delivers to your industry?” Increased productivity was ranked in either first or second place by a majority of the respondents followed by quicker market responsiveness and better/faster decision making.

**BENEFITS OF DIGITAL TECHNOLOGY / “SMART” MANUFACTURING (RANKED)**



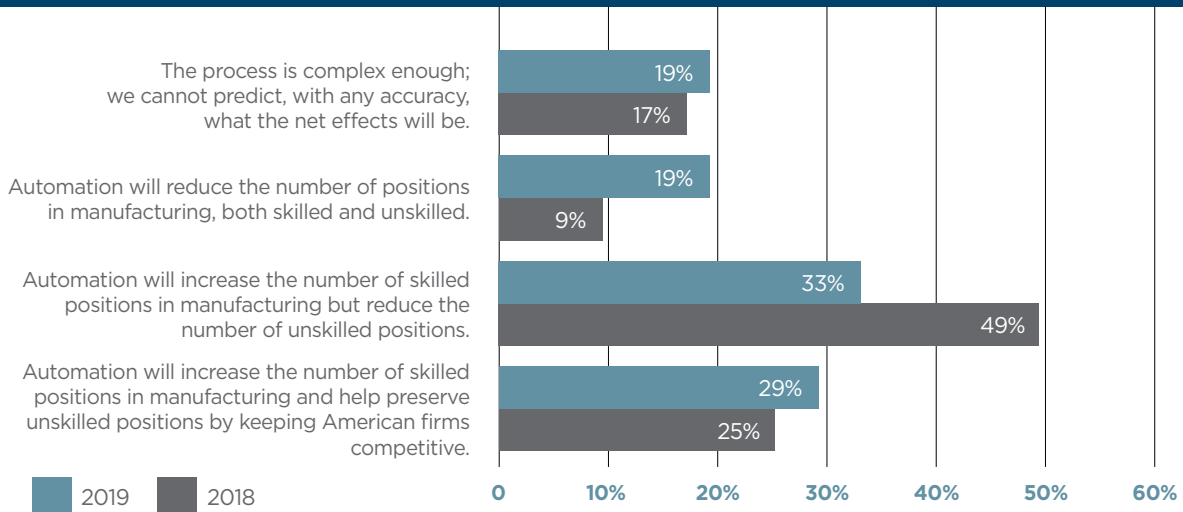
Similar to prior studies, this year’s survey included questions on a variety of advanced manufacturing technologies and programs rated on a scale of one to five, with one being “No Use” and five being “Very High Use.” In general, the use of almost all advanced manufacturing technologies and philosophies, such as lean manufacturing, has increased in recent years. In the same way, apprenticeship programs for training workers have rapidly expanded in use, with 90% of manufacturers presently using it in their businesses.

<b>2019 SURVEY</b> Advanced Manufacturing Technologies	No Use	Limited Use	Some Use	High Use	Very High Use	Mean
Automated Guided Vehicles (AGVs)	94%	0%	3%	3%	0%	1.16
Automatic Storage / Retrieval Systems (AS/RS)	91%	3%	3%	3%	0%	1.19
<b>CNC Machines</b>	<b>25%</b>	<b>6%</b>	<b>3%</b>	<b>22%</b>	<b>44%</b>	<b>3.53</b>
<b>Computer-Aided Design / Engineering (CAD-CAE)</b>	<b>6%</b>	<b>3%</b>	<b>13%</b>	<b>28%</b>	<b>50%</b>	<b>4.13</b>
Computerized / Video Assembly Instructions	52%	35%	3%	6%	4%	1.74
<b>Coordinate-Measuring Machine (CMM) Inspection</b>	<b>37%</b>	<b>3%</b>	<b>19%</b>	<b>22%</b>	<b>19%</b>	<b>2.81</b>
Flexible Manufacturing Systems (FMS)	52%	16%	23%	6%	3%	1.94
<b>Laser as a Tool (e.g., cutting, welding, forming)</b>	<b>47%</b>	<b>9%</b>	<b>22%</b>	<b>6%</b>	<b>16%</b>	<b>2.34</b>
<b>Novel Materials (e.g., composite or renewable raw)</b>	<b>45%</b>	<b>19%</b>	<b>26%</b>	<b>10%</b>	<b>0%</b>	<b>2.00</b>
Rapid Prototyping or Tooling (e.g., stereo lithography)	59%	19%	16%	6%	0%	1.69
RFID Product / Part Tracking	68%	10%	13%	6%	3%	1.68
RFID Tool Control	80%	10%	10%	0%	0%	1.30
<b>Advanced Manufacturing Programs</b>						
<b>Apprenticeship Programs for Training New Workers</b>	<b>10%</b>	<b>13%</b>	<b>35%</b>	<b>32%</b>	<b>10%</b>	<b>3.19</b>
<b>Lean Manufacturing</b>	<b>15%</b>	<b>23%</b>	<b>26%</b>	<b>23%</b>	<b>13%</b>	<b>2.94</b>
Six Sigma	44%	14%	28%	7%	7%	2.17
Work Cells / Cellular Manufacturing	23%	23%	20%	23%	11%	2.73

<b>2018 SURVEY</b> Advanced Manufacturing Technologies		No Use	Limited Use	Some Use	High Use	Very High Use	Mean
Automated Guided Vehicles (AGVs)		94%	4%	2%	0%	0%	1.08
Automatic Storage / Retrieval Systems (AS/RS)		82%	10%	4%	4%	0%	1.31
<b>CNC Machines</b>		<b>24%</b>	<b>8%</b>	<b>20%</b>	<b>22%</b>	<b>26%</b>	<b>3.18</b>
<b>Computer-Aided Design / Engineering (CAD-CAE)</b>		<b>16%</b>	<b>10%</b>	<b>12%</b>	<b>20%</b>	<b>42%</b>	<b>3.62</b>
Computerized / Video Assembly Instructions		49%	24%	10%	9%	8%	2.02
<b>Coordinate-Measuring Machine (CMM) Inspection</b>		<b>49%</b>	<b>16%</b>	<b>14%</b>	<b>12%</b>	<b>9%</b>	<b>2.14</b>
<b>Flexible Manufacturing Systems (FMS)</b>		<b>45%</b>	<b>17%</b>	<b>15%</b>	<b>21%</b>	<b>2%</b>	<b>2.19</b>
<b>Laser as a Tool (e.g., cutting, welding, forming)</b>		<b>45%</b>	<b>15%</b>	<b>22%</b>	<b>12%</b>	<b>6%</b>	<b>2.20</b>
Novel Materials (e.g., composite or renewable raw)		56%	23%	5%	6%	10%	1.92
Rapid Prototyping or Tooling (e.g., stereo lithography)		46%	22%	18%	10%	4%	2.04
RFID Product / Part Tracking		61%	16%	7%	10%	6%	1.84
RFID Tool Control		73%	14%	8%	3%	2%	1.45
<b>Advanced Manufacturing Programs</b>							
<b>Apprenticeship Programs for Training New Workers</b>		<b>8%</b>	<b>31%</b>	<b>31%</b>	<b>18%</b>	<b>12%</b>	<b>2.96</b>
Lean Manufacturing		19%	11%	28%	31%	11%	3.04
Six Sigma		30%	27%	28%	11%	4%	2.32
Work Cells / Cellular Manufacturing		28%	17%	25%	23%	7%	2.64

For the 2018 survey, we also asked for respondents' opinions on the effect of automation on the number and skill of workers in manufacturing. The majority (49%) thought that automation would increase the number of skilled positions in manufacturing but reduce the number of unskilled positions. In 2019, that percentage dropped to 33%. Conversely, 9% anticipated that automation would reduce the number of skilled positions and unskilled positions in manufacturing in 2018. That number noticeably more than doubled to 19% in 2019.

## EFFECT OF AUTOMATION ON THE NUMBER AND SKILL LEVEL OF JOBS IN MANUFACTURING



Two of the newest process and information innovations in the toolbox of Industry 4.0 are additive manufacturing (3D printing) and data analytics (DA). Starting with the 2016 study, we began tracking the uptake by Hoosier manufacturers of both technologies. Additive manufacturing, in particular, is beginning to be used more and more in fabricating spare parts, standardized and customized finished goods, and component parts and subassemblies.

### 2019 ADDITIVE MANUFACTURING / 3D PRINTING

	No Use	Some Degree	High Degree
Fabricating Component Parts and Subassemblies	83%	17%	0%
Fabricating Standardized Finished Goods (e.g., regular production)	90%	3%	7%
Fabricating Customized Finished Goods (e.g., mass customization)	93%	0%	7%
Fabricating Spare Parts (e.g., OEM replacement parts)	90%	7%	3%
Fabricating Shop Floor Tools (e.g., fixture and jig fabrication)	81%	13%	6%

### 2018 ADDITIVE MANUFACTURING / 3D PRINTING

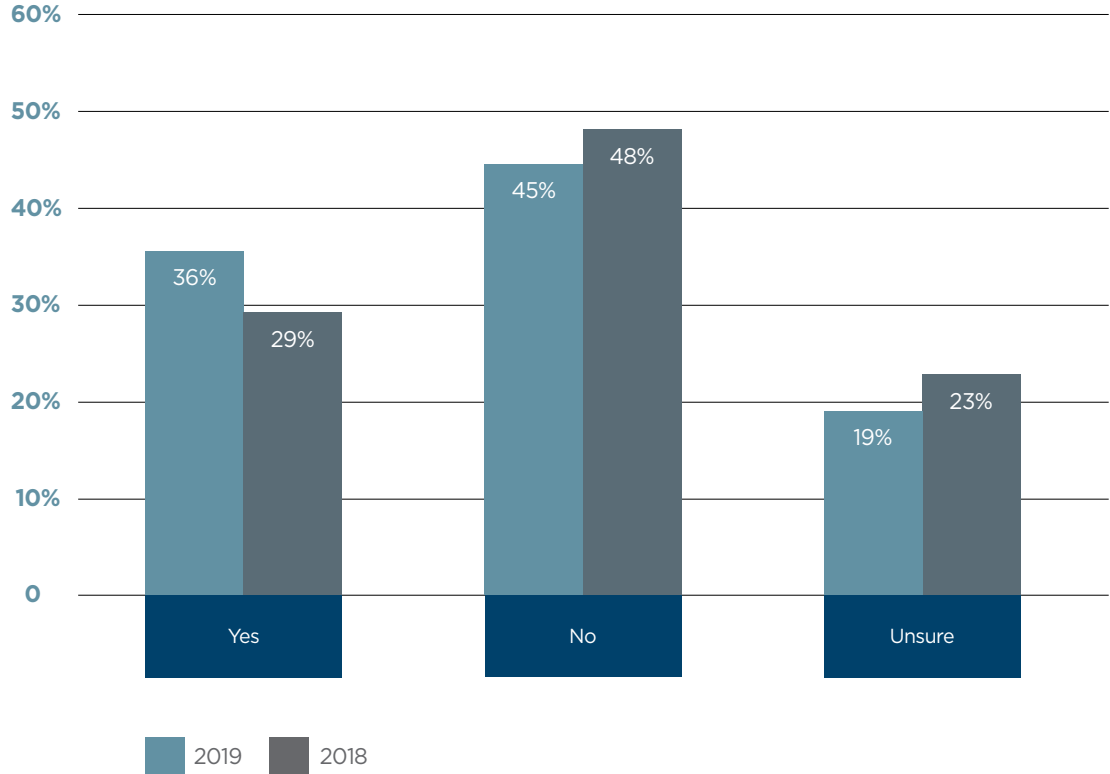
	No Use	Some Degree	High Degree
Fabricating Component Parts and Subassemblies	81%	17%	2%
Fabricating Standardized Finished Goods (e.g., regular production)	89%	9%	2%
Fabricating Customized Finished Goods (e.g., mass customization)	87%	9%	4%
Fabricating Spare Parts (e.g., OEM replacement parts)	91%	7%	2%
Fabricating Shop Floor Tools (e.g., fixture and jig fabrication)	81%	6%	13%

<b>2019 DATA ANALYTICS (DA)</b>	No Use	Some Degree	High Degree
Product Design (e.g., engineering)	53%	37%	10%
Advertising and Selling Products (e.g., sales and marketing)	60%	33%	7%
Planning and Scheduling Production (e.g., forecasting, production planning, and control)	42%	48%	10%
Managing Raw Materials and Finished Goods Inventory (e.g., purchasing, inventory, and warehouse management)	42%	52%	6%
Managing Shop Floor Production (e.g., line / manufacturing management)	42%	52%	6%
Planning and Coordinating Inbound and Outbound Supply Chains (e.g., transportation management)	61%	39%	0%

<b>2018 DATA ANALYTICS (DA)</b>	No Use	Some Degree	High Degree
Product Design (e.g., engineering)	49%	45%	6%
Advertising and Selling Products (e.g., sales and marketing)	53%	32%	15%
Planning and Scheduling Production (e.g., forecasting, production planning, and control)	34%	55%	11%
Managing Raw Materials and Finished Goods Inventory (e.g., purchasing, inventory, and warehouse management)	30%	59%	11%
Managing Shop Floor Production (e.g., line / manufacturing management)	32%	55%	13%
Planning and Coordinating Inbound and Outbound Supply Chains (e.g., transportation management)	51%	47%	2%

Unfortunately, along with the performance benefits of the Industry 4.0 digital manufacturing revolution comes a host of potential threats in the area of cybersecurity. In 2018, while 48% reported no issue, 29% said it is a problem for them. This year (2019), 36% reported that it was still a problem, with 45% reporting that it was no problem. Approximately one in five (19%) were unsure if they had a problem. Such manufacturers may be the most vulnerable given their uncertainty as to whether they have an issue.

### IS CYBERSECURITY A PROBLEM IN YOUR MANUFACTURING OPERATIONS?

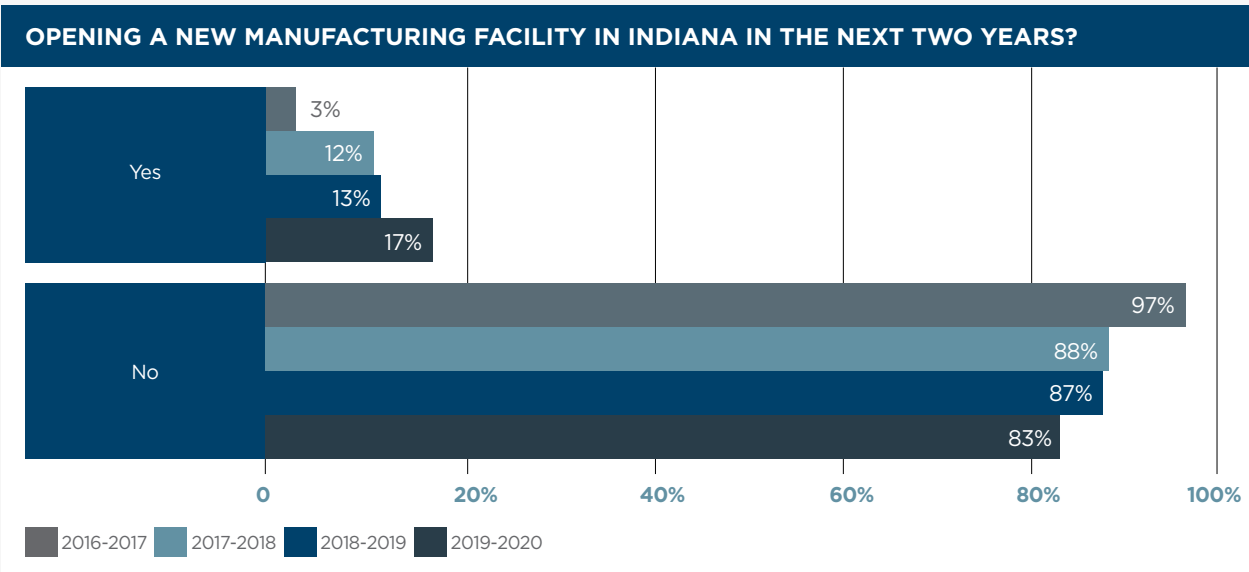




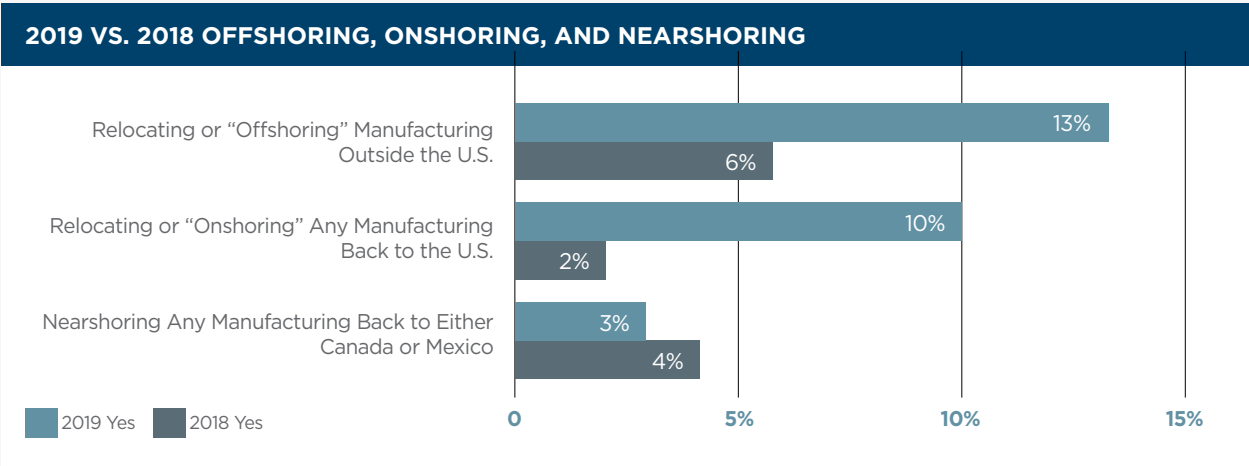


# **V. Manufacturing Workforce Issues**

When asked about plans to open a new manufacturing facility in Indiana in the next two years, only 3% responded “yes” in the 2016 survey. For 2017, that number jumped to 12%, and in 2018 it was 13%. This year the trend continued with 17% of participants responding “yes.”

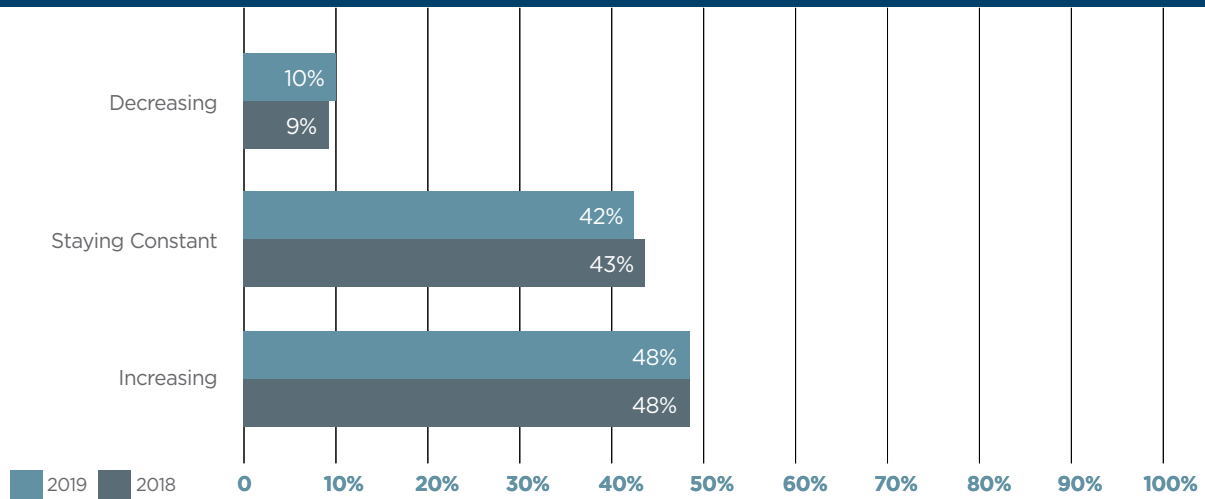


In recent surveys, we also asked respondents if they expect to “onshore” any manufacturing back to the U.S., “nearshore” it to Canada or Mexico, or, alternatively, relocate or “offshore” any production outside the country. In 2018, 4% intended to nearshore, 2% onshore, and 6% offshore some manufacturing. For 2019, 13% intend to offshore some manufacturing versus 10% and 3%, respectively, that were planning on either onshoring or nearshoring some of their manufacturing.



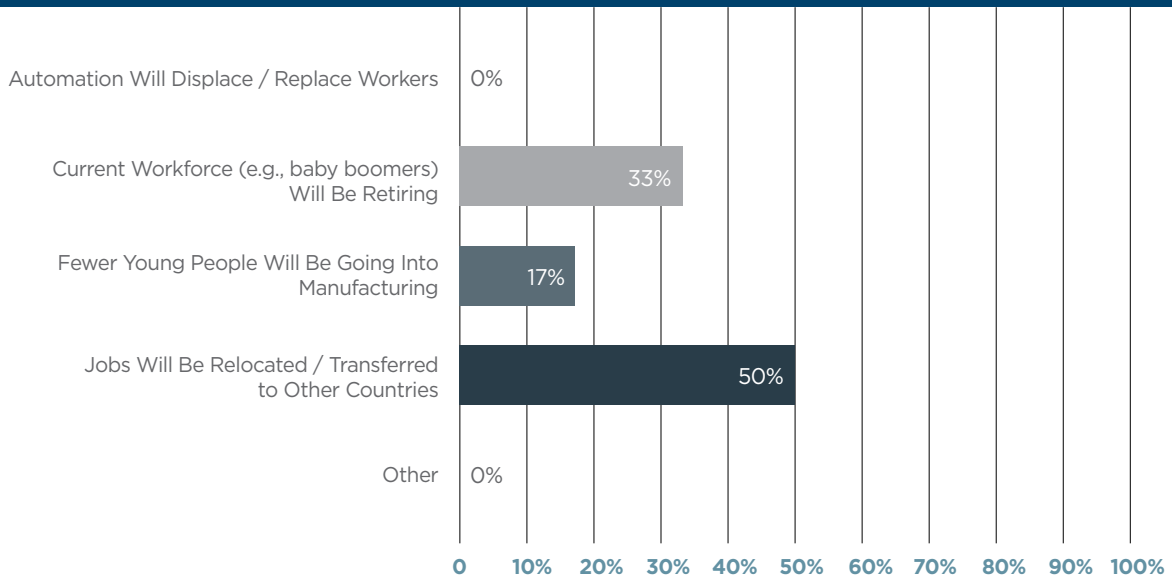
Recently, there has been a lot of speculation on whether jobs in manufacturing are increasing, shrinking, or remaining constant in terms of employment levels. In the 2018 survey, 48% of the respondents indicated the number of manufacturing jobs at their organization was increasing, 43% said the number was staying constant, and only 9% replied that the number was decreasing. In 2019, a nearly identical pattern emerged with 48% reporting the number of manufacturing jobs at their organization is increasing, while 42% said “staying constant,” and only 10% replied that the number is decreasing.

## HOW ARE THE NUMBER OF MANUFACTURING JOBS IN YOUR BUSINESS CHANGING?



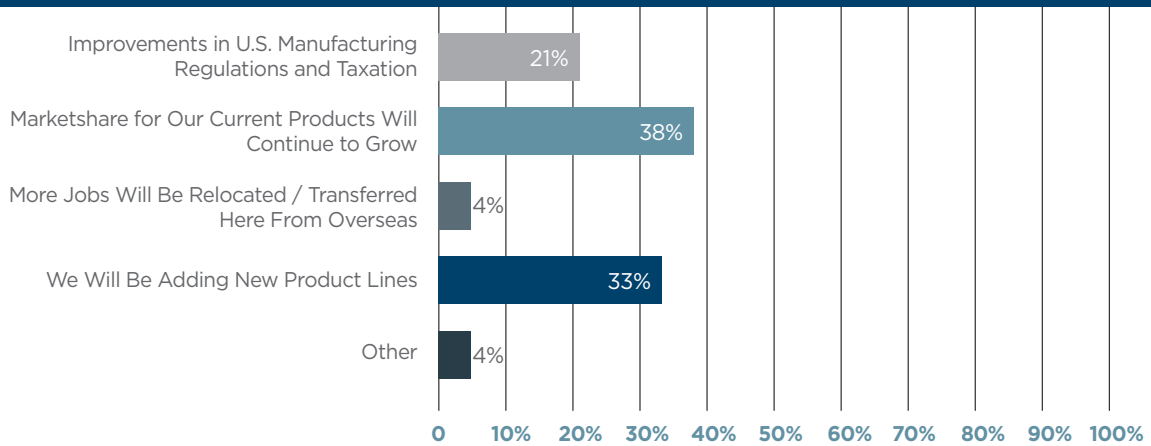
For any respondents that reported “decreasing” to the question above, we then asked them for reason(s) why. In 2019, half said it was due to jobs transferred to other countries. Interestingly, 0% thought the jobs will be lost due to automation, while 33% believe the decrease will be caused by baby boomers retiring.

## 2019 REASONS THAT MANUFACTURING JOBS WILL BE DECREASING



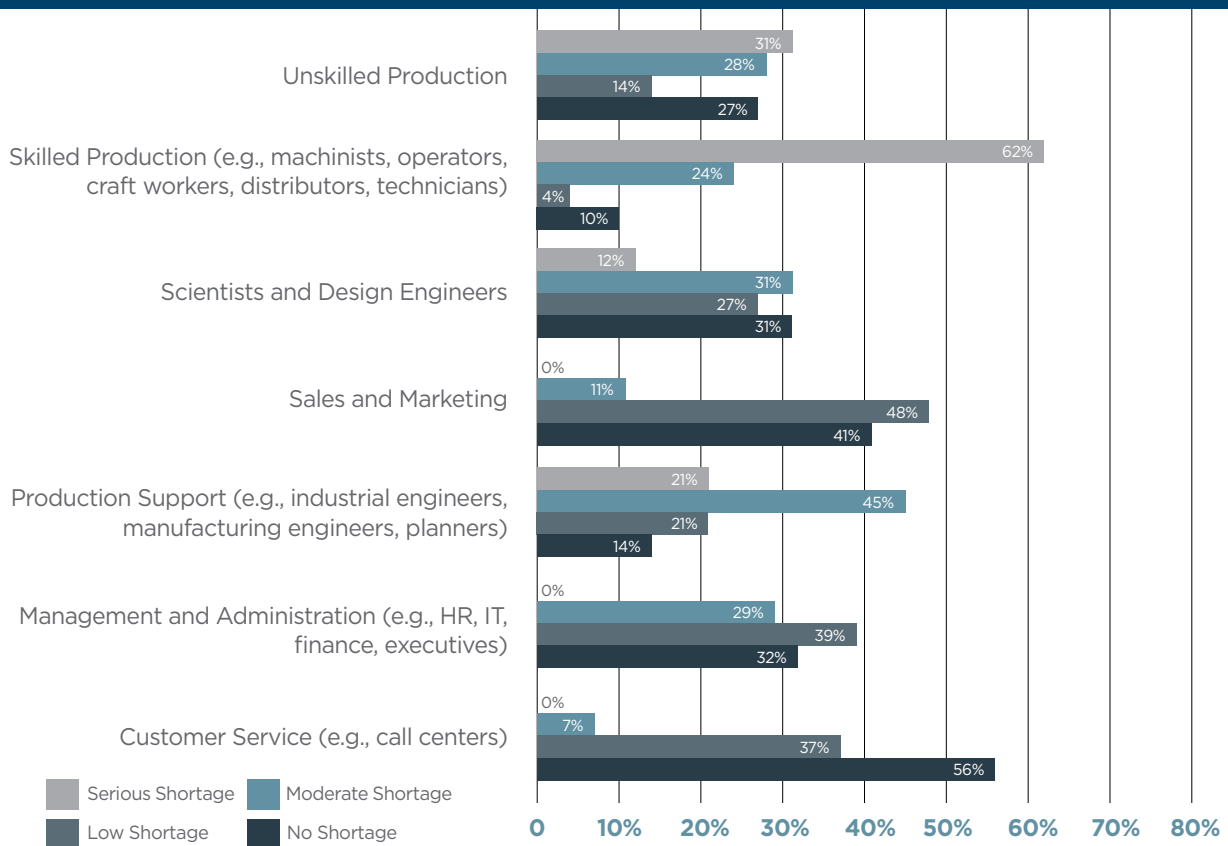
Alternatively, for those respondents that reported “increasing” to the same question, we asked them why. In 2019, 38% said that their marketshare is growing, while another 33% noted that they planned to add new product lines. Twenty-one percent believe that regulatory changes will increase manufacturing jobs, while 4% anticipate that more positions will be relocated/transferred back to the U.S. from overseas.

## REASONS THAT MANUFACTURING JOBS WILL BE INCREASING

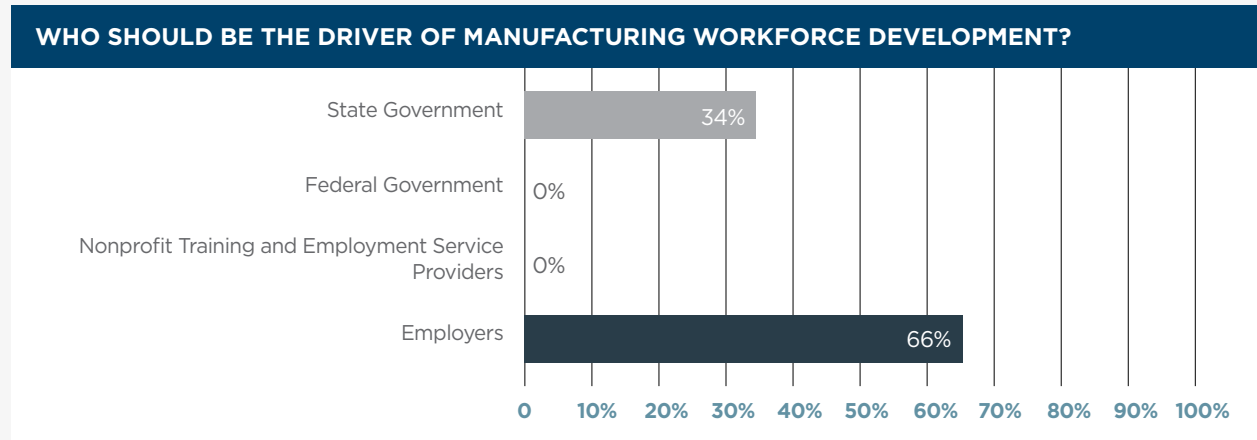


Indiana's manufacturers reported serious to moderate shortages of qualified workers in a wide variety of areas for 2019. The most critical shortages were for skilled (62%) and unskilled (31%) production workers. Forty-five percent and 31% respectively also reported moderate shortages for production support personnel as well as scientists and design engineers.

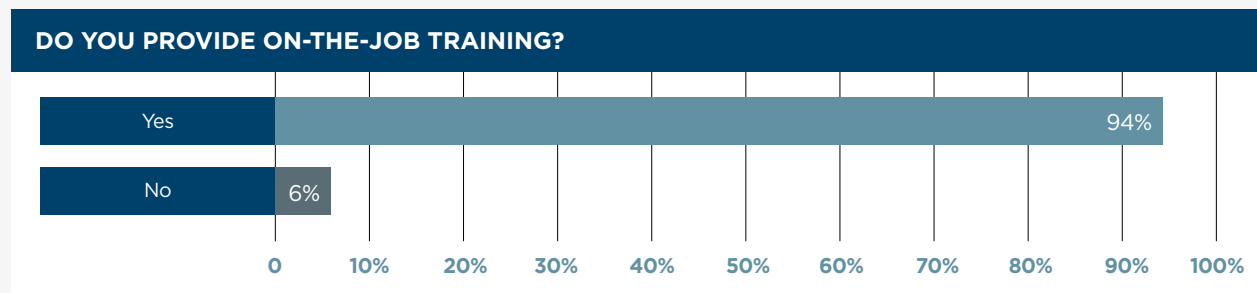
## WORKER SHORTAGES IN INDIANA MANUFACTURING



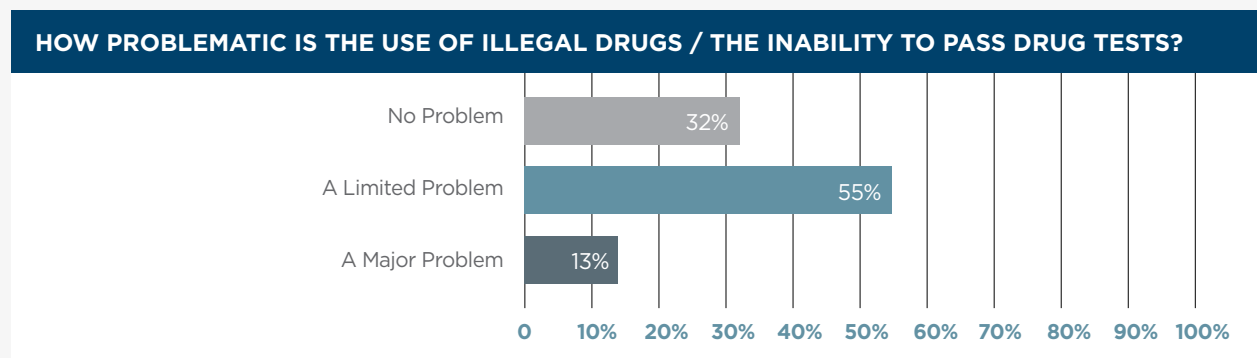
Turning to workforce development, 66% (up from 61% in 2018) believe that employers (i.e., manufacturers) should be responsible for workforce development. Conversely, 34% (up from 31% in 2018) think it should be driven by the state, while federal government and nonprofit training and employment service providers were both rated 0% in 2019.



Similar to our 2017 and 2018 findings, the overwhelming majority (94%) of respondents have some type of on-the-job workforce training program.

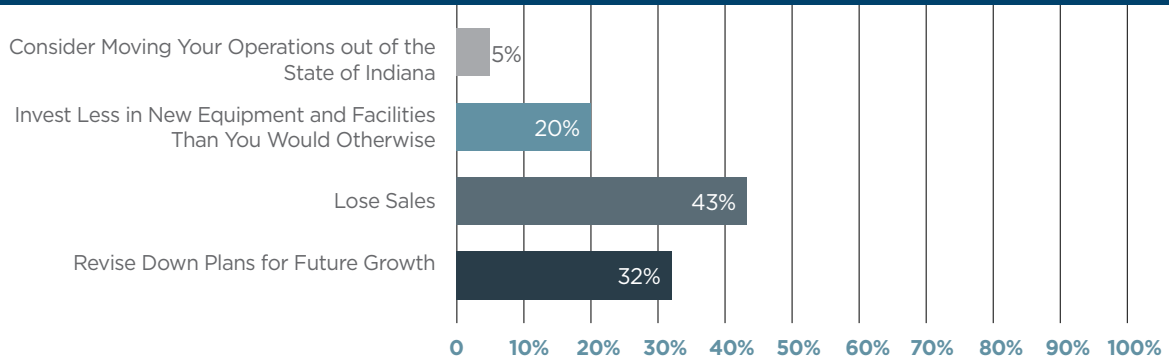


Over the past three surveys, we have included a question around problems related to illegal drugs and workers' inability to pass drug screening tests. In 2018, 27% of respondents reported that this was a major problem, with another 46% saying that it was a limited issue, and 27% replying it was not a problem. In 2019, approximately 13% of respondents report that this is a major problem, with another 55% saying it is a limited issue, and 32% indicating it is not a problem.



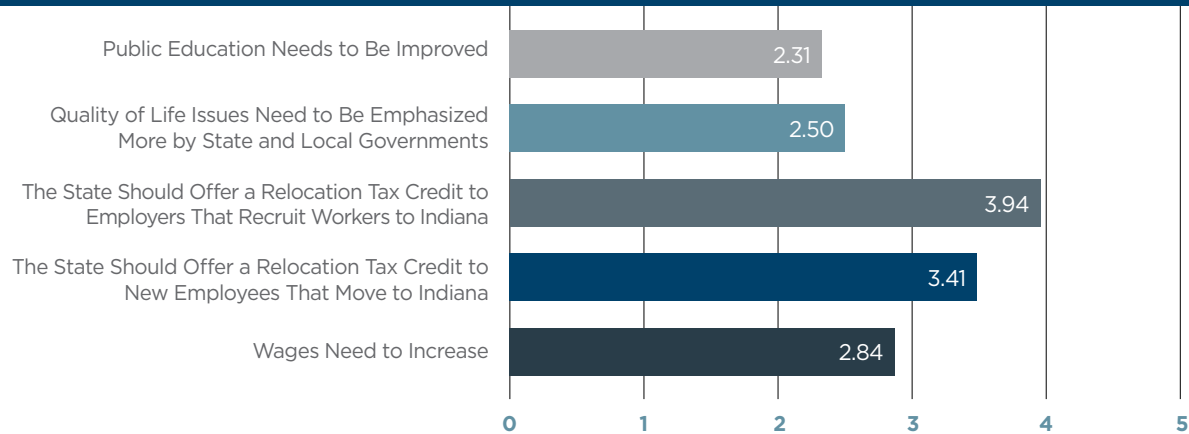
In 2019, we asked respondents if a shortage of qualified labor was causing them problems. Forty-three percent reported that they were losing sales as a result, while 32% have had to revise down their plans for growth, and 20% are investing less in new equipment and facilities than they would otherwise. In addition, 5% are considering moving their operations out of the state of Indiana due to the shortage of qualified workers.

### IMPLICATIONS OF INDIANA'S LABOR SHORTAGE



Given the serious nature of Indiana's qualified labor shortage problem, we asked respondents to rate five strategies (1 = highest likelihood of success/5 = least) for attracting more qualified workers to our state. The most popular options were Indiana offering relocation tax credits to both employers that recruit workers from other states and employees who relocate to Indiana.

### STRATEGIES FOR REDUCING INDIANA'S LABOR SHORTAGE



Like previous years, we also gave respondents an opportunity to **share any advice they had to young people interested in a career in manufacturing**. Once again, almost every manager had something to tell young people about manufacturing, and below is just a short list of their opinions.

- “It’s an exciting field!”
- “Get some technical training while in high school or immediately thereafter. Great start to a high-paying career.”
- “Study math, technology, AI, robotics.”
- “Try to learn basic, hands-on machine skills in high school. Have a good work ethic and show up. There is opportunity in the skilled and unskilled manufacturing trades.”
- “Establish a skill set early and work to become accomplished in that skill set.”
- “Manufacturing provides many opportunities for career growth, continuing education, and advancement.”
- “Look for a company that provides good wages, benefits, and a good working environment.”
- “Work a couple of internships during high school and early college summers to really determine what you are passionate about and where the field is heading in the future.”
- “Be responsible for your own growth and advancement. Do not rely on your employer or any other group.”
- “Learn automation and computer programming, but also be ready to get your hands dirty.”
- “There are major opportunities to move up to supervisory and management roles.”

Finally, we gave our 2019 survey participants an opportunity to **share any ideas they had on how to better promote careers in manufacturing** to young people. Almost everyone had thoughts on this important issue. Below are some of their suggestions.

- “Manufacturers need to learn how to ‘sell’ their businesses to students given the industry’s lack of glamor versus service industries (tech).”
- “Educate parents on careers in multiple areas. Don’t just promote college.”

- “Get back to shop class in lower schools, and promote working with your hands to kids not going to college.”
- “At the middle school and high school level: Continue high school skills programs.”
- “Provide regular industry tours for students during middle and high school - not just for students in manufacturing classes.”
- “High schools need to start offering classes again to engage the high school student that is not going on to college.”
- “Incentivize employers and trade schools to partner with middle and high schools to offer training, part time jobs, tours, expos.”
- “Let us talk to high school kids and stop brain-washing them that college is always the answer. Because it isn’t!”
- “More field trips to manufacturing facilities.”
- “Exposure through afternoon and summer jobs (paid).”
- “Raise entry-level base pay. Promise training and fulfill that promise.”

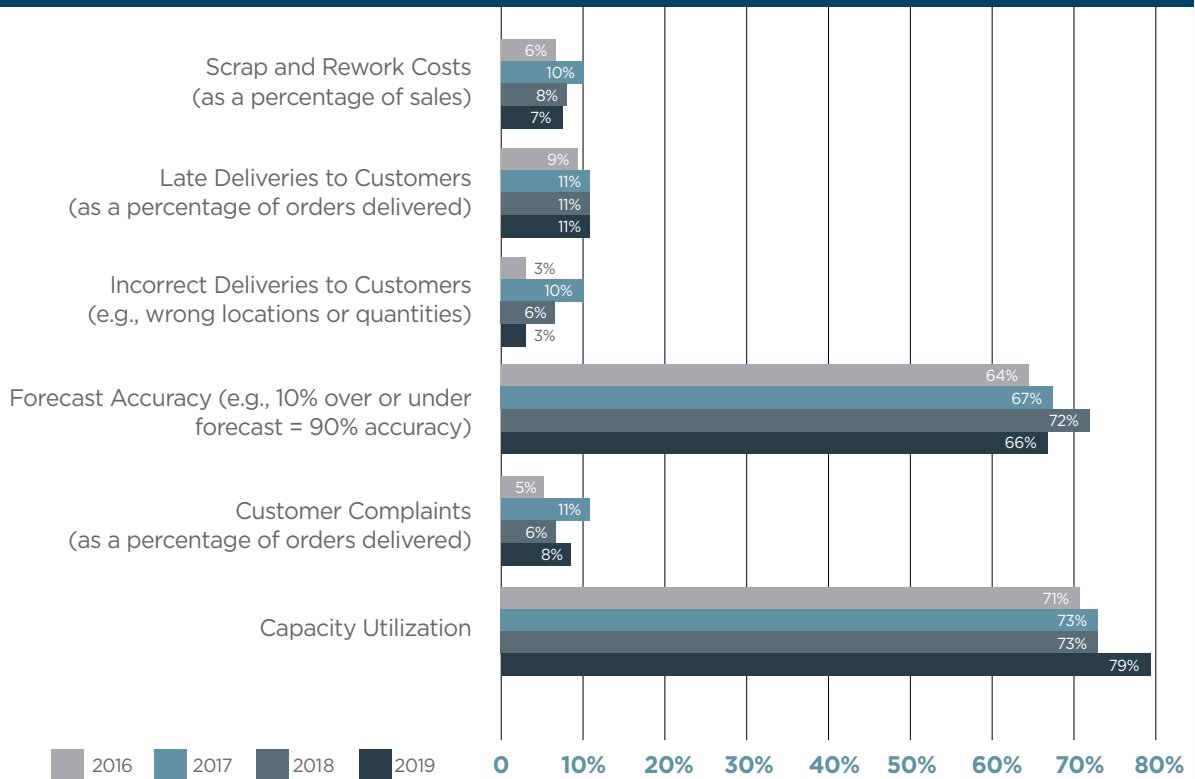




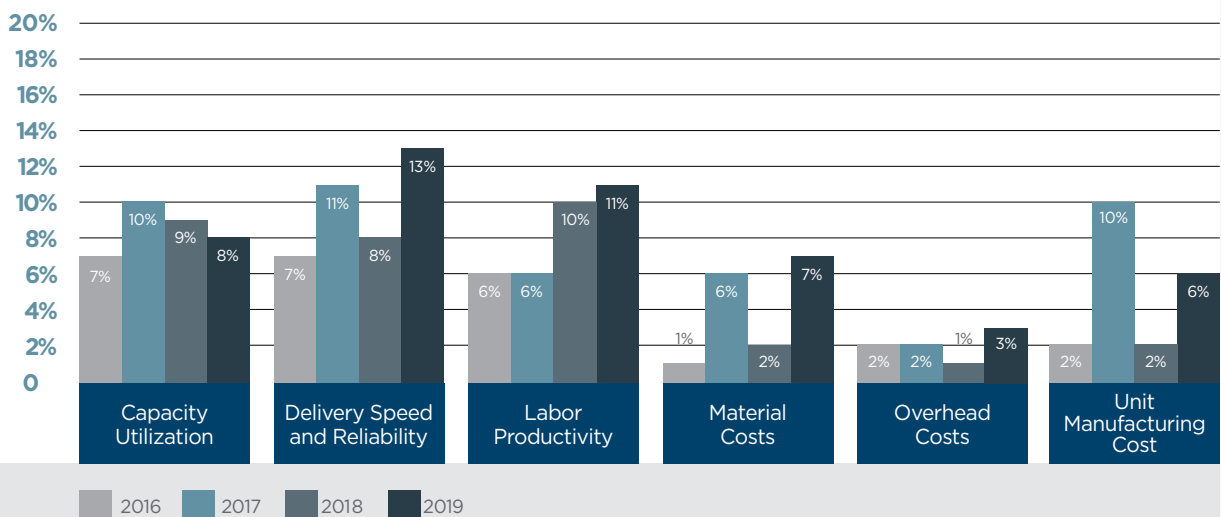
**Appendix:  
Benchmarking Indiana's  
Manufacturing**

The following data are averages for an array of performance metrics over the last four surveys.

### WHAT WAS YOUR BUSINESS UNIT'S APPROXIMATE PERFORMANCE LEVEL FOR THE FOLLOWING?



### BY WHAT PERCENTAGE HAS YOUR BUSINESS UNIT'S OPERATIONAL PERFORMANCE IMPROVED, STAYED THE SAME, OR DECLINED IN THE PAST THREE YEARS FOR THE FOLLOWING?



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KSM has long believed the manufacturing and distribution industry is both key for Indiana and strategic for our firm. Accordingly, we have made a strategic commitment to this practice area. We consistently dedicate substantial resources, including our top talent, to ensure we stay on top of emerging industry issues and provide the highest level of service to our clients. As a result, our Manufacturing and Distribution Services Group is one of our largest practice areas.

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The research study was conducted in conjunction with faculty from Indiana University's Kelley School of Business at IUPUI.

### **ASSOCIATE PROFESSOR MARK T. FROHLICH** **D.B.A. Boston University 1998**

Dr. Frohlich's research interests are in manufacturing and supply chain strategy, and he currently serves as the director of the IU Kelley School Center for Excellence in Manufacturing. His research has won numerous awards, including best papers of the year and best operations management case study. He was identified as one of the most cited authors in the field by the *Journal of Operations Management*. He has likewise won IU's "Trustees Teaching Award" multiple times and, through executive education, had the opportunity to teach on four continents in more than a dozen countries. He also serves on APICS' Research, Innovation, and Strategy Committee (RISC) and chairs their research subcommittee.

### **PROFESSOR STEVEN L. JONES** **Ph.D. Purdue University 1989**

Dr. Jones' research interests are in financial management and strategy, including how financial decision-making interacts with capital market conditions. He has been published in the top scholarly journals in finance, including the *Journal of Financial Economics*, the *Journal of Finance*, the *Journal of Business*, *Financial Management*, and the *Journal of Corporate Finance*. He also serves as director of the school's Finance Education Enterprise. He teaches courses in financial management, financial markets and investment analysis, and he is a four-time winner of a Kelley School teaching excellence award.

**For more information regarding Indiana University's Kelley School of Business at IUPUI, please visit [kelley.iupui.edu](http://kelley.iupui.edu).**

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