2019 NEW Manufacturing Alliance Needs, Skills, & Talent Survey

2019

Executive Summary, Frequency Questionnaire, and Open-Ended Comments

EXECUTIVE SUMMARY

KEY OBJECTIVES AND GOALS

Quantify perceptions of the NEW Manufacturing community in the following areas:

Operations: Needs, priorities, and current workplace functions.
Industry 4.0 Future Preparedness: hire new employees or reskill; invest in new technology or roles.
Educational Pathways: Industry 4.0 career pathways aligned with local educational institutions.

SURVEY AUDIENCE AND PROFILE

NEW Manufactures (N=104). Median employee size living and working in Wisconsin was 101 to 250 employees. Approximately two-fifths had between $1 million to $15 million or more in total annual sales in 2018; 50% had more than $30 million.

Manufacturing Sector (N=104)	%	Total Annual Sales (N=104)	%
Metal & Allied Products	24	$1,000,000 or less	3
Machinery	22	$100,000,001 to $5,000,000	12
Paper & Allied Products	14	$5,000,001 to $15,000,000	17
Food Products	10	$15,000,001 to $30,000,000	14
Electrical & Electronic Machinery	9	Over $30,000,000	49
Plastic & Rubber Products	8	Not Sure	4
Transportation Equipment	8	Refused	2
Furniture & Fixtures	2		
Lumber & Wood Products	2		

SURVEY METHODOLOGY AND DESCRIPTION

An online survey designed by the NEW Manufacturing Alliance. Data collection lasted from March 6 to April 16, 2019. Reponses frequently represent a team effort to answer all questions.

PRIMARY OUTCOMES

1. There is general economic optimism, but many companies do not have an implementation plan for Industry 4.0.
2. Technologies most likely to have an immediate or near future impact on operations include Process Monitoring, Connectivity Technologies, Mobile Friendly User Interfaces, Predictive Modeling Systems, and Robotic Vision Systems.
3. Curriculum and training programs that develop **process engineers** and **data analysts** are in high demand.
4. Future Industry 4.0 investment diverges by current level of investment; current investment in Industry 4.0 technologies is associated with increasing investment in the near future. Companies' that have not or have only partially invested in Industry 4.0 technologies more frequently report being unsure if they will invest in most Industry 4.0 technologies in the near future.

SURVEY METHODOLOGY AND DESCRIPTION

The NEW Manufacturing Alliance (Alliance) collaborated with the Strategic Research Institute (SRI) at St. Norbert College in early 2019 to conduct a study of current and future manufacturing needs, skills, and talent in Northeast Wisconsin. Findings from the study will inform the NEW Manufacturing Alliance, and help guide future manufacturing and skill development efforts by the Alliance.

The SRI administered the survey and performed all data analysis and reporting.

Data collection lasted from March 6 to April 16, 2019. All Alliance members were encouraged to participate. Survey solicitation arrived by email with multiple reminders sent each week or so.

At closing date, 104 surveys were fully completed. Metal, paper, and allied products, along with machinery represented the largest economic sectors. The median employee size living and working in Wisconsin was 101 to 250 employees. Approximately two-fifths of respondents had between $1 million to $15 million or more in total annual sales in 2018; 50% had more than $30 million. Additional details can be found in the presentation report.

SUMMARY POINTS BY FOCUS AREA

Perception of economic climate

There is general optimism among Alliance members. Half see their business as better off than last year and only one in five report a decline in business from 2018 to today. However, fewer than one in ten manufacturing businesses report they have a complete plan in place for Industry 4.0 and more than one-third report they have no plan in place. Most report a partial plan that needs development. Planning is likely a needed key focus area for the Alliance in the very near future.

Preparation for Industry 4.0:

The areas with the greatest current investment in preparation for Industry 4.0 are Cybersecurity and Automaton – Robotics, but fewer than 20% of report they are heavily invested in these areas. More importantly, fewer than 50% of Alliance members have invested in Artificial Intelligence, Simulation, Additive Manufacturing, or Virtual/Augmented Reality. Cloud Computing has the most unusual pattern, suggesting that either companies are using Cloud Computing in diverse ways or we needed to use a clearer definition of Cloud Computing.

The pattern for the next three years is clear, the entire region is investing or holding steady in at least some technologies and essentially no company or organization is decreasing technological development. The largest investment increases in the near future will be in Automation – Robotics (62%), Cybersecurity (56%), Cloud Computing (56%), Industrial Internet of Things (48%), Smart Integration (48%), and Big Data Analytics (47%). Virtual/Augmented Reality, Additive Manufacturing, and Artificial Intelligence are areas of great uncertainty; many respondents are unsure of whether to hold steady or increase investment in these technologies.

The following functions/departments that will be most heavily impacted by the integration of Industry 4.0 are IT, Engineering, Production, and Research & Development. It is clear that IT will be important in the near future, but many companies are not sure what exact role IT will play at their company.

Technologies most likely to have an impact on/opportunity for operations:

In the next 12 months (Percentage reporting current need):
1. Process Monitoring (44%)
2. Mobile Friendly User Interfaces (36%)
3. Robotic Vision Systems (31%)
4. Inventory Tech (25%)

In the next 2-3 years (Percentage reporting near future):
- Connectivity Technologies (5G wireless, Bluetooth, etc.) (51%)
- Predictive Modeling Systems (45%)
- Mobile Friendly User Interfaces (38%)
- Smart Energy Consumption (36%)
- Inventory Tech (35%)

In the next 4-5 years (Percentage reporting long-term investments):
- Virtual Guided Equipment (25%)
- Facial Recognition (19%)
- Smart Energy Consumption (17%)
- Inventory Tech (15%)

Technologies that are most confusing or have the least obvious return on investment: Digital Twin (74%), Drones (72%), Blockchain (70%), and Facial Recognition (58%).

Co-bots:

At this time, most companies are not sure or do not plan to implement co-bots.

Changing employment patterns:

There were essentially no occupations facing planned reduction in the next few years.

Occupation demand/need changes likely in the next three years:

Increasing occupation (Percentage reporting a role or occupation will **be in demand**):
- Process Engineer (61%)
- Industrial Computer Programmer (56%)
- Data Management Analyst (55%)
- Manufacturing Analyst (55%)
- Data Architect (51%)
- Supply Chain Business Analyst (50%)

Occupations reported as **not** needed (Percentage reporting not needed):
- Virtual Reality/AI Specialist (35%)
- Industrial Data Scientist (28%)
- Industrial UI/UX Designer (28%)
- Robot Coordinator (26%)
- Vision Technology Networker (26%)
- Digital Thread Engineer (25%)

   Note: More than one-third say that a Virtual Reality/AI Specialist is not at all needed!

Not sure if occupations are needed (Percentage reporting not sure):
- Digital Thread Engineer (34%)
- Virtual Reality/AI Specialist (32%)
- Industrial Data Scientist (27%)
- Industrial UI/UX Designer (26%)

   Note: Nearly two-thirds report they either do not need or are unsure if they need a Virtual Reality/AI Specialist!

Management of occupations/roles:

New employees are most likely to be hired in the following occupations (Percentage reporting new hires in a particular role):
- Process Engineer (33%)
- Application Developer (23%)
- Industrial Computer Programmer (23%)
- Supply Chain Business Analyst (23%)

Half or more of all companies report they are **not** planning to fill the following occupations Percentage reporting they will not fill):
- Virtual Reality/AI Specialist (69%)
- Digital Thread Engineer (65%)
- Industrial UI/UX Designer (60%)
- Industrial Data Scientist (56%)
- Vision Technology Networker (53%)
- Data Scientist (50%)

Local companies will **not** be outsourcing the following occupations (fewer than 10% report they will outsource these occupations):
- Process Engineer (1%)
- Manufacturing Analyst (5%)
- Robot Coordinator (5%)
- Supply Chain Business Analyst (6%)
- Predictive Supply Network Analyst (8%)

At least 20% of companies report they intend to outsource the following occupations (Percentage reporting intend to outsource):
- Application Developer (23%)
- Cybersecurity Officer (21%)
- Data Architect (21%)

A CLOSER LOOK

HOW DOES PLANNING FOR INDUSTRY 4.0 INFLUENCE WORKFORCE PLANNING?

The following tables investigate how planning for Industry 4.0 is associated with filling the following roles in the near future. The Industry 4.0 planning responses come from Question 2 and the occupations/roles are listed in Question 11.

Table 1. Industry 4.0 Planning by percentage **planning to hire new employees.**

Primarily planning to fill role by hiring new employees.	Plan for implementing Industry 4.0?			
	No plan (35%)	Partial plan (53%)	Complete plan (7%)	Difference between "complete" and "no" plan
Application Developer	11%	30%	43%	32%
Cybersecurity Officer	14	22	57	43
Data Architect	22	39	14	-8
Data Engineer	6	19	57	51
Data Management Analyst	6	26	43	37
Data Scientist	8	19	43	35
Digital Thread Engineer	6	9	43	37
Industrial Computer Programmer	11	32	43	32
Industrial Data Scientist	3	11	43	40
Industrial UI/UX Designer	6	13	29	23
IT/OT Architect	8	13	43	35
Manufacturing Analyst	17	24	43	26
Predictive Supply Network Analyst	8	26	43	35
Process Engineer	31	35	57	26
Robot Coordinator	6	22	29	23
Supply Chain Business Analyst	19	26	43	24
Virtual Reality/AI Specialist	3	9	43	40
Vision Technology Networker	6	9	43	37

The pattern in Table 1 shows that planning for Industry 4.0 is associated with an increase in hiring across diverse roles. The results suggest a second clear pattern; those companies that report they have "no plan" for implementing Industry 4.0 are unlikely to hire relative to companies with a more developed plan for Industry 4.0.

Table 2. Industry 4.0 Planning by percentage **not planning to fill this or role**.

Not planning to fill this role.	Plan for implementing Industry 4.0?			
	No plan (35%)	Partial plan (53%)	Complete plan (7%)	Difference between "complete" and "no" plan
Application Developer	33%	22%	14%	-19%
Cybersecurity Officer	33	22		-33%
Data Architect	44	19	14	-30%
Data Engineer	44	28	14	-30%
Data Management Analyst	39	22	14	-25%
Data Scientist	61	46	29	-32%
Digital Thread Engineer	75	65	43	-32%
Industrial Computer Programmer	44	28	14	-30%
Industrial Data Scientist	75	48	29	-46%
Industrial UI/UX Designer	83	50	29	-54%
IT/OT Architect	72	33	14	-58%
Manufacturing Analyst	44	17	14	-30%
Predictive Supply Network Analyst	64	39	14	-50%
Process Engineer	33	15		-33%
Robot Coordinator	67	35	29	-38%
Supply Chain Business Analyst	47	24	14	-33%
Virtual Reality/AI Specialist	92	63	29	-63%
Vision Technology Networker	67	46	29	-38%

The results in Table 2 reinforce the patterns present in Table 1; those companies with "no plan" do not plan to hire replacement or additional employees; essentially, they are planning to leave a number of Industry 4.0 occupations vacant.

More than half of those reporting "no plan" plan to leave all the Industry 4.0-related occupations/roles vacant. By contrast, only two of the 18 occupations above will be left vacant by more than half of those that say they have a "partial plan," and no occupation will be left vacant by a majority of companies that have a "complete plan."

OCCUPATIONAL CLUSTERS

After reviewing the baseline findings in Questions 3, 4, and 9, we reviewed correlations between occupations and roles to determine if there were clusters of skills that emerged beyond specific job titles listed in the questions blocks. The following clusters skill/occupation/role clusters emerged:

Data Analyst

Data analysts have expertise and facility in the following skills

Artificial Intelligence, Big Data Analytics, and Virtual/Augmented Reality, Computer Programming, and Blockchain

Process Engineer

Process Engineers have expertise and facility in the following skills

Just Process Engineer!

Process Engineer was the only role/occupation that did not correlate with any other position. This means the definition of Process Engineer varies widely by sector. It will be important to agree on a classification for Process Engineer.

PLANNED FUTURE INVESTMENT (NEXT THREE YEARS)

The pattern is simple. Those that have already invested in Industry 4.0 to a moderate or great extent (Question 3) are increasing their investment at an increasing rate in the next three years. Those companies that have not or have only partially invested in Industry 4.0 report being unsure if they will invest in most Industry 4.0 technologies.

Moderate or Great Investment

More than **three-fourths** of those that **have invested to a moderate or great extent** in the following areas have plans to increase their investment in the **next three years** (Percentage reporting they will invest in this technology):
- Artificial Intelligence (90%)
- Big Data Analytics (77%)
- Automation – Robotics (85% increase)
- Cloud Computing (83%)
- Smart Integration (90%)
- Virtual/Augmented Reality (75%)

More than half of those that **have invested to a moderate or great extent** in the following areas have plans to increase their investment in the **next three years** (Percentage reporting they will invest in this technology):

- Cybersecurity (61%).
- Additive Manufacturing (53%)

Limited or No Investment

More **than half** of those that **have to a limited extent or not at all** in the following areas have plans to increase their investment in the **next three years** (Percentage reporting they will invest in this technology):
- Cybersecurity (50%).

Overall, investment in Industry 4.0 is strongly associated with previous investment in Industry 4.0.

EMPLOYEE SIZE DIFFERENCES

Planning for Industry 4.0

The tables below show clear patterns in planning for Industry 4.0 by employee size. Planning for Industry 4.0 is positively associated with number of employees; as number of employees' increases, more companies report having a more developed Industry 4.0 plan. Those with few employees are least prepared for implementing an Industry 4.0 plan. Large companies (more than 250 employees outside of Wisconsin) are most likely to have a complete plan (14%). Most companies report having "no" or a "partial plan." It is clear that most companies in the NEW Manufacturing sector are not confident they are adequately prepared to fully implement Industry 4.0.

Table 3. Wisconsin employee size and plan for implementing Industry 4.0?

Do you have a plan for implementing Industry 4.0?	Employee Size (Wisconsin)			
	50 or fewer employees	50 to 250 employees	251 or more employees	Total
No plan	55%	31%	29%	35%
A partial plan	40	59	55	54
A complete plan	5	5	10	7
Not sure		5	7	5
	100%	100%	100%	100%

Table 4. National employee size and plan for implementing Industry 4.0?

Do you have a plan for implementing Industry 4.0?	Employee Size (National)			
	50 or fewer employees	50 to 250 employees	251 or more employees	Total
No plan	57%	32%	27%	35%
A partial plan	43	61	54	54
A complete plan			14	7
Not sure		7	6	5
	100%	100%	100%	100%

Business Perception

Nearly half of all respondents' report that business today is better than a year ago. Tables 5 and 6 show that employee size is associated with both increases and decreases in perception at a local and national level; large employers' are likely to say their business is better off and worse off compared to smaller employers'.

There is essentially no difference in business perception by size of local or national workforce.

Table 5. Wisconsin employee size and business perception.

Business perception from a year ago?	Employee Size (Wisconsin)			
	50 or fewer employees	50 to 250 employees	251 or more employees	Total
Better off	40%	51%	50%	49%
About the same	40	36	29	34
Worse off	20	13	21	18
	100%	100%	100%	100%

Table 6. National employee size and business perception.

Business perception from a year ago?	Employee Size (National)			
	50 or fewer employees	50 to 250 employees	251 or more employees	Total
Better off	38%	50%	52%	49%
About the same	48	39	25	34
Worse off	14	11	23	18
	100%	100%	100%	100%

REVENUE DIFFERENCES

The results in the tables below indicate that revenue is not associated with general business perception. Nearly half report their business is "better off" today than it was a year ago, regardless of annual sales. However, sales are associated with planning for implementing Industry 4.0. More than half of companies with less than $15 million in annual sales report they have "no plan" in place for implementing Industry 4.0 and not one reported they have a complete plan. One of out of ten business with sales greater than $15 million report having a "complete" Industry 4.0 plan and only 30% report having "no plan" in place.

Table 7. Annual sales and business perception.

Business perception from a year ago?	Annual Sales		
	Less than $15 million	$15 million or more	Total
Better off	47%	48%	47%
About the same	38	33	35
Worse off	16	19	18
	100%	100%	100%

Table 8. Annual sales and plan for implementing Industry 4.0.

Business perception from a year ago?	Annual Sales		
	Less than $15 million	$15 million or more	Total
No plan	50%	30%	37%
A partial plan	47	56	53
A complete plan		10	6
Not sure	3	5	4
	100%	100%	100%