EAB

Who Should Read

COE Executives

Manufacturing, Engineering, and Technology Program Directors

Employer Partnership Staff

Industry Futures 2021: Technological Advancements in Smart Manufacturing

How Advancements in AI and Automation are Changing Industry Skills Demand and the Future of Academic Programming

Professional and Adult Education Forum

Three Ways to Use This Resource

- Understand the needs and opportunities in the manufacturing industry
- Learn how higher education is adapting offerings to meet manufacturing's tech needs
- Explore regional manufacturing employer demand trends

Professional and Adult Education Forum

Project Director

Katie Langford

Contributing Consultants

Jon Barnhart
Brynna Morgan

Executive Director

Jennifer Lerner
Ann Lippens

Study Methodology

EAB's research guides strategic decisions at partner institutions. This research combines qualitative and quantitative data to help administrators assess job market trends, identify opportunities for new course development, and align curriculum with employer and student demand. Unless stated otherwise, this report includes data from online job postings from September 2018 to August 2021. The qualitive research included interviews with higher education institutions, companies, and professional associations.

Labor Market Intelligence Partner: Emsi Burning Glass

This report includes data made available through EAB's partnership with Emsi Burning Glass a labor market analytics firm serving higher education, economic development, and industry leaders in the U.S., Canada, and the United Kingdom.

Emsi Burning Glass curates and maintains the most comprehensive labor market data sets available for academic course planning, providing real-time job posting data, workforce and alumni outcomes data, and traditional government sources of data. Under this partnership, EAB may use Emsi's proprietary Analyst™ and Alumni Insight™ tools to answer partner questions about employer demand, the competitive landscape, in-demand skills, postings versus actual hires, and skills gaps between job postings and professionals in the workforce. The Emsi Burning Glass tools also provide EAB with in-depth access to unsuppressed, zip-code-level government data for occupations, industries, courses, and demographics. For more complete descriptions of the Emsi tools, visit:

- http://www.economicmodeling.com/analyst/
- https://www.economicmodeling.com/alumni-insight/

To learn more about Emsi and its software and services, please contact Bob Hieronymus, Vice President of Business Development at bob.hieronymus@economicmodeling.com or (208) 883-3500.

Table of Contents

Executive Summary

SECTION 1

- Executive summary

Executive Summary

The Digital Revolution has Come for the Manufacturing Industry

Gone are the days of manufacturing factories being dirty, dark, and dangerous. Instead, the modern factory better resembles a clean room laboratory: humans and machines working side-by-side, high-skilled tech works operating advanced machinery, enhanced safety measures and monitoring systems, all governed by AI-powered data-driven decision making.

Workforce, Consumer Demand, and Technological Pressures All Contribute to These Changes

Like most industry sectors, manufacturing is experiencing seismic shifts in who performs labor, what they produce, and how they produce it. The pandemic ushered in the long-anticipated mass retirement of baby boomers, forcing manufacturing companies to replace generational talent while simultaneously updating their technology and processes. Increasing global consumer demand has put manufacturing under pressure to produce more with less, forcing many companies to adopt automation just to keep pace. And while this automation helps with the growing demand, it does not replace human labor—in fact, in the immediate term, automation is creating more jobs in manufacturing than it's eliminating.

The Modern Manufacturing Workforce is Tech-Savvy, Highly Flexible, and Data-Driven

While the core jobs of a factory carry the same titles—technicians, engineers, managers—their job descriptions look radically different. Technicians are increasingly required to understand the interaction people human and robotic labor and serve as both user and troubleshooter of equipment. Engineers increasingly manage teams of both humans and robots and are responsible for their development, efficiency, and identifying opportunities to change processes when needed. Managers rely more heavily on data than ever before to keep tabs on overall productivity, changing customer demands, and fragmented supply lines. In all, these jobs require greater knowledge of automation, machine learning, AI, problem solving, and data analytics.

Institutions are Essential to Upskilling Needed Talent—If Their Curriculum is Up-to-Date

As manufacturers seek to hire these high-tech employees, they turn to higher education institutions to bolster their talent pipelines. But many manufacturing programs at colleges and universities are stuck in the past and have not integrated the emerging tech skills required to succeed in today's manufacturing industry. Institutions must assess their current offerings and determine what changes will get them closer to their region's manufacturing needs. Sometimes this will require adding new courses and adjusting old courses to get a program up to speed; other institutions may opt to develop an entirely new program or create a new offerings at different level.

Access and Perception Barriers Remain Prevalent in Manufacturing

As colleges and universities update and offer manufacturing programming, they must also be mindful of the historical inaccessibility to manufacturing jobs for women, people of color, and people with disabilities. While manufacturers are working hard to create more diverse and inclusive working environments, they often find these populations struggle to achieve the prerequisite training—this is where institutions can help through more targeted recruitment efforts, more flexible programmatic offerings, and through enhanced educational support services. Institutions and manufacturing companies can also work together in their regions to better market opportunities in the industry and overcome the outdated beliefs that some still carry.

Manufacturing and the Digital Revolution

SECTION 2

- Introduction to the state of smart manufacturing
- Preview of the emerging tech skills required for manufacturing jobs

Manufacturing and the Digital Transformation

The Manufacturing Industry Embraces Advancement

The manufacturing industry often battles outdated stereotypes: factories full of assembly lines with individuals manually sorting items; dangerous work with noisy machines; and low-paid, low-skilled jobs with little room for advancement.

In reality, the industry is successfully embracing the technological advancements of the digital revolution. In search of greater efficiency, manufacturing companies are increasingly investing in advancements like automation, Internet of Things (IoT) applications, and robotics. This transformation has been spurred by industry pressures such as an aging workforce, recruitment challenges, and a desire for increased efficiency on the heels of the pandemic.

Digital Revolution Technology in Smart Manufacturing

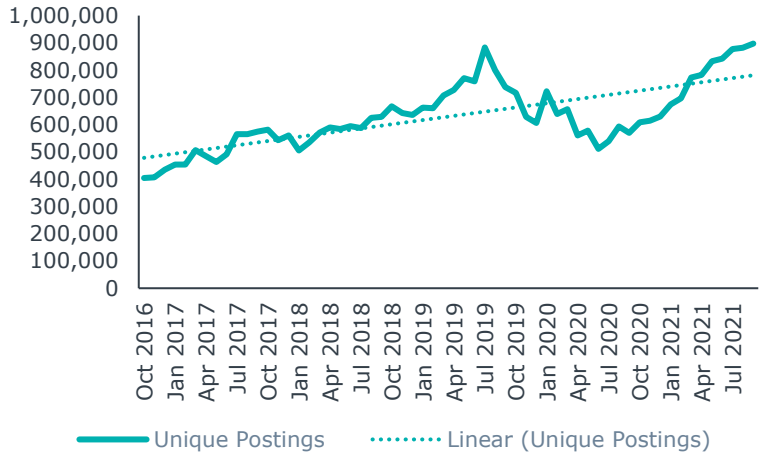
- Automation
- Smart sensors
- Robotics
- Artificial Intelligence
- Machine learning technology
- IOT applications

Increased Output Leads to Increased Demand for Qualified Professionals

Thanks to this digital revolution, smart manufacturing has enabled the industry to produce more. And in February 2021, U.S. manufacturing expanded at the fastest pace in three years—the Institute for Supply Management's index of manufacturing activity rose to 60.8%, the strongest performance since February 2018.

Demand for All Professionals in the Manufacturing Industry

October 2016–August 2021, National Data



Rising production levels have increased the demand for manufacturing professionals. Between October 2016 and August 2021, the average increase in demand for these workers was **94%**, much higher than an average increase of 64% for all U.S. jobs across the same period.

In terms of both industry performance and job demand, the manufacturing industry is surpassing pre-pandemic levels. The industry is adapting and is ripe for further technological disruption.

Manufacturing by the Numbers

As of August 2021

12.9M
U.S. Manufacturing Jobs

826K
Manufacturing Job Openings

6.6%
Projected Industry Growth

Source: Emsi Burning Glass data with EAB analysis; PBS, US Manufacturing Activity Jumps to Three-Year High; EAB interviews and analysis.

All Manufacturing Jobs Require Tech Skills

The Low Skilled Manufacturing Job Doesn't Exist

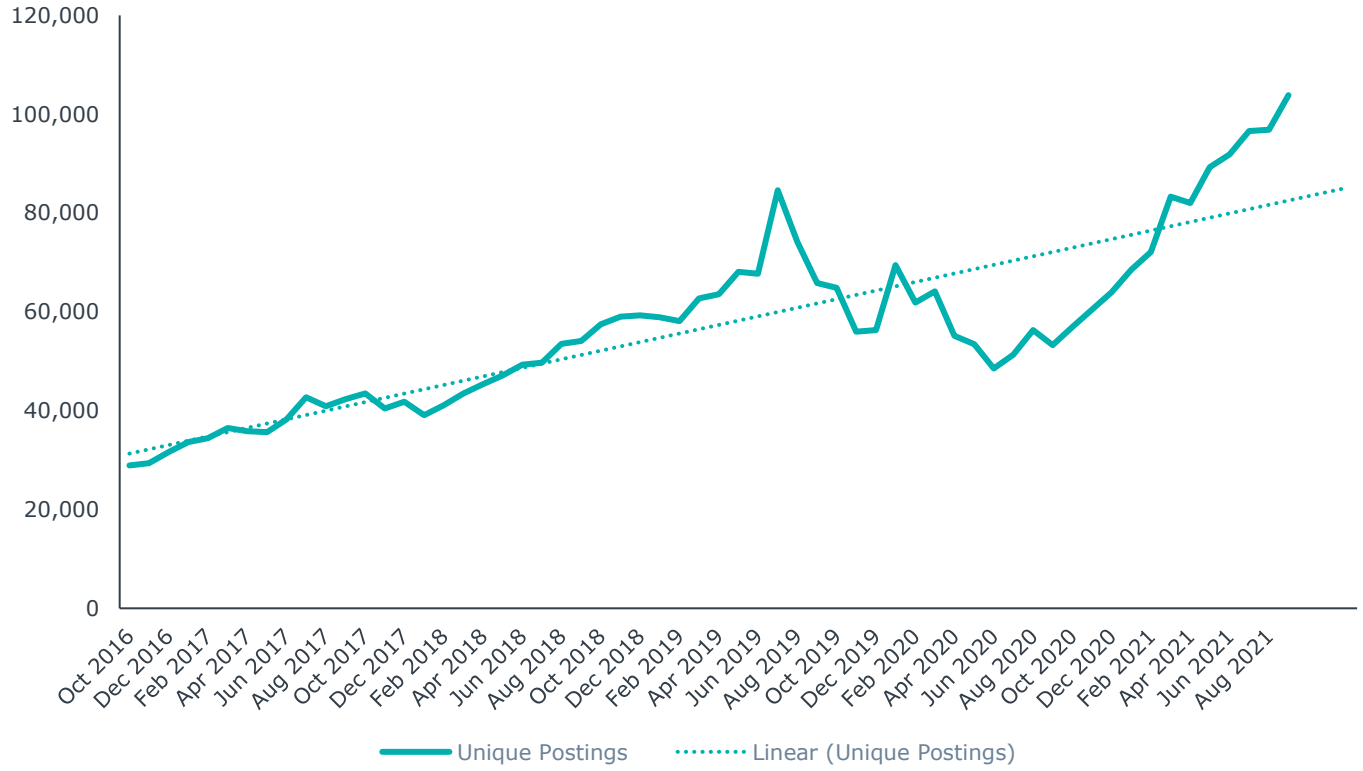
As the industry integrates new technologies, manufacturing jobs are becoming increasingly sophisticated and complex. While futurists may imagine a smart factory without humans, the present world is one where traditional trade skills undergird a greater digital and technological literacy. And this holds true at every level, from technicians to engineers to executives.

Demand for manufacturing professionals with emerging technology skills increased on average by 145% between October 2016 and August 2021. That's higher than the average demand increases for all manufacturing jobs (94%) and all jobs across all industries (64%) during the same time.

58%
of manufacturing jobs require an emerging technical skill

Demand for Professionals with Emerging Tech Skills in the Manufacturing Industry

October 2016–August 2021, National Data



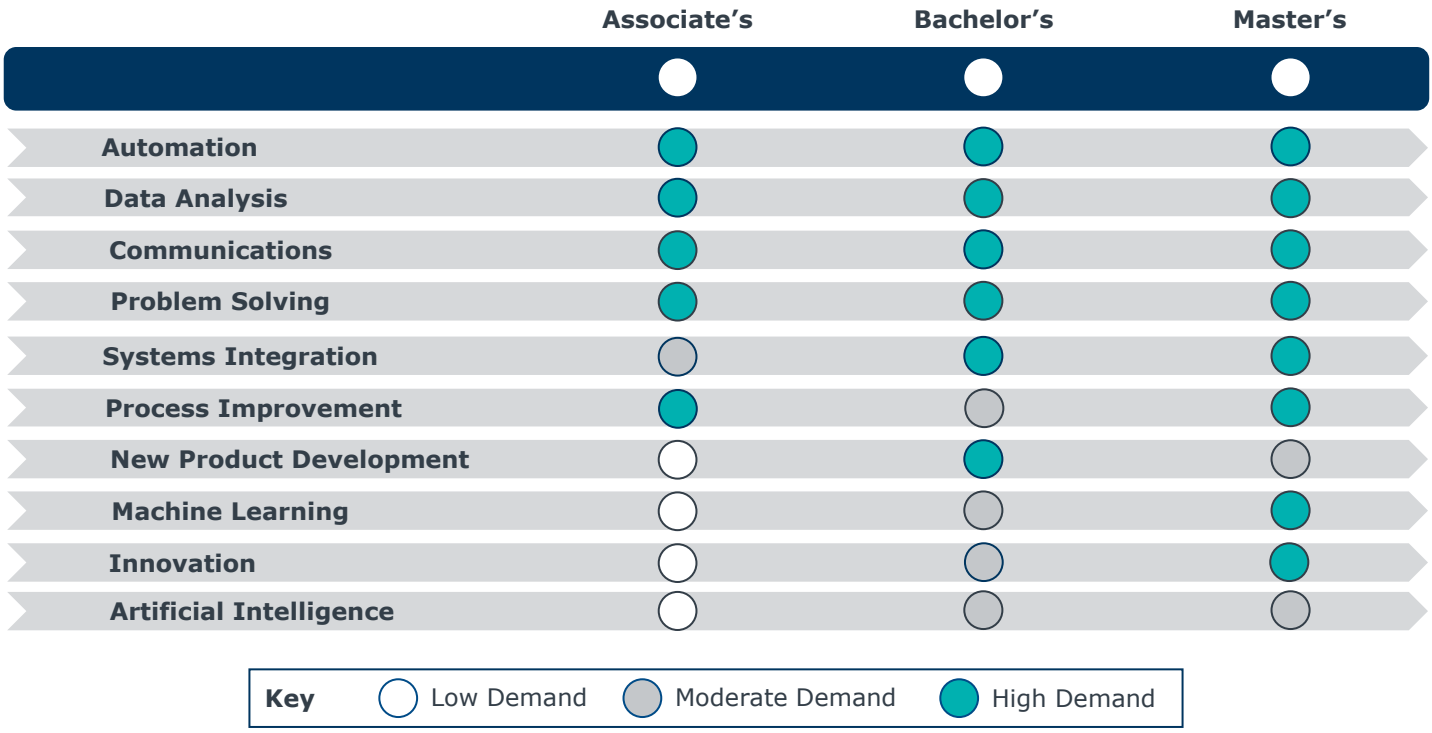
Source: Emsi Burning Glass data with EAB analysis; EAB interviews and analysis.

Digital Revolution Skills in Manufacturing

The graphic below illustrates in-demand skills for manufacturing professionals. In 2018, just 17% of manufacturing job descriptions included these emerging technology skills. By 2021, 58% of jobs require at least one—a 2.4x increase across three years.

Top Requested Skills for Manufacturing Professionals

September 2018-August 2021, National Data



While manufacturing employers express high demand for some skills across educational backgrounds, they have different expectations by education level and role. Data analytics, in high demand across all three education levels, is one example: at the associate's level, employers need technicians who can record and analyze data from complex machines. Bachelors and masters-level employees are increasingly expected to use analyses to identify trends and make data-based decisions.

Similar nuances exist for effective communication skills. Associate's-level employees are expected to clearly communicate on technical topics to internal stakeholders. Bachelor's-level professionals need strong presentation, data storytelling, and strategic thinking skills to communicate effectively with senior leadership, technical staff, and clients. Master's-level professionals have similar expectations but must also communicate how emerging technology can be integrated within business processes to meet the company's strategic goals.

Source: Emsi Burning Glass data with EAB analysis; EAB interviews and analysis.

Breaking Down Skill Needs by Job Level

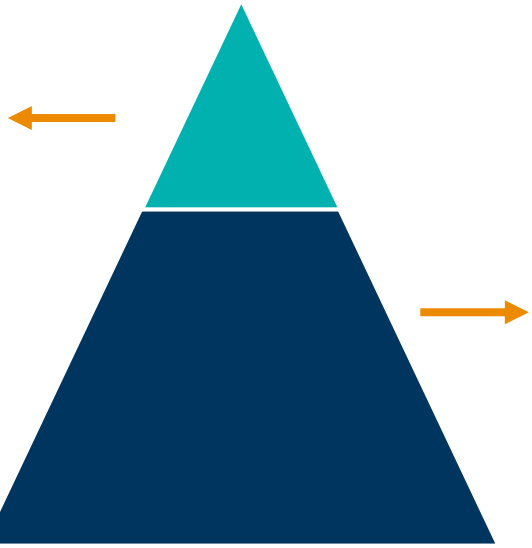
Manufacturing Companies Vary in Response to Digital Transformation

Even as the manufacturing industry evolves, companies are adopting digital tools at different rates—determining their specific talent needs. The graphic below illustrates two broad categories. Larger companies, deemed lighthouse factories by the World Economic Forum, have more resources, greater scale, and therefore more automation. By comparison, most manufacturing companies are mom and pop shops. These smaller to mid-sized companies often produce one product and have a more regionalized reach. They typically have fewer resources and are adopting automated tools and processes more slowly.

Lighthouse Factories

Smaller percentage pushing industry forward

- Comfortable at the cutting edge of innovation, investing in the most advanced technologies
- Possess the resources, partnerships, and talent to iterate with new technology
- Create strategic goals to expand reach and increase agility in the face of disruption



Mom and Pop Shops

Comprise about 75% of manufacturing sector

- Smaller companies with a niche market
- Have a smaller applicant pool, fewer partnerships, and fewer resources to invest in wholesale digital transformation
- Require a step-by-step process for investing in new systems, starting with the sure bets

Agreement on Need for Tech Skills, Differences on How to Deploy Them

Despite both types of manufacturing companies hiring for these emerging tech skills, their needs look slightly different in how workers execute their work in an increasingly autonomous workplace.

Lighthouse Factories		Mom and Pop Shops
Managers with business acumen and basic understanding of advanced tech to oversee transformation	Executives	**Consultants** with business understanding of new tech to create detailed digital transformation strategy, starting with 'sure-bet' investments
Engineers with deep knowledge of newest, most advanced tech like artificial intelligence and integrated systems	Engineers	**Engineers** with technical understanding of advanced tech to test and implement new processes
Technicians with skills in automation, robotics, and data analytics	Technicians	**Technicians** with foundational production and engineering skills and a willingness to learn new technologies

Source: EAB interviews and analysis.

Pinpointing Manufacturing Job Changes by Level

Regardless of employment destination, manufacturing companies need talent with advanced skillsets to implement, manage, and troubleshoot new technologies. The graphic below summarizes more specific expectations for frontline technicians, engineers, and managers.

Executives

- **Managers** need to possess both business acumen and a basic understanding of the advanced technology.
- Expected to determine which technological investments are the right bets for the company based on strategic goals.
- Oversee the change management process.
- Create step-by-step processes for digital transformation and automation adoption.

New Skills Required

Emerging tech applications and business strategy skills

Engineers

- **Engineers** must possess a deep understanding of the latest, most advanced technology in AI, robotics, and automation.
- Tasked with implementing, testing, and iterating new processes.
- Expected to have some business knowledge to track new tech implementation against strategic goals, whether that be decreased energy costs or increased customer satisfaction.

New Skills Required

Business, management, and emerging tech skills

Technicians

- **Technicians** need foundational manufacturing engineering knowledge and the ability and willingness to learn new technologies.
- Increasingly expected not only to maintain equipment on the factory floor but to troubleshoot complex technical systems and analyze data.

New Skills Required

Data analysis and uniquely human skills

Source: EAB interviews and analysis.

Training Smart Manufacturing-Ready Graduates

SECTION 3

- Review of gaps between company needs and educational offerings
- Programming opportunities in pre-baccalaureate and bachelor's fields
- Key considerations for augmenting existing and launching new programs

Gaps in Higher Education Manufacturing Programs

Currently, many academic programs provide students with strong foundations in traditional manufacturing processes and business acumen. But most fall short of providing the right mix of digital revolution skills necessary to get a job in the smart factories of today. Furthermore, these tech skills are necessary to getting promoted at these same jobs—as factories take on more technology, all managers and executives must understand how they work and impact businesses process.

Institutions can help correct this shortcoming by adjusting their programming. The table below outlines industry expectations, current gaps, and opportunities for higher education to update or develop manufacturing programs.

Skills Gaps and Opportunities for Manufacturing Programs

	Pre-Baccalaureate	Undergraduate	Graduate
Industry Expectations	Technicians with a fusion of data analysis, production, and problem-solving skills	Engineers with a deeper knowledge of emerging tech and broad understanding of business processes	Change agents who integrate new technology processes to help companies evolve through the digital revolution
Current Gaps in Education	Data analysis and uniquely human skills	Business, management, and emerging tech	Applications of emerging tech to business strategy
Higher Education Opportunities	• Retain foundational manufacturing courses • Add introduction to data analytics courses • Incorporate advanced critical thinking and problem-solving applications into program	• Create programs with meld of engineering, advanced tech, data analytics • Embed basic business coursework or experiential, real-world projects	• Retain foundational business process courses • Focus on change management and leadership • Integrate broad knowledge of emerging tech

Source: Emsi Burning Glass data with EAB analysis; EAB interviews and analysis.

Market-Responsive Pre-Baccalaureate Programs

Fundamentals of Pre-Baccalaureate Manufacturing Programs

The integration of automated processes within factories reduces the need for technicians who can complete routine or repetitive tasks. Instead, the manufacturing industry increasingly requires associate's-level professionals with strong creative problem-solving, critical thinking, and data analysis skills. For example, employer demand for associate's-level professionals in the manufacturing industry with data-driven decision-making skills grew 571%, on average, from September 2018 to August 2021.

Average Change in Demand for Associate's-Level Skills in the Manufacturing Industry[1]

September 2018-August 2021, National Data

Demand for Data Knowledge

571%

Data-Driven Decision-Making

133%

Data Recording

Need for Human Skills

201%

Strategic Thinking

171%

Creative Problem-Solving

Common Characteristics of Innovative Manufacturing Associate's Degrees

The most innovative associate's-level programs integrate coursework in traditional manufacturing processes, emerging technology skills, data analysis fundamentals, and creative problem-solving. These programs typically require hands-on learning opportunities with industry partners to help students develop uniquely human skills. Graduates of innovative pre-baccalaureate manufacturing programs can monitor and troubleshoot robots, record and manage data from sensors, and provide feedback on newly implemented processes.

Industry 5.0 Courses

Teach classes in robotics, artificial intelligence, and automation.

Data Analysis Basics

Include data analytics applications within smart manufacturing programs.

Paid Training Options

Partner with local industry to offer co-op and internship experiences.

Human Skill Focus

Embed complex problem solving and critical thinking into offerings.

The following page outlines noteworthy associate's-level programs.

1) Average change in demand for all skills is 55%.

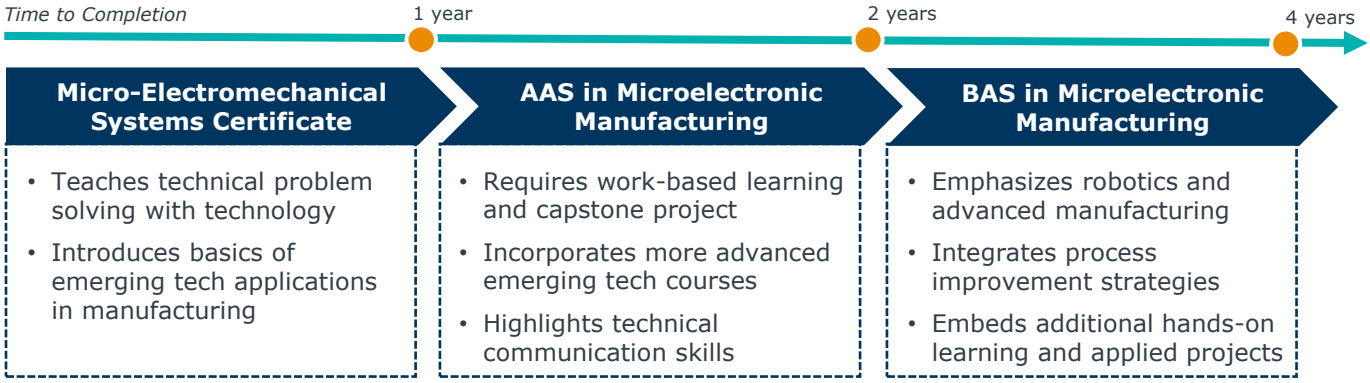
Source: Emsi Burning Glass data with EAB analysis; EAB interviews and analysis.

University at Buffalo Digital Manufacturing and Design Technology Coursera Certificate

The University of Buffalo launched a non-credit bearing program aimed at professionals seeking rapid upskilling. Faculty at the University at Buffalo partnered with the Digital Manufacturing and Design Innovation Institute, Accu-Solve, and Siemens to offer a Digital Manufacturing and Design Technology certificate on Coursera. This short certificate does not have education prerequisites and enrolls everyone from high school students to operations managers. The program primarily serves small and medium-sized manufacturing companies to help them understand the impacts of emerging technologies and how they can adapt business processes to respond.

Student Learning Pathway at Lorain County Community College

Progressive institutions are developing stackable learning options at every level to facilitate career advancement opportunities in industry. Lorain County Community College offers students the opportunity to earn short-term certificates, associate's degrees, and bachelor's degrees to serve students with various professional and educational goals. For example, students who complete a one-year certificate in Miro-Electromechanical Systems can seamlessly transfer their credits into a degree program. These structured educational pathways serve a variety of professional goals and help meet regional manufacturing needs.



Embeds Emerging Tech Into Existing Programs at Finger Lakes Community College

Institutions can also restructure existing degrees to meet changing employer demands rather than investing resources to create a new program. Finger Lakes Community College worked with its administration and industry partners to update the existing AAS in Instrumentation and Control Technologies to an AAS in Smart Systems Technologies. Emerging technology courses were added to the curriculum, including content on big data, automation, and artificial intelligence. The restructured program also includes site visits and co-op experiences to provide soft skill development and network opportunities for students.

MARKET-ALIGNED

Retitled existing program to "Smart Systems Technology" to emphasize emerging tech.

EMERGING TECH SKILLS

Added courses in data analysis, automation, and artificial intelligence within curriculum.

PROFESSIONAL DEVELOPMENT

Incorporated visits to modern factories and co-op opportunities with local industry partners.

Source: Linked program websites; EAB interviews and analysis.

Upskilling Bachelor's-Level Manufacturing Programs

Common Characteristics of Bachelor's Level Manufacturing Programs

Most bachelor's programs in Manufacturing follow a set of criteria that remain consistent regardless of how progressive the program is in adopting digital revolution coursework.

Credits	Typically require more than the average undergraduate credit load, with a range of 120 to 138 credits. The credit increases with lab requirements and experiential learning opportunities like co-ops and internships (offered at most programs).
Program Type	Typically in-person given requirements listed above. There are some opportunities for online or continuing education degree completion if students already have an Associate's degree or sufficient prior learning.
Typical Student	Recent high school graduate, 18-22 years old.
Ownership	Largely housed within the college of engineering. Undergraduate degrees focused on management or technology occasionally housed within colleges of innovation and technology.

What to Change to Meet the Digital Revolution Needs

Where progressive bachelor's programs differ is in offering a mix of courses in foundational manufacturing processes, the latest industry technology, data analytics, and business. Engineers are expected to implement new production processes using the latest technology. Once implemented, they are tasked with iterating on the process for maximum efficiency, which requires data analytics skills and a strong business sense. They are expected to utilize technology to reach strategic goals like increased customer satisfaction and decreased energy costs.

Average Skills Demand Change of Bachelor's-Level Manufacturing Professionals

September 2018-August 2021, National Data[1]

Foundational	Digital Revolution	Data Analytics	Business
+148% Production Systems	+230% Manufacturing Automation	+135% Data-Driven Decision Making	+75% Innovation
+108% Industrial Engineering	+164% Artificial Intelligence	+75% Data Integration	+68% Thought Leadership
	+147% Machine Learning		+65% Strategic Thinking

1) 41% baseline increase in demand for bachelor's level manufacturing skills.

Source: Emsi Burning Glass data with EAB analysis; EAB interviews and analysis.

Varying Ownership for Differentiated Outcomes

While most bachelor programs are housed within the engineering department, the institutions profiled below showcase the variety of options for manufacturing programming at this level. Here are two such examples.

PURDUE UNIVERSITY

BS in Smart Manufacturing Industrial Informatics

- Curriculum created in partnership with industry leaders, including Microsoft, General Mills, CAT
- New curriculum based on the latest technology like AI, IoT, Robotics
- Interdisciplinary program with science, engineering, info systems, and computing in manufacturing
- Physical and virtual labs represent the most advanced factories equipped with newest machinery and applications

M FLINT

BS in Digital Manufacturing Technology

- Interdisciplinary degree combining liberal arts and technical training
- 13 credits in programming and design-thinking, 72 credits in application of new technology
- Co-curricular opportunities with industry partners for hands-on experiences, including capstones, entrepreneurship and leadership programs

Adding in Digital Revolution Coursework

Universities are responding to this change in skills demand, creating curricula with a balance of all four skillsets. Brigham Young University updated the curriculum for the Bachelor's of Science in Manufacturing Engineering to match skills changes. Students complete courses in foundational engineering, digital revolution technology, data analysis, and business. The program outcomes are aligned with the mix of hard and human skills industry partners want—ability to solve complex engineering problems, experiment with and interpret complex data, adapt new information or skills with applied learning strategies, and work as an effective teammate.

BYU *BS in Manufacturing Engineering*

Engineering
- Lean Manufacturing & Systems Design
- Statics
- Quality Systems in Manufacturing

Digital Revolution
- Industrial Automation
- Intro to Smart Manufacturing
- Computer-Aided Manufacturing

Data Analysis
- Data Analysis
- Manufacturing Systems & Simulation
- Statistical Methods

Business
- Innovation & Entrepreneurship
- Manufacturing Leadership
- Product & Process Design

Source: Linked program websites; Emsi Burning Glass data with EAB analysis; EAB interviews and analysis.

Two Approaches: Add to or Build New Programs

Given these transformations in manufacturing, higher education institutions must decide whether to augment an existing program or build from scratch. For institutions with existing manufacturing programs (or adjacent programs like industrial engineering), there may be sufficient foundational coursework and faculty expertise to add a few new courses that result in a more industry-aligned, tech-focused program. Other institutions may opt to build a new program from scratch that promotes the institution in a new light, attracts a different kind of student, or fills a different industry need. Both approaches require careful planning, and the best processes for each are illustrated across the following pages.

1 Steps to Update Existing Program Curriculum

The less resource-intensive option for creating smart manufacturing programming is **to embed new digital revolution content into existing programming.** This can include tactics like adding advanced technology courses into technical or engineering programs, creating business-focused specialization tracks at the bachelor's level, or incorporating change management courses into a graduate certificate. This graphic outlines the steps to determine the right coursework to add.

Analyze

Examine labor market data and competitors with similar programs. Check if the industry is growing in your region, what kinds of skills employers require, and what types of courses and experiences other higher education institutions are offering in manufacturing-related programming.

Audit

Review existing programs to identify gaps in curriculum and in co- and extra-curricular opportunities.

Convene

Gather internal and external stakeholders to discuss findings. Faculty provide input on the necessary expertise and capacity to take on new courses. Industry confirms the need for new opportunities to develop specific skills.

Decide

Determine which adjustments are feasible and worthy of investment. Decide where new content will live, whether that be within a college or as part of the executive education unit.

Launch

Establish new courses within existing programs and track metrics for success.

Source: EAB interviews and analysis.

2 Guidance on Launching a New Manufacturing Program

The most resource-intensive option is to create a net new degree program related to digital transformation in manufacturing. Because this option is time-consuming and expensive, there are several key considerations to review before committing to a new degree.

Key Considerations For New Program Launches

- Unique value-add beyond current program offerings
- Institutional funding and support
- State approval, if necessary
- Inter-collegiate support for interdisciplinary programs
- Faculty expertise and willingness
- Realistic timeline to launch
- Flexibility to adjust content as tech changes
- Industry partnerships

When a new program is greenlit, there are two important considerations to explore further: involving industry partners and collaborating with colleges to create interdisciplinary options.

Involve Industry Partners

- Create opportunities for partners to provide **specific, task-based input** on skills demand and necessary coursework.
- Work with partners **to create real-world work opportunities** like co-ops, practicums, or earn and learn programs.

Outcomes

- Industry partnerships become stronger
- Students develop uniquely human skills necessary to succeed in workplace
- Students enhance technical skills in a low-risk environment

Collaborate with Colleges Across Campus

- **Embed coursework from related colleges**, like engineering, business, and computer science, to create interdisciplinary degrees.
- Tap into **existing faculty expertise** rather than hiring for new positions.

Outcomes

- Students receive the correct mix of in-demand skills
- Colleges avoid duplicative efforts by opening courses in one college to students in new degree program

Source: EAB interviews and analysis.

Setting Up Manufacturing Programs for Success

SECTION 4

- Imbedding DEI into manufacturing programming
- Strategies for marketing manufacturing offerings

Diversity, Equity, and Inclusion in Manufacturing

Infuse DEI Opportunities within the Curriculum

The expected growth of the manufacturing industry, combined with the pressures of baby boomer retirement, will result in millions of unfilled manufacturing jobs. Institutions have an opportunity now to intentionally recruit diverse populations and companies to create inclusive workplaces and meet the impending talent shortages.

Experiential learning opportunities, like earn and learn programs, can help higher education institutions and their industry partners meet diversity, equity, and inclusion goals through paid hands-on training. By offering these professional and educational opportunities together, institutions can attract financially burdened students who cannot afford the opportunity cost of giving up a job to pursue a degree. 'Earn and learn' programs can help students advance or change their career with limited risk.

Manufacturing Industry Demographics, 2020

65%	Percentage of workforce that is non-Hispanic white professionals
71%	Percentage of workforce that is male

For example, Columbus State Community College offers the Modern Manufacturing Work-Study program with regional companies to help underrepresented students secure full-time positions in the industry. Administrators at Columbus State help students with interview preparation to secure work-study roles, where they typically work three days per week. After completing this program, most students secure full-time roles at partner companies and earn a $55,000 starting salary on average.

Modern Manufacturing Work-Study Program at Columbus State Community College

$18	85%	45%
Average hourly wage for program participants	Percentage of students who secure careers with industry partners after work-study	Percentage of students from underrepresented groups

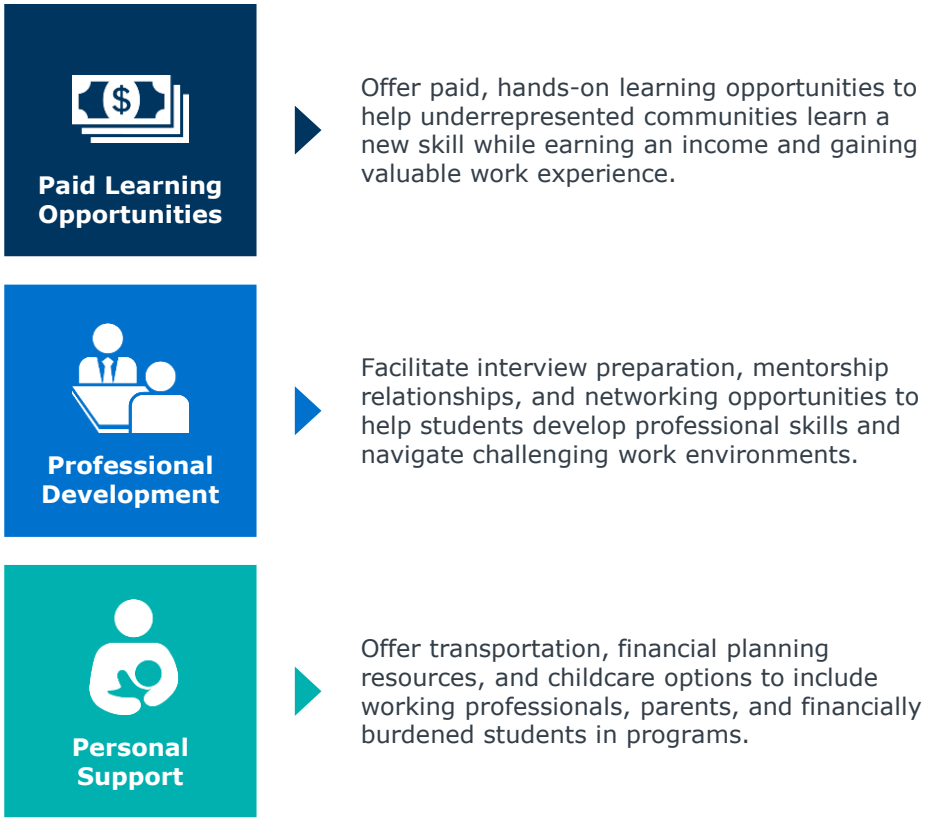
Source: Various linked sources; EAB interviews and analysis.

DEI Considerations in Manufacturing Education Offerings

Institutions can partner with industry, non-profit organizations, and government agencies to offer manufacturing training opportunities for underrepresented groups. The University of Kentucky, the University of Louisville, and Bluegrass Community and Technical College partnered with Toyota to offer the Toyota Engineering Technology Diversity Scholarship Fund. This scholarship fund, targeted toward female and minority students, gives students full-tuition scholarships to one of these institutions, secures learners a paid internship position, and pairs participants with a Toyota engineer for mentoring and networking opportunities.

In addition to financial assistance for underserved populations, many institutions offer personal support like interview preparation and coaching sessions. Manchester Community College, in partnership with their regional YWCA, the Connecticut Center for Advanced Technology, and a local homeless shelter, developed the Women in Manufacturing Pipeline Initiative. This free 8-week training and career placement program helps women enter the manufacturing industry as an entry-level machine operator at a local factory. In addition to the program's low cost and fast time to completion, participants receive individual coaching sessions, financial planning resources, and childcare options. These additional personal supports reduce barriers to entry for women in the manufacturing industry and promote long-term success.

Fundamentals for DEI Success in Manufacturing Programs



Source: Various linked sources; EAB interviews and analysis.

Marketing Essentials for Manufacturing

Outcomes-focused marketing that emphasizes the careers and responsibilities of future graduates is integral for successful recruitment strategies. Institutions must feature labor market data, such as possible job titles, employers, and salaries, on the program website to attract prospective students and demonstrate the professional value of earning a degree. Program websites should showcase graduate testimonials and videos of innovative factory floors to promote modern manufacturing companies. Additionally, institutions can include words like "technology," "digital," and "smart" in program titles and courses to increase student interest and highlight the technologically advanced careers within the manufacturing industry.

Marketing Strategies for Manufacturing Programs

Promote Innovative Careers and State-of-the-Art Workplaces

Feature technology-focused jobs and modern factories on program websites to appeal to prospective students.

Highlight Outcomes-Focused Marketing to Attract Students

Advertise high wages and job placement rates online for students seeking career advancement.

Emphasize Emerging Tech in Program Titles and Marketing

Use trending words, like "digital" and "technology," to attract students seeking innovative degrees and jobs

Partner with K-12 and Other Institutions to Create Pathways

Target prospective students early to create excitement about manufacturing and develop educational pathways.

The high need for professionals in the manufacturing industry, combined with the challenge of marketing manufacturing programs, means institutions must develop inclusive marketing strategies to recruit students from non-traditional groups. Institutions that expand their marketing messages to underrepresented, veteran, and formerly incarcerated populations can attract new kinds of professionals into the manufacturing industry. Universities can also work with local K-12 districts and community colleges to attract students to manufacturing programs early in their educational journey and establish a career pathway for prospective learners.

Learn More on Our Website

For additional information on marketing techniques for online programs, review our Competing on Student Outcomes to Attract Today's Career Changer study.

Source: EAB interviews and analysis.

Diagnostic: Is a Smart Manufacturing Program Right For Your Institution?

SECTION 5

- Academic capacity and regional employer demand diagnostic

Decision Matrix: Smart Manufacturing Programming

Delivering high-quality, in-demand academic programming in Smart Manufacturing is a balancing act between university capabilities and labor market demand. To help partners navigate the program development-refinement question, EAB created a diagnostic with critical considerations broken down across these two categories. Below are the initial questions in this diagnostic; after completing these questions, reach out to your **EAB Strategic Leader** to continue the assessment.

What are your institution's opportunities in Smart Manufacturing?

Institutional Capacity

Does your institution currently offer any Manufacturing programming?

This can be traditional manufacturing programs (e.g., CNC, QA, mechatronics) or traditional engineering programs (e.g., industrial engineering).

If Yes

Consider updating curriculum to include more of the technological skills in demand among manufacturing employers today

If No

Review non-manufacturing data, technology, and engineering offerings to determine if there is capacity to stretch into manufacturing:

- Are there courses that can be cross-applied?
- Are there faculty interested in cross-teaching?
- Are there co-curricular opportunities that can also include manufacturing?

Labor Market Demand

Are there regional manufacturing companies looking to hire?[1]

Manufacturing specializations and hiring needs vary widely by region, and a single institution in a region usually cannot meet all a manufacturing region's talent needs.

If Yes

Determine which level of talent and types of skills regional employers need, and then align those with degree levels and course offerings

If No

Assess out-of-region (or state) opportunities not being served by other institutions:

- Are there manufacturing companies with unmet talent needs in nearby regions?
- Is there state interest in growing manufacturing?
- Is there federal money available to fund programs in nearby regions?

Ready to complete the rest of the diagnostic?

Contact your EAB Strategic Leader to discuss the remaining questions in the audit, request a customized market insights report, and explore our case study library of Smart Manufacturing programs at institutions like yours.

1) *Employer demand reports for regions of the US, Canada, and the UK can be found on the same webpage as this report*

Source: EAB interviews and analysis.