

**Episode 35, *The Emerging Workforce for Advanced Manufacturing***

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**Mike:** From the Center for Occupational Research and Development, welcome to Preparing Technicians for the Future of Work. I'm your host Mike Lesiecki. In each podcast we'll reach out to people who are actually on the front line of the future of work and hear what they have to say. That means interviews with industry, interviews with working technicians, forward thinkers in the field. We'll do some background research, and we'll curate that research to make sure you have the most up to date and relevant information. And in every episode, we'll suggest action that you can take. We want to inspire you to take that action.

This podcast is brought to you by the Center for Occupational Research and Development, known as CORD, with financial support by a grant from the National Science Foundation's Advanced Technological Education program. Opinions expressed in the podcast do not necessarily represent those of the National Science Foundation. You can find out more about our project and our approach at "PreparingTechnicians.org."

Our guest today is Matt Kirchner. He's the President of Lab Midwest. He's an author, a speaker, and host of the TechEd Podcast. Matt, you serve on national boards, and your LinkedIn tagline says, "Securing the American dream for the next generation." Tell our audience a bit more about yourself, Matt.

**Matt:** Well, Michael, thank you so much for having me. It's a pleasure to be with you. And I really admire all the great work that you're doing—bringing attention to these topics that are so very important in the world in which you and I both live: that world of technical education. I know that's a world that your audience spends their time in as well. So, it's just wonderful to be invited. And thank you.

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I appreciate you mentioning our mission. My personal mission is securing the American dream for the next generation of STEM and workforce talent. I spent 23 years running manufacturing companies in the United States, Chief Executive of two of them, Chief Operating Officer of a third one. And I saw lives fundamentally changed by careers in manufacturing. People who literally started out sweeping the floor and ended up running the company, or paused anywhere in between, and had an amazing, sustainable, family-supporting, rewarding career.

And so, about five-six years ago now, we sold our manufacturing company to DuBois Chemicals out of Ohio, and I needed to figure out what came next. And I really dedicated my life to that mission. And as you suggest living that mission out takes a number of different forms.

I am proud to host a weekly TechEd Podcast. We talk to leaders in technical education and in industry about how we build bridges between manufacturing, industry, STEM, and education. So, that's been a great project.

LAB Midwest is the company of which I'm President. We're the largest distributor of Technical Education Learning Systems in seven US states, one of the largest in the country. So, I get to—every day—get up and work with amazing educators at every level: Kindergarten through 12th grade level, we work with educators of technical colleges, community colleges, universities, and industrial employers in upskilling their incumbent workforce. So, it's just wonderful to be part of such a great community doing important things and in finding ways to inspire the next generation around careers in advanced manufacturing and STEM.

**Mike:** It certainly gives you a great perspective on things, Matt. As you look at—let's call them—the emerging technician workforce in advanced manufacturing, what skill gaps do you see? What do your colleagues see of people that are coming into the workforce that they wish they could change?

**Matt:** Well, I like the words that you chose, Michael. That word "emerging" is so very important. Because we do live in an age where technology in the manufacturing world is changing at rates that it never has before. And for any of us that worked in manufacturing, that think we know what incredible changes, it's nothing like what we've seen the last couple

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of years, and what we will see in the next several years. Then, to your point, what we need our technicians to be able to do is going to change as those emerging technologies come of age.

So, there's a couple points I'd like to make. The first one is that all the things that make us successful in manufacturing don't go away just because we're in this new era of IIoT or Industry 4.0, or whatever we want to call it. We still need to understand LEAN. We need to understand quality. We need to understand safety. I say show me a technician that has read "The Goal" by Goldratt and understands how to remove a constraint in a manufacturing operation, and I will show you somebody who is worth their weight in gold in manufacturing.

The other thing that doesn't go away as all the base technologies that we've worked with. So, if we work in an environment where we're welding, where we're machining products, where we're operating press brakes, or punch presses, or turret presses or conveyors, none of this stuff goes away just because technology's advancing. So, we need to have a really good base understanding of that.

But what we layer on top of that is what we now call Industry 4.0 technologies. Smart sensors and smart devices. So very important. And what we mean by those is these are devices that communicate with each other and have the ability to make their own decisions. They have embedded intelligence. So, knowing how to get data into a smart sensor. How to get data back out of a smart sensor. These things are really, really important. How to network sensors in an operation. How to attach sensors to an operation.

And then, the smart sensors and smart devices... A lot of times we think of them as installing something on an existing manufacturing line. But more and more our technicians are going to understand that as they purchase new equipment, or their companies purchase new equipment (a new CNC, a new robotic welder, a new robot), there is a tremendous amount of embedded smart technology on that hardware when it arrives at the plant. So, understanding what's there understanding how to maintain it, understanding how to use it to predict the future—these things are really, really important.

A couple other things that don't go away. We still have industrial control systems. We still have programmable

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logic controllers, computer networks. Now, computer networks, I'm sure we'll get into things like cybersecurity and network security as our discussion goes on.

And then the other part of it is this whole smart data, what I call "inform-actionable data." All the data that will be available to the technician of the future, and even the technician of today, how do they engage with software? How do they engage with other people within their companies to use that data to maintain equipment, to foresee potential problems and head them off before they take place, and so on. So, a really, really exciting time to be a technician in the world of advanced manufacturing.

**Mike:** You know, Matt, you struck a chord there. Several folks who we've talked to recently have said it's one thing for, let's say, a student to understand a particular device, a particular tool, a particular piece of equipment. But today, they're often faced with integrating it into an ongoing process. Right? And there's a whole set of skills involved with that. Do you think that's true?

**Matt:** Without question, Michael, that's true. As you talk to industrial manufacturers, as you talk to manufacturers in the world of advanced manufacturing, it's more and more they will tell us that that integration piece is really, really important.

I had the opportunity to work with Ashley Furniture on a number of endeavors over the course of the last several years. The largest furniture manufacturer in the world, by the way. And what their head of automation has told me is that is the number one element, the number one competency, that is important to him when he hires new team members (whether from a technical college or from a university, as an engineer, an industrial engineer, a manufacturing engineer) is understanding, not just the component technologies, but how do I integrate a robot with a conveyor, with smart sensors and smart devices? How do I integrate a robot loaded machining center (CNC machining center) into a manufacturing operation? So, connecting these systems and having them work together in concert. And then having them communicate with whatever comes above them (whatever control system, programmable logic controller, computer network), so that we can use that data—that will be increasingly important. So, you're right. It's not just understanding the component technologies. It's understanding how to put them together into a process that

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manufactures a product, maximizes yield, maximizes throughput, and so on.

**Mike:** Right, right. You mentioned things like networking. Our project itself has really taken more of an approach to look at what we're referring to as "cross-disciplinary skills," like IT, Cybersecurity, Data Science. Do you see that also as an emerging trend? How much does a manufacturing tech need to know about cybersecurity, for example?

**Matt:** It's undeniably a trend that we are seeing in manufacturing. We call it the "IT-OT convergence." In other words, the convergence of Information Technology and Operations Technology.

So, Michael, in my years of manufacturing, I'll be honest with you. We had an IT department of people that took care of our servers, took care of our computers, our laptops, our software. And we had Operations people that were running the manufacturing floor. And that was fine back in those days. But now, as our systems become increasingly connected, as the data component in manufacturing becomes more important than it ever has been (and it's always been important, but it's now a huge differentiator between manufacturers that will be successful, and those that are not), the convergence of IT and OT should be on everybody's mind. So, if I'm training the technician of the future, or if I'm training the IT professional of the future, I need to recognize that.

I'll give you one example. I work really closely with Kohler Company. I'm sure your listeners would recognize that company from the bathtubs and the sinks in their bathrooms, maybe the generators (stand-by electric generators) they're using to power their homes. An amazing, iconic company. And I had, not too long ago, their head of IT (a guy named Jim Walter) on a webinar that I did. And Jim was talking all about how he needs to train his IT team to understand Operations Technology. We actually worked with them to put together a training program around that.

So, as his IT folks are being called to the manufacturing floor... And I'll be honest with you, in the old days, and probably even today, that's the last place sometimes the IT people wanted to be! But they're being called there more and more often. And they get to a conveyor. They get to a robotic weld cell. And they know that it's communicating through the internet. They know that it's communicating

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with the network. Well, they wanted those individuals to understand the technology. And so, we're actually training IT people around Operations Technology.

And it works the same the other way. Our technicians need to understand at least enough about IT to know which pieces of equipment are connected, how they're connected, what data is being pulled off of them.

And then, how we make sure we keep that data safe and protected within the plant. And that we don't let things that we don't want in the general public out of the plant, in terms of our IP and so on, that we're using to create the secret sauce (if you will) of somebody's individual manufacturing operation.

**Mike:** Right. I have to admit, I listened to one of your earlier podcasts. (I'll switch gears a little bit and talk about AI and machine learning.) You use the word "scary" in that podcast though. And here's the question, okay? So, I know you think about this, obviously. But what does a manufacturing technician have to know about AI and machine learning? They just need to know the basics? They have to know more? What do educators have to do? I know you've talked a lot about this, but give us your capsule-form of it.

**Matt:** Well, it's going to become increasingly important as we have computers, as we have algorithms, mathematical models that we use in artificial intelligence and machine learning. I tell stories about robots that can predict their own future failure and order their own replacement parts before the failure ever happens! And that's true, not just of robots, but of all of the equipment, all of the technology that we use in manufacturing. Artificial intelligence and machine learning is going to increasingly become a way of life for the manufacturing technician.

But here's the thing to remember, we don't need to know everything about something in order to use it. I can build a really, really cool Excel spreadsheet. Believe me—I don't have any idea what's going on in the back end of that software. I don't have any idea what's going on on the hardware in my computer. I don't necessarily know all that stuff. But I do know how to build a spreadsheet in Excel!

Artificial intelligence and machine learning is exactly the same thing. So, we don't need to be an expert on those algorithms. The mathematical models. What's classification?

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What's supervised learning? What's unsupervised learning? What's transfer learning? All these terms that we use in machine learning and artificial intelligence. It's interesting stuff. We don't really need to know that. What we need to understand is why artificial intelligence and machine learning are important to the technician. And the answer to that is that we now have computer models that can do a much better job of predicting the future than human beings ever could.

And, if I'm a technician responsible for the health of a manufacturing operation... If I'm the person that's going to get that call when the manufacturing project or the manufacturing line goes down... If I'm the person that's going to be in trouble (if you will) if we can't produce product off of that piece of equipment, and we're missing lead times to customers, or we've got yield issues related to maintenance—that's on me! And so, why wouldn't I want to know how I can use software. How I can use embedded smart technology. How I can use information that is going up to my employer's MRP or ERP system to predict the future and to be able to head off a manufacturing problem before it ever happens.

You know, I spent my years in manufacturing. And when I was supplying the Big Three (at that time) automakers, if you shut one of their production lines down, they could backcharge you a quarter million dollars an hour for that downtime! I don't want to be the maintenance technician that has that hanging over my head! And if I can use artificial intelligence and machine learning to avoid that and to improve process, THAT'S what's important!

So, we don't need to be an expert. We need to have a working knowledge of what AI and ML applications and technology and information is available to me in my manufacturing operation. And then how I use it to do my job even more effectively.

**Mike:** The concept of working knowledge. That's good, Matt. What struck me, as I listened to that podcast, is AI and ML can do things like improving defects. Making them zero. Eliminating waste in product lines. Boy, I could really see that! Especially when you're dealing with customers who start to expect that, right?

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**Matt:** That's precisely right. I like to observe that, in the Industry 3.0 days, and even today in manufacturing, we have a term called "ppm." And your listeners who work in manufacturing know that term, incredibly intimately. PPM stands for "parts per million." That means that, for every million parts that I produce, how many of them have a defect? And again, in my days of manufacturing, we were held by some customers to ppm levels of less than 5. Meaning: if I shipped a million parts, at the very most, I could have 5 parts out of that 1 million that had a defect on them.

Well, with artificial intelligence, machine learning, digital twins, and other technologies very, very quickly, we are going to drive defects to zero in manufacturing! You won't differentiate from another company in your space by what your parts per million rejects are. You'll be differentiated by whether you have ANY rejects AT ALL! And those companies that can't make 100% good parts aren't going to be able to "be a part of the dance." They're not going to be able to be at the table with others that are getting business.

And so, as we move toward that age where yield is expected to be zero, now we need to make sure we're using those technologies available to us such as artificial intelligence, and machine learning, and digital twins, for that matter, to make sure that we are in the group of manufacturers that can actually compete on that expectation.

**Mike:** Interesting take on quality, isn't it? It's quite a different perspective. And not that many years ago!

**Matt:** It's changing at a rapid speed. There's no question.

**Mike:** Let me switch gears on you a bit, Matt. What about certifications, right? So, I'm either employed and I'm looking to upskill. Or I'm at a technical college program. I'm looking for credentials. So, I know you're involved in this. A lot of talk about certifications and credentials like that. But does industry really value them?

And here's the question, Matt. One day, are we going to see a job announcement that might say something like "SACA Certified Industry 4.0 Associate preferred?" Is a job description going to say that at some point?



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**Matt:** Well, I think it will. And in some cases, it already does. I will tell you in our company (ATS Lab Midwest), when we recruit technicians, and we're recruiting a tech services lead right now, it says right in that particular Indeed ad (if you will), that the certifications from the Smart Automation Certification Alliance are highly valued by our company and many others. So, I think that's a really, really good question.

And at the heart of the question was where you started, which is, "Do industry employers really value these credentials?" And my answer is "Sometimes. but not always."

And I will tell you that I spent all those years in manufacturing, and with maybe one or two minor exceptions, I didn't really even know what a "third party credential" was. So, here I was hiring welders, hiring CNC programmers, CNC operators, plenty of people in manufacturing. And I didn't really even know, as CEO of a company in that space, that there were all these certifications. And then I get over to education. And by somebody's count, they told me about a year and a half ago, 900 different certifications that students can earn while they're going through their education pathway!

Well, here's the question. If we are telling a student, looking him in the eye or her in the eye and saying, "If you earn this certification, there's a job waiting for you on the other end of that certification," and then they get the certification, and they go to the workforce, and there's no job—haven't we just lied to that student? So, for me, if we're going to tell students that certifications are going to lead to jobs, we better mean it! Because otherwise we're wasting that student's time. We're wasting that student's money. And that is immoral. And it's unethical.

So, here's what's important to me. And that is that (to your point) we have certifications that are valued in industry. Now, I'll raise a couple of different examples of ones that I think are. You mentioned the Smart Automation Certification Alliance. Full disclosure: I serve on the National Board of that organization, I don't get paid to do that. I do it on a volunteer basis. And I'm a huge advocate for them. And part of the reason that I'm a huge advocate is I love their cost model. Part of the reason that I love their model is that they worked with industrial employers to identify what competencies are important.

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How do we determine what competencies should be in a certification? You ask industrial employers. Companies like Rockwell Automation, like FANUC, like Sargento, like SC Johnson, like Ashley Furniture. And that's exactly what SACA did. Was they went out and they asked employers, "When you're hiring people for an industry 4.0 career, what are you hiring for?" And they built certifications around THAT!

I would also point to the NOCTI certifications through FANUC Robotics. More than half the robots in industry today—way more than half the industrial robots in our territory in the Midwest—are FANUC. If you have a branded certification around a product that is that ubiquitous, that's a valuable certification.

Manufacturing Skills Standards Council (MSSC) went out to industrial employers and said, "What are you hiring for?" That is the way that we build a certification. And if the employers are involved in creating the competencies, they will also highly value that certification when the individual holding that credential gets to industry. So, it's all about how you get your industrial employers involved—multiple industrial employers.

What I like to say, and I'll finish the answer with this, is that a certification should be a pathway for a student or learner to an amazing career. Not a pathway for somebody in education, in the certification world, or in manufacturing to make a bunch of money. So, what's important is the student. What's important is the learner. What's important is their educational pathway.

**Mike:** I'll make a comment here as well, Matt. I do think SACA's cost model is very favorable to educators. And I've been impressed by that. And their focus on competencies. So, thanks for those comments.

As we wrap up today, if I were to ask you to get out your crystal ball, peer out there (I know you do a lot of this anyhow!), what do you see out there in the next, let's say, three years or so, that's changing in advanced manufacturing? What advice would you give for educators to help prepare their students for that change?

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**Matt:** Well, I love looking into the crystal ball. I love living in the future. So, I definitely appreciate the question, Michael. And I would tell you a few things. Number one is: I have a whole philosophy that we are seeing what I call the convergence of the Exponential Economy and Industry 4.0.

And what I mean by that: the "Exponential Economy" is the idea that 15 years ago, I had an iPod that would play music. It did nothing else. Today, we have iPhones, we have smartphones, that have replaced all these different things that we used to use. They replaced our calendars, our airline tickets, our flashlights, our rolodexes, all these things that we used to have, we don't have those things anymore, because it's all on our smartphone. It's amazing!

Sometimes we forget how quickly Manufacturing Technology is advancing. Products now doubling in price performance every 12 to 18 months, so that products that I could buy 18 months ago, I can now buy for the same price, but they do twice as much!

That world is converging with the idea of Industry 4.0, which, as we all know, are cyber physical systems, predictive analytics, artificial intelligence, machine learning, digital twins, augmented reality, virtual reality—all of these different technologies. And I believe that we are in the era of what I call "Industry [Infinity].0, where there won't be an "Industry 5.0," "6.0," "7.0." Manufacturing technology's advancing so quickly, that we're gonna be struggling to keep up with all the changes. And we won't be under another Industrial Revolution. We'll be in this era of continuing evolution and revolution in manufacturing technology.

So, what that means for educators: first of all, we have to have our eyes on those technologies. We've already talked about artificial intelligence, machine learning, digital twins, augmented reality, virtual reality, smart sensors, smart devices, cybersecurity, network security. These are really, really important! And if we're not up-to-speed on these technologies, we will quickly fall behind.

The other advice I would have for educators, number one: make sure that you're engaged with your industrial employers. And that you are not just listening to them (which is really, really important), but also (especially for small to mid-sized business; they don't always see this

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change, this pace of change, that the rest of us see), make sure you're advising those constituents, those stakeholders in your organization (especially our community and technical colleges here in the United States)—make sure you're advising them on what changes you are seeing.

And then, as far as our educators are concerned, they have to be lifelong learners. We are done with the age (and we probably have been for a while) where you can learn a trade, you could learn a profession, such as technical education, and just be able to do that for an entire career, maybe brush up 5 or 10 hours a year, make sure that some of your competencies are remaining fresh—those days are gone!

And we have to be committed to lifelong learning. We have to be constantly curious. We have to be gathering information. We have to be benchmarking against other technical and community colleges. Because the truth of the matter is the colleges, the educators that stay on top of this stuff, that morph their curriculum quickly and stay connected to their industrial employers in this age of advanced manufacturing, are going to be the bastions, they are going to be the destinations for students who want to have amazing careers. And, as we all know, the careers available to people of all ages in advanced manufacturing are greater, more interesting, more fascinating, better paying than ever before. It's a really, really exciting time to be in technical education, especially as it relates to advanced manufacturing in Industry 4.0.

**Mike:** That's a really strong message, Matt. I really appreciate your thinking on that. Today, I'm just reflecting. All the things we talked about really resonate. I mean, we still need those basic skills, right? As a manufacturing technician. You can't get away from that. And yet you're dealing with devices that have embedded intelligence. So, you've got to begin to understand that as well.

That term "inform-actionable data." I just love that term, Matt!

And so, as we think about another thing that struck me, the number one competency that you mentioned is the ability to think about integrating these new and emerging technologies into existing processes. And I could see that. Hopefully our educators out there are doing that in their own

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curriculum, right? Giving students learning opportunities to do that. I think that would be an important thing.

That "IT-OT convergence." Boy, that's a great concept. And I think it makes a lot of sense.

And then finally, you mentioned this convergence of the Exponential Economy and Industry 4.0. Interesting convergence, isn't it?

It's great talking to you today, I'm going to put a number of links in the Show Notes. Some articles that you've written. And to the TechEd Podcast, as well. I'm sure our listeners will find a lot of value there as well. Matt, I really appreciate the time and your insights today.

**Matt:** Well, great to be with you. Michael, thank you so much for your advocacy on the part of technical education, especially at the community and technical college level, and especially as it relates to national policy in terms of education and continuing to drive our nation forward in this world of advanced manufacturing. It's a passion of mine. I know it's a passion of yours, and I really admire the work you're doing. Thank you for having me.

**Mike:** Thanks again, Matt. In today's interview, you heard about many challenges and possible solutions educators in industry face in preparing the advanced manufacturing workforce.

Matt stressed Industry 4.0. And that's your first action for today. In the Show Notes, we have a link to Matt's article on preparing students and learners for Industry 4.0. He's got some great ideas there, so check that out.

Number two, Matt felt that AI and machine learning are important and actually "knowable" in the technician workforce. Your second task is review his article on how artificial intelligence will transform manufacturing and a very engaging podcast on predictions of how artificial intelligence will transform manufacturing. So, check both of those out when you have a chance.

I'd like to acknowledge that our audio production for these podcasts is done by John Chamberlain at CORD. Thank you, John, for all of your excellent work. Our project is led by Principal Investigator Ann Claire Anderson, also at CORD. Thank you, Ann Claire.

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Lesiecki, Michael (Host). Preparing Technicians for the Future of Work Podcast: Episode 35, *The Emerging Workforce for Advanced Manufacturing* (audio podcast, transcript). Center for Occupational Research and Development, Waco, TX. 2021. Retrieved from <http://www.preparingtechnicians.org/>