[music]

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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.

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Our guest today is Sarah Boisvert. She's the founder and CEO of the Fab Lab Hub, the Co-founder of the New Collar Network, and the author of the book, The New Collar Workforce. Well, beyond that, Sarah has more than 30 years of experience in the design, development, and commercialization of high technology products, utilizing digital fabrication, including laser machining and 3D printing. So, I'm really pleased to have her join us today. Thank you, Sarah. Would you tell us a little bit about some of the motivations that you've had that's brought you forward in your career?

Sarah: Well, thank you so much for having me here today. As someone who was in the forefront of technology, like laser micromachining, it was a challenge for us as a company to be able to hire trained workers. And I'm particularly thinking of operators and technicians; not so much, engineers. I had not too much trouble finding laser physicists or electrical engineers. But finding someone who, in 1986, had the skill set to laser-machine products that we were building for customers was very challenging. And we ended up having to have our own in-house training program to get people up to speed. And we would hire people right out of high school, from community colleges, and bring them in to a really fun, engaging, and well-paying job that, in many cases, led them to STEM degrees, where they would

go on to an undergraduate degree. I saw it as a really wonderful pathway for people to get good jobs that they didn't even know existed.

But the situation has not changed radically over these many years. My colleagues always talk to me about how hard it was to find anyone with the skills they needed in digital fabrication. And that was really the motivation to increase opportunity for people, but also to help my industry.

Mike: That's perfect, Sarah. Speaking about digital fabrication skills... So, when you think about this, and in your past work, you've studied this, how do you know what skills are needed in that area? Not only today, but think maybe the next two to three years, what you see emerging as well. How do you know those things? How do you know what those skills are?

Sarah: I have a lot of requests from Fab Labs (in the MIT Fab Lab Network) to help them build two-year curriculum in Digital Fabrication. And I thought, well, I don't know what each of these geographic areas need. I had worked with schools in our area. And I focused mostly on the kinds of skills that my company needed so that I could hire these people. But I was not aware what everybody else needed. And so, I interviewed 200 employers in manufacturing—skills they needed for operators and technicians. And I talked to a wide range of companies that ranged from Fortune 10. So, companies like Ford, and GM, and GE, and Apple, all the way to startups, and also the national labs. And I started to get a really good picture across industries, in manufacturing, in terms of what people were looking for. And there were a number of skills that came up again and again.

And on the technical side, one of the most prevalent skills that people were looking for was digital skills. Today, if you're running a welding machine, you also have to be able to look at a CAD design and determine what are the parameters. And my experience at Potomac was: when something failed, 99% of the time, it had to do with the translation between the CAD file, and the G-code, and the machine actually being able to do what the designer wanted. I was dealing with good companies, like Motorola and Medtronic. But still, there's that disconnect. So, your operator has to be able to look at a CAD file, and be able to, not just have the G-code pre-programmed so that it fixes things, but be able to really get beyond that and to make the kinds of adjustments that will ensure good quality parts. And since I was working on very small spatial scales, typically in the range of a few microns, quality was really an issue for us. So, I could relate to that.

The number one thing that the international community is looking for, I found in my research, is predictive analytics. And so, most CEOs saw the ability to predict machine maintenance, machine

failures, those kinds of events that we don't want to be catastrophic. They really saw that as a competitive advantage in the global economy—which comes back to AI. I was seeing a lot more need for both the programming—but also the repair of—automation tools in robotics.

Mike: Yes.

Sarah: The robots don't fix themselves yet. So, those were the big ones.

But 95% of the people that I spoke with said that problem solving was the number one skill they were looking for. And as anyone who has ever attended MIT or know someone who did, the problem steps that are the cornerstone of an MIT education—as well as at other schools—really ensure that people have the capability to go in and fix a problem. And I think that is something that's becoming more important as new technology is coming on board.

And people don't have the experience. And so, a technician can't go to an engineer in the back room and say, "How do I fix this 3D printer?" When, in fact, the engineer went to school before 3D printing was in the curriculum. So, as the technology is speeding up, the need for quicker solutions from our operators and technicians is becoming more important.

Mike: That's an interesting point, isn't it? That you just can't go into the, say the older folks or the veterans in the company, and say, "Hey, how do I do this?" Because the technology is changing so fast, as you say, they might not have that knowledge. Do technicians these days? In your opinion? How do they get it? Do they do Zoom meetings with the vendor? And they put on their VR headset to look at a machine? How do they figure things out like that today? How do THEY learn when they're in the workforce? What's your experience with that?

Sarah: My experience is that they go to YouTube, before the pandemic. I see it with our technicians in my lab. I see it with my lab manager, who's 26, and the first thing he does is he goes and searches on the Internet. And whereas I would have probably thought I had to go and take a course. People learn differently today and are wanting immediate gratification. And so, I do find that the problem is, like with many things on the Internet, there isn't curation. I've looked at a lot of YouTube videos that are pretty bad. My very good friend, Larry Dosser, who was the founder of Mound Laser in Ohioand I always talk about the terrible laser misinformation there is, where they'll talk about machining of stainless steel.

Mike: Yes.

Sarah: And I'm sure you've seen this. [laughing] And we just cringe, you know, on... I think if you go to the vendor sites, it's better.

We, in our lab, predominantly use Fusion 360 (from Autodesk), and we start people on Tinkercad. And so, I had originally, thanks to the generosity of Carl Bass, when I was doing fundraising for the Fab Lab Network, I was able to get licenses. And so, we would send people to the tutorials. And it is a slog for somebody to make that quantum leap, and they have to really be dedicated to trying. And it's not easy. So, it is not exactly a foolproof solution to the problem.

Mike: Sure. You know, if you had to be in charge, and you looked at a community college program that was helping prepare students for the workforce—you've talked a lot about CAD and things like Fusion 360—what would you recommend to people that they do to improve their programs? I know we're talking in a general sense—to make those students more adaptable to the workforce? What would you like to see them do?

Sarah: Well, I've thought about this a lot. [laughing] In the last 10 years, across the country, across all of higher education, we have seen a 11% decline in college enrollment.

Mike: Right.

Sarah: And we all know what's happening in terms of the financial situation where people are spending small fortunes to go to college. They're coming out in debt or their parents are going into debt. And they're not necessarily getting the promise that was made to them.

And so, as I started to look at this, and I was working with the National Governors Association on a project called Future Workforce Now, we brought in a lot of people: from policymakers, and universities, and nonprofits, and all kinds of—a real mix of people who were in the trenches. And so, what I would recommend to colleges is, yes, of course, we want our degree programs. And, of course, we want four-year and two-year training. But, in addition to that, we need to really open our minds to the opportunity that exists for non-degree programs.

And so, my lab here in New Mexico (one of my labs—I have two) is at the New Mexico Santa Fe Higher Education Center. So, we serve four colleges. But I was originally at the community college in town. And it was a battle with the Engineering Department because they were so threatened by the idea of us offering digital badges.

Mike: Yes.

Sarah: And I, of course, saw us as a "pathway." That, if we could get somebody interested, who had a lot of fun, it was $250, and six weeks, and we could open their minds to the possibilities of going into a STEM field, that I was doing a great job there. Or upskilling people in the workforce. Or in today's world, re-skilling displaced workers who were displaced by the virus. And, it was really sad, because... (We do teach still through the Continuing Education department. I still have a relationship with the Higher Education Center.) And these classes are booming! The continuing education department... I think I remember them saying that they bring in more revenue to the college, than the entire academic side of the house.

Mike: Wow.

Sarah: The colleges are going to go out of business if they don't meet the needs of the community and meet them where they are. We can turn those into pathways to higher... I mean, I'm highly educated and really have more degrees than I probably need. But that's not for everyone. I mean, I loved school. And for me, it was so much fun, but it's not for everyone.

I interviewed for my new version of my book on, called, *How to Get a New Collar Job*. And I did an interview with an engineer at Potomac, who 20 years ago, we had hired as a technician with no experience. And he said, "You know, I really loved math in high school, but I didn't like all the other stuff. I did so poorly in English and all of the other subjects. And so, college wasn't a possibility for me, but I loved math so much!" And I thought, well, good, somebody who loves math is going to be really good at working with the machines. And I think that we help people where they are and let go of our preconceived ideas and our power struggles at the college level.

Mike: You know, Sarah, you mentioned digital badges. Now, a lot of our listeners, they've had some experience with badges, certificates, micro credentials. I wonder, why haven't these things taken off more? They have in some areas. But it seems to me that industry doesn't really yet recognize all these things. Do you think that's true? Or what could we do to, let's say, encourage recognition of these credentials? Increasing their value to industry? What do you think about that?

Sarah: I think that's a really good point. And badge people call that "currency." So, we have to have... a badge program has to have currency for the student AND for the employer. And we're talking about decades of tradition that is suddenly being up-ended. And it takes some time. But I'm starting to see some real changes.

I mentioned Autodesk, but also Cisco and Adobe, all offered certifications that are based in the international Open Badge platform, which we use, which has an international standard. And

so, within their certificates, they're certainly using the badging program.

I think it's starting to change. This past summer, Ginni Rometty, who had been the CEO of IBM and is now, I think, their Executive Chairman, was on the White House Workforce Task Force with a number of other industry leaders including Tim Cook. And they got the White House to push through a mandate for the government agencies to value skills over degrees. And we started some change there. I think as more employers accept credentials, the schools will have to change. And they will have to get on the bandwagon or, as I said before, be left behind. And with the declining enrollments, we really have to respond to the employers, and also to the needs of the students. And so, I think that we have to work with policymakers.

Another big problem is that many states reward colleges via their funding mechanism that is based on how many degrees they have issued the previous year. And I know that's true in Ohio. We see it in New Mexico. So, there's no incentive to offer more badges because you're incentivized to really push on those degrees.

Mike: Sure.

Sarah: And so, I think, from a policy standpoint, that has to really change.

Mike: I totally agree with you. Another thing we found in our own project, Sarah, is that these credentials and badges help the students convey better what they know. Imagine, like a job interview, right? Sometimes it's hard for a new entrant to the workforce to really explain what they know how to do, and what their knowledge is. But having that credential, that digital badge, I think it gives them a better ability to convey what they know and what they're able to do. So, I think there's an added benefit there.

Sarah: I think that's exactly right. And when I started to look at, you know, like I'd done the research for the book, and I thought, well, two-year degrees—definitely not what I need to work on. And when I started to look around education options, and I started to really research badges, the thing that kept coming back to me when I looked at what was already out there in terms of certifications from various organizations, and nonprofits, and schools, was that it was typically that you read a bunch of material and took a test. And I thought, well, as an employer, if somebody comes to me, and they tell me, they have a badge in "running a CNC machine," I want to know that they've RUN a CNC machine, right?

Mike: Right!

Sarah: That they've been in the trenches. And they know what to do when...like, you're running a metals 3D printer, and it catches on fire! I want them to know what to do! I don't want it to be a theoretical exercise.

And so, our badges are based upon a portfolio. And so, all of our work is in project-based learning, which is just an extraordinary methodology that opens up the creativity of our students. When I find that people are having trouble teaching this way, I find that they are trying to micromanage their students and don't trust that they can solve a problem. People are very creative and resilient. And I think this kind of methodology, where you solve a problem, and then in your portfolio, you document, "how did you solve the problem." And the first thing is they have to identify the problem. Giving people problems, it's not typically the answer.

If they have a job, what is something at work that is not going well, for you? Is there something in your home? Is there something in your social life? And, as you know, identifying a problem in engineering is half the battle. You can't solve the problem if you don't know what it is. So, we start with identifying a problem that is meaningful to the students, so that they're going to really want to spend the time and energy it's going to take. And then documenting the process. So, estimating what they think is wrong. And, as you know, when you start to go through the process, it never works the way you think it will. And it takes many iterations. And the information that I get from that process is so valuable as an employer, it tells me: Did the person think creatively? Did they cut corners? Did they find some way to solve the problem that actually would cause a problem down the road with another part of the system? So, it's a very valuable tool. As you say, there are so many benefits. It teaches the student problem solving. It teaches them the exact skill we want them to have, whatever that skill might be. And it also teaches them to communicate. And then on top of that, it provides a potential employer or an Admissions department at a college a way to evaluate the student's capabilities. And so, I think you're right on.

Mike: I'll pile on there, Sarah. I think that there's one more thing. It helps them know how to learn going forward. And as you've mentioned in some of your remarks, that's so important to be able to continuously learn as these new technologies change. So, there's one more thing that we'll add to the pile there.

It's just been exciting talking to you today. We talked about the emerging skills. The need for people that understand operations CAD programming.

You mentioned that the problem often lies in the translation of those CAD files into real working processes.

You mentioned about predictive analytics and all the data that's now flowing from these machines. The ability to do predictive maintenance to help keep things running all the time.

Oh, I liked it very much when you said, "The robots don't fix themselves...yet." I mean, maybe there'll be a time when the cobots are starting to fix themselves—or each other! That should be interesting! Heh, Sarah?

And also, I appreciate your comments on the National Governors Association Toolkit. We'll put some links to the Show Notes to that.

And I have a question for you. You mentioned the new book you're working on. It's *How to Get a New Collar Job.* When's that coming out?

Sarah: It will I expect be out in March of this year [2021].

Mike: That's exciting! I'll make sure that we also have your current book on the *New Collar Workforce* in the Show Notes as well.

Sarah: Thank you.

Mike: Sarah, it's just great talking to you today. I appreciate your insights, your background and this thing, all the experience. It just gives you a good perspective in looking at this whole problem of "how do we prepare the technicians for that future?" And that's what our project is about, too. So, thank you again, Sarah. It's just a pleasure working with you.

Sarah: Well, thank you so much for having me.

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Mike: That's it for today, listeners. But before we wrap up, I'd like to ask you a favor. We would like your help with our podcasts. We have a brief three-question anonymous survey that asks you to check a box that indicates your affiliation, identifies what you might do as a result of listening to the podcast, and then asks you how you might like to be more involved. It should take less than a minute to do and it will help us add value to our series. You'll see the survey link right near the Show Notes. Thanks very much for doing that.

Now, in today's interview, you heard Sarah Boisvert, founder and CEO of the Fab Lab Hub, focus on digital fabrication skills for the technical workforce. Sarah has a great passion for this topic, and she kindly provided a set of links for further information that we'll make sure that we put in the Show Notes.

Now, here's your action item for today, or should I say action items. You can either update your knowledge on digital badges and micro-certifications using those links, or familiarize yourself with the current workforce policy recommendations using those links, or both. Also, take a look at Sarah's books to get a sense of what innovative organizations can do for training and education in this emerging field.

As you know our series is produced by John Chamberlain at CORD. John, thanks very much for all the expertise on the production. The project is led by Ann-Claire Anderson at CORD. Thank you, Ann-Claire.

You can find our podcasts on PreparingTechnicians.org, or on Apple Podcast or Google Play. A rating and review is always appreciated. And thank you, our listeners for *Preparing Technicians for the Future of Work*.

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