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Mike: From the Center for Occupational Research and Development welcome to Preparing Technicians for the Future of Work–The Podcast. I'm your host Mike Lesiecki. In each podcast we will reach out to people who are actually on the frontline of the future of work and hear what they have to say. That means interviews with industry leaders, working technicians and forward thinkers in the field. And, in every episode, we will 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 "preparing technicians"—all one word—preparingtechnicians dot o-r-g.

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Mike: Today, in our third episode. We are talking about OEE—Overall Equipment Effectiveness. Now, before you run away shouting, "Not another one of those things!" let me influence your perception of what once was a dry topic. I was recently at an industry advisory board meeting for a project at a community college in Wisconsin. Someone said, "What about metrics for measuring factory and process performance?" One industry member said "Well, we use OEE all the time." Several of the people in the room said "Well, what is that? What is OEE?" That comment actually led to this podcast. The gap that may exist between an industry practice and what our students learn and practice in our education environment. Today nearly every industry is digitally transforming itself. Whether they're producing biopharmaceuticals, semiconductor chips, corn chips, or cellphones. The accompanying high levels of automation and sensors monitoring every process and every piece of equipment generates an unbelievable amount of data to assimilate. This data can help answer the question, "How efficient are we?" And "Can we be better?" This often falls

under the broad term "factory dynamics." Suppose I'm managing a production line. It's not enough for me to know how many things I'm producing. What I really want to know, "Is the equipment ready when it's supposed to be? Am I getting the most performance out of the machines? And am I getting the quality I need? I don't want to make a hundred and five parts to get a hundred good ones." Really, that is OEE. It's a combination metric: Availability times Performance times Quality. A score of a 100% is perfect production. In rough terms a score of 85% is world-class for manufacturers. A score of 60% is pretty typical. And a score of 40% is not uncommon, just to give you an idea of where this factor lies. Okay, here's a very simplistic example. You have an office with a copy machine. It's available, except when it's down for maintenance or repairs. Most of the time it's performing, but if it jams or always needs clearing that will hurt its performance. And finally, the copy quality might be good, except when the toner is getting low or it starts streaking. We could record those things. We could measure the times it's available. We could measure its quality, its performance, and calculate OEE for this machine. That's a pretty simple example. Now let's look at some references. According to Vorne, that spelled V-O-R-N-E, Vorne Industries (They specialize in all things OEE), the metric is a framework for measuring the efficiency and effectiveness of a process by breaking it down into three constituent components. They're called the OEE factors. In the shownotes, I'll give a link to a good reference from them. Now it's time for our interview.

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Mike: Joining us today is Mariano Carreras, the Director of SMC International Training. He's based in Spain, and he travels all over the world, and really has a pulse on business and workplace trends. Mariano, thank you very much for joining us today.

Mariano: Well thank you for inviting, Mike. It's a pleasure for me.

Mike: You know SMC is a large international corporation that's been around for over 60 years, you were telling me, headquartered in Japan. And they specialize in pneumatics and highly automated systems. And your group is the Training Division of SMC.

Mariano: Yes, that's correct.

Mike: Good. Thank you, Mariano. You know, today in our topic, we're talking about "Overall Equipment Effectiveness." I know that you travel the world, visiting companies, looking how they implement automation, how they implement equipment. What have you seen? Why is OEE so important? Is it gaining importance in these industries? Tell us about it.

Mariano: Yes, as you know industry now, when you enter in a factory, it's highly automated because they need automation to be competitive in the world nowadays. Everything that they produce should be perfect, on time, as much productive as possible. And companies are looking at the return of investment. This is the main indicator that they do have, ok. So, if I invest, I put 1 million dollars in this factory, I need to return this investment, and by selling the products that we produce as soon as possible. This is what the investors need to see. And in order to reach that indicator, and they have different ways of measuring their performance, and one that is really important, and is becoming more and more important, is the one called OEE. Ok, so this is, as you know, the product of three different factors that we can formulate. But the main topic here is return of investment. If I have my OEE 50%, 50% of a hundred, that means that I am going to make the calculation simple. I will return my investment in the double of the time, and I am not ready to do that. I need to return my investment as soon as possible, okay?

Mike: Yes, yes, of course.

Mariano: So, as you know, there are several, I would say, trends or even fashion in industry, and there has been many years people talking about LEAN. Okay, so when I travel the world and I make some conference, mainly in education, people ask me, "What is the difference between LEAN manufacturing now and OEE?" Basically, we are talking about the same topics. So, in order to increase the three factors of the OEE, we really need to reduce the waste, to reduce the losses, okay? So, once I look at how I am losing Availability? Why I am losing Performance? Why I am having less Quality? Not everything that is leaving the end of the production process is okay. I have to recover things. I have to reject something. If I really monitor and analyze what is happening with the losses, and I, of course, take action about that, I will increase my OEE. So, we are talking about the same concept of making a factory like LEAN or increasing the OEE is exactly the same. And again, is all

addressed to really reach the shortest return-of-investment time. Okay? The trend—this is what is now being called Smart Manufacturing, or Connecting Enterprise, or Industry 4.0, now in Europe—the trend is just to have the machines like a kind of more intelligent, or smarter. So that the machines are really prepared with smart sensors and smart actuators, so that they can monitor and record all the data which is needed to calculate the different factors of the OEE. So, I see different levels of automation, and different levels of digitalization, and also different ways of measuring the OEE. Okay? But as you mentioned during our previous conversation, the important thing is not necessarily the real figure today. If it is 90, or if it is 50, or if it is 60. The important thing is just the trend, that we can see that the evolution, with the same ways of measuring the evolution of that factor is going to go higher and higher until reaching 100, which is Excellent, we say, okay? But the way of measuring it will depend on the different type of factory. I have seen companies that have a process which is not highly automated, and they are measuring some of the parameters automatically, and some others are taking manually. But, at the end of the day, they are calculating. But what I see in most of the companies that are using this factor to measure the performance, what I see is that the data is available for all the workers in the shop floor, and, of course, in the offices—in real time.

Mike: Ah, yes.

Mariano: So, everybody's aware because it's a kind of strategic measurement for the company, and it's a kind of management decision that we should continue improving the OEE factor. So, everybody is aware. You see, therefore, on the wall of the shop floor, and you see the indicators. Sometimes the whole OEE, sometimes the different factors, the availability, the performance, the quality. So that they see where we are, and what has been the trend in the last one week, or two weeks, or whatever. And because this is not a question of the Management saying, "Hey, we are going to go ahead in the OEE measurement." It is a question of the education of every worker, every single employee in the factory needs to be aligned with the strategy of improving OEE. This is what I've seen in the ones that we can consider kind of successful stories, or good practice companies that are having a very good OEE and also a very good team improvement. Okay, so what I see also by talking

with the people that have this system implemented is that going for 30 to 40 is pretty easy. Going for 95 to 96 is very difficult. [laughing]

Mike: Oh, yes.

Mariano: It happened everywhere in life. But, you know, at the beginning you see the impact of the improvements, which, at the end of the day, is reducing the waste. Reducing the losses. You see at the beginning of putting this in place, the impact is much higher, in terms of percentage, than when you are reaching higher levels of overall equipment efficiency.

Mike: You know, that's a very good point. But I have a question for you. The management says, "Ok, this is really important to everybody. We're going to focus on OEE. But do the technicians, the workforce... What motivates them to be part of this? To pay attention? You know, management is always telling them something. But are their other motivations that make sense to employees?"

Mariano: Yes. For me one of the best examples of how to manage this was a company that I was visiting: a future manufacturing plant. When I was talking with the production manager, when I look at the OEE that day, it was 98.2, which is huge! And I said, "Oh my goodness!" And, of course, my first question to the production manager is to say, "How do you get to that level?" Because as you mentioned, just because the management said, "You have to." It's not working like that, ok? And he said, "We have been trying different ways of doing this. But finally, what worked is having three shifts: two shifts of production, and one shift for maintenance. The maintenance shift, working eight hours in the plant without any production, they are paid according to skills. They have a fixed salary. But then they have a variable, a bonus based on the OEE of the next two shifts. That means that these technicians, working in the plant without having production, their goal is preparing the plant in such a way that the next 16 hours, the next two shifts, the factory will work perfectly. That means there won't be any trouble, any stop, any waste. All the parts will be 100% quality. So, we have been discussing about this several times, Mike and you have heard me. I always put this as an example. It's like flying in a plane. When you get into a plane to go through the Atlantic for a 9 or 10-hour flight, you

don't expect the technician to be called during the flight to fix something.

Mike: Yes.

Mariano: So, in this plant where I have seen the OEE higher, it is because they have the technicians and the ones that are preparing the plant under preventive maintenance to work continuously the next shifts without stopping, this is like a plane! The ones that are preparing the plane to fly over the ocean for the next 10 hours! Okay? So, this is the real best practice that I've seen around the world. In other companies they have different strategies. They say, "stopping the plant for one hour." And, of course, this is planned non-productive time so, it doesn't count for the OEE.

Mike: Sure.

Mariano: But this is one thing that pay my attention when I was visiting. It was really amazing because I'd never seen such a level of OEE.

Mike: That's a great example and, of course, I always find your travel-across-the-Atlantic example very interesting. You don't expect the technician to be called during that flight!

Mariano: Yeah, that's correct.

Mike: I have one last question for you. You've visited many universities and colleges around the world. Would you say that, let's say, technician programs at colleges, perhaps community colleges—do they talk about OEE? Do they even do this? And should they be putting it more into their courses? Into their curriculum?

Mariano: Starting with the real technical programs and their learning makes sense for the students, because otherwise they are studying topics without any context, you know what I mean?

Mike: Yes.

Mariano: So, this is one idea and the other idea which, in some countries, mainly in Europe, we are using in technical degrees or programs is this project learning base concept. That means, instead of having the teaching or the learning just divided in traditional topics, like the one I mentioned, having a real project which could be a manufacturing plant, or a machine, or a part of the plant,

or a part of the machine, whatever the sub-assembly, or whatever it is, but a multi-technology topic as a project. So that all the contents that the students have to learn are related to that particular project or challenge. So, what we have seen is that, in this case, learning outcomes, I mean the final skills that the students get after this particular way of teaching, are much related to what industry need than the traditional way of dividing the courses and topics. Of course, as you can imagine, this is a challenge for the teachers.

Mike: Yes.

Mariano: This is much more difficult to organize at the college or university level. It is much more difficult for the teachers to be coordinated, etc. But, in my opinion, it is much more effective. But this is really the challenge that we have. If we are training the future of work, I mean, we are training the future technicians, the future engineers, we need to try to reproduce the real scenarios that we have in industry as much as possible in education. And the way we traditionally teach in colleges and universities has nothing to do what is happening in industries.

Mike: Yes, yes.

Mariano: So, there is a big gap there that needs to be covered. And it's not a question of one week or even one year. It is a kind of cultural change and will take a few years. But I think sooner or later we need to start with something, because always the gap is going to be higher and higher. I don't know if you agree with that, but this is what I see.

Mike: I do. And, you know, in this project we're working on, Preparing Technicians for the Future of Work, we hope to make changes about that. And also, I wanted to thank you, too, for being a member of that Advisory Board of that project. We appreciate it very much.

Mariano: Oh, it's my pleasure.

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Mike: That concludes our interview and you heard Mariano say OEE is critical because it indicates a "return on investment." And, after all, that is what industry is looking for. In one company we heard bonuses were tied to OEE. Now, that's going to get attention! You know by now that I want you to take action after every one of these podcasts. Here's your action for today. Get yourself up to speed on OEE. Use the

resources in the show notes to increase your own knowledge, or to help you add OEE into your training and education programs. Educators, when your students enter the Workplace, make sure the acronym OEE does not faze them. That's it for today. One of the key things to measure in highly effective production organizations: O-E-E. Overall Equipment Effectiveness.

Mike: Find our podcasts on PreparingTechnicians.org, or subscribe on Apple podcasts. Our series is produced by John Chamberlain at CORD. Thank you, John. And we appreciate Mariano Carreras for joining us from Vitoria, Spain on our podcast today. Mariano is also a member of our project's industry advisory board. Thank You, Mariano. And thank you, our listeners, for Preparing Technicians for the Future of Work!

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