



## The Deloitte On Cloud Podcast

**David Linthicum, Managing Director, Chief Cloud Strategy Officer, Deloitte Consulting LLP**

**Title:** Harnessing AI and data to build the smart factory of the future

**Description:**

Manufacturers continue to respond to an increasing demand for products amid a volatile supply chain, labor shortages, and a fluctuating global economy. Improving production processes in the factory can help, but it's not the only answer. In this podcast, David Linthicum and Deloitte's Stephen Laaper talk about how companies can use AI and other cognitive tools to harness the vast streams of data collected from manufacturing operations to automate and increase safety, productivity, and quality and build the smart factory of the future.

**Duration:** 00:27:12

**David Linthicum:**

Welcome back to the On Cloud podcast. Today on the show I am joined by Stephen Laaper, and he's with The Smart Factory and is a partner at Deloitte Consulting LLP. Stephen, how you doing?

**Stephen Laaper:**

Doing great today, David. Thank you.

**David Linthicum:**

I'm excited about this because I toured The Smart Factory about four weeks ago, and I just really came out of there energized in terms of kind of how everything is being taken to the next level. Really kind of taking production to the next level and doing things in a way that is more sustainable, more energy-efficient, and more safe, and I think that's a great thing. So, give us the Stephen Laaper story. How did you come to Deloitte, and how did you end up at The Smart Factory?

**Stephen Laaper:**

Interesting. Yeah, so actually I started my career working in automotive and I was really interested in continuing to operate at that intersection of operations and technology that I was so steeped in from my early automotive experience that I branched a bit into consulting. And I really took great pleasure in being able to bring that intersection of ops and technology to a wide range of industries. Now, of course, I stepped into consulting back in 2005, and while it's always been an interesting intersection, some of those advancements in the underlying technologies really have given rise to some very, very significant impacts happening in manufacturing, really over the course of the last five, six years.

**David Linthicum:**

Yeah, it's really amazing the acceleration of innovation and the production in the factory space. So, we're moving into smart factories and dealing with cloud-based systems and more computing and AI systems, and we're going to talk about that during the show. We're getting to this thing called Industry 4.0. I'm sure some of the listeners out there, mostly cloud professionals, have heard of it but don't know exactly what it is. So, why is this important to Deloitte and why are we focusing on investing in The Smart Factory and specifically moving to the concept of Industry 4.0?

**Stephen Laaper:**

Yeah, when organizations are thinking about kind of what is their smart factory strategy, or as you point out, some of the other vernacular around that is the likes of Industry 4.0, it's really all about how you harness some of these technologies, some of these tools, some capabilities that have been there for in some cases even decades but we're able to do different things. We're able to apply artificial intelligence, cognitive tools, and others in new ways that are allowing us really, in some cases for the first time, to harness the power of all that data and information that many manufacturing operations spin off. That's really exciting because it's that connectivity and the ability to make decisions, some cases even in real time or near real time, that have very, very direct impacts on productivity, on cost measures. A lot of organizations, they use things like OEE, overall equipment effectiveness, as some of those measures of productivity. Really driving big impacts in those—in that space.

**David Linthicum:**

So, why was it important for us to model what a smart factory should be doing, and not only look at it as a concept, something that's running on a presentation, but something that physically exists, that you can overlook and actually touch and see the machines and even understand how things—how machines fail sometimes, the ability to use automation such as robotics, and understand the ups and downs of leveraging that. Can you tell me about that experience and what did you learn by setting up The Smart Factory, and what are we learning by running the thing on a daily basis?

**Stephen Laaper:**

Yeah, well David, as you point out, here at Deloitte, we made a very intentional decision to actually build our own smart factory. Now, we felt like that was a really important thing to do because oftentimes we would get questions from our clients, and they would generally say, "Hey, could you take me somewhere and show me kind of what a smart factory looks like?"

And, of course, the answer is always yes, we're able to do that. The challenge is, when you're trying to show, and explain, and demonstrate, and bring to life the power of some of these technologies in an environment that's not designed for that kind of learning, rather it's a manufacturing facility designed for high-volume production, it can be a bit difficult to really get that message across. Why? Well, safety obviously is the primary consideration, so now if you have all these different guests in your factory, you've got to really think about how to keep them safe.

Second thing is, and many manufacturing professionals listening today would know this, factories tend to be really loud, and sometimes it's really difficult to communicate in those environments and really kind of get that learning well understood. So, that right there is some of the underpinnings of why we thought, well it's important for us to establish our very own smart factory. Obviously, safety is the paramount. We very carefully selected many of the manufacturing processes that exist so that our guests are safe. We've very appropriately dialed in the right noise levels to ensure ease of communication within the factory.

And the third thing is, while we have a real functioning manufacturing line and people might be wondering what do you make there, we manufacture a STEM education kit that is then donated to different at-need communities around the US. We're currently engaged with middle schools in three different geographies where those smart rovers, those STEM education kits that we make, ultimately get distributed. So, we have this manufacturing facility that is designed around hosting guests, being able to showcase, demonstrate, and bring to life what some of these industry 4.0 and smart factory technologies are and—this is a really important part—the impact that that can have on organizations that are adopting these types of capabilities.

**David Linthicum:**

Yeah, I was considering the concept, the courage to try it. That's what kind of came to me as I was touring The Smart Factory. It's dealing in a world of everything's conceptual and dealing with architectural concepts, things like that, rarely touching hardware and software anymore, certainly where everything lives in the cloud, but in terms of The Smart Factory, you've got to be able to get in there and get dirty and try the stuff because lots of things can go right, lots of things can go wrong, and there's no way to get around learning that but other than the experience.

Now, one of the things I was reading this morning in terms of data utilization by industry out there, and not just manufacturing, but holistically within the industry, only 10 percent of the industries out there are leveraging data effectively. In other words, they're not weaponizing it correctly to make decisions and operationalize the systems, things like that. Ultimately, data plays a big role. So, how does data and information play a role in a smart factory? What about data that we're dealing with, and how are we more effective at producing goods and services by leveraging this data as a force multiplier?

**Stephen Laaper:**

Yeah, it's really probably the thing that most organizations are struggling with the most. And that 10 percent statistic that you described in terms of effectively utilizing the data doesn't shock me at all. When we think about manufacturing operations, when we think about the high frequency of data and information that can come from manufacturing equipment—our ability to scan and collect that data from PLCs, so the logic controllers that are controlling all the machines, and any additional sensors that might be added as part of an industrial internet of things platform or approach—it can be mindboggling how much data could be produced.

In our one-line factory at The Smart Factory at Wichita, from the manufacturing line and the building, as well as many of our sustainability elements, we collect over 10,000 data points at any given time. And if you just start to think about a human's ability to process all of this information and data that we're collecting and storing at various frequencies—it's not all sub-second data for sure, but it's an enormous catalog of information, the human's ability to derive meaningful answers from that is becoming increasingly difficult for two reasons.

Many organizations, the obvious answers are already known. They know that, hey, when this particular line, when this integer goes from four to five, I have this particular problem. Or hey, when I'm looking at the amperage requirements at sub-second levels out of a particular motor, when I know—when I see that crosses a certain threshold, I know that maybe I need to investigate some preventative maintenance or something on that particular motor. Those are the easy answers. Those are the ones that are well known. The challenge really for us now is the volume of data has expanded so significantly and the multivariate analysis that really comes into play.

So, we have less obvious answers, less obvious correlations, less obvious things to the human to be able to pick up, and that's where we need some of these different machine learning algorithms. Now, it's really important, and it's not to prescribe that takes the machine operators, material handlers, or the supervisors out of the process. It's actually quite the opposite of that. The thing that we see kind of creating the most impact is actually persona-based data presentation and tools.

So, let me tell you a little bit about what that might look like. You can imagine a machine operator, imagine a fairly complex machine that has not only hundreds or potentially thousands of different data points, but also has a number of different parameters that can be set and fine-tuned on this particular piece of equipment. Some of the most experienced operators may have spent decades with this piece of equipment and understand every vibration and sound and deviation and smells and all sorts of different things to determine, hey, is this operating at its peak.

But as we're finding many, many new people stepping into the workforce that maybe don't have that long history of experience with that machine, suddenly they don't have that—the benefit from all those learnings. And in this particular case, we're seeing the data being used not to make decisions automatically but rather to take that data, run it through both machine learning models to ultimately create the recommendation engine, and then recommendation engines that sit on top of that data to analyze it in real time to be able to push ideas and suggestions and recommendations back to that machine operator.

And the way that might look is, hey we noticed a deviation that looks like it's causing a reduction in throughput or potentially quality of material, and we recommend the following set point changes, A, B, or C. And it gives the machine operator the opportunity to understand both what's happening, some suggested recommendations based on data profiles, and then ultimately allows them to close the loop by selecting one of those and putting that, in this case, set point adjustments right back into the process.

So, this, David, is an example of how organizations are creating persona-based tools that are really, really focused in on helping the operator, the machine operator in this particular example, make better use of that massive amount of data coming from the equipment.

**David Linthicum:**

Yeah, and I think other industries can take lessons from this as well, and you kind of see really three concepts here. Number one, the concept of real time analytics where real time data is coming off a device or coming off a machine or coming off a production area, even coming off a human being in terms of a wearable device, things like that, and we're making instantaneous decisions based on the information. We're also gathering historical information and then making decisions on that based on just how the information exists, but what you're saying, I think, is even more important.

The ability to leverage the historical information as training data and coming up with actionable tasks that are really going to be externalized to keep us out of trouble. So, in other words, we're not going to run a motor into the ground because it's running 10 degrees over temperature, and we saw that a year ago when it ran 10 degrees over temperature throughout the day, that the motor seized up, and we understand about that action, therefore we learn about that, and therefore we're able to avoid, in some cases, \$5,000, \$10,000 motor that has to—and also a shut-down factory floor.

So, it's weaponization of data to kind of bring the most productivity out of the factory floor. And, so, when you're getting into that, we're really not talking about space age things. I mean, AI's been around—I'm 60 years old. I was an AI analyst when I got out of college. And then moving forward, the ability to store and analyze data, that's kind of old stuff. We're finally bringing this together and making these things actionable and making it operationally efficient. Am I getting that wrong?

**Stephen Laaper:**

No, I think you're exactly right. In fact, if we look at some of the data models that we use on a regular basis, a lot of the equations and the tools that we apply are, as you point out, they're not new. In fact, many of them have been around for—well, perhaps even when you were first exiting school. It's really the focused application and the ease of use that is making these much more accessible combined with—and this kind of takes us back to where we started—generally massive improvements in the cost performance of computing, data storage, bandwidth, and connectivity just to name a few. And, so, it allows us to apply those tools to many, many, many more challenges that exist in manufacturing.

**David Linthicum:**

So, another dimension to artificial intelligence systems, what I saw on the factory floor – and I'd love to get your take on this: video analysis, looking at productivity, looking at other things, in other words how the human beings are moving and how the goods are moving across the factory floor, and the

ability to kind of put eyes on the system, so not only we're gathering binary data, numeric data, data around the temperature of a machine and things like that

We're actually visibly looking at the process, in other words, how human beings are working the machines, how the machines are working the particular product, and making detections that deal with safety and deal with productivity, and really kind of take things to the next level. I was very impressed by that because I wasn't aware that technology was advanced as it was. Tell me about that.

**Stephen Laaper:**

Yeah, that's a great example of an area that is really changing the game for manufacturers. So, if we think about a camera that may be pointed trained on some part of your manufacturing operations, if we think about that as a highly sensitive and highly configurable sensor, and then on top of that video stream that comes from that camera, which by the way, that camera might be a normal kind of camera that you and I would look at a video stream from and be able to understand what that looks like. It could also be from an infrared camera, a hyperspectral camera.

There's a whole series of different video streams that could be analyzed, and that's a really important thing to think about when we imagine the possibilities here. But imagine that video stream in whatever form it comes from, from the camera, going through a series of algorithms that are able to detect different things that are happening, transpiring inside that video stream. And there's a number of quite sophisticated tools out there now that make these sorts of capabilities quite accessible. And, some of the things that organizations are doing with this combination of video stream and cognitive tools are really transforming manufacturing.

Now, many of our listeners that are familiar with manufacturing operations may actually be thinking, "Gosh I think I've seen cameras used in the manufacturing environment for quality detection," and they're right. That's not necessarily that new. There's a number of solutions out there that have matured for the last really even decade related to quality inspections, so visual inspections of parts. They can detect is something in the right place, is it missing, or is it perhaps the wrong item? Quite a bit of sophistication around that. What we're talking about here is actually quite different than that.

We're actually watching, as you pointed out, the manufacturing process. So, what can you do with that? Well, as anyone who's spent time in manufacturing well knows, safety, followed by generally the cost performance of a facility, are really the two—the number one and the number two kind of measure. Sure, there are others, and does what a particular facility do kind of fine-tune what those others are? Absolutely. But let's just look at those two examples, safety and productivity.

From a safety standpoint, organizations are using video streams that are being analyzed in real time by cognitive tools to detect slips, trips, and falls. "Has one of my employees in the field of view of this camera, have they fallen, and how do I react to that appropriately?" Similarly, in the safety realm, companies are using video streams for PPE detection. "Do the people entering—does my workforce or perhaps even visitors to a facility entering certain areas?" So, now imagine safety precluded zones that require certain PPE. "Are they in fact wearing the appropriate PPE and wearing it correctly?" So, from a safety standpoint, you can start to imagine the possibilities of how these types of tools could be used.

From a productivity standpoint, we can think about what an analysis of a video stream might look like as we think about machine uptime. Or how are the motions of an operator the most optimal in a work cell? Or are the different elements required in a manufacturing line all coming together in a sequence that allows for optimal efficiency?

This makes me think of an example of an organization not that long ago that was really trying to tackle some of their smart factory challenges, and they had a whole hall of stamping presses. So, think about this large area under one roof that has in excess of 50 stamping presses. And those stamping presses actually—they were all fairly aged equipment, worked generally well, all fully depreciated, and they knew that they could get more productivity out of this equipment, but the challenge they had is that the cost to outfit 50-plus machines with modern control systems, or even just modern sensor systems that would allow them to collect data was actually quite cost prohibitive.

Instead, they used video analytics by deploying relatively inexpensive cameras to watch the performance of a stamping press and be able to infer all sorts of data points, actually create the data that would go into a record that would allow it to be analyzed in a sub-second kind of way, actually create all the performance data based on this video stream that was being analyzed by cognitive algorithms.

In the end, they chose to deploy this at scale and ultimately were able to create a video analytic solution, so a solution that had no physical interface to the machine to be able to create all the productivity data. They could very quickly determine, "Hey, is the machine up, is it down? What rate is the machine running? Is the machine starved for material? Is there a maintenance issue?"

This was fascinating for them and transformed their productivity because now they could very quickly direct teams to the area of highest need. It also provided them a pretty cool capability, that if one of the machine operators, or a production supervisor, wanted to show an engineer something that had happened that caused some downtime or caused a failure in manufacturing, they could now refer back to the video and actually show them, "Hey, here's what happened in the machine at the moment of failure." So, a really cool side effect that wasn't initially kind of formulated in the plan but turned out to be quite impactful for how they communicate with other parts of the organization.

**David Linthicum:**

Yeah, it's fascinating. I think visibility into AI-based systems and the ability to react to these things and make these processes, allowing computers to finally see—they could always see but not as well as they can right now, and doing more with the information. So, say we're going to hop in a time machine, we're going to go forward five years, ten years, what does a smart factory look like? What are we going to be talking about on that podcast?

**Stephen Laaper:**

Yeah, I love the idea of thinking about that. Well, here's the first thing I'd say. People often think that a modern smart factory is like a lights-out facility. And are there some facilities that have that type of characteristic? Yes, there are. And will we see more of those five years from now than we do today? I would say the jury's still out. Here's what I can say is even in lights-out facilities, it's really, really important for us to think about what the future talent looks like that's going to power a smart factory. We see, amongst a whole variety of different technical solutions and automations, we see labor profiles changing.

They're shifting. Organizations are still looking for high-talent individuals in the manufacturing space, and, in fact, we see that as actually one of the largest challenges for organizations.

A challenge they face today very acutely, as COVID has exacerbated a number of talent challenges for manufacturers, but it's also going to be a big challenge for them in the future. So, if we're wondering, "Gosh, are there going to still be people in our factory five years from now?" The answer is absolutely yes. It's incumbent upon organizations to be very thoughtful about what that profile of individuals is and how to make sure that they are training and cultivating those individuals today.

I think the other thing that we're going to note, David, is that the use of data and information is going to continue to really almost explode exponentially. We're going to see new sensors, much in how I described the camera as maybe a more sophisticated configurable sensor. We're going to see more and more data being generated and processed out of manufacturing facilities, and that's really important because it also points us to, hey, we're going to need more individuals—kind of back to talent here—that understand how to establish those systems, how to utilize those systems, and ultimately, as I mentioned earlier, kind of close the loop on decisions and insights that are coming from that data and putting them in action in the manufacturing environment.

**David Linthicum:**

Yeah, I'm looking forward to these smarter, better, cleaner, safer factories that are coming our way, including replicating the smart factory that you have out in Wichita. So, where can we find out more about The Smart Factory and yourself online?

**Stephen Laaper:**

Yeah, I think a variety of different places to go, but probably the easiest one to get started is—it's actually our smart factory website. So, we've created a special website just for The Smart Factory at Wichita. It can be found at [thesmartfactory.io](https://thesmartfactory.io). So, again, that was [thesmartfactory.io](https://thesmartfactory.io). And there you can learn all about The Smart Factory that's located on the Innovation Campus of Wichita State University. You can learn all about the ecosystem that we've built out there. I think, David, it's important to note that really to bring these different types of capabilities to life, it does take an ecosystem, so we've got a lot of exciting partners with us on this journey, so folks can learn a little bit more about that and how we are leveraging some of the technology disruption that our ecosystem brings.

They'll also learn a little bit more about the sustainability aspects of smart factory and smart manufacturing. And perhaps that's even one of those elements that as we think about five years from now what we're going to see, much, much, much increased focus on sustainability. The Smart Factory at Wichita, for example, we've got over 400 sustainability assets that take the form of solar panels, we have wind trees to collect the breeze, which at times in Wichita can turn into a howl, and turn that into energy which we store onsite in a battery and ultimately consume during peak periods. So, that's one of the things you're going to find on the website.

And you're also going to learn a little bit about our philanthropic mission. I did mention those STEM education kits that we manufacture and distribute from The Smart Factory at Wichita. So, that's the best place to start for The Smart Factory. And if anybody would like to connect with me, or learn a little bit more about my background, I would suggest that LinkedIn is the best place to find me. Somewhat unique last name, Laaper, L-A-A-P-E-R, and that's Stephen at Deloitte.

**David Linthicum:**

Yeah, check it out. It's a very impressive place. I'm looking forward to revisiting The Smart Factory sometime soon. I was just—I couldn't even consume all the information and the learning that you guys had to share that day, so I'd love to get back and just kind of do a follow-up. So, if you enjoyed this podcast, make sure to like us, rate us, and subscribe. You can also check out our past episodes, including those hosted by my good friend Mike Kavis. Find out more at [deloittecloudpodcast.com](https://deloittecloudpodcast.com). And if you'd like to contact me directly, you can e-mail me at [dlinthicum@deloitte.com](mailto:dlinthicum@deloitte.com). So, until next time, best of luck on your cloud journey. Everybody stay safe. Cheers.

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