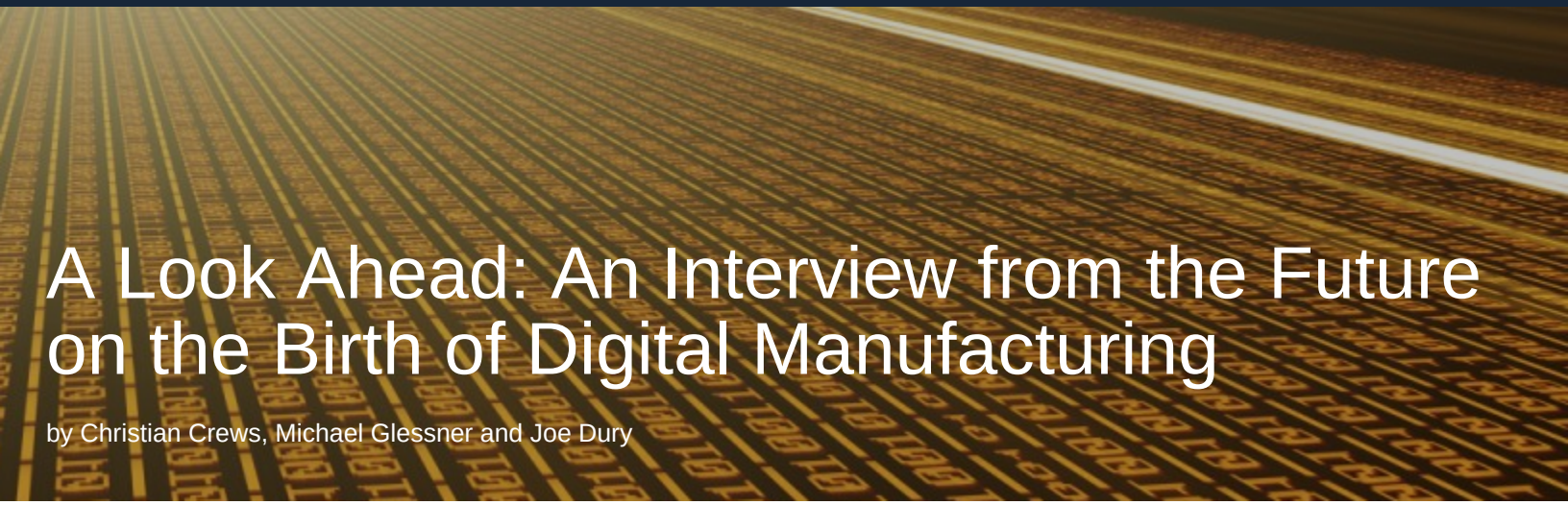

A Look Ahead: An Interview from the Future on the Birth of Digital Manufacturing

by Christian Crews, Michael Glessner and Joe Dury

> To understand what digital manufacturing really means for industrial manufacturers, and how it might evolve from where we are today, here's our peek into the future. All people, company and product names (except ours) are fictitious.

January 19, 2026

Viewpoints on Innovation (VoI) interviews Connor Smith, the Chief Digital Manufacturing Officer (CDMO) for Entity X, the U.S.'s hottest manufacturing company. Over the last ten years, he's helped Entity X go from an old-line fabrication plant serving the automotive industry in Detroit to a multi-billion-dollar company producing relevant, connected hard goods for both businesses and consumers.

VoI: As we sit here today in 2026, can you share with us what you found when you arrived at E-X ten years ago back in 2016?

CS: Well, I walked into a small but very capable fabrication plant making components for the auto industry. We had very smart and dedicated people, but were really beholden to a few big customers. We had first rate equipment, and were known for being able to hit our deadlines for delivery of new designs.

VoI: What started the shift into what E-X is now?

CS: Let's remember what it was like ten years ago. The Internet of Things (IoT) was still in its early stages. The ideas were there but the cost was still dropping. And the cloud was in its infancy. We can say that now. I think 10 years ago we would have said the cloud was pretty far along. But we had no idea how the cloud would evolve into what it is today. We had the Internet for 10 years before social media platforms came and completely redefined what the Internet meant. So back in 2016 we could only imagine what the combination of the cloud and IOT would do for data and information storage. This evolved into a system of systems, easily connecting disparate data streams into useful information and revolutionizing innovation and production of products. Smart use of data has become the key.

Let me share an example: In 2016, simulation was firmly embedded in design, but we were at the beginning of being able to simulate people and how they interact with products – something we take for granted now. I would say now that social media has evolved into connected business, and the old platforms like Twitter and Facebook are now the bones and sinews linking together the new environment of ambient intelligence. This "internet of services" provides enormous data on how our products are used in

the field, helping us make them better even after release to the market and create new products that build upon this constant learning.

The E-X CEO Jen Mayor saw these elements as the start of something that could allow the company to shift its business model a bit. Millennials were forming families and settling down, really entering the prime age of consumption. But they still valued connectedness and had an open and flexible view of privacy. When she considered the immense amount of data being generated combined with E-X's internal capabilities of fast fab, she realized we could use that data and build a smart, fast, consumer-facing business supplying relevant, connected hard goods to a new market. At the same time, we could serve our business customers with parts and sub-assemblies embedded with sensors to enable their own smart products and reap the same rewards.

Vol: And Cloud Baby was born…

CS: For these Millennials, we wanted our first product to serve their most pressing need. Their babies didn't have Facebook pages; they weren't connected or online. If they were in day care you'd have to get a caregiver to tell you how their day was. That was clearly unacceptable for Millennial parents! Cloud Baby was a piece of hardware that started as a simple tracker to connect parents to critical information about their kids - heart rate, body temperature, diaper condition, etc. We expanded to include a streaming camera, control over the environment, and Wi-Fi communication with a nearby care-giver or spouse. We could deliver updates over the air and dramatically change the device's functions and capabilities, and parents could choose what services they wanted. From there we expanded into a whole line of connected cloud goods for Millennial parents.

Vol: But how? A lot of companies had good ideas like that. How did you guys come up with those ideas, and how did you know which would work?

CS: We had a strong focus on innovation, and paid attention to the data as it poured in. We realized that as more things became connected to the cloud, that the impact on product ideation, design, and manufacturing would be enormous. You have to remember that in 2016, our feedback on products came from warranty cards and people complaining to customer service or through Twitter! When the product left our factory, manufacturing was done and in many cases the entire enterprise thought the same. With cloud-enabled connectivity, manufacturing's involvement with the product continues at a very fundamental level. Suddenly we had data on where our products were used, how they were used, how often and for what. So manufacturing continued to learn how to improve the product long after it shipped. We could institute design changes for quality adjustments or cost reductions if use in the field was different than expected, and we could apply these learnings to the new products coming down the line. We could even push software updates out to our deployed products to quickly solve problems in the field.

William Gibson, the Science Fiction novelist, has a famous quote that the street finds its own uses for things. And having a connected device showed us that. On the consumer side, our customers were using our devices for all sorts of things we hadn't thought of. People were using Cloud Baby as bicycle security devices! We turned those uses into new app updates available in the cloud, or entirely new products we could simulate. Since it was on-demand, we were only paying for a few days of simulation time for initial testing of each new product idea. Then we'd 3D print to test a physical version and send data straight to the factory floor from the 3D print file. Any problem with how it was used in the field was instantly communicated back to the development team and design changes were almost instantaneous.

Vol: E-X's track record on new products is remarkable, can you share any insights about why this is?

CS: When I joined in 2016, we initially had all this data and no way to make sense of it. Bringing in the capacity to analyze the data and turn it into actionable intelligence was the first step. And we soon realized that fast fab meant we didn't have to do a year of analysis; we could put some prototypes out there, get the data on how they were being used, and quickly adapt. It meant a little more work done on the front end in digital modeling before the physical prototype. Also, we were sharing our work real-time with suppliers, so we were getting predictive costing and updates from suppliers based on assembly line data and performance in the field. Sometimes they would see and correct a failing part at the factory before we even contacted them! So we soon saw the benefits of a truly connected supply chain all the way down to the production environment. All of this helped –

and continues to help – continuously improve our products.

VoI: But you still had to have the capability to do it in a way that was cost effective, something a lot of companies struggle with.

CS: When I started in manufacturing, we had in-house product lifecycle management (PLM) systems that smoothed the process of getting a new product out the door. PLM enabled all the product information to stay together from the time the product was designed to when it left the building. But we needed a lot more. Company policy and government regulations required traceability back to source for all parts and ingredients, along with carbon footprint or other sustainability information. And now we had PLM extending out to the product's life in the marketplace – on the shelf at the retailer, in the online fulfillment center, and during shipment to the customer. There was data around the entire life of the product while it was in use, including service updates and information on end-of-life recycling. This is fine if the products were staying fairly static, but with the added requirement to constantly update existing products in the field and churn out entirely new ones, PLM needed to integrate into a larger innovation platform covering a broader scope of data.

VoI: What did that mean at the plant level? Your traditional factory had to change as well, right?

CS: Yes, there's no doubt we benefited from taking advantage of the new digital factory. We started with democratizing the data. A networked data model, rather than a hierarchical model, meant the use of the data was not confined to one application or structure. Users could design the structure "fit to purpose." This meant all parts of the organization had access to all the data we had, from internal design and production data to external feedback from the marketplace. They found many creative and valuable new uses for that data, too – more than we could have thought possible!

It wasn't magic – there was a lot of work done to create standards to manage the transition as we matured and progressed through our plan. There was a lot of organizational change management. But some of that was removing processes and standards, not adding them. Content was reused, which reduced all the documentation involved, such as work instructions, training, and technical specifications. This eased the transition and made things less complex for the workforce to adopt the new way of working.

From there we could use the digital factory not just to optimize our products, but to optimize the plant itself. Again we allowed the data and information to tell us the way. We could simulate everything from environmental aspects like humidity to how a design change could impact production schedules and costs, or the impact of switching to a new supplier for a key part. Since the data was networked and unstructured, we could use data models and predictive analytics to find answers to complex production problems that had many contributing factors, creating seemingly random defects.

With today's new era of digital manufacturing, we have an innovation platform; a system of systems supported in the cloud. We are now at a place where the product influences how it is built as it is built. That's pretty amazing. PLM systems now have to integrate across a wide range of other systems, and store and track product data in a much wider sea of information.

VoI: How did your plant workers at the traditional fab plant embrace this new world?

CS: There were certainly some organizational change management issues and these had to happen. All of a sudden the products were talking to them as they were being manufactured. Cloud-based PLM was flexible, but did require some training of the workforce both in manufacturing and engineering as well. We invested in hybrid systems that we could customize to fit our needs when necessary. The intelligence of today's products is getting truly amazing – they tell us when they are built incorrectly or something isn't working right. Testing is no longer a separate activity; instead it is baked into the product itself. The synergy we see between operations and engineering has been amazing and it started by staying focused on the product and the data it was giving us about the use in the market.

VoI: I hear it's all fun and games there now…

CS: You are referring to our gamification platform. For our baby and parenting products, we used the motivation and structure of video games, something Millennials knew very well, to help them learn about and use the products to the fullest. We used the same thing for training and work on the line at the plant.

Today, we have dashboards tracking all of our production, from idea generation through to product shipping. It allows for self-directed work teams, and encourages collaboration across functions. The work can be fluid, allowing people to come together around problems and organize through capabilities. Our product designers don't really "work" anymore; they come in and play a game together. You own your score, so it's up to you to optimize and own the processes that contribute to the score. Artificial Intelligence always wins, of course.

VoI: Yes, you were one of the first to have algorithms take a leadership role.

CS: It's not appropriate for everything, but there are places where artificial intelligence can do a great job. Some of our employees have had to get used to working on projects run by AI's. It frees our people up to deal with the exceptions and the problems, or to dream up new solutions for our customers.

VoI: Any last thoughts?

CS: This is the way the world is now. There is no part of the market that is safe from being a part of connected businesses. Even our B2B products are feeling it, as we supply our sub-assemblies to companies going through the same thing with the same needs in terms of connectivity, speed to market, and ongoing real-time changes on the factory floor. The traditional coal face isn't the front lines of where work gets done anymore: today the front lines are a digitally connected block of silicon enabling data that's changing every second.

Digital manufacturing is here. Get all your data into the cloud, use a cloud-based innovation platform that connects your PLM with best in class systems to handle the process from ideation to end-of-life, customize where you need to and invest in organizational change management for your people. This will give the organization a learning method to supply products that really meet the customers' needs and wants!

More Reading

Harnessing the Power of Big Data for Digital Manufacturing

Two Ways IoT is Disrupting (and Helping) the Manufacturing Process

The Manufacturing Executive's Primer on Digital Innovation

Originally published on January 20th, 2016

What's your view? Add your question or comment

Christian Crews

christian.crews@kalypso.com

As the global Foresight practice lead for Kalypso, Christian works with clients to use the future to deliver better results from innovation.

Michael Glessner

michael.glessner@kalypso.com

Michael is a Director with Kalypso. His areas of expertise include new