

Overcoming Barriers

Depending on who you ask, the Industrial Internet of Things is growing more slowly than anyone predicted. Why is that, and what does that mean for the gear manufacturing industry?

Alex Cannella, Associate News Editor

IIoT, Industry 4.0, whatever you want to call it: Ever since it came onto the scene, the Industrial Internet of Things was supposed to be the next big advance in manufacturing technology. Even from the start, it was hailed as the Fourth Industrial Revolution, and accordingly with that name, was supposed to completely upend how we did business. That's how it got its slightly more marketing-savvy Industry 4.0 moniker in Europe, after all.

And here's the thing: IIoT technology does have the power to be everything it's been promised to be and more. But the future that many, myself included, have been hailing as just around the corner for a few years now is...very much still somewhere around that corner. Massive industry shifts such as the one that would be predicated by IIoT advances don't happen instantaneously, but the more I talk to people about how this particular field is advancing, the more mixed the signals I get, and the critical point always revolves around one thing: adoption rates.

Before anyone starts thinking it's all doom and gloom, it's not. Depending on who you ask, IIoT is a booming business that's expanding just fine. Governmental push from multiple coun-

happening relatively slowly.”

So what are those factors that need to come together? What's slowing IIoT down from being the juggernaut of industry everyone thought it would be?

Part of it is a lack of infrastructure and the industry's still-fledgeling state, part of it is a lack of skilled talent, and part of it is baked into IIoT's very nature as a more forward-looking, long-term technology with comparatively fewer upfront benefits. Those first two are understandable speed bumps for any bold new endeavor that has yet to be widely adopted, and the third makes sense the moment you look at how most businesses are actually run. From energy efficiency to the benefits IIoT promises, delayed gratitude and profits stemming from savings over time are both tough sells for a business world run on year-over-year profits and shareholders expecting a return on their investments.

The easiest to talk about is the infrastructure issue, or namely, as Kulkarni put it, the need to set up the foundation to make IIoT “scalable, secure, and future proof.”

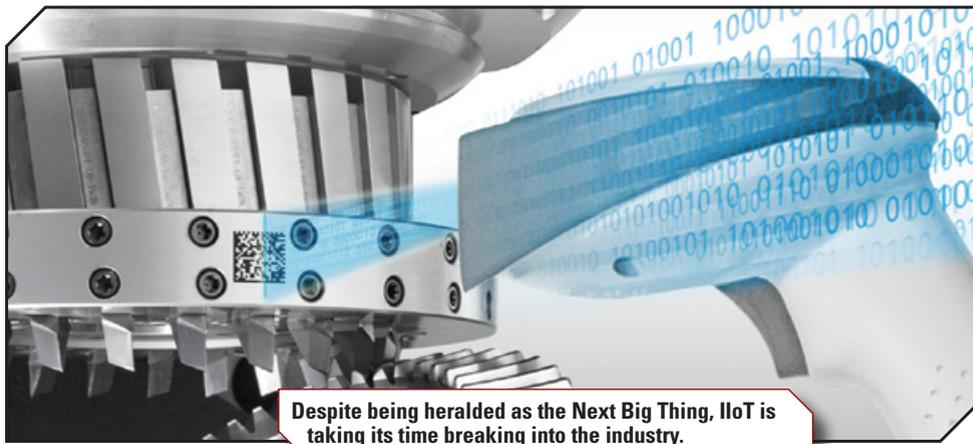
“The ability of companies to do this is quite often limited considering the challenges in developing IIoT solutions – long pilots, value based pricing, long/risky implementation cycles, vendor lock-in/high switching costs,” Kulkarni said. “On the other hand, the lack of vision and roadmap of future use cases makes the return of the initial investment dependent on only a few initial IIoT use cases. This makes it a barrier to get going on the right infrastructure investments.”

That issue is particularly poignant in our gear industry, where some feel that those limited use cases don't always cover the

specific pain points that might bring value to your average manufacturer.

Though not in the same words, Daniel Meuris, engineering director for digitization and virtualization for Klingelberg GmbH, echoed that sentiment. That lack of vision and dearth of case studies make actually showing off the benefits of IIoT to would-be users a challenge.

“Until now, if you look at the market of IoT solutions, then many solutions exist because there's technology that makes it possible, but there's not a real value that is delivered,” Meuris said. “So you have these MES systems and big data approaches and machine learning and all this stuff, but really the value that makes your production more efficient, especially in the gearing



Despite being heralded as the Next Big Thing, IIoT is taking its time breaking into the industry.

tries, including here in the U.S., all but ensures that the field will continue to grow and most market forecasts are plenty optimistic. IIoT as a field doesn't look like it's at much risk of failing.

But bring the topic up at a trade show, and you might be surprised by how many manufacturers have cooler expectations compared to those forecasts. That's not to say that IIoT isn't growing — just that it isn't the sweeping revolution everyone speculated it would be, or at least not yet.

“In general, IIoT has not spread with the speed that a lot of people had expected it to catch on everywhere in the world,” Rakesh Kulkarni, director of digital manufacturing solutions at Gleason Corporation, said. “There are a number of factors that need to come together to make IIoT successful, and we see that

world, is hard to find. Companies are waiting for the suppliers to give us something that gives us value and makes us more efficient, but this proof is still missing to a certain amount for many solutions.”

The challenge, according to Meuris, largely stems from the gearing industry’s specific local concerns. As with most any sweeping change, the high level theoretical benefits IIoT brings are easy to list off. Prime among them is the fact that digital twins and other solutions provide unprecedented transparency into your own manufacturing line, which in turn allows manufacturers to make all kinds of corrections to their production to improve both quality and efficiency. Getting noisy gears? Go backwards through your process one step at a time until you find the reason and you can solve the problem. Want to change your cutting process to something more efficient? Trace the consequences of how that will affect your gears with a digital twin. In this matter, Kulkarni and Meuris agree.

“One of the most important parts of IIoT technology that U.S. manufacturers like is their ability to make better data driven decisions in their plants with IIoT,” Kulkarni said. “In the past, there were a lot of black boxes in the plant that were not fully understood and led to suboptimal decisions. With IIoT, one is able to connect key metrics in the plants to root causes, solve those problems and see their effects at the plant level.”

“There are many dependencies in this long process chain,” Meuris said. “The only way to get transparency of all these dependencies is to use digital technology.”

However, according to Meuris, it’s also necessary to look at specific applications in different industries. IIoT can promise plenty in the abstract, high-level sense, but you still need to investigate how to apply it to each local industry, and in gear manufacturing’s case, IIoT technology still hasn’t quite reached out to make that connection.

In some cases, as with smart tooling, that connection’s beginning to form, but according to Meuris, this is largely because the tech is concrete. It’s easy to show off. The lion’s share of IIoT solutions don’t have that benefit.

“There are other topics like this whole big data stuff and machine status analytics,” Meuris said. “This is not so concrete. Of course, they are still very interested in it, but we need to walk some steps to get this final value that we can deliver that makes it easy to explain to customers. That’s still a challenge.”

This, in turn, connects the issue of the industry’s nascent infrastructure with both of IIoT’s other roadblocks, the first being the more long-term, esoteric benefits of most IIoT solutions. As Kulkarni noted, many of IIoT’s most powerful advances have a long gestation period or require substantial up-front effort before they start realizing any of their promised returns. Pair that with the lack of concrete case studies, and you sometimes have an uphill battle convincing a manufacturer that fields like, say, big data analytics will give them a better return on investment when they could allocate that money on a newer, more efficient gear grinding machine with demonstrable returns.

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intelligence can be applied effectively in companies,” Kulkarni said. “AI typically needs rich data to be able to analyze it and provide valuable insights. In the short term, this data may not be available and the value from some of the use cases do not get easily extracted.”

Then there’s the final roadblock: skilled talent. That’s an endemic issue that’s faced the gear industry specifically for years. But more specifically, according to Meuris, there need to be more people reaching across that gap. Tying back into IIoT’s need to focus on individual industries, Meuris believes that the gearing industry needs, at bare minimum, more communication between gearing specialists that can trade their industry-specific knowhow with software specialists that develop the actual IIoT products that can help that industry.

“With IoT solutions, if you talk to [customers], we could talk for five months and both have a different idea of what we’re talking about. You really need to bring something on the screen or give somebody a mouse to click something, and then you can start talking and...come to an iterative solution.”

According to Kulkarni, this is specifically important for predictive maintenance solutions, one of IIoT’s most important cornerstones, and also one of the solutions with the longest arm to translate into benefits.

“Although manufacturers struggle to reach to predictive maintenance in early stages of their IIoT journey, it is important to develop the data monitoring and storage capabilities to make use of human knowledge in this stage,” Kulkarni said. “So in these early stages, manufacturers are using the domain knowledge gained by experts and combine it with the data collected to get to valuable insights.”

Bridging the Gap

So how does the IIoT industry overcome these barriers? For Kulkarni and Gleason, it’s all about breaking adoption down into steps, first providing more upfront value before graduating to more long term, data-hungry solutions.

“This is a digital journey,” Kulkarni said. “And we have broken it down into phases where we are developing offerings for short term along with the infrastructure for long term benefits.”

As an example, Gleason is developing a new predictive maintenance solution they’ve dubbed Gleason *Fingerprint*. *Fingerprint* is designed specifically to tackle one of those critical infrastructure problems that IIoT faces: Predictive maintenance requires a vast stream of existing data in order to work. And that’s data that a company wouldn’t have if it hasn’t jumped onto the IIoT bandwagon yet.

“IIoT products today monitor and visualize signals from the machines without a proper reference,” Kulkarni said. “The challenge is the amount of data that gets monitored is limited in duration and [has] a lot of noises within it.”

Without reams of already recorded data, an AI algorithm will struggle with that noise — variables in the process such as different tooling, job settings, and so on. But according to Kulkarni, the data itself can also be just as difficult for a flesh

and blood person to parse.

So *Fingerprint* tries to make up the difference with its own prepackaged data. Before a new machine is shipped to the customer, this software takes a “*Master Fingerprint*,” essentially a dry run of one machine cycle. And for every test after that, the *Master Fingerprint* is held up as a control group to compare the machine’s current parameters against. And through this method, any drift in the machine’s parameters over time can be detected and diagnosed from there, giving advance warning on when a machine might be in need of repair or getting long in the tooth.

Fingerprint’s main selling point is its ability to provide a preventive maintenance solution, but it also combats two of IIoT’s woes. It gives the user something concrete they can hold up next to any data they generate while also handily solving one of IIoT’s main stumbling points by providing immediate benefit for a solution that formerly took far more work and time to achieve.

“*Fingerprint* can generate an accurate analysis in far less time, with a fraction of the cost and effort, and without requiring a



The Gear Engine is part of Klingelberg’s ongoing efforts to tackle IIoT’s growing pains.

skilled technician as the first step,” Kulkarni said. “Ultimately, checking on the machine’s status, performing self-checks, and recommending actions can all be done proactively.”

Klingelberg has their own similar product in the *Machine Status Analyzer*, a condition monitoring program that works by first recording a test run of a job without the workpiece, then using that data to monitor the actual cutting process and check for errors. While older and more concerned with specific manufacturing jobs than preventative maintenance across a machine’s full lifetime, the product draws some striking similarities, and according to Meuris, it’s just the start of a longer strategy.

Central to that ongoing strategy is an effort to bridge that talent gap, and they’ve started that process at home with their own company. The hope is that by getting the gearing experts in the company talking with their software side, Klingelberg can tailor its IIoT solutions to what the gear manufacturing industry needs.

“If our guys here know nearly everything about bevel gears, and they say ‘this thing, you really can solve a customer’s problem,’ and we can also put that into software, that’s our

approach,” Meuris said. “That’s the best we can do.”

Doing so tackles the issue of a lack of case studies. But instead of just producing more concrete and numerous case studies to try and sway gear manufacturers to use already-established solutions, this method works in reverse, instead looking for pain points the industry is suffering from that Klingelberg can specifically build IIoT solutions around solving.

And in order to support this effort, another component of Klingelberg’s strategy is to focus on responsiveness and become more “agile,” to basically iterate faster and start a project as a bare functional, more open-ended prototype, then fill in and finalize the details based on customer feedback to those early ideas.

“If you look at software solutions today in the production field, they are really slow,” Meuris said. “And with this gear engine approach, we really try to change this. We really try to bring on a solution where we can really be agile, so if customers have ideas and want to have changes on this platform, that we are really able to deliver fast. That’s a core idea.”

More advances are doubtless to come, but the most recent fruits of this strategy are Klingelberg’s *Gear Engine Platform*, which is essentially their centralized software suite that allows them to easily provide new programs and updates to existing machines, and some smart tooling solutions.

What Does This Mean For Us?

But all of this has been a lot of talk about the trials and tribulations that IIoT’s sellers face, and not as much about what it all means for the gear industry, the buyers in this equation. One IIoT vendor’s roadblock is another gear manufacturer’s excuse for not being interested.

But frankly, the reason to care is the same as it’s ever been: IIoT still remains a technology that could potentially do everything it’s promised and completely overhaul how we manufacture everything from phones to cars to, yes, even gears. And right now, that technology is a bit of a hard sell thanks to its nascent state — certainly harder than anyone in the IIoT industry expected it would be — but that’s probably going to change over time.

While there are still plenty of stumbling blocks that IIoT needs to clear before it can become the revolutionary force it envisions itself as, those issues are being targeted and whittled down one after another. As each kink in the system gets worked out, IIoT is going to become an increasingly attractive and, more importantly, accessible product to consider buying. And even if you aren’t in the market for an IIoT solution today, it’s worth asking yourself: at what point would you be? As the industry continues to work to broaden its appeal, we might reach that point sooner than you think. ⚙️

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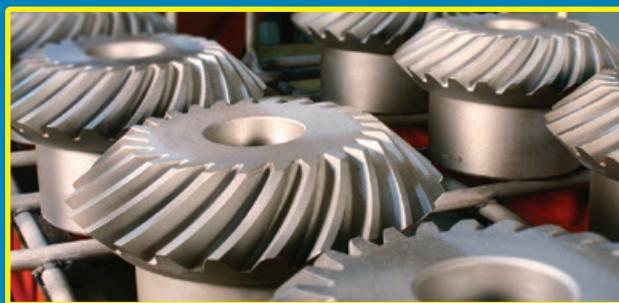
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