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Manufacturing's missing link: **the need for real-time data and analytics**

How connecting factory floor machinery with IT infrastructure leads to innovation, efficiency and improved productivity.

CIO

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INDUSTRY 4.0, frequently called the Fourth Industrial Revolution, is driving the digitization of manufacturing operations. For much of the past decade, manufacturers have been leveraging the following four categories of technology to exploit the full potential of digitization: connectivity and computing power, data analytics, advanced robotics and advanced technologies such as additive manufacturing and nanoparticles.

Industry-wide disruption caused by additional trends has made the case for this kind of digital transformation increasingly powerful. These sources of disruption include rapidly changing behavior among consumers and supply chain dislocation triggered by the pandemic and deglobalization.

Our research shows that most manufacturers are intent upon far-reaching change. However, the future of manufacturing relies on something fundamental: the ability to automate and analyze data generated by machines on the factory floor, preferably in real time.

How well are manufacturers collecting, integrating and managing the data that enables improved productivity and fosters operational agility? How do they feel about the benefits of doing so? How do they think about the obstacles that lie in their way?

To address these questions, SoftServe partnered with Foundry in late 2022 to run qualitative and quantitative research studies among senior decision-makers within manufacturing companies of varying sizes in North America and Europe. This white paper summarizes the findings of our research.

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The long road to automated data collection

Factories of the future will depend on three key capabilities, each extending the gains created by the others:

- **automated real-time collection of data from machines on the factory floor**
- **the ability to understand and act upon this data using analytics**
- **using digital twins and simulations to run "what if" scenarios that optimize quality, performance and availability**

Our research suggests that manufacturers vary widely in terms of their ability to address the first of these requirements: the need to capture real-time overall equipment effectiveness (OEE) data. Asked to score their organization's ability to measure overall OEE, 42% described it as 'strong', 43% as 'acceptable' and 15% as 'weak'.

At one extreme, automated data collection and ingestion is no longer a problem for a minority of respondents. In these organizations, attention has moved on to more challenging tasks, including analytics and scenario planning based upon digital twin technology. In the interviews that accompanied our quantitative research survey, one respondent in this group, the Director of operations technology at a European manufacturing giant with $135bn in revenue, described their organization's situation as follows:

'Previously, we had 40 workers on an assembly line. Our new plants based in Germany are so highly automated that a single person can also handle the assembly line, working with an automation engineer, an assembly line operator and a co-worker'.

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At the other extreme, in the absence of integrated data flows, 22% of larger manufacturers – and 63% of smaller manufacturers – rely partly or entirely on manual OEE records. Typically, when a machine goes offline, this requires operators to record the time lost and the explanation for it on a notepad or user device, before uploading the same information later into an OEE spreadsheet.

Measuring OEE in this way is often error-prone, leading to incorrect diagnoses and delays in taking remedial action. Guy Merritt, Vice President of Solutions and Consulting at SoftServe, describes the results as 'only a feel-good exercise. You're dealing in the past. It's historical data because the data is old. If you really want to get value out of OEE, you've got to automate data collection'.

'In addition, you are spending 80% of the time collecting data, and only 20% analyzing it. Automating OEE reverses that. Manufacturers need to spend 20% of their effort collecting the data, and 80% analyzing it'.

Yet automation is undoubtedly taking root. Overall, 93% of respondents had embarked on the journey with 63% saying data capture is 'somewhat' or 'mostly' automated. In the interviews that accompanied our quantitative research, one of these respondents described the struggle to achieve automation:

'I see this as a journey. The first thing, which a lot of companies are struggling [with] right now, is to at least make sure that there is a good connectivity with your machines and your back-end data... I think we have been able to do it. We [now] have very good connectivity with our machines, which can then become a basis for measuring operational efficiencies and doing some analytics'.

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Nevertheless, there are signs that organizations in the early stages of automating production underestimate the importance of specific actions. For example, when asked to rank their organization's top priorities, more respondents identified the need to physically upgrade equipment to connect with IT infrastructure than anything else (53%). However, substantially fewer identified the need to leverage field data to improve quality (36%) or to converge IT and OT software and data (27%). Findings like these suggest that an industry-wide educational effort is required to accelerate the shift toward data-driven manufacturing.

The next challenge: analytics

Once manufacturers have automated the data capture process, their focus shifts to using analytics tools to interpret it. Ultimately, this path leads to deployment of AI and machine learning and the ideal of a self-optimizing assembly line. Just as often, the initial shift to detailed analytics is prompted by more basic needs. One interviewee describes a classic scenario:

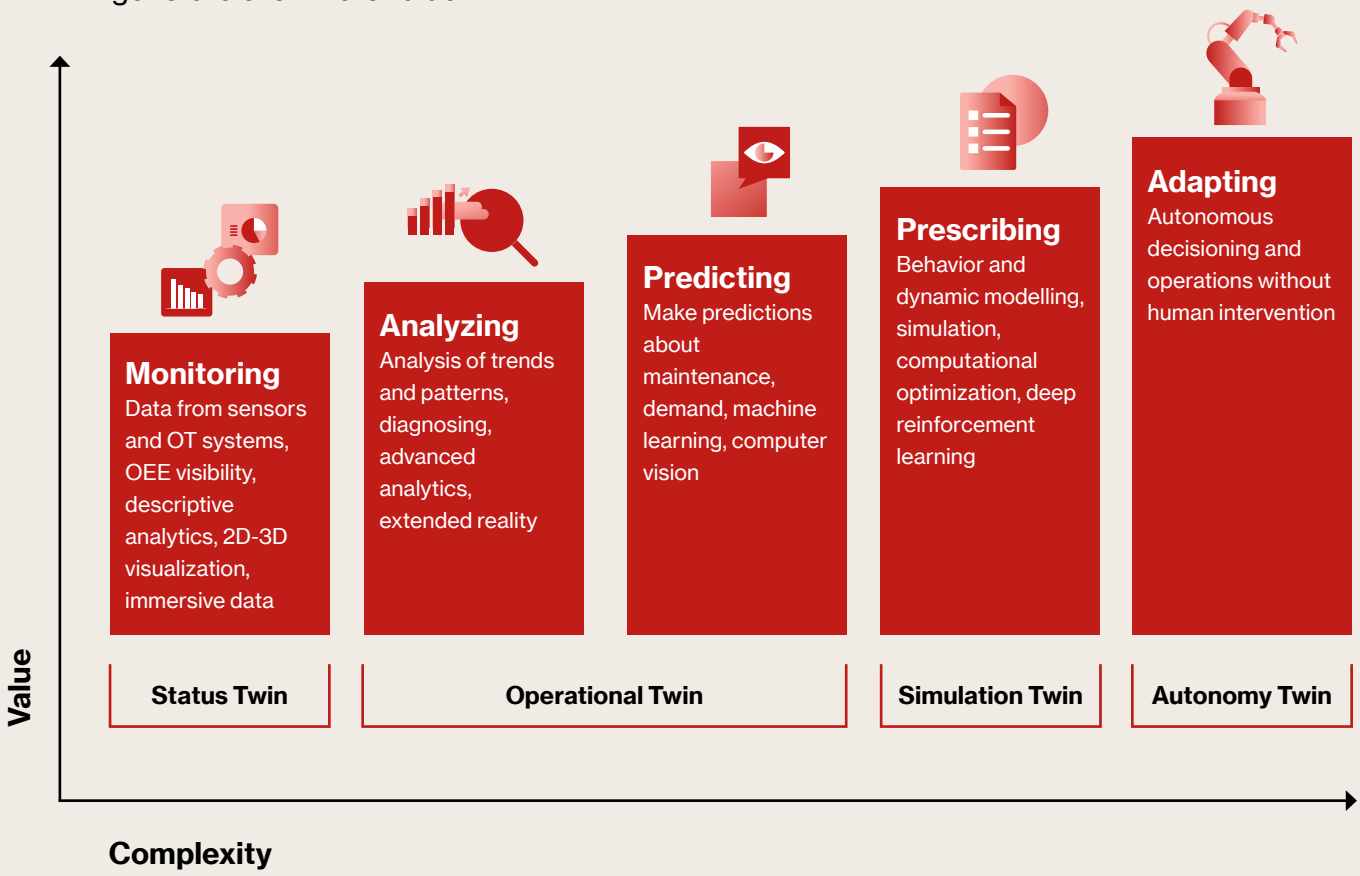
'The reason I was hired is there was a big ramp-up of production here in the US. It was not going well. . . I knew we needed to implement this [analytics]. The business was not performing at the level that it should, and nobody could really say why'.

However, many manufacturers encounter barriers to implementing analytics. The most obvious is absent connectivity ('interface doesn't allow data extraction', 'equipment doesn't have data interface', 'not enough APIs'). In all, 38% told us that they simply don't have access to real-time data.

When it comes to the job of analytics itself, the biggest specific barriers are a lack of tools to process data (cited by 30%) and a lack of expertise within the company (29%). Overall, 34% told us that they lack dashboard tools to contextualize analytics data. A further 49% indicated that the 'way the data is presented makes it difficult to interpret'.

Digital Twins Spectrum

Here is an extended view on digital twin taxonomy to help match industrial needs with appropriate solutions. It is represented as an evolutionary step-by-step approach from foundational to more complex scenarios that can generate even more value:



SOURCE: https://info.softserveinc.com/the-rise-of-digital-twins

Behind this, the research offers glimpses into widespread sources of frustration ('process is too slow', 'inability to view data in real time'). One in particular stands out: for 25% of respondents, the biggest single barrier to OEE data analysis is 'inertia from senior management'.

Advanced data use cases: simulations & digital twin technology

The digitalization and virtualization of physical assets, combined with the rise of the cloud and AI, has created the possibility of using digital

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twin technology to create 'what-if' simulations in industries including manufacturing, transportation, energy, mining and life sciences. Digital twin technology enables organizations to predict patterns of demand and schedules for maintenance, and to prescribe optimization strategies in dynamic circumstances. Ultimately, digital twin technology enables autonomous decision-making without human intervention on the factory floor.

Around half of the organizations surveyed are moving toward this goal. For example, over half of respondents (55%) use OEE data to run simulations, and slightly less than half (44%) say their organizations use digital twin technology. For obvious reasons, companies using these techniques are highly likely to already be collecting real-time data from sensors and machinery. The vast majority of companies pursuing digital twin technology describe their ability to collect OEE data as either 'acceptable' or 'strong'. By contrast, 52% of respondents attribute their inability to use digital twin technology to partial or incomplete digitization of the manufacturing process.

For many, the value of simulations resides in the ability to address real world problems, rather than more complex hypothetical scenarios:

'Hypothetical scenarios, that still is a challenge... Our goal is to look into what we call it – real-time analytics. First, at least find what is happening on a plant real time, understand what the issues are, and then take a corrective action. I think that itself is a huge task. If we do that correctly and if we can get what we expect out of it, that's going to be [worth very much more than becoming] an oracle of the future'.

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Conclusion

The research strongly suggests that analytics powered by factory-floor data generates significant benefits, including improved equipment productivity, better detection of quality problems and improved identification of the causes of OEE losses.

As Guy Merritt says: 'You [have] got to automate your data collection. To improve overall intent data integrity, you must get rid of paper, you must get rid of spreadsheets'.

Additional benefits raised by interviewees included: accelerated time-to-insight, reduced maintenance costs and the ability to apply lessons learned in one plant to others. Respondents interviewed in person also described how dashboard-based gamification can result in a visible improvement in employee morale and motivation among operators on the shop floor.

Some manufacturers are already making the journey towards full automation, leveraging automated OEE data to the maximum extent. Behind these pioneers, a vast trail of manufacturers exists, mostly making progress. Many are already working with simulations and digital twin technology.

For other organizations, barriers stand in the way at a more fundamental level: the constraints of legacy machinery, a lack of analytics tools and the scarcity of relevant expertise. Addressing these challenges will take time and the right kind of partnerships – as well as a continuing commitment to realizing the benefits of data-driven manufacturing.

Wherever your organization finds itself on the journey towards data-driven manufacturing, SoftServe has the industry expertise and technology smarts required to tackle complex challenges in product design, on the factory floor, within your supply chain and in field services.

We specialize in using industrial internet of things, machine learning and AI to help you unlock actionable insights, boost productivity and reduce costs. Our aim is to help your organization become smarter, better and more innovative. To learn more about us and what we do, visit our manufacturing hub. ◆