Enabling *intelligent manufacturing* with an OT data foundation

Intelligent manufacturing initiatives are transforming production processes – but unlocking the full value requires companies to apply enterprise-level governance to operational technology data

Capgemini

Companies across all manufacturing sectors have long recognized that any improvements to the production process can deliver significant financial and operational benefits – and that's driven one of the biggest transformations in manufacturing since the invention of the assembly line. That transformation is Intelligent Manufacturing, which leverages digital technologies to realize significant enhancements to productivity, quality, flexibility, service, and sustainability.

But in many organizations, initiatives to leverage data from manufacturing assets have been designed and deployed in silos. The types of data collected from these operational technology (OT) sources, the format in which they're saved, the other industrial data with which they're combined, and the analytical tools applied often vary from machine to machine or use case to use case. What's more, this data often falls outside enterprise resource planning (ERP) activities, and is not addressed by typical IT data governance. This ad-hoc approach is preventing companies from realizing the full value of many smart manufacturing use cases.

To address this, organizations must prioritize applying a robust enterprise data governance program to their OT and industrial data.

OT data essential for smart manufacturing

Operational technologies include machines, sensors, industrial control systems, and software applications used throughout the production process. They generate valuable information that's essential for many intelligent manufacturing operations. This OT information commonly consists of two types:

- Time series data is a series of snapshots collected over specific time intervals. These provide a basis for tracking changes during the production process. Variations in the feed rate for a machine is an example of time series data.
- Industrial data describes manufacturing assets and production processes. The maintenance and repair history of a machine or sensor is an example of this type of data. Industrial data is often combined with time series data to enable intelligent manufacturing use cases.

As this information is captured and stored, it typically moves through multiple systems, devices, plant networks, and edge gateways – and with each movement, the risk increases for data loss or corruption.

A well-designed enterprise data governance framework for OT will address this. Successfully implementing such a framework requires an overall strategy and an understanding of several factors, including the following.

Who within the organization is the subject matter expert about the data source?

If the data is generated internally, it's essential to know who can provide insights into important data characteristics – including the data type (string, Boolean, numeric), unit of measurement (pounds, gallons, feet), data quality (high or poor), how it's being captured (including the scan rate), how it's stored, security attributes, and so on. If the data is from a third party, it's important to know who within the enterprise has the relationship with the vendor and who at that vendor can be contacted if there are any issues.

What data quality measurements are needed?

Companies should consider how the data will be consumed – for example, will it be used for AI, analytics, or reporting, or for a combination of these? This will determine what data elements are the most critical for the use case. Depending on the purpose for collecting the data, only certain elements must be high-quality and accurate to provide trustworthy results. As an organization determines this, it's important to also consider any important metadata associated with the captured information – for example, details about the machine or process and the sensors that monitor it.

What are the defining characteristics of the data?

It's vital to understand when and why the data is collected. For example, data may be captured at regular intervals (with or without a time stamp) or it may be collected only after a certain event occurs. Understanding this enables the organization to assess how the data is interpreted, processed, and contextualized.

How will the company determine that the collected data is of high quality?

For each data element being collected, it's important to identify the associated rules that will help determine whether the data is accurate, complete, and consistent. These rules might include standard values to be used in the data field, and whether the field can accept null values. This information will inform any data quality checks that are performed.

Implementing an OT governance framework

One of the biggest issues organizations face is the sheer volume of data generated by OT. This is particularly challenging in asset-heavy industries that rely on controls and automation, such as the resource and energy sector. A single production site – an offshore oil platform, for example – may have thousands of potential data sources. What's more, legacy use cases may have resulted in the information from these sources being collected in multiple ways and stored in incompatible formats.

It's easy to feel overwhelmed by a perceived need to fix all of a company's previously collected OT data before implementing a governance program. But based on its work with clients, Capgemini has developed several recommendations that make the task easier.

First, it's important to remember this isn't unfamiliar territory. Many companies have already established data governance programs elsewhere in their organization – for example, for IT and financial operations.

As with those frameworks, it's important from the outset to assign ownership and accountability for maintaining the quality of OT data. It's also valuable to remember that applying proper governance to all OT data will take time, and to plan for the transition period. For example, those responsible for this program are advised to develop and implement dashboards and reporting systems to convey data quality issues as they're identified. These will enable downstream users to account for defects or anomalies when analyzing data that has not yet been repaired and incorporated into the governance framework.

Capgemini also recommends manufacturers clearly identify specific use cases, what data must be collected to enable them, and their business value or expected outcome. For example, a use case for an energy company might be stated as, "This use case will monitor downtime at a single oil well. The data collected will include the reason for the downtime and the business impact. The goal is to use this data to make better investment decisions to mitigate the risk by reducing downtime." Start small by identifying use cases that are easy to implement, with a focus on ensuring high-quality data is collected. At the same time, it's important to plan from the outset for scaling so the company can capitalize on the experience – both by applying this use case to other, similar operations and by developing new use cases that rely on the same data.

Unlocking value from OT data

With a proper governance structure in place, OT data becomes a trusted resource that can help asset-heavy enterprises understand equipment health and performance, assess overall equipment effectiveness, improve predictive maintenance, optimize production in real time, and enhance overall plant performance.

It also creates the essential foundation for a broad range of intelligent manufacturing capabilities that leverage digital technologies – including remote monitoring, tracking and tracing, intelligent automation such as robots, additive manufacturing, product lifecycle management, immersive technologies such as virtual reality for employee training and augmentation, quality analytics, digital twins, and the more efficient use of energy, materials, and other resources.

As the Capgemini Research Institute noted in its 2019 report *Smart factories at scale,* nearly 70 percent of manufacturers surveyed were pursuing the transformation to intelligent manufacturing. Only those that master their OT data will succeed.

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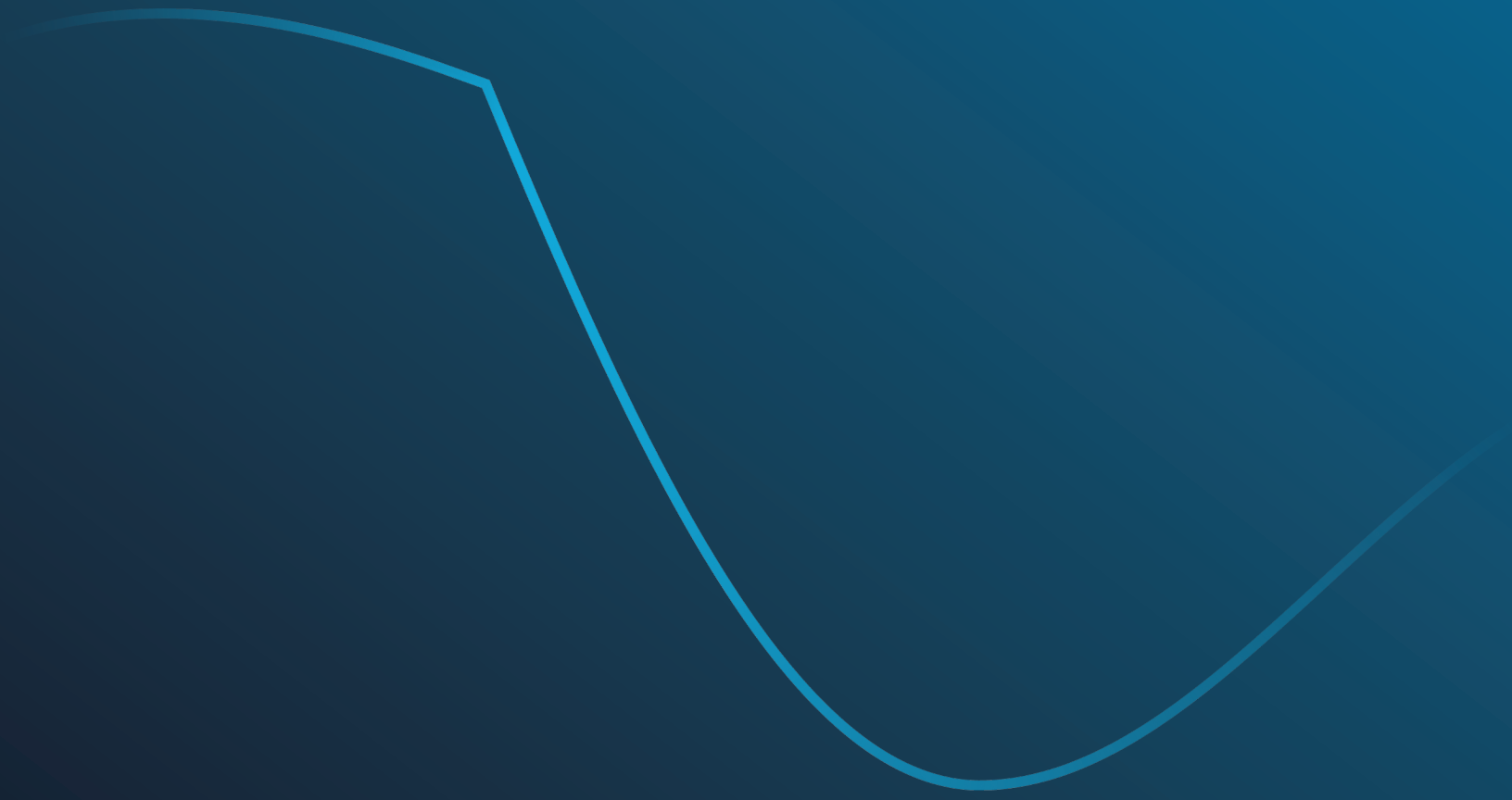

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