

Case Study: Predictive Analytics and Improved Product Decisions with Machine Learning

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Watch a video demo of this use case



The Internet of Things (IoT) has exploded, creating unprecedented demand for IoT-enabled devices, services, and solutions. According to McKinsey, by 2025 more than a third of the IoT's projected annual value of \$6.2 trillion will be attributed to the global manufacturing industry.

Manufacturers seeking to gain and maintain a competitive edge have been implementing smart equipment to improve operations. Operational performance improvements such as reduced downtime, improved response times, and reduced human error translate to measurable improvements on the bottom line.

As manufacturers have become increasingly connected, their connected systems, machines, sensors, and other devices are generating a wealth of new data. But this data is complex in nature, and given the sheer volume of data generated, isn't easily gathered and analyzed. It is a challenge traditional manufacturing systems are not designed for – and manufacturers are missing out on valuable insights as a result.

Machine learning technology can help, when implemented in support of an IoT strategy and validated via a strategic experiment that proves the potential value. Manufacturers should take a comprehensive approach to machine learning and analytics, integrating equipment, systems and people into a highly collaborative environment that rapidly adapts to changing operational requirements and operates on a scale much larger than simple IoT applications.

With the right strategy, industrial manufacturers can capitalize on the opportunity to generate business insights from data, capturing sustainable economic value. Here's an example of a use case, developed by ThingWorx partner Kalypso, for machine learning in industrial manufacturing. This use case is centered around wind farms, but could apply to any manufacturer with smart, connected capital equipment in the field.

Of all these new technologies, big data may prove to be the one with the broadest impact on the largest number of companies. There is no one-size-fits-all technology – different kinds of big data problems require different kinds of solutions, and in most cases a mixture of solutions is required.

– [Chad Markle](#), partner and Digital Practice lead at Kalypso

Predictive Failure of Equipment in the Field

Imagine a wind farm that has implemented smart, connected turbines using the ThingWorx Platform with the goals of gaining better insight into operational performance and making improvements for better outcomes. The farm has experienced problems stemming from repeated equipment failure, including lengthy and unplanned downtime and costly unplanned maintenance – which translates to bottom line losses and unhappy customers.

Its wind turbines are all connected and the farm wants to identify patterns that signify proper operation, signs of impending failure or maintenance issues, and other operational performance indicators. These insights will help to improve decision-making, planning, and operations outcomes.

Each turbine generates millions of points of data. But the business lacks a system to properly gather and analyze it and currently monitors data manually. This is problematic for several reasons:

1. Manpower resources are insufficient to monitor and process the high volumes of incoming data
2. Employees monitoring data are not experts in the field of data science or mathematics
3. The data is complex and in new and varying formats, making it difficult to manage with any traditional analytics tools
4. Risk for error is high due to the volume, velocity, and variety of data

Without the ability to properly and effectively manage incoming data from the turbines, the business is unable to get the much-needed insights from its connected operations.

A Powerful Analytics Solution

The wind farm seeks out an analytics solution that will monitor, manage, and analyze its data in order to:

- Identify performance patterns and trends
- Alert to anomalies in performance
- Predict unwanted events such as downtime or required maintenance
- Minimize human intervention and risk for error

In this example, the wind farm or the original equipment manufacturer could benefit from developing a business case for machine learning, and then validating the business hypothesis with strategic experiments and a functional prototype. Using strategic services from [Kalypso](#) and [ThingWorx Analytics](#) technology from PTC, a functioning proof of concept can be developed in a few short weeks, using the company's data. In this example, the solution provides powerful, automated analytics capabilities directly via the ThingWorx platform. Capabilities include adaptive learning technology, real-time pattern and anomaly detection, simulative and prescriptive analytics, and automated predictive analytics.

Real-time monitoring helps to minimize and avoid downtime or failures by enabling detailed monitoring of equipment condition and operating parameters such as wind conditions, vibrations, temperature and wind speed. Anomalies automatically trigger alerts and proactively initiate responses from maintenance teams or service networks as soon as a problem occurs.

Predictive analytics automatically deliver proactive information to decision makers to improve quality and performance of complex manufacturing processes and transform maintenance processes into predictive maintenance before failure occurs.

The Results

In this example, the wind farm first uses ThingWorx Analytics to analyze historic data sets numbering into millions of rows of data, to understand what's happening and what the conditions are when equipment failures have occurred. Then, ThingWorx Analytics is used for real-time usage monitoring to detect similar conditions and predictive analytics to identify when a failure is approaching.

Better insight into operational performance can be used to improve the business in a number of ways. With the [Machine Learning Quick Start services from Kalypso](#), organizations can rapidly create value from the ThingWorx Platform and ThingWorx Analytics. In a short period of time, companies can leverage these technologies to connect historical data to a predictive analytics engine. In this example the wind farm operator can analyze and predict equipment failures, and the operations teams can better anticipate issues, schedule proactive maintenance, and avoid or minimize costly downtime. Then, this information is used to discover new insight and optimize business processes and equipment performance.

Operations managers then use these insights to develop and implement processes or solutions that will prevent typical failure conditions from occurring. This information is also used in long-term planning. The data can also be used by the equipment manufacturer, helping R&D and product engineers understand the circumstances under which failure is likely, so they can make improvements to equipment or develop products that will minimize instances of failure in the future.

More Details

[Watch a full demo of the predictive analytics use case described above](#)

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