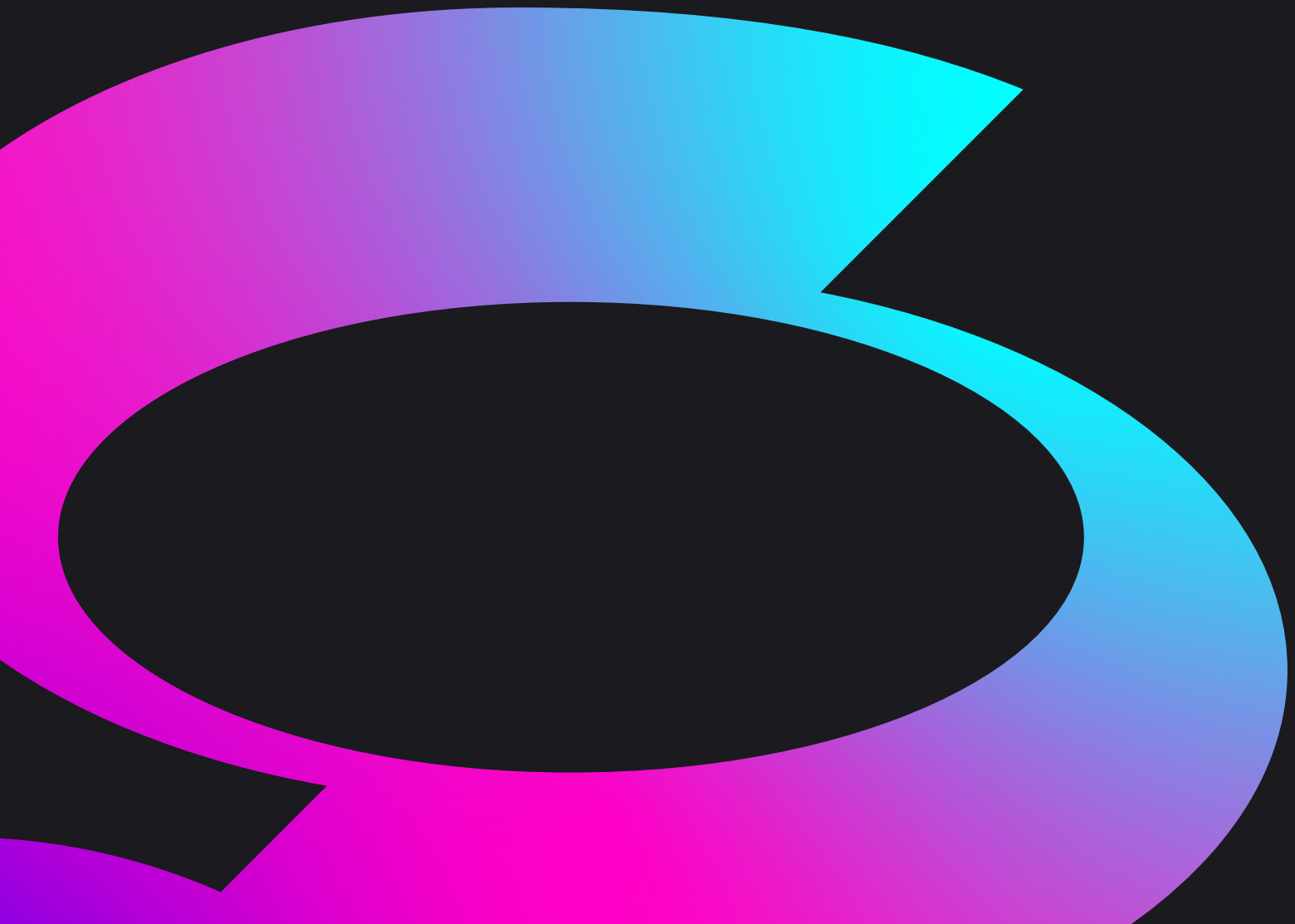
WHITE PAPER

4 steps to implementing predictive quality analytics in manufacturing



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"Advanced analytics is becoming a vital tool in the quest for improved quality. It can help decrease total costs by identifying and addressing the root causes of defects more swiftly, as well as defining more efficient methods to maintain quality. The results of deploying advanced analytics in quality management can be measured in improved customer satisfaction and retention, as well as increased cash flow. This matters because the total cost of quality has a major impact on economics— costing up to 20% of revenue for a business."

Picture a factory where manufacturing equipment can identify when conditions are likely to produce defects and alert workers before production is affected. In this factory, workers proactively intervene to prevent quality issues instead of just reacting to them as they happen.

This isn't some hypothetical factory of the future — it's reality, made possible by predictive quality analytics. By using real-time data to anticipate problems, manufacturers can switch from a reactive approach to a proactive one, preventing costly defects and maximizing efficiency on the factory floor.

Are you ready to stop reacting to quality issues and start predicting them? This guide will show you how to turn manufacturing data into actionable insights using predictive analytics.

Understanding predictive quality analytics

Predictive quality analytics refers to the process of collecting and analyzing data to predict future outcomes based on past patterns and trends. Digital transformation is the hallmark of Industry 4.0, and leveraging predictive quality analytics has become a critical component of quality management in manufacturing. It is also a key way for manufacturers to gain and maintain a competitive edge.

From reactive to proactive quality management

In the past, manufacturers had no choice but to address quality problems after they occurred. They simply didn't have access to the real-time data and analytics tools to support any form of advanced predictive modeling.

Now, in the age of artificial intelligence and machine learning, predictive models are accessible and automated, programmed to deliver insights based on a constant stream of real-time data. This allows manufacturers to detect potential issues before they escalate, optimize production processes and minimize costly disruptions — all based on real data, not guesswork.

The role of data in predictive quality

Many manufacturers already collect large amounts of data on the factory floor, including:

- Machine performance metrics like uptime, downtime and speed
- Cycle times
- Defect rates
- Environmental conditions like temperature and humidity
- Production output rates
- Energy consumption
- Tool wear and tear
- Material usage and waste

Predictive analytics is not about investing in entirely new systems and installing a million new sensors. It's about gleaning valuable insights from existing data. Even when companies already have plenty of data, it often remains underutilized. By applying predictive analytics and advanced algorithms, manufacturers can get the most out of the data they're already collecting and strategically implement new sensors and solutions to gain new insights.

Step 1: Collecting and preparing quality data

Successful predictive analytics starts with the right data. Data-driven manufacturing needs a foundation of high-quality, relevant and organized data to feed into predictive models.

Identifying key data sources

Primary data sources manufacturers should focus on for predictive analytics include:

Machine and equipment sensors

Data on performance metrics like pressure, vibration and energy usage.

Production logs

Data on production volume, cycle times and machine utilization.

Quality inspection reports

Historical data from inspections and audits, including defect rates and compliance with quality standards. Leveraging this data helps identify recurring quality issues and improve overall product consistency.

Maintenance logs

Offer insight into the frequency of repairs, preventive maintenance schedules and downtime events. This data helps manufacturers predict future maintenance needs and prevent unplanned downtime.

Connected worker devices

Data collected from connected worker technology, such as RFID scanners, shop floor tablets, connected tools and wearables.

Ensuring data accuracy and consistency

Once primary data sources are identified, manufacturers should ensure data is accurate and in a format suitable for analysis. Then, establish uniform formats and protocols for data collection across all departments and automate data collection whenever possible to reduce manual entry errors.

Use a quality management system (QMS) to consolidate data from various sources and gain a comprehensive view of quality activities. Keeping your data in a centralized, secure repository like a QMS makes it more organized and accessible for use in predictive models.

Step 2: Setting up predictive alerts

With your data collected and prepared for analysis, you can begin to set up predictive alerts. This involves configuring your analytics tools to monitor specific data patterns and thresholds that may indicate potential quality issues or equipment failures. Predictive alerts enable you to address potential issues before they escalate into costly problems.

Defining the right alerts for your processes

Predictive alerts may vary according to each production process and even each piece of equipment. You'll need to determine which metrics are vital for each process and then define acceptable ranges for each metric based on industry standards and historical data.

For example, if a certain machine has a normal operating temperature of 80 degrees Celsius, you could set an alert for temperatures exceeding 85 degrees. You can then further define your alert by establishing who receives a notification when the alert is triggered. With automated sensors and alerts, manufacturers can ensure timely interventions and maintain high-quality standards.

Customizing alerts for different teams

As you set up predictive alerts for different processes, you can test, adjust and assign notifications to different teams. Your maintenance team needs timely alerts about equipment wear and tear and notifications about abnormal operating conditions. Still, they likely don't need to know about inventory levels or material shortages — those alerts should go to the production team.

An alert about rising defect rates should go to your quality control team, but if defects stem from an equipment issue, your maintenance team should be involved as well. With predictive analytics tools, you can customize alerts to stay ahead of potential issues while keeping workflows streamlined.

Step 3: Implementing real-time monitoring

Data collection and alerts make predictive quality analytics possible, but you need real-time monitoring to make it actionable. Real-time monitoring continuously feeds predictive models with the data required for accurate forecasting. Manufacturers can use real-time dashboards and analytics to keep an eye on operations, keep things running smoothly and foster a more data-driven manufacturing environment: compliance and internal audits. It also includes feedback mechanisms designed to collect and analyze customer feedback to identify and rectify potential issues.

Choosing the right monitoring tools

There are many tools available for monitoring quality data in real-time:

- **IoT platforms:** Often, connected devices and sensors on the factory floor are controlled via a centralized IoT platform and those platforms often offer real-time dashboards that display sensor data.
- **Quality Management Systems (QMS):** A QMS integrates quality data from across the organization and provides real-time monitoring and data dashboards.
- **ERP systems:** Many ERP platforms have quality modules that allow companies to track and monitor quality metrics alongside other operational data.
- **Manufacturing Execution Systems (MES):** An MES provides visibility into various production processes and enables manufacturing process optimization.

Integrating monitoring systems with existing infrastructure

Your organization likely has some monitoring tools in place, but you may not be using them to their full potential. Investigate the features of your current enterprise system(s) and consult with quality experts to see what they can offer in terms of new predictive quality analytics applications and modules. You don't necessarily need to overhaul your current technology stack if you can integrate new monitoring tools with existing infrastructure.

Step 4: Calculating ROI predictive quality analytics

Digital transformation is a significant investment, and implementing predictive quality analytics is no exception. There are costs associated with upgrading your infrastructure and adopting new tools but consider the financial and operational benefits of such an investment.

Reducing downtime and scrap rates

With predictive alerts and real-time monitoring, workers can detect potential issues and implement corrective actions quickly, preventing breakdowns and defects. This proactive approach leads to a measurable reduction in downtime and scrap rates.

Improving production efficiency

Predictive quality analytics can further reduce production costs through manufacturing process optimization and the elimination of inefficiencies. When monitoring workflows in real-time, quality professionals can easily identify bottlenecks and spot underutilized or underperforming equipment. Then, they can quickly make adjustments to improve resource allocation and optimize production.

Key considerations for quality managers implementing predictive analytics

Aligning quality metrics with business goals

With so much data at our fingertips, it's easy to get lost in the weeds. Quality managers should make sure quality metrics and resources are supporting broader business objectives like cost savings and operational efficiency. Predictive analytics can support these goals by providing deeper insights into production quality.

Collaborating with IT and operations

Implementing predictive analytics is a collaborative effort involving several departments. Quality managers need to work closely with IT and operations teams to integrate new monitoring tools with existing systems successfully. Define roles, establish clear communication channels, and create opportunities for feedback.

Ensuring data integrity and usability

Data integrity and formatting issues can wreak havoc with predictive model performance. Quality managers are responsible for maintaining data accuracy and consistency. This means standardizing data formats and processes, enforcing those standards across the organization, and setting up a system for routine data validation checks.

Making data-driven decisions for continuous improvement

Predictive analytics is not a set-it-and-forget-it solution. Quality managers need to use insights from predictive models to make data-driven decisions that lead to continuous improvements in production processes. They should identify emerging quality issues and refine predictive models to make them more accurate and efficient over time.

Overcoming common implementation challenges

Integrating predictive quality analytics isn't without its challenges, but these hurdles can be overcome with proper planning and execution.

Data silos and integration issues

It can be challenging to break down existing data silos and successfully integrate various data sources into a single platform. These solutions can help ease integration issues:

- Use a centralized data platform. If data is consolidated, it's easier to feed into a predictive analytics program.
- Ensure your predictive quality analytics solution understands manufacturing data and has already integrated data feeds and signals.
- Use API integrations to ensure smooth data sharing.
- Leverage QMS and ERP platforms to get a holistic view of production and quality metrics.
- Establish strong data governance policies to bolster security and accessibility.

Employee training and change management

Another potential hurdle is employee training and change management. Predictive tools may be unfamiliar to some of your team members, and there can be a learning curve. To get everyone on the same page and foster a culture of data-driven decision-making, offer structured, hands-on training sessions tailored for specific departments. Help your team understand the importance of predictive analytics and how these tools benefit their specific efforts.

Harnessing the power of predictive quality analytics

By leveraging predictive quality analytics, manufacturers can shift from a reactive to a proactive approach to quality management. When workers have the tools to address quality issues before they escalate, the entire operation becomes more efficient, with less time and money spent on costly defects and downtime.

Predictive analytics offers the key to becoming a more data-driven manufacturing operation and achieving long-term excellence.

Reliance and predictive quality analytics

Find out how your quality management processes can benefit from integrating predictive quality analytics with Octave Reliance® (formerly ETQ Reliance) to create better products faster.

About Octave

Octave is a leader in enterprise software, turning data into decisive action and intelligence into your edge. Our software solves for and simplifies complexity, from the design and build to operations and protection of people, property, and assets– for any scope, at any scale. For decades, we've partnered with customers to sharpen performance, elevate efficiency, and amplify results. From factory floors to entire cities, our solutions are tuned to scale up what's possible from day one onward.