

Manufacturing Process Optimization

BENEFITS

- Increased uptime, reduced downtime
- Minimized surplus and defects
- Better yields
- Reduced cost due to better quality
- Fewer deviations and less non-conformance

Today, you can improve product quality and gain better control of the entire manufacturing chain with data virtualization, machine learning, and advanced data analytics. With all relevant data aggregated, analyzed, and acted on, sensors, devices, people, and processes become part of a connected Smart Factory ecosystem providing:

- Increased uptime, reduced downtime
- Minimized surplus and defects
- Better yields
- Reduced cost due to better quality
- Fewer deviations and less non-conformance

PRODUCT QUALITY AND SAFETY WITH DATA ANALYTICS

Nowadays, with bigger and more diverse datasets, it can be even more difficult to establish root causes of quality and reliability issues. Constant iterative analytics helps to quickly detect and respond to quality issues. You need to understand product quality in all its facets: quality levels, trend prediction, risk identification, and performance evaluation.

With a data analytics platform, you can minimize risk by making it easy to rapidly detect emerging issues and take corrective actions. Scrap, rework, and quality issues can be significantly reduced with advanced quality-control analytics, root-cause analysis, and validated reports. And by increasing supply chain visibility, bottlenecks can easily be identified and resolved.

With more accurate, real-time data, you can share a better understanding of your manufacturing process with customers and suppliers. Further, a secure and validated analytics environment can help maintain compliance with the most stringent regulations, while delivering auditable workflows and reports for regulated manufacturing. Data can also be shared among teams, allowing engineers and process experts to proactively identify and resolve emerging issues.

DATA VIRTUALIZATION

Every manufacturer understands the importance of data. But getting the right data to the right people at the right time is one of the biggest challenges. Data virtualization helps you get the data you need, when you need it, in the way you want to use it.

Data virtualization lets you:

- Access data from all your sources. Access data distributed across your supply chain, including traditional enterprise, big data, cloud, IoT, third-party, and other sources.
- Make your data business friendly. Transform data from native IT structures and syntax into easy-to-understand, easy-to-use, easy-to-share business data services.
- Combine data faster and more easily. Combine data from multiple sources reliably at a fraction of physical warehousing and ETL rigidity, time, and cost.
- Deliver your data just-in-time. Provide the freshest data whenever you need it to your analytics and transactional applications, wherever they may be.

- Secure and govern your data. Ensure the data security, governance, lineage, and audibility you need.
- Operate reliably, at scale. Enable 7x24x365 global operations across your suppliers, factories, distribution centers, and customers.

Data can help you innovate and optimize your manufacturing processes, leading to higher yields, lower costs, improved customer satisfaction, more innovative products and services, faster new product introductions, and higher data quality.

The following are just a few business cases in which we helped manufacturers make the most of their data:

PRODUCTION AND LOGISTICS OPTIMIZATION

An electronic contract manufacturer:

- Gained easy access to factory and supply chain data for operational decisions and customer reporting
- Connected teams by sending real-time details about trends, inventory, yields, and shipments to program managers' and planners' mobile devices

CROSS-PLANT OPTIMIZATION

A petro chemical refiner:

- Attained one place to go for common data across plants
- Conformed data to the MIMOSA standard for operations & maintenance and collaborative asset lifecycle management (CALM)

GLOBAL SUPPLY CHAIN OPTIMIZATION

A computer manufacturer:

- Attained consistent access to global supply and demand data
- Used supply data to run an order fulfillment system
- Used supply and demand data to run a chain planning system

SAP DATA QUALITY IMPROVEMENT

A petroleum producer:

- Used common SAP master data services for reference data such as cost centers, account codes, market segments, etc.
- Simplified access to data cleansing and remediation services

MACHINE LEARNING AND ADVANCED ANALYTICS

Machine learning techniques employ an emerging class of algorithms that learn from the data presented to them and automatically construct the best possible model of it for automatic comparison and analysis. As such, they empower analysts who have little expertise in statistics and modeling to solve complex problems otherwise beyond their reach.

The Gradient Boosting Machine (GBM) algorithm is an iterative method that uses an ensemble of simple decision trees. The model is built in a stage-wise fashion, adding the best tree to improve model accuracy at each successive stage. Benefits of GBM for root cause analysis in manufacturing include:

- Good performance in culling the most significant predictor variables from a large pool of candidates.
- Responses and predictors for either continuous (including dates) or categorical variable types.
- Modeling of complex interactions between predictors.
- Accurately modeled complex nonlinear relationships. GBM often produces models that fit the data better than regression or single decision-tree methods.
- No need to specify a data model, so no prior knowledge or theoretical understanding of variable relationships is needed. This is an advantage over regression-based statistical modeling techniques that require matching the appropriate model to the data based on prior knowledge of variable relationships.
- GBM models are robust. They handle missing data and outliers well, and data transformations are not required.

In the initial phase of identifying the root causes of product quality problems, “low hanging fruit” will typically be identified. Correlation analysis may be performed to identify simple linear correlations between end-product quality measurements (yield, defects, field returns, etc.) and upstream product, process, equipment, component, material, or environmental measurements.

ANOVA-based equipment commonality analysis can be performed to identify the individual process steps and factors (machine, setup, recipe, operator, and others) that produce bad products, helping to understand defects.

After this initial phase, when the most evident causes of product-quality problems have been identified, additional problems may remain that are more difficult to diagnose. These are often due to complex non-linear effects and interactions between predictors that were not detectable with the techniques used during the first phase of analysis. GBM can help uncover these complex relationships to solve the next phase of quality problems.

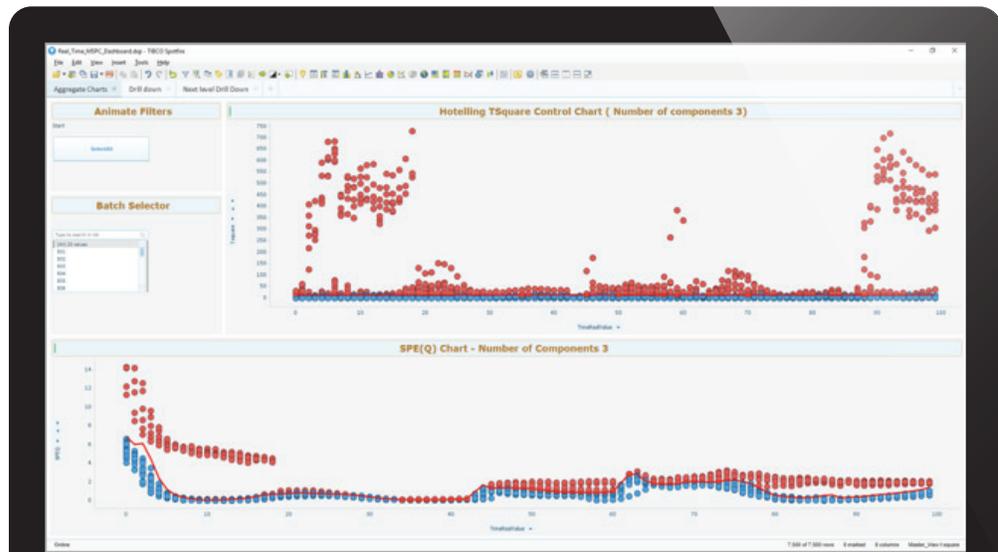
Through constant iterative analytics, the following questions can be answered:

- Can we establish an early warning system, and what are acceptable product quality levels?
- Can we predict trends? Is this a one-time event or systematic degradation?
- Can we identify product performance exceptions and calculate our exposure to risk?
- Can we detect in real time changes from a historical baseline?
- Where do my products perform better? In what assemblies? In which climates, languages, demographic groups?

Finding insight from multiple data sources can be difficult, as data sources are siloed and multiple formats are difficult to combine and integrate. The TIBCO® Data Virtualization system allows all relevant data to be mashed up and available in one virtual place—whether that data is historic or real-time, structured or unstructured. This capability allows you to bring together supplier quality, manufacturing process, quality and reliability, test, field return, and external data sources. Jointly with advanced analytics all the relevant data can now be used to understand how to optimize your processes and determine true root causes of manufacturing issues during production.



Univariate Statistical Process Control



Multi-variate Statistical Process Control

CONCLUSION

Smart factories are becoming more common, so it is crucial that manufacturers take steps to create one. By building a Smart Factory system that combines technologies, you will better optimize processes. With TIBCO’s Connected Intelligence solutions, such as TIBCO® Data Science, TIBCO Data Virtualization, TIBCO Cloud™ Integration, TIBCO Cloud™ Mashery®, TIBCO® Streaming, and TIBCO Spotfire®, you have all of the tools you need.

For more information on TIBCO’s Smart Manufacturing solutions visit: <https://www.tibco.com/solutions/industry-40>.



Global Headquarters
 3307 Hillview Avenue
 Palo Alto, CA 94304
 +1 650-846-1000 TEL
 +1 800-420-8450
 +1 650-846-1005 FAX
www.tibco.com

TIBCO fuels digital business by enabling better decisions and faster, smarter actions through the TIBCO Connected Intelligence Cloud. From APIs and systems to devices and people, we interconnect everything, capture data in real time wherever it is, and augment the intelligence of your business through analytical insights. Thousands of customers around the globe rely on us to build compelling experiences, energize operations, and propel innovation. Learn how TIBCO makes digital smarter at www.tibco.com.
 ©2019, TIBCO Software Inc. All rights reserved. TIBCO, the TIBCO logo, Mashery, Spotfire, Statistica, TIBCO BusinessWorks, and TIBCO Cloud, are trademarks or registered trademarks of TIBCO Software Inc. or its subsidiaries in the United States and/or other countries. All other product and company names and marks in this document are the property of their respective owners and mentioned for identification purposes only.
 04/05/19