IQMS® Manufacturing Software becomes DELMIAWORKS

3DEXPERIENCE®

HOW ANALYTICS AND BUSINESS INTELLIGENCE CAN HELP YOU EXCEL AT MANUFACTURING

Whitepaper

DASSAULT SYSTEMES

HOW ANALYTICS AND BUSINESS INTELLIGENCE CAN HELP YOU EXCEL AT MANUFACTURING

Improving Production Runs with Better Data

Bottom Line: The expertise and insights it takes to excel at quality are the guardrails Business Intelligence (BI) projects need to stay on course and deliver results starting with closing production run performance gaps.

Always up for the challenge of discovering new ways to improve product quality, reduce costs and deliver customer orders on time, the path to improving manufacturing is paved with solid data. Keeping production runs on track by removing the roadblocks that stand in the way of achieving more, and knowing how quickly changing supplier, customer, market and service costs help or harm production goals is key to surviving in uncertain times. For all these reasons and more, BI has become the uncertainty cure manufacturers want.

Being pragmatic, practical and goal-driven is the framework manufacturers rely on for evaluating any new technology. And that's especially true when it comes to BI's role in helping to improve daily production performance. Manufacturers are evaluating any new technology by its contribution to improving operations and shop floor productivity.

Always on the lookout for new growth opportunities, manufacturers are looking to BI as the catalyst they need to find and capitalize on new areas of operations improvements and growth. BI is the fuel that transforms ERP systems into more adaptive, flexible production systems that enable manufacturers to scale in response to customers' needs. Relying on real-time monitoring to capture data from the shop floor and translate it into insights that reduce uncertainty is a cornerstone of smart manufacturing. Knowing how production, quality and resource allocation decisions impact production, machinery and quality is what's needed to become and stay competitively strong as a manufacturer.

HOW BI HELPS TO IMPROVE MANUFACTURING PERFORMANCE

Business Intelligence (BI), prescriptive and predictive analytics are redefining manufacturing today by providing insights, intelligence, and knowledge not available before. Manufacturing is the most data-intensive industry there is. Mining the massive amounts of data a manufacturing operation generates daily by using industry-standard metrics and Key Performance Indicators (KPIs) opens up new opportunities to compete and win more business. Analytics and BI tools are reducing uncertainty across manufacturing by doing the following:

Attain Higher Levels Of Product Quality

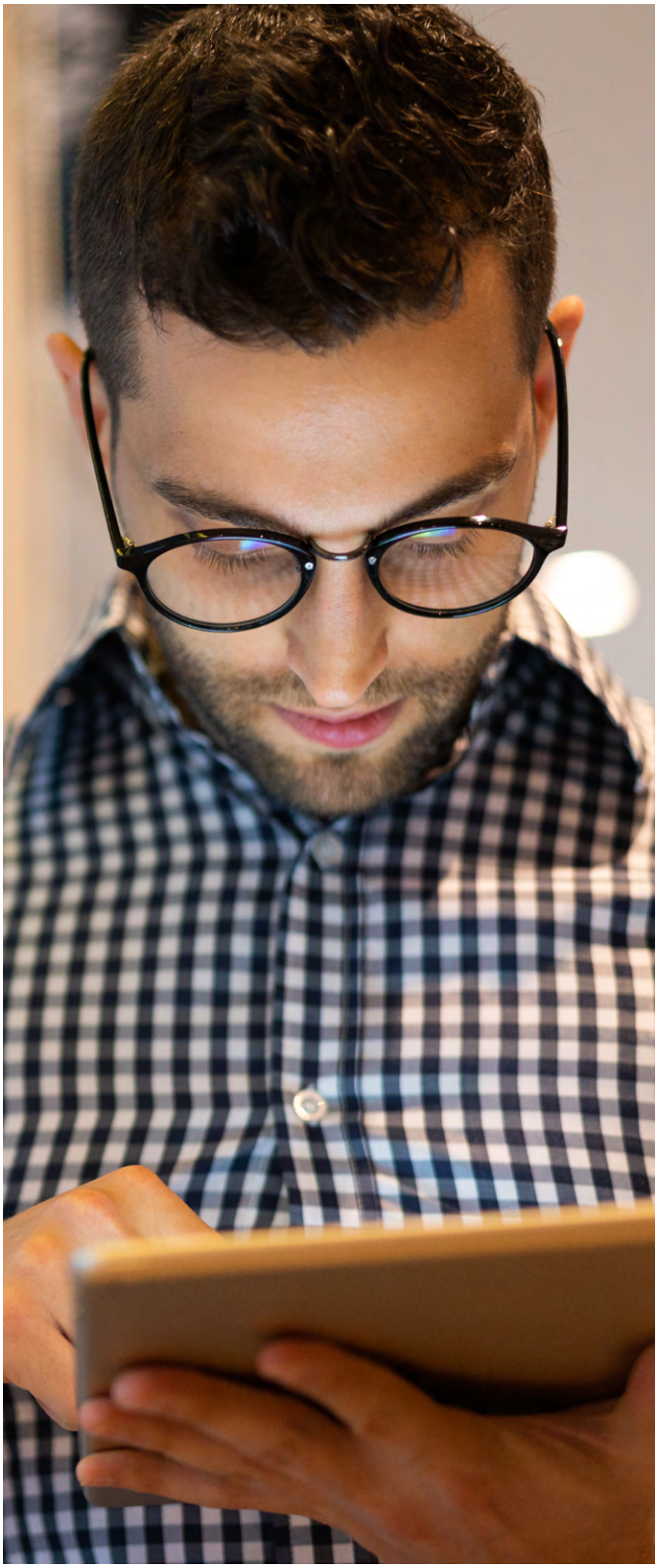
Knowledge can turn quality into the strongest competitive differentiator a manufacturer has. Capturing data from machines, production processes and work centers using real-time monitoring provides an invaluable glimpse into what's working your manufacturing operations. From fine-tuning Statistical Process Control (SPC) to each phase of your quality management, compliance, production, fulfillment, and service strategies, WebBI provides insights for improving your business from the shop floor to the top floor.

Excel At Shop Floor Analytics Including Overall Equipment Effectiveness (OEE)

Manufacturers consider this is the most important metric there is for making sure their daily production operations are stable and profitable. OEE measures the performance of a given machine, product line, work team or entire production center. The majority of the time, OEE is tracked at the machine level to capture each production asset's utilization rate, performance levels, and quality. It's calculated using the formula of Availability x Performance x Quality. IQMS provides OEE templates in WebBI so you can get up and running fast, gaining insights on equipment and shop floor performance.

Access Manufacturing Intelligence On Any Device, Anywhere

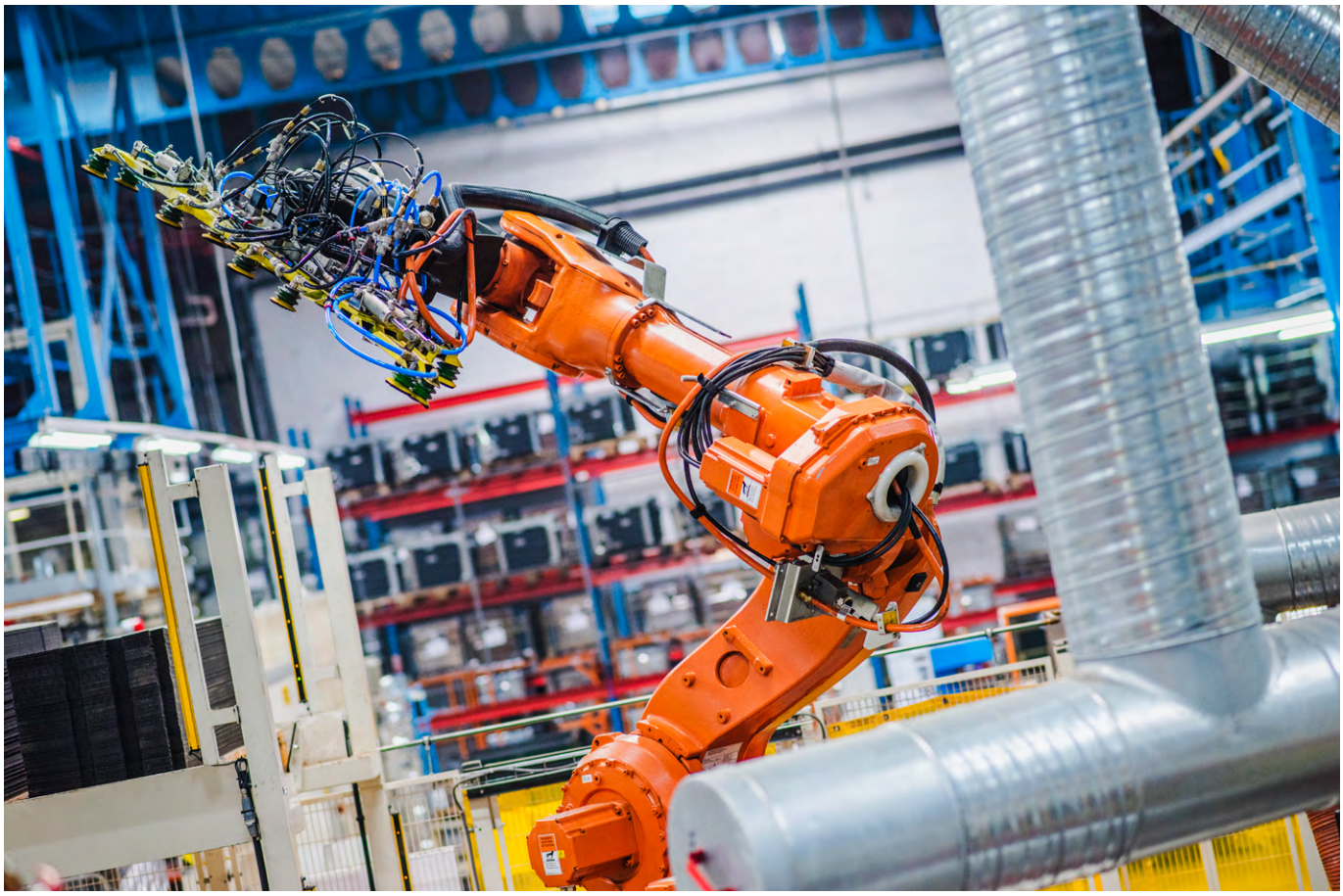
As manufacturing operations become more distributed and production shifts increase, there's a corresponding need for greater mobile support in all ERP applications. Every major cloud platform today has Application Programmer Interfaces (APIs) that enable software partners and providers to create mobile applications. As a result, mobility and ease of use on smartphones, tablets and handheld devices are making it possible to manage manufacturing operations remotely. The most valuable resource of any manufacturer is time. Being able to check dashboards and real-time reports on mobile devices on a 24/7 basis is already revolutionizing manufacturing. WebBI is designed to support mobile devices at the platform layer.



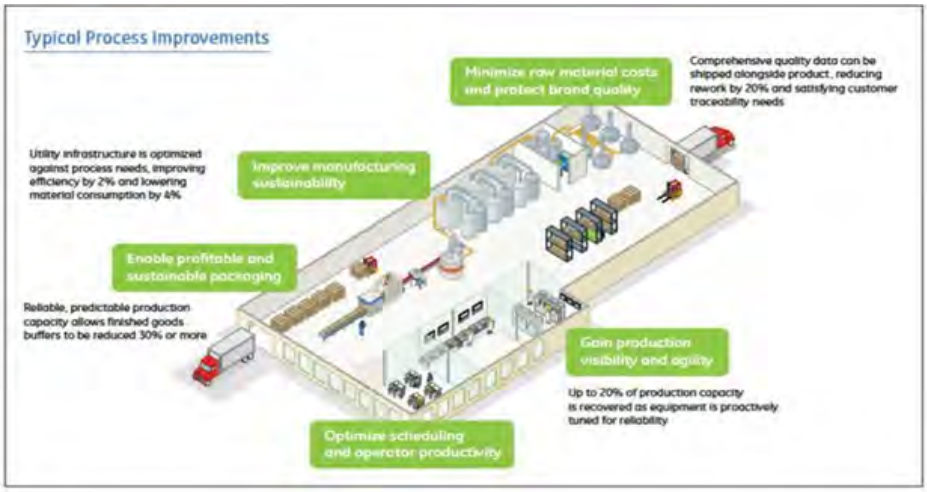
HOW BUSINESS INTELLIGENCE IMPROVES COMPETITIVENESS

Real-time monitoring to the machine level is providing a consistent, high-quality stream of data to BI, analytics and Manufacturing Intelligence applications. Manufacturers are creating entirely new metrics and KPIs based on the combination of real-time data and Manufacturing Intelligence apps based on BI technologies. Reducing the delays in getting data analyzed is leading to entirely new areas where Manufacturing Intelligence is making an impact today. The following are ten areas where integrating advanced analytics or Manufacturing Intelligence, ERP systems and specific production processes are delivering solid results and continued to today:

Figure 4: The Predictive Maintenance Solution for the OEM Plant



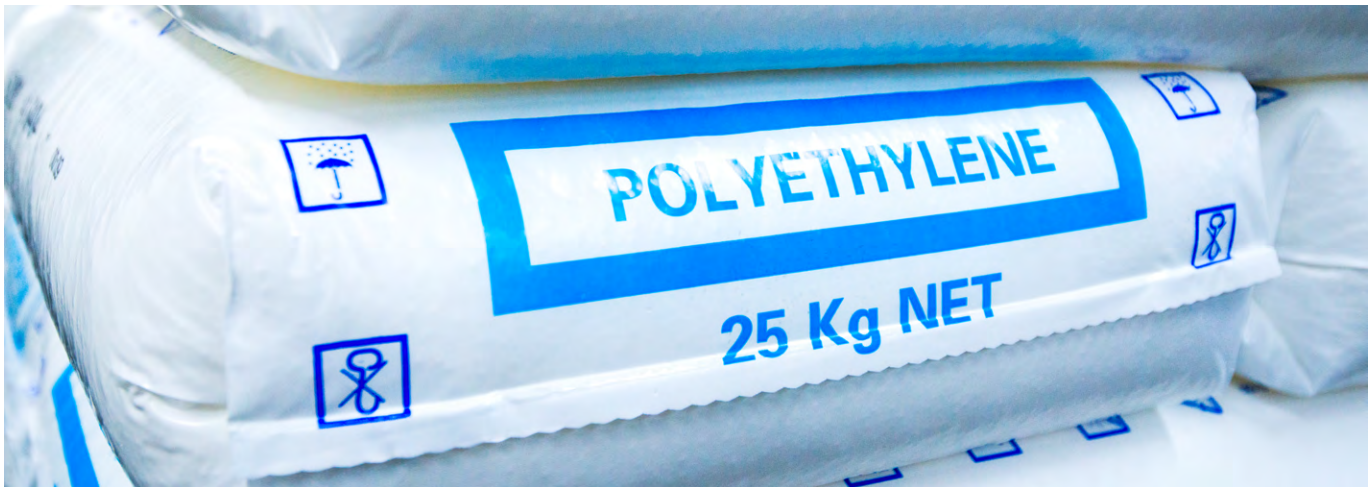
It's possible to increase production capacity up to 20% while lowering material consumption rates by 4% by combining ERP apps and Manufacturing Intelligence. Current and future manufacturing systems are being designed to capitalize on predictive data analytics, and Manufacturing Intelligence has the potential to improve yield rates at the machine, production cell, and plant levels. The following graphic from General Electric and cited in a National Institute of Standards (NIST) provides a summary of benefits that are being gained using predictive analytics and Manufacturing Intelligence in a typical production operation today.



Manufacturing Intelligence is proliferating quality management and compliance across all shop floors and locations, enabling manufacturers to make quality a core strength quickly. The most enduring, resilient and strong differentiator any manufacturer has is a reputation for product quality. Using Manufacturing Intelligence-based insights from the shop floor and translated into financial metrics for top floor executives, CEOs and other manufacturing leaders can now see financial value of improving product quality. In 2018, more manufacturers will combine ERP, quality management systems, and Manufacturing Intelligence to get a 360-degree view of quality across all production centers.

Optimizing pricing by predicting cost increases and decreases using Manufacturing Intelligence increases gross margins and fuels revenue growth. By monitoring, managing, and optimizing pricing across all product lines, manufacturers can plan out production runs to gain the greatest margins. Pricing is a potential differentiator, and in 2018 this area is where ERP systems are seeing the greatest revolution delivering greater growth.

Improving production yields by having real-time Manufacturing Intelligence guide the optimizing of the team, machine, supplier and customer order planning and fulfillment. Manufacturing Intelligence is making a difference on the shop floor daily in aerospace & defense (A&D), discrete, industrial and high-tech manufacturers today. Manufacturers are turning to more complex, customized products to use more of their production capacity, and Manufacturing Intelligence can help to optimize the best possible selection of machines, trained staffs, and suppliers.



By combining real-time data from the shop floor, ERP-based product histories and Quality Management data, manufacturers can rank supplier quality and improve yields quickly. Manufacturers often are challenged with making product and service quality to the workflow level a core part of their companies. Often quality is isolated. Manufacturing
Intelligence is revolutionizing product and service quality by determining which internal processes, workflows, and factors contribute most and least to quality objectives being met. Using Manufacturing Intelligence manufacturers will be able to attain much greater levels of prediction regarding how their quality and sourcing decisions contribute to greater Six Sigma performance within the Define, Measure, Analyze, Improve, and Control (DMAIC) framework.

Accelerating Manufacturing Cycle Times based on greater insights from Manufacturing Intelligence. By definition, Manufacturing Cycle Time quantifies the amount of elapsed time from when an order is taken until the product is produced and entered into finished goods inventory. Cycle times vary by a segment of the manufacturing industry, size of manufacturing operation, global location and relative stability for supply chains supporting operations. The greater the level of insight into how cycle times can be improved, the more competitive any manufacturer is. This area is one of the primary catalyst revolutionizing ERP systems' values delivered in 2018.

Tracking Perfect Order Performance for the first time across multiple production centers globally using ERP systems as the system of record. Perfect order performance measures how effective a manufacturer is at delivering complete, accurate, damage-free orders to customers on time. The equation that defines the perfect order Index (POI) or perfect order performance is the (Percent of orders delivered on time) * (Percent of orders complete) * (Percent of orders damage free) * (Percent of orders with accurate documentation) * 100. The majority of manufacturers are attaining a perfect order performance level of 90% or higher according to the The American Productivity and Quality Center (APQC). The more complex the product lines, configuration options including build-to-order, configure-to-order and engineer-to-order workflows, the more challenging it is to attain a high, perfect order level. Greater analytics and insights gained from real-time integration and monitoring help complex manufacturers attained higher perfect order levels over time.

Improving preventative maintenance and Maintenance, Repair and Overhaul (MRO) performance with greater predictive accuracy to the component and part-level is another area Manufacturing Intelligence is driving an ERP inflection point. One of the foundational elements of Manufacturing Intelligence is the development and delivery of predictive analytics and an advanced algorithm that can predict when a production machine will need maintenance. The data hidden in MRO-based processes are now being discovered with Manufacturing Intelligence, fueling entirely new process workflows to improve manufacturing performance.

Understanding why the Return Material Authorization (RMA) Rate and % Of Manufacturing Returns fluctuates and what can be done to improve quality. Return Material Authorizations (RMA) are by definition the percentage of products shipped to customers that are returned due to defective parts or not otherwise meeting their requirements. RMAs are a good leading indicator of potential quality problems. Manufacturing Intelligence is helping to create new KPIs and metrics that define and quantify the factors that most lead to RMAs happening in the first place. Best of all, ERP systems combined with Manufacturing Intelligence predict which supplier and their quality level, production process and quality metrics need to improve to reduce RMAs.

How Real-Time Data Fuels Greater Manufacturing Intelligence

Competing for new opportunities and growing quicker than competitors requires real-time data and the insights it provides. All manufacturers are pursuing greater speed, scale, and simplicity across every area of their operations. Real-time data is the catalyst making these three goals and many others possible to achieve. For many manufacturers, they are competing more against time and customers' continually increasing expectations of consistent manufacturing quality. Of the many areas where real-time data is contributing today, product quality is one where the results are most measurable and revolutionary.

The technologies enabling real-time data capture are also fueling a revolution in manufacturing quality. Programmable logic controllers (PLCs) are now commonplace across many manufacturing operations, providing real-time data on machine quality, reliability, and performance. Machine to machine (M2M) technology is also bringing real-time data to Statistical Process Control (SPC) applications capable of providing real-time alerts, graphs, and reports. And the potential for Internet of Things (IoT) to capture data that has eluded manufacturers for many years is now within reach.

10 Ways Real-Time Monitoring Helps Improve Manufacturing Performance

From the shop floor to the top floor, real-time data is one of the most powerful catalysts enabling greater manufacturing growth. By improving the quality of decisions, real-time data is meeting a diverse and demanding series of needs across every phase of manufacturing today. The results are greater revenue earned from higher levels of compliance, manufacturing quality and best of all, delighted customers.

The following are ten ways real-time data is revolutionizing manufacturing:

1. **Continually improve product quality by using real-time data for Statistical Process Control (SPC).** Knowing which production processes, machines, work centers and product lines are operating at high-quality levels and which aren't is essential for keeping shop floor operations running smoothly. Having real-time data to use in SPC for continually tracking, controlling and fine-tuning manufacturing processes is key. Machine operators can also get a real-time view of process performance using quick inspection, control, and trend charts. Setting up alerts in SPC Modules to alert quality management, production engineering, and scheduling when there is a deviation in performance can help avert millions of dollars in lost production time.

2. **Attain higher levels of compliance and traceability by receiving data directly from any machine on the shop floor in real-time.** Given the rapid advances in PLC-based monitoring and Machine to Machine (M2M) interfaces, it's possible to capture real-time data on metrics and Key Performance Indicators (KPIs) of interest. Collecting data across the shop floor in real-time and looking for patterns, trends and predictive insights from the foundation of Manufacturing Intelligence. It's possible today to capture item number, manufacturing number, work order details, lot numbers, date, time and additional KPIs to make traceability one of the strongest aspects of a manufacturing operation.

3. **Improve production plan performance by attaining greater schedule accuracy.** It's best to consider fixed production times on the Bill of Materials (BOM) as an average or median estimate that can vary widely depending on work center assignments, parts availability and many other factors. By having real-time data, the production time on BOMs can be fine-tuned and checked for accuracy. Without it, long-standing assumptions of fixed production times can hold an entire production line back from accomplishing more. Greater schedule accuracy based on real-time data from the shop floor makes production plans more efficient, increasing work center productivity and improving machinery utilization as well.

4. **Convert more sales quotes and proposals into orders by providing real-time Available- To-Promise (ATP), and Capable-To-Promise (CTP) dates on all standard or custom product configurations.** Manufacturers who are the quickest at delivering complete quotes are the ones winning the most deals. Providing ATP and CTP dates on every quote requires real-time integration between quoting, selling and manufacturing systems that scale across a company's entire product line. With real-time ATP and CTP embedded in each quote regardless of the product configuration, customers have the information they need to make a purchasing decision.

5. **Manufacturers are gaining up to a 6% improvement in Overall Equipment Effectiveness (OEE) when they rely on real-time quality metrics.** By relying on real-time data, manufacturers are gaining quicker insights and can determine which areas of availability, performance, and quality are most impacting performance. LNS Research found that manufacturers who rely on real-time data gain a significant competitive advantage over their peers. In the blog post, Improving OEE through Real-Time Visibility of Quality Metrics, the research firm advises that manufacturers with OEE levels below 80% need to consider shifting from batch-based to real-time data.

6. **Prolonging the life of equipment, machinery, and tools using real-time data to predict when maintenance, repair, and overhaul need to take place.** Real-time monitoring is providing an entirely new series of insights into how manufacturing equipment and machinery lifespans can be improved. By combining real-time data with predictive analytics, it's possible to determine when a given machine will need repair. Best of all,long-standing assumptions regarding preventative maintenance are changing due to greater insights gained from real-time data. All of these factors contribute to better business results, driving up Return On Invested Capital (ROIC) as machinery lasts longer.

7. **Enable higher levels of inventory control accuracy and performance across all production locations.** Batch-oriented approaches to inventory control, while economical, delay decisions and are prone to errors. Migrating to real-time inventory control delivers a wealth of benefits including eliminating overstock of raw materials, increasing inventory turns, and drastically reducing physical inventory from weeks to days. Manufacturers are also reducing inventory holding costs and safety stocks while optimizing inventory levels for their most in-demand products. The bottom line is that real-time data is the lifeblood of any world-class inventory control system and manufacturing operation.

8. **Reaching a new level of accuracy, quality, precision, and speed with internal and regulatory audits.** For medical device manufacturers who face many of the most stringent compliance requirements including those from the FDA, 21 CFR Part 11 and ISO, having real-time data can reduce the time taken to get audits done from weeks to days. Internal quality audits can be done faster and more often to undercover areas for improvement. Aerospace and Defense (A&D) manufacturers are relying on real-time data to meet AS 9100 Rev. C and D requirements, further accelerating their time-to-market.

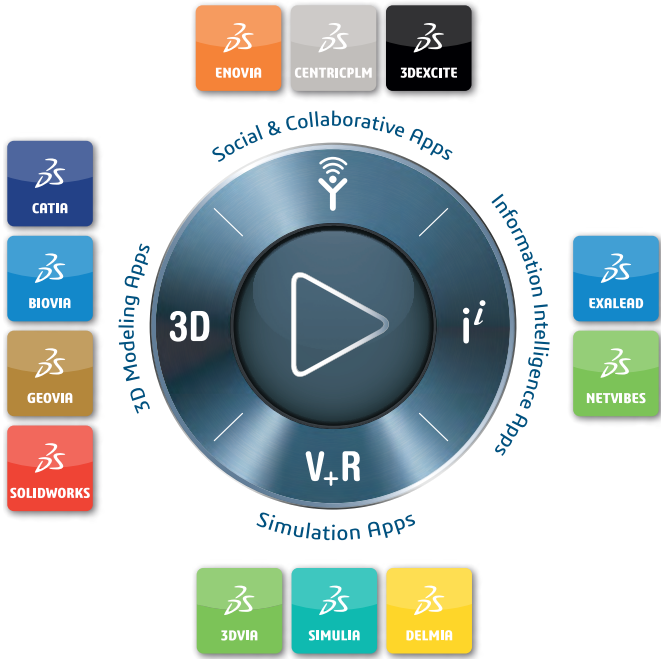
9. **Improving cycle times and reducing scrapped parts by using real-time data to better manage and optimize against constraints.** Attaining higher levels of cycle time performance often requires redefining and re-engineering parts of the production process. Constraints that get in the way of gaining greater cycle time improvements are integrated into the production process itself. Knowing which plant floor processes to change and how much to improve cycle times is key. Real-time monitoring can help to quantify constraints more accurately and define plans on how to overcome each to attain higher cycle times.

10. **Simplifying and scaling complex new business models based on mass customization and build-to-order profitable faster.** Managing mass customization and build-to-order manufacturing strategies are among the most challenging business models for manufacturers today. A prerequisite to excelling at these business model is real-time data on supplier inventory positions, quality levels, acceptance levels, production yields, Bill Of Materials (BOM) and work instruction accuracy, and most of all, order performance. The bottom line is that real-time data is a must-have for these business models as customers' expectations of immediate responses is the new normal.

Conclusion

Excelling at product quality, serving customers better than competitors and earning their trust, and being flexible enough to support short-notice production runs is how manufacturers are growing today. Combining all three and infusing an intensity into each being a core strength will further accelerate the growth of any business. Manufacturing Intelligence, or the applying of BI-based applications and tools to manufacturing, is making this happen today. Manufacturers are relying on analytics platforms and tools to increase product quality by tracking Overall Equipment Effectiveness (OEE), and better understanding what customers need.

Manufacturers are searching for new ways to reduce time-to-market, increase quality and excel for customers by being more responsive. Manufacturing Intelligence is providing new data-driven insights, often in real-time, that provide a roadmap and guidance to achieving these goals. Combining real-time analytics and Manufacturing Intelligence is a proven catalyst that drives faster, more profitable revenue growth, higher product quality, and greater agility in responding to customers and their product and production scheduling needs.



DASSAULT SYSTEMES | The **3DEXPERIENCE®** Company

Americas
Dassault Systèmes
175 Wyman Street
Waltham, Massachusetts
02451-1223
USA

Europe/Middle East/Africa
Dassault Systèmes
10, rue Marcel Dassault
CS 40501
78946 Vélizy-Villacoublay Cedex
France

Asia-Pacific
Dassault Systèmes K.K.
ThinkPark Tower
2-1-1 Osaki, Shinagawa-ku,
Tokyo 141-6020
Japan