

MANUFACTURING TECHNOLOGY INVESTMENTS THAT DRIVE GROWTH

Whitepaper



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INTRODUCTION

In some ways, the business challenges facing manufacturers today are timeless. For example, according to a recent IndustryWeek survey, the top two business challenges facing manufacturing firms were “growth and profitability” and “changing customer demands,” with each concern being named by 60% of respondents. Following in a distant third was “competitive pressure,” which was identified by 41% of survey participants.

However, these traditional challenges are taking on new dimensions as manufacturers face greater complexity and urgency in the wake of rapid shifts in customer demand, supply chains, and the costs and availability of parts and materials. These dynamics were reflected in the top three competitive challenges identified by manufacturers in the IndustryWeek survey: cost control and maintaining competitive pricing – 42%, scaling to meet customer demands – 41%, and manufacturing flexibility to meet changing market demands.

Manufacturers are responding to the challenges by increasing their investments in technologies that can improve processes, increase visibility across operations, and enhance decision-making. Notably, 93% of manufacturing executives surveyed by IndustryWeek are using one or more technologies in their digital transformation efforts today, and 59% of respondents plan to implement a technology platform that fully integrates their business systems.

The question then becomes: “Which technologies can have the greatest impact on the business?” In our years of working with manufacturing firms, the four areas that provide the greatest return on investment (ROI) are:

- End-to-end visibility
- Real-time production and process monitoring
- Demand-driven scheduling
- Real-time reporting and analytics

Let’s review how each of these four categories of technology investment provide the insights to optimize manufacturing operations and strategies, as well as rapidly adapt them as needed.



END-TO-END VISIBILITY

More manufacturers are seeking end-to-end visibility of their operations in order to understand how decisions made on the shop floor impact financial performance. The most cost-effective way to achieve this is when manufacturing and financial reporting applications, such as manufacturing execution system (MES) and enterprise resource planning (ERP) software share the same database. By eliminating the gaps between systems operating independently, companies gain the real-time visibility and control needed to get the most value out of every minute of manufacturing and make data-driven decisions about how to improve business performance.

Hand-in-hand with 360-degree visibility is the concept of design-to-manufacturing in which engineering, production, product quality, sales, and marketing all operate at the same cadence or clock speed, despite their supporting systems each having a different pace. It begins with the definition and design of a product and continues through to production and delivery to customers.

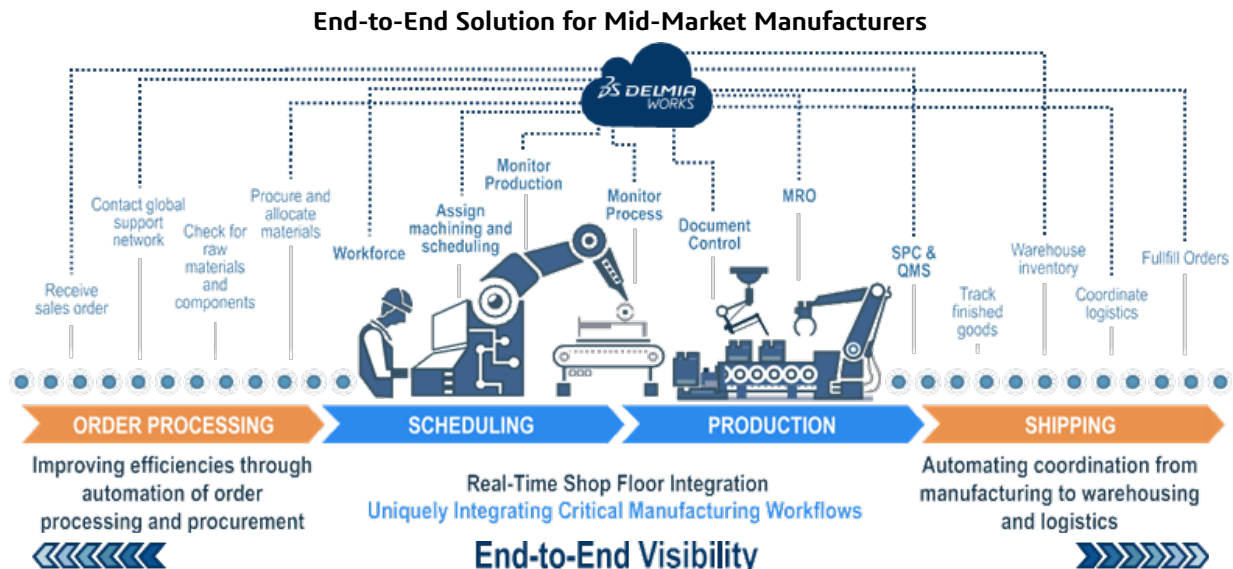
Getting diverse systems to operate in unison while producing new products is a central part of design-to-manufacturing strategies paying off today across a broad base of manufacturing sectors. A few notable benefits include the ability to:

- Reduce time-to-market by getting every department contribute to new products.

- Enable customers to make more informed decisions based on how different design and material choices will impact quality, cost and availability.
- Take on more customers without additional machinery or workers through better production and capacity planning.
- Strengthen account receivables through timelier, more accurate quoting and invoicing.

By ensuring that systems share a common source of data, design-to-manufacturing also provides the insights needed to enhance product quality, streamline production, and improve on-time customer deliveries. In doing so, it has proven effective both in absorbing supply chain shocks and in setting a strong foundation for future growth.

While manufacturers can integrate different products to have them use a common database, there are solutions on the market today that offer pre-integrated functionality, so companies can get up and running faster. For example, as the diagram below shows, the DELMIAworks platform delivers end-to-end visibility through a comprehensive set of ERP and MES modules all designed to work together and all unified on a single database. Additionally, DELMIAworks plugs into the 3DEXPERIENCE Works platform to create a seamless experience from design to production to delivery—enabling manufacturers to achieve their speed, quality, cost and revenue goals.



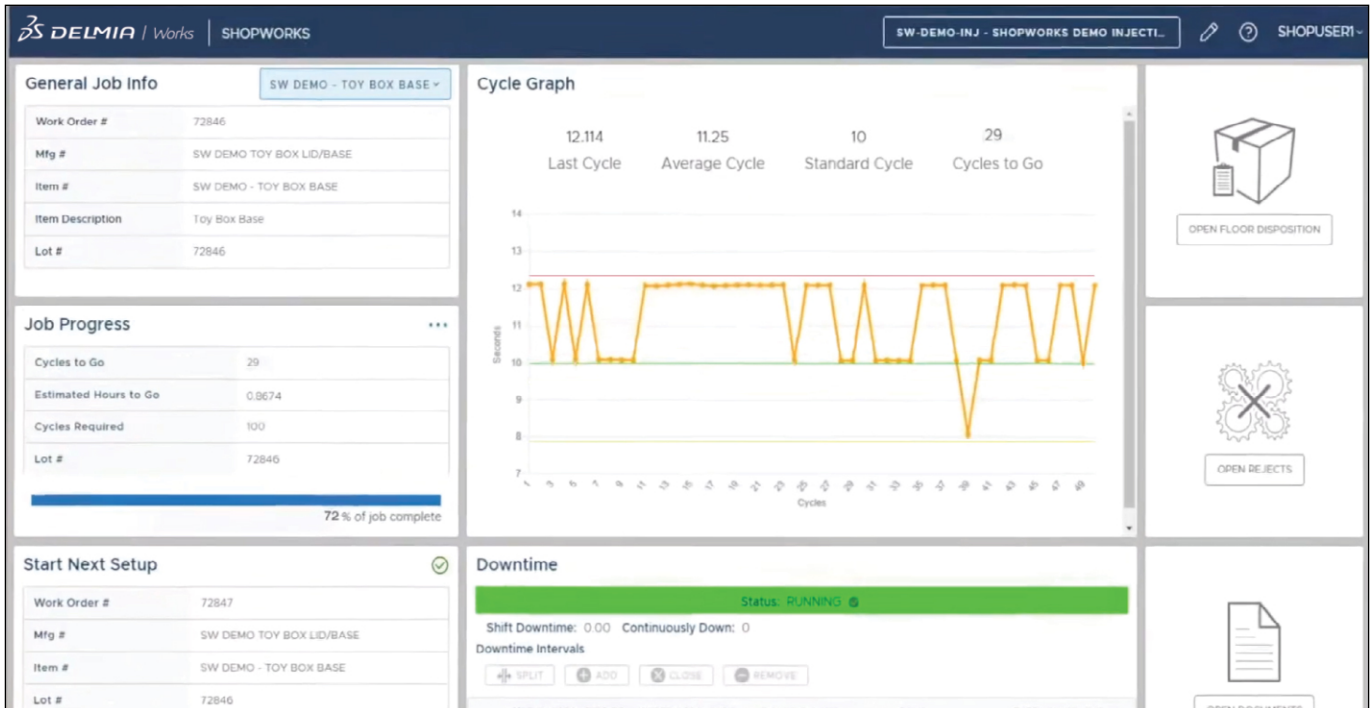
The bottom line is that time spent looking for new ways to streamline key manufacturing processes through end-to-end visibility is just as critical an investment as buying a new machine or software application.

REAL-TIME PRODUCTION AND PROCESS MONITORING

More manufacturers are purchasing smart machines that can report on production, utilization, wear, and energy use, among other metrics. These companies are also retrofitting their existing machinery with smart sensors that similarly provide valuable data, such as variations in production processes, which help to improve production efficiency and product quality. Collectively, these machines and sensors are producing a wealth of real-time data that is being applied to production and process monitoring.

In turn, real-time production and process monitoring are driving smart manufacturing by automatically updating ERP, MES, and related manufacturing modules with the data needed to enable continuous process improvement. With real-time production monitoring, manufacturers most often count production cycles, measure scrap, ensure all production steps are executed, measure production times, and predict completion times. Industry-leading real-time process monitoring systems rely on programmable logic controllers to capture data from machinery about how process parameters change during production. These include temperatures, pressures, weights, measures, and event durations by machine.

Manufacturers can then capitalize on the insights gained from real-time production and process monitoring by employing statistical process control (SPC) analysis and similar quality management techniques to see how they can take action and improve metrics over time. Key metrics include demand forecast accuracy, fill rate effectiveness as a percent of all orders, gross contribution margins by product and production facility, inventory carrying costs, inventory turnover, order cycle times, and order pick, pack, and ship accuracy. Companies can improve these metrics and more by using real-time production and process monitoring as a feedback system. For example, customer satisfaction goes up, driving down days sales outstanding (DSOs) on invoices because product quality meets or exceeds customer expectations. The data-driven lessons learned also can be used to make automated scheduling more accurate.



DEMAND-DRIVEN SCHEDULING

Facing constraints across their supply chains, demand planning, and labor, manufacturers need to make their production scheduling as efficient as possible by converting paper- and spread-sheet-based worksheets to an automated scheduling process. Doing so enables greater flexibility in prioritizing and scheduling orders. Additionally, it provides real-time visibility into the shop floor and all orders in process, which gives manufacturers greater insights into how they can increase shop floor productivity and grow.

Scheduling software may be offered as a standalone offering. Alternatively, it may be provided as part of an ERP or MES solution, such as Manufacturing Scheduling and Planning module available with the . DELMIAworks integrated ERP/MES platform. Typically, this software will include forecasting and production planning, and it will organize materials and resources to minimize lead times and ensure all product and packaging components, whether manufactured in-house or outsourced, are present when needed to run a job. Scheduling and planning software often also supports material requirements planning (MRP), master production schedules (MPS), an advanced planning and scheduling system, and capable-to-promise (CTP) functionality. Each of these provides manufacturers with greater end-to-end visibility across their production process.

Capable-to-promise is especially useful for keeping customers updated on when the orders they place will ship. This feature automatically checks raw material, machine tools, scheduling slots and impacts, and labor availability to complete an order—providing added edge of customer responsiveness it takes to keep winning orders. As a result, it is proving critical for manufacturers to set expectations with their customers and supply

chains. This is particularly true for small and mid-tier companies who are often part of broader supply chains; the ability of these manufacturers to accurately predict the completion date of customers' orders based on constraints is a strong competitive differentiator.

An interactive drag-and-drop graphical screen interface is increasingly being incorporated into manufacturing scheduling and production planning software in order to display the status of every order, task, and work center in real time. These screens may be mounted at work centers or on large-screen flat-panel monitors mounted over shop floors for easy reference. This enables employees on the shop floor to check a graphical scheduling screen any time. And any member of the production team can learn what job is next on the schedule, how it fits in with other jobs, and what they need to do, ensuring that everyone stays in sync.

The availability of real-time data for scheduling and production planning brings greater stability into daily manufacturing operations and contributes to a smoother, more consistent production cadence among teams. Having real-time end-to-end visibility of the production schedule also helps keep customer orders on schedule even while dealing with unforeseen interruptions on the fly. This has become crucial for meeting the expectations of customers who have used leading e-commerce sites and have come to expect split-second responses to their order status and inquiry requests. The bottom line is that the more efficient and responsive real-time production scheduling is, the more manufacturers can differentiate themselves with customers on their responsiveness and accurate delivery updates, as well as set their business up for growth.



REAL-TIME REPORTING AND ANALYTICS

Smart manufacturing starts with capturing real-time production and process data and understanding how trade-offs made across the diverse areas of production operations impact profits. Analytics and business intelligence (BI) tools that share the same database as a company’s ERP, MES, manufacturing scheduling, and planning solutions can provide the insights needed to improve shop floor efficiency.

Manufacturers rely on analytics and BI to understand how and why a given machine or series of machines in a workflow is driving exceptionally high costs due to excessive scrap. Analyzing real-time production and process data helps unlock why a given machine is operating out of spec and what can be done to solve the problem. The same base of analytics can be used to identify the cost implications of refurbishing a machine versus simply tolerating the problem and hoping to make it up in the gross margin of every day. Analytics technology also assists in uncovering the root cause of why one specific workflow with a given production team is struggling to reach daily output targets while another is surpassing production goals.

When analytics and BI tools have access to real-time production and process data, they can provide a broad base of metrics that streamline manufacturing operations. Five key metrics used by manufacturers to manage their operations include:

- Manufacturing cycle time**

The goal of this metric is to measure the time elapsed from when a product order is first taken to when it is produced and moved to finished goods inventory, Manufacturing cycle times improve when real-time data integration enables manufacturers to gain greater insights into overall production performance and use predictive and prescriptive modeling understand how removing constraints or roadblocks can improve cycle times.

- Overall throughput effectiveness (OTE)**

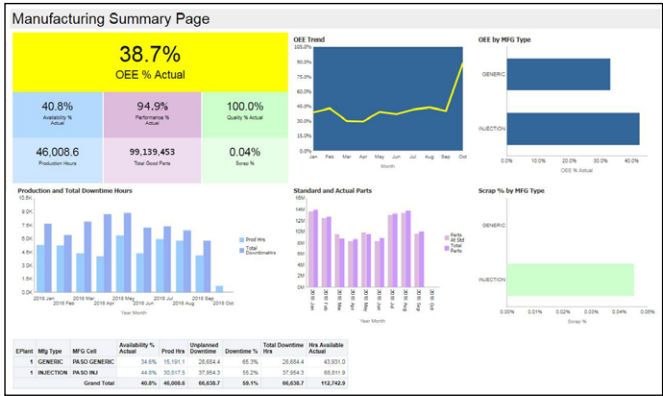
This metric quantifies plant or product center performance and has been constrained in the past by a lack of real-time data and monitoring. Using manufacturing intelligence applications and platforms based on business analytics-based technologies managers can use the insights provided to streamline production workflows and find additional capacity.

- Production yield rates by product, process, and plant location**

This metric defines how much salable product can be produced in a given period. The yield is invaluable in determining how the product, process, and plant locations perform against plan. By combining the real-time integration of monitoring with predictive analytics, it is possible to calculate a more precise analysis of yield variances or what most often causes production projects to vary in throughput levels.

- Perfect order performance**

Each manufacturer creates its own specific perfect order index (POI) to measure how accurate it is in taking an order, defining production scheduling—including inventory allocation—and fulfilling



the order on time. Perfect order performance is calculated using the following equation: % of orders delivered on time x % of orders complete x % of orders damage-free x % of orders with accurate documentation x 100. Combining order histories, customer purchase patterns, supply chain delivery, quality schedules, and production schedule makes it possible to determine which factors most and least contribute to perfect order performance.

- Return material authorization (RMA)** – This metric defines how many products were returned by customers due to a quality problem or because the products did not meet customer expectations. A surprising number of manufacturers still rely on Microsoft Excel spreadsheets to manage their RMAs. However, with just a simple listing of RMA numbers, manufacturers lack insight into what led to a product’s return in the first place. By combining returns data and managing it in a scalable database, manufacturers can classify the factors behind an RMA request and then complete a cause analysis of the problem.

CONCLUSION

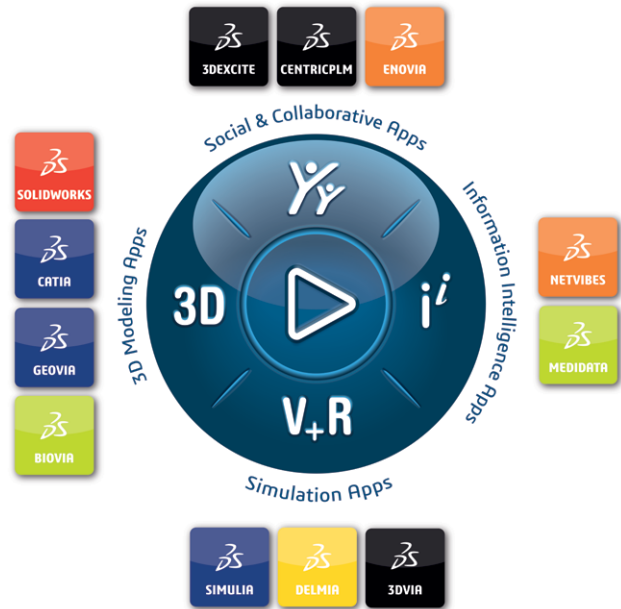
Traditional business challenges are taking on new dimensions as manufacturers face greater complexity and urgency in the wake of rapid shifts in customer demand, supply chains, and the costs and availability of parts and materials. Manufacturing firms are responding to the challenges by increasing their investments in technologies that can improve processes, increase visibility across operations, and enhance decision-making.

In working with manufacturers, we have identified four areas provide the greatest return on their technology investments. Chief among these is getting applications to share a common database in order to gain end-to-end visibility of the business, understand how to know how shop floor decisions drive financial results, and rapidly adapt to change. Similarly, through automated real-time production and process monitoring, demand-driven scheduling, and BI and analytics, manufacturers can more readily adapt their production, pricing and planning to changing customer demands and market conditions. In doing so, companies are better positioned to compete on quality and superior customer experiences while continuing to increase profitability and grow the business.

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