

## ARC WHITE PAPER

By ARC Advisory Group

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# Executive Guide to Real Time Operations Profitability: Benefits Manufacturers can Expect: Part 2

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## Executive Overview

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This is part two of a two part paper addressing the value of implementing a real time operations infrastructure to gain visibility, productivity and throughput, quality management, and real time asset utilization; all of which extend the value of plant to business integration.

ARC has noted that the primary benefits in manufacturing operations management (MOM) solutions are in the additional profits and business

**Benefits from implementing manufacturing operations management solutions:**

- Enhances process and operational visibility
- Increases productivity and throughput
- Improves product quality
- Tightens plant-to-business integration
- Raises asset utilization, uptime and equipment performance

value that companies get from applying the technology. Manufacturing operations management and manufacturing intelligence are among the fastest growing technologies that the ARC Advisory Group researches. This two part guide elaborates on the typical benefits that a manufacturing company can expect from implementing manufacturing operations management technology.

ARC has surveyed and contacted a number of end users, many of whom will testify that the return on investments (ROI) for using manufacturing operations solutions is obtained in six to nine months in most cases. Having a platform that integrates data from operations or the shop floor and makes the information easier to access, contextualize and turn into intelligence will enable faster and better business decisions.

According to these recent ARC surveys, most manufacturers obtain more benefits than expected from manufacturing operations management solutions. This is further validated based on a Wonderware / TechValidate survey, where the most cited benefits that manufacturers have received from implementing manufacturing operations management solutions:

- Enhanced process and operational visibility
- Increased productivity and throughput
- Improved product quality
- Tightened plant-to-business integration
- Raised asset utilization, uptime and equipment performance

Part one of the “Executive Guide to Real Time Operations Profitability: Benefits Manufacturers can Expect” white paper discussed how manufacturing operations management enhances process and operational visibility, increases productivity and throughput, and improves product quality. Part two of the white paper discusses how manufacturing operations management tightens plant-to-business integration and raises asset utilization, including uptime and equipment performance.

## **Tightened Plant-to-Business Integration**

### **Manufacturers Can Expect Benefits of About 10 Percent in Productivity Improvements**

Successful companies are integrating plant and business information into manufacturing operations management software and are collaborating better – among workers, plants, and executives globally. Being able to synchronize production and industrial operations with business objectives can enhance profitability. One caution for executives is that what works well in the business or enterprise environment may not work well on the plant floor. That is why it is important that manufacturing operations management software plays an integral part of and be synchronized into the business or enterprise environment without trying to clone it. For example, manufacturing operations management software should be able to integrate with work orders from the ERP or other business systems, but still be flexible enough to modify and change processes and products as needed. Benefits of this integration for manufacturers include, for example, reducing the need for safety stocks, having fewer production errors, etc.

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### **Closing the loop: Extending ERP into Manufacturing**

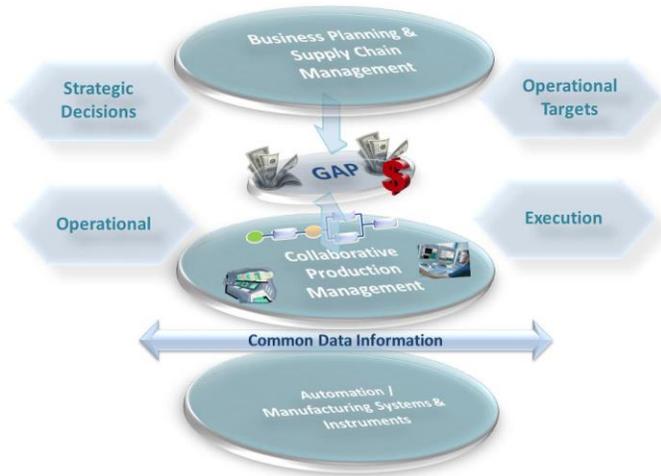
Integrating order and build information from the ERP system to the manufacturing orders or BOMs can have tremendous value. By integrating the product design into the manufacturing process, companies can reduce inaccuracies, time to market, and time to value. And as products are being designed faster than ever and with increased product complexity, reduced production cycles can have a positive impact on the manufacturer’s bottom-line. Early manufacturing involvement in initial product design can increase visibility and collaboration between product teams, which leads to

reduced risks, improved accuracy, better quality, increased compliance, lower costs and faster time to market.

Connecting and converging the business process to the manufacturing processes helps reduce downtime and empowers a more productive workforce. Manufacturing operations management helps close the loop between the business activities, such as work orders and product movements, with both the flexibility and agility to make changes based on real time events.

To be able to extract the correct information from the production floor, ARC believes that companies need a manufacturing operations solution that is capable of taking the data and converting it into intelligent, analyzed information. The integration of the business and shop floor systems is vital, for this to occur. An integrated enterprise can mean a better understanding of complex processes, capable of adapting to changes quickly and optimizing the enterprise.

**Solve the Money Gap with Convergence**



**Closing the Money Gap by Converging Business and Manufacturing Processes with Manufacturing Operations Management Software**

quality and process improvement facilities, supply chain planning, and visibility and process planning.

Converging business and plant information technology helps solve the gap between the automation system and the enterprise system, which still exists today. This gap often leads to lower performance and reduced profitability. When productivity declines due to a lack of real time information, money is lost.

Today’s modern manufacturing operations management software represents a broader set of functions, and helps businesses to solve the gap between the ERP or business system and the automation system by integrating real time production visibility, plant operations portals, plant-focused business intelligence,

### **Ease of Integrating Data in Real Time**

In order to gain visibility to big data, manufacturers need to be able to easily integrate data both within plants and across the enterprise. Companies need to be able to leverage the information to obtain the intelligence that enables real time responses to process changes, such as raw material variations, energy sources, or order demand variations.

ARC cannot emphasize the value of real time data enough.

ARC cannot emphasize the value of real time data enough. Most plants have historical data, often which has not been utilized or analyzed effectively. By collecting and integrating the data to the manufacturing operations solution, it can be contextualized and visualized in a format to enable decisions in real time or near-real time, and certainly before a problem becomes overwhelming or there is a shutdown.

The ability to easily integrate technologies within a standard platform allows for standardization, collaboration, and knowledge sharing so a system can be rolled out consistently and globally.

### **Ease of Integration**

Companies can utilize technology to connect plant floor and business systems, and present information to the viewer in the context of their role, responsibility, and authority. This arms the manufacturer with the ability to look at KPIs on business dashboards that utilize this intelligence and aligns the process with business goals.

Built in real time, manufacturing intelligence allows operations to manage structured and unstructured data (process data or events) and analyze complex data from any source over long periods of time, providing faster insight into recurring issues so workers can respond promptly and resolve issues quickly.

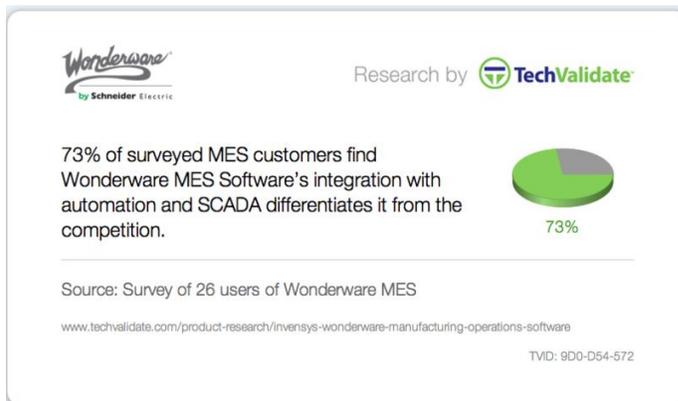
With manufacturers looking to make themselves more sustainable in order to achieve new levels of efficiency and improve their use of resources, integrated enterprises promise to help companies get more insight into their manufacturing operations and be able to make decisions quickly using the new information. Manufacturing operations management systems enable manufacturers to integrate data from areas, such as inventory and bills of materials, shortening the quote to cash lifecycle that adds up to bottom line benefits.

### Capture Real Costs in Real Time

Costs, such as materials, labor, waste, and downtime, can be captured more precisely and directly from the shop floor in real time. This makes the information more reliable and actionable for pricing new work or renegotiating unprofitable business. This also enables companies to measure and track the value of their manufacturing operations management system.

### Integrating Silos

Manufacturers are besieged with all kinds of information, including a complex plethora of spreadsheets, reports, and numerous disparate custom



applications and data from many different systems, sensors and equipment. The information can include information and data from process equipment, diverse automation systems, such as DCS, PLCs, PACs, MES, CPM, ERP, PLM, WMS, PIMS, LIMS, QMS, batch management systems, historians, Microsoft Excel, Microsoft Access databases, and other legacy systems

and databases. And manufacturers need manufacturing operations management solutions that integrate information, systems and databases easily so that everyone from the shop floor worker to the business worker has a unified vision of the information and users can make intelligent decisions globally, or based on a "single version of the truth." Without manufacturing operations management tools, employees end up evaluating hundreds of static spreadsheets or reports rather than making business-critical decisions based on timely information. Plants need real time quality information that allows them to track the product end-to-end from raw materials to shipping. Enabling an organization with tools that allow workers to make consistent, accurate, and timely decisions drives efficiency.

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One of the most often cited issues that prevent companies from implementing a manufacturing operations management solution is the inability to integrate all of the islands or silos of automation; the automation systems, the databases, sensors and other equipment in manufacturing or operations. In many cases, the equipment generates data

that is not integrated and employees end up collecting and collating the data manually.

“We manage allergens at the plant level instead of relying on the ERP Provider. This gives us full uptime to protect our customers without relying on an external system that may or may not be available at a given moment.”

Process Engineer, Global 500 Food Company

Manufacturing operations management software can provide the platform for integrating the data, analyzing the data, and making the required data available to the appropriate person at the correct time. The amount of data is increasing faster than anyone can imagine and in order to make sense of the data, manufacturers need a solution that can take the appropriate data and turn it into knowledge

and intelligence that enables the manufacturer to make real time decisions.

Companies that use manufacturing operations management solutions find that they reduce downtime because they are able to predict potential problems faster and fix the problem quicker. The ability to connect to the devices, equipment, machinery and systems, and integrate and utilize the information and intelligence that is embedded in these devices can lead to significant performance improvements.

Plant managers have repeatedly told ARC “We are drowning in data, but starving for information.”

Companies do not improve performance just by connecting to the latest new smart device or application. All the connected devices and the zettabytes of data are not always useful unless the operations management technology is integrated into the process.

Plant managers have repeatedly told ARC “We are drowning in data, but starving for information.” By using the manufacturing operations management software, companies can extract the value from the data, analyze and visualize the data using new intelligence, and make faster, fact-based decisions. The software provides industrial operations with the ability to gain the relevant knowledge and utilize the information.

## Raised Asset Utilization, Uptime and Equipment Performance

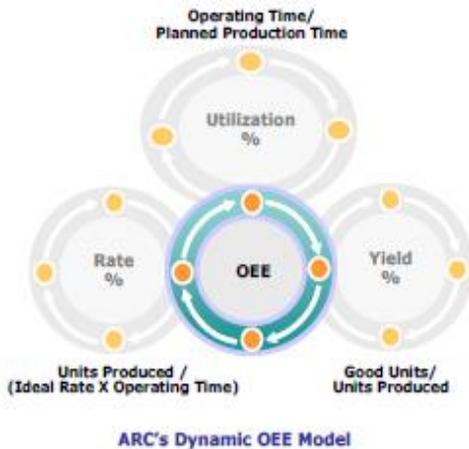
### Manufacturers Can Expect Benefits up to 50 Percent in Reduced Costs; Uptime Improvements of up to 30 Percent; and OEE Improvements of up to 20 Percent

Asset utilization and asset availability are two key indicators that show how well assets are being managed, but the information must be based on real time intelligence. Companies can improve asset utilization by monitoring real time equipment downtime and analyzing the effectiveness of assets used in the production process. Critical equipment downtime and efficiency information needs to be communicated in real time to operators and decision-makers who can take immediate actions to improve plant performance and productivity. The measurements may include reliability and maintenance information, but the data must be real time information to provide accuracy and enable production improvements.

#### Real Time Dynamic OEE

Manufacturers must address process and business issues that include globalization, faster product lifecycles with demand for more customized products, and economic pressures driven by increased competition. Over-

all equipment effectiveness (OEE) is often used to measure efficiencies and enforce standards, such as the availability of machines or utilization of equipment. OEE is a formulation of three dynamic variables used to determine a metric that represents the overall performance of an asset and includes a combination of yield of the production run: rate of production when manufacturing, utilization availability to produce product when scheduled, and product quality.



Most companies have room to improve OEE. The calculation can identify waste and inefficiencies in manufacturing processes because it focuses on the wasted time when a plant is not producing. It not only considers machine downtime due to poor maintenance programs, but also lengthy set ups or slow machine throughput. It also helps managers understand the trade-offs

between operating equipment at a faster rate while perhaps suffering a poor yield during the start-up phase.

OEE helps determine what impact the current performance of any individual piece of equipment has on the overall efficiency of the plant in terms of key performance indicators (KPIs), such as throughput or downtime, and

Real time, or Dynamic OEE metrics, need to be integrated into the operations management software based on real time performance indicators because non-real time OEE, while an excellent metric for gauging production performance, is not sufficient to completely measure performance if it is not based on real time data and information.

generates reports of actual performance versus targets. To increase productivity, it is important to know how machines and equipment are running so that the company can reduce downtime.

Understanding the OEE on the existing asset base gives a manufacturer insight as to whether performance improvements are

needed on an existing asset or if augmenting the asset base with new equipment is a better capital spend. Many manufacturers use OEE to determine equipment utilization and downtime using measurements that compare cycle times, downtime, uptime, idle time, etc. Comparisons between current performance and performance relative to design specifications are possible due to the use of a predictive model-based method. This method helps production management make essential operating decisions to increase plant performance by optimizing maintenance schedules that account for the maximum economic performance of equipment rather than solely depending upon attempts to predict and avoid failures. Having a consistent measure of asset performance enables manufacturers to make intelligent decisions about capital investments that can yield the greatest return on investment. However, real time, or Dynamic OEE metrics, need to be integrated into the operations management software based on real time performance indicators because non-real time OEE, while an excellent metric for gauging production performance, is not sufficient to completely measure performance if it is not based on real time data and information.

### **Dynamic OEE Leads to Quality Improvements**

An integrated Dynamic OEE can be used to gauge, measure and improve quality. For example, Dynamic OEE may keep track of how often the sample is collected, and quality of the sample against the plan. Dynamic OEE can also be combined with statistical process control (SPC) calculations to determine if the process is in control or out of control, and the operations

management software may be designed to determine what action should be taken with the products that do not meet the quality standards.

### **Standards and Multi-Plant Benefits for Large and Small Businesses**

Many industrial companies with regional or global operations are working towards standards for their technologies, equipment, applications, process and plants across their enterprise. Having a system with a manufacturing operations management model flexible enough to be able to customize for multiple plants can lead to global best practices and standards, faster time to market, and lower costs in greenfield and brownfield plants. Smaller companies can also leverage multi-plant and multi-site implementation capabilities by adapting to product and process changes, and reducing costs using a model that easily adapts and scales to multiple processes.

An enterprise-wide management operations system enables sharing of best practices and standards for processes and technologies, increasing visibility, throughput, yield, and efficiency while reducing energy consumption and costs.

Some multinational companies are working to standardize the management of shop-floor systems across their networks of plants. Standardization across plants using a customizable multi-site, multi-country model enables a best practice approach to manufacturing operations management. The use of a model can help companies gain a more comprehensive view of all plants in the supply chain, achieve better control over plants, optimize the plant network as a whole to drive operational excellence in manufacturing, and reduce manufacturing costs. When plants operate collaboratively it is easier to benchmark, share knowledge and improve performance.

An enterprise-wide manufacturing operations management system enables sharing of best practices and standards for processes and technologies, increasing visibility, throughput, yield, and efficiency while reducing energy consumption and costs. Plants do often differ significantly, especially when a company produces a wide variety of products. It is important to understand how a flexible manufacturing operations management model based approach can help improve plant performance and puts the manufacturer in a better position to quickly implement new approaches in plants around the world. Manufacturing operations management solutions that can adapt to changing best-in-class practices is helping manufacturers become more competitive in a demanding global marketplace.

ARC believes that a best practice for all companies, large and small, is to adapt scalable manufacturing operations management system technology that addresses organizations ranging from multi-plant to single plant with scalable, modular processes.

### Enforcing Standards and Workflows and in Real Time

In addition to enforcing standards, manufacturing operations management systems technology includes the ability to incorporate best practices, knowledge management, and workflow enforcement.

Workflow execution and real time visibility can provide workers with the appropriate information and intelligence to make and implement decisions quickly. Manufacturing operations management functions include dispatching production orders to the appropriate workstations or automated process units, delivering work instructions that aid production personnel in completing jobs successfully, and identifying, tracking and monitoring specific raw materials.

### Keeping Score of Overall Benefits

Improved product quality, rapid consumer product development, better product planning and scheduling, ease of integrating information and systems, and enhanced visibility into the manufacturing process are possible

with the use of modern manufacturing operations management solutions. The improvements all add up to production, process and product efficiencies and more profitable operations. The benefits discussed in this series of white papers are based on a survey of users who measure performance. However, some users do not measure the benefits and instead take a leap of faith, which is not always the best method of determining the ROI of manufacturing operations management systems. ARC believes that it is important for companies to establish a baseline of performance before the

ROI Scorecard					
	Year 1	Year 2	Year 3	Year 4	Year 5
Increased Revenues					
Cost Reductions (10-20%)					
Operational Visibility (~ 80%)					
Productivity & Throughput (20-30%)					
Quality Improvements (10-20%)					
Downtime Reduction (10-50%)					
Production Improvement (20-30%)					
OEE improvements (>20%)					
Work enforcement...(>20%)					
Total Benefits	\$___	\$___	\$___	\$___	\$___
Total Investment	\$___	\$___	\$___	\$___	\$___
ROI (\$)	\$___	\$___	\$___	\$___	\$___
ROI Benefit (%)	___%	___%	___%	___%	___%
Payback Period	\$___	\$___	\$___	\$___	\$___
3-Year ROI (NPV)	\$___ ( ___%)				
5-Year ROI (NPV)	\$___ ( ___%)				

**It is Important that Manufacturers Track the Value from the Technology**

software is implemented to help them better understand and measure benefits in real time, using an ROI scorecard.

### **Many More Benefits**

There are also many other benefits that can be realized by implementing modern manufacturing operations management systems.

A few other top benefits cited include:

- Increased collaboration, task management and workflow enforcement, where end users can expect benefits of at least 10 percent in productivity improvements
- Enhanced energy management, with energy savings ranging from between 11 to 21 percent per year
- Improved scheduling lead times, inventory reductions and performance improvements ranging from between 25 to over 100 percent

## **Summary**

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Manufacturing operations management software helps executives gain better insight into the process and to really understand what is happening in

“What used to take hours or days to solve, can now be done in seconds,” said an ARC client about using manufacturing operations software.

real time. Manufacturing operations management software can result in significant benefits that improve time to market, asset utilization, manufacturing flexibility, safety and efficiency, all with lower operational risk. The benefits that manufacturers can gain from deploying manufacturing operations management

software can really impact the bottom line. However, companies need to measure and track the value.

The ability to integrate legacy systems and business systems with plant floor systems is sometimes difficult or even a deterrent for implementing manufacturing operations management software. However, with modern systems this should be easier. The software should be able to integrate easily to other systems, access and exchange information from the shop floor and the plant floor to the business system.

Metrics, such as Dynamic OEE, KPIs and other performance indicators should be integrated into dashboards with real time information and made available to the appropriate worker at the correct time. If users haven't established a benefits baseline and measure the results it is difficult to determine the real benefits and ROI.

Because performance targets are critical to the success of productivity improvements, executives need to base their information and decisions on real time information and metrics that measure benefits and that realistically reflect current conditions.

#### **A Summary of the Top Cited Benefits Include:**

- **Enhanced Process and Operational Visibility:** Manufacturers can expect as much as an 80 percent decrease in decision making time due to improved operational visibility combined with real time analytic tools
- **Increased Productivity and Throughput:** Manufacturers can expect overall productivity improvements ranging from 15 to 20 percent by employing a real time manufacturing operations solution
- **Improved Product Quality:** Expect consistent quality products and brands with 10-20 percent in cost reductions and as much as 20-30 percent increase in yields
- **Tightened Plant-to-Business Integration:** Expect benefits of about 10 percent in productivity improvements
- **Raised Asset Utilization, Uptime and Equipment Performance:** Expect benefits up to 50 percent in reduced costs; Uptime improvements of up to 30 percent; and OEE improvements of up to 20 percent

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**Acronym Reference:** For a complete list of industry acronyms, please refer to <https://arcadvisorygroup-public.sharepoint.com/research/Lists/IndustryTerms/AllItems.aspx>

<b>BOM</b>	Bill of Material	<b>MOM</b>	Manufacturing Operations Management
<b>CPM</b>	Collaborative Production Management	<b>NPI</b>	New Product Introduction
<b>DCS</b>	Distributed Control System	<b>OEE</b>	Overall Equipment Effectiveness
<b>EMI</b>	Enterprise Manufacturing Intelligence	<b>PAC</b>	Programmable Automation System
<b>ERP</b>	Enterprise Resource Planning	<b>PIMS</b>	Process Information Management System
<b>FDA</b>	US Food & Drug Administration	<b>PLC</b>	Programmable Logic Controller
<b>HAACP</b>	Hazard Analysis Critical Control Point	<b>PLM</b>	Product Lifecycle Management
<b>IT</b>	Information Technology	<b>QMS</b>	Quality Management System
<b>KPI</b>	Key Performance Indicator	<b>ROI</b>	Return on Investment
<b>LIMS</b>	Laboratory Information Management System	<b>SPC</b>	Statistical Process Control
<b>MES</b>	Manufacturing Execution System	<b>WMS</b>	Warehouse Management System

Founded in 1986, ARC Advisory Group is the leading research and advisory firm for industry. Our coverage of technology from business systems to product and asset lifecycle management, supply chain management, operations management, and automation systems makes us the go-to firm for business and IT executives around the world. For the complex business issues facing organizations today, our analysts have the industry knowledge and first-hand experience to help our clients find the best answers.

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