

Event Driven Manufacturing Intelligence

Creating Closed Loop Performance Management

May 2008

Executive Summary

Executives face numerous challenges in successfully optimizing performance across global manufacturing operations and aligning this with overall corporate goals. In today's economic environment, the number one driving force for performance management is the reduction of operating costs. Prior Aberdeen research found that to accomplish this objective, many executives are attempting to synchronize asset, production, quality, and inventory management across multiple facilities to reduce the impact of adverse events. This new research identifies the key business capabilities and technology enablers that enable manufacturers to close the performance loop by gaining visibility across the production, inventory, assets and quality management aspects of manufacturing operations.

Research Benchmark

Aberdeen's Research Benchmarks provide an in-depth and comprehensive look into process, procedure, methodologies, and technologies with best practice identification and actionable recommendations

Best-in-Class Performance

In the following analysis, Aberdeen uses three Key Performance Indicators (KPIs) to identify Best-in-Class performance. Across these metrics Best-in-Class manufacturers averaged:

- 97% On Time Delivery (OTD)
- 91% Overall Equipment Effectiveness (OEE)
- 98% Overall Yield

Competitive Maturity Assessment

Aberdeen's survey analysis shows that the firms enjoying Best-in-Class performance shared several common characteristics.

- Best-in-Class are 65% more likely to standardize exception handling processes and procedures across manufacturing operations
- Best-in-Class are 2 times more likely to enable continuous improvement teams with analytics and real time visibility
- Best-in-Class are 4 times more likely to display operational data and metrics in real-time

"We have found that through the use of real-time line performance data we are able to more accurately and quickly get to real root cause and therefore improve problem resolution. We are at fledgling stage with this tool but are seeing real benefit already."

~ Peter York, Supply Chain Development Manager
Simplot Australia Pty Ltd

Required Actions

To achieve and sustain Best-in-Class performance, companies must focus on improving operations in the following ways:

- Automate data collection across manufacturing operations and use this data to control production optimization and enable analytics
- Provide role based visibility and establish automated workflows across manufacturing operations to manage adverse events
- Invest in visualization and analytical technologies to gain visibility across manufacturing operations and improve decision making.

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Chapter One: Benchmarking the Best-in-Class

Business Context

Manufacturers are continually challenged to react effectively when adverse events occur throughout the manufacturing process, all while continually optimizing performance. Both reaction time and closing the loop with affected parties are key differentiators for minimizing the cost of adverse events and ensuring effective decision making. Adding to the complexity of implementing event-based manufacturing intelligence and closed loop performance management are globalization, shrinking product lifecycles, and increasing government and customer compliance obligations among others.

Through an examination of the specific strategic actions Best-in-Class manufacturers are implementing around business processes, organizational architecture, and knowledge management, this benchmark report establishes how closed loop, event-based performance management enables Best-in-Class manufacturers to optimize operational performance while reducing the cost of adverse events. Additionally, particular interest will be paid to how event-based manufacturing intelligence and closed loop performance management can play an integral role in the success of each.

Fast Facts

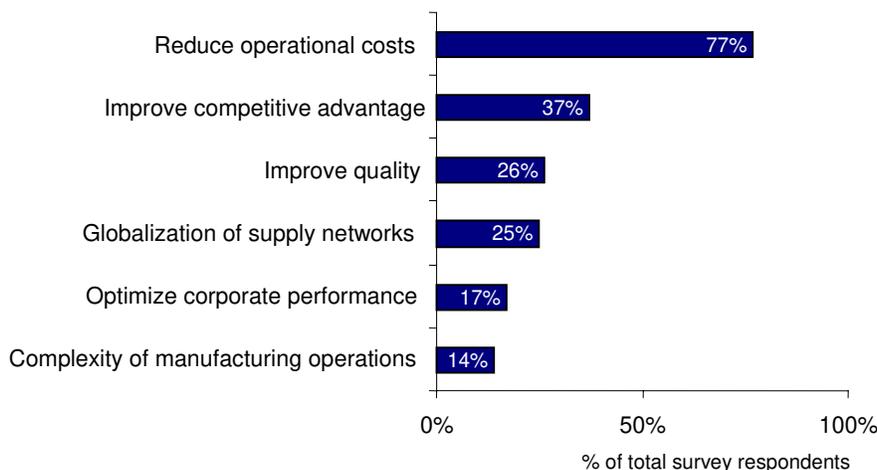
Best-in-Class enterprises significantly out perform their competition in all three KPI. These manufacturers enjoy:

- √ 97% On Time Delivery (OTD)
- √ 91% Overall Equipment Effectiveness (OEE)
- √ 98% Overall Yield

Cost Reduction: Mantra for Manufacturers

Given today's economic climate, manufacturers can ill afford to neglect any aspect of the enterprise. Of particular interest to the executives leading these organizations are operating costs, which are a dynamic part of an equation that drives the success of every organization.

Figure 1: Top Market Pressures



Source: Aberdeen Group, May 2008

Manufacturing operations have a significant impact on the overall cost structure of the enterprise, including the costs associated with assets, production, quality, and inventory. Subsequently, the overwhelming majority of enterprises are being forced to focus on manufacturing operations in response to the pressure of reducing operational costs. The focus of these enterprises on cost reductions across manufacturing operations will remain central throughout the rest of this analysis and continue to re-emerge in our key findings, starting with the strategic actions manufacturers are taking in attempting to reduce operational costs.

The Maturity Class Framework

Aberdeen uses three key performance criteria to distinguish the Best-in-Class from Industry Average and Laggard organizations. These are:

- **On Time Delivery (OTD)** Percentage of products delivered on time as compared to total original commitment
- **Overall Equipment Effectiveness (OEE)** Measured in percentage as availability * performance * quality
- **Overall Yield** Given the raw materials consumed during production; Actual Yield / Theoretical Yield.

Respondents were divided among three categories based on their aggregate performances in these three metrics: the top 20% of performers (Best-in-Class), the middle 50% (Industry Average), and the bottom 30% of performers (Laggards). Table 2 displays the aggregated performance of Best-in-Class, Industry Average, and Laggard organizations.

"Sonoco has set a corporate objective to make customer service level a competitive advantage in each of our businesses while at the same time operating at top operational performance levels in cash gap compared to our peers. To deliver both objectives we must understand and respond to customer demand to a far greater extent than today."

~ Keith J. Holliday, Director
 Corporate Supply Chain,
 Sonoco

Table 1: Top Performers Earn Best-in-Class Status

Definition of Maturity Class	Mean Class Performance
Best-in-Class: Top 20% of aggregate performance scorers	<ul style="list-style-type: none"> ▪ 97% On Time Delivery ▪ 98% Yield ▪ 91% Overall Equipment Effectiveness
Industry Average: Middle 50% of aggregate performance scorers	<ul style="list-style-type: none"> ▪ 92% On Time Delivery ▪ 92% Yield ▪ 82% Overall Equipment Effectiveness
Laggard: Bottom 30% of aggregate performance scorers	<ul style="list-style-type: none"> ▪ 78% On Time Delivery ▪ 76% Yield ▪ 70% Overall Equipment Effectiveness

Source: Aberdeen Group, May 2008

The Best-in-Class PACE Model

Reducing manufacturing costs in the face of increasing commodity prices and complexity in the manufacturing environment can be a daunting task. Table 2 below summarizes some of the strategic actions, business process capabilities, and technology enablers Best-in-Class companies have implemented to address these market pressures.

Table 2: The Best-in-Class PACE Framework

Pressures	Actions	Capabilities	Enablers
<ul style="list-style-type: none"> Reduce operational costs 	<ul style="list-style-type: none"> Reduce the variability in product processes Integrate analytical capabilities with event monitoring 	<ul style="list-style-type: none"> Standardized processes for responding to adverse events across the enterprise All levels of the operation, executives to operators, have both role-based visibility and defined responsibilities in the case of an adverse event Historical data is mined for predictive analytics and optimized decision making Non-Conformance alerts are displayed in real-time and are role-based for optimal decision making Operational metrics are linked with financial metrics Visibility and analytical solutions are integrated across manufacturing operations Technology interoperates across the S95 stack based on industry standards 	<ul style="list-style-type: none"> Plant Floor Automation (PFA) Manufacturing Execution Systems (MES) Enterprise Asset Management (EAM) Quality Management Systems (QMS) Enterprise Manufacturing Intelligence (EMI) Asset Performance Management (APM) Statistical Process Control (SPC) Manufacturing Analytics Role-based Dashboards Automated Workflows Non-Conformance / Corrective and Preventative Action (NC/CAPA)

Source: Aberdeen Group, May 2008

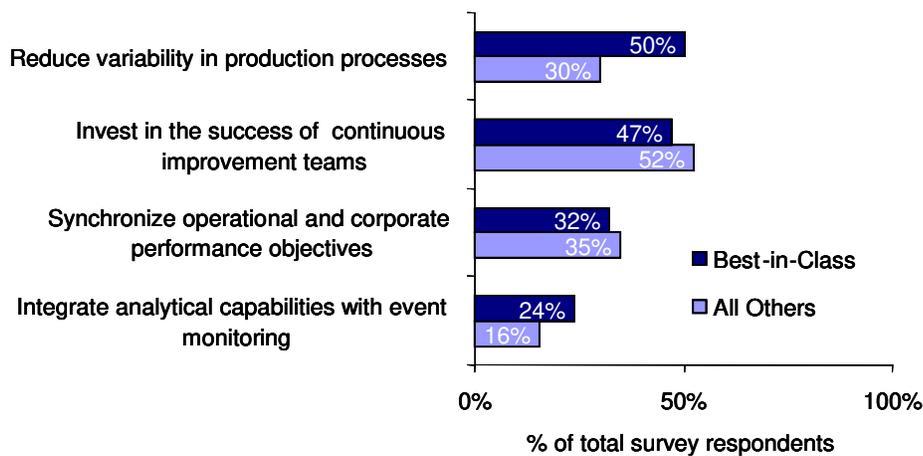
Best-in-Class Strategies

The top strategic action, being taken by half of Best-in-Class manufacturers to address the market pressure is to reduce variability in the production process. Best-in-Class manufacturers are 40% more likely than other manufacturers to establish strategies around reducing variability in the production process. Reducing variability is a critical step to ensure that products are manufactured in compliance and within established specifications.

The Best-in-Class are making this possible by establishing continuous improvement teams and providing these teams with resources to ensure success. Continuous improvement teams and the programs that support their efforts are largely under-funded and very often managed at the plant level. Over the past several years and multiple benchmark reports produced by Aberdeen's manufacturing practice, the plant-level view has been continually shown as less and less accurate.

Investing in the success of continuous improvement teams can be done in many ways, often coupling cross-functional participation, technology and streamlined business processes. Furthermore, the way in which manufacturers make these investments goes a long way to achieving Best-in-Class performance and successfully reducing operational costs while increasing overall profitability.

Figure 2: Best-in-Class Strategic Action



Source: Aberdeen Group, May 2008

Best-in-Class companies are more likely to establish strategies around integrating analytical capabilities with event monitoring. Adopting analytical capabilities is important to ensure that the volume of data collected from the plant floor as well as from the enterprise is easily interpreted by decision-makers from plant floor employees and corporate executives. The integration of analytical tools with event monitoring makes it possible to monitor data in real time and inform appropriate decision-makers in case of a non-conforming incident. While this is a critical strategy to preventing adverse events, less than one quarter of respondents are currently taking this as a top strategic action.

Fast Facts

Event Monitoring in the context of manufacturing is the process of collecting, analyzing, and signaling event occurrences to subscribers such as operating system processes, active database rules, as well as machine operators. These event occurrences may stem from arbitrary sources in software, hardware, or manual processes, including operating systems, database management systems, application software and processors, or the machine operators themselves.

Aberdeen Insights — Strategy

In order to address the market pressures successfully and execute the strategies mentioned in Figure 2, manufacturers are facing a variety of challenges. First and foremost, manufacturers of every size, even those with only a single site, face the challenge of effectively managing complex data sets from across operations for decision-making (49%). These data sets are often trapped in un-intelligible data bases and can not be effectively leveraged by decision-makers or analytical tools. To leverage these data sets effectively, manufacturers must overcome another one of the top three challenges, a lack of understanding in how technology can help alleviate this situation (39%). This finding is supported by the low adoption of the "Enterprise Manufacturing Intelligence" technologies that Aberdeen has consistently identified in previous research. However, Aberdeen research shows that the awareness of such technology solutions is increasing with more than 50% of the responding manufacturers planning to adopt these solutions in the next 12 to 24 months.

The next chapter will uncover the business processes and technologies that are critical to unlocking the value trapped in the disparate data sets distributed across the manufacturing operations.

"At Hormel Foods we believe that you measure what is important and that what gets measured gets improved. Variation is our enemy and by using Statistical Process Control (SPC) to reduce this variation we have seen multiple benefits. Namely, we remain in compliance with our nutritional statements and the USDA, we deliver a more consistent product to our customer, all while simultaneously reducing costs."

~ Marty Slagel,
Corporate Quality
Hormel Foods

Chapter Two: Benchmarking Requirements for Success

Competitive Assessment

Aberdeen analyzed the aggregated metrics of surveyed companies to determine whether their performance ranked as Best-in-Class, Industry Average, or Laggard. In addition to having common performance levels, each class also shared characteristics in five key categories: (1) process (the standardization and management of processes across the enterprise); (2) organization (continuous improvement teams and role based visibility to all levels of organization); (3) knowledge management (automating data collection and using it as actionable intelligence); (4) technology (the software and capabilities that are crucial for achieving operational excellence); and (5) performance management (measuring the metrics and linking those metrics to financials). These characteristics serve as guidelines for best practices, and correlate directly with Best-in-Class performance across the key metrics.

Fast Facts - Technology Adoption

Best-in-Class manufacturers are more likely than Laggards to adopt the following solutions for Manufacturing Operations Management

- √ 3 times as likely to adopt EMI
- √ 5 times as likely to adopt APM
- √ 2 times as likely to adopt MES
- √ 38% times more likely to BI

Table 3: The Competitive Framework

	Best-in-Class	Average	Laggards
Process	Exception handling processes and procedures are standardized across manufacturing operations		
	45%	41%	27%
	Escalation procedures for non-conformance events are standardized across the enterprise		
	52%	44%	29%
	Measurement of operational Key Performance Indicators (KPIs) are standardized across the enterprise		
	71%	52%	38%
	Production optimization uses real time data from production processes and responds to process deviations		
	50%	28%	22%
	Plant floor exceptions are monitored in real time		
66%	38%	22%	
Organization	Production release and control leverages real time data		
	52%	29%	20%
	Continuous improvement teams leverage analytics and real time visibility into operations for improved performance		
62%	31%	32%	
All levels of the organization have both role based visibility and defined responsibilities in the case of an adverse event			
36%	34%	23%	

Fast Facts - Three Letter Acronyms

Technologies described in this research that fall across the S95 stack in layers 3 and 4 include:

- √ **EAM** - Enterprise Asset Management
- √ **MES** Manufacturing Execution Systems
- √ **QMS** Quality Management Systems
- √ **APM** - Asset Performance Management
- √ **EMI** - Enterprise Manufacturing Intelligence
- √ **SPC** - Statistical Process Control
- √ **BI** - Business Intelligence

	Best-in-Class	Average	Laggards
Knowledge	Data collection from manufacturing operations is automated		
	41%	37%	24%
	Manufacturing data is maintained and managed in a data historian application		
	61%	47%	40%
Technology	Percentage of manufacturers currently using technology:		
	▪ EAM: 39%	▪ EAM: 20%	▪ EAM: 20%
	▪ MES: 35%	▪ MES: 28%	▪ MES: 16%
	▪ QMS: 66%	▪ QMS: 62%	▪ QMS: 54%
	▪ APM: 29%	▪ APM: 15%	▪ APM: 6%
	▪ EMI: 19%	▪ EMI: 12%	▪ EMI: 6%
	▪ SPC: 55%	▪ SPC: 51%	▪ SPC: 40%
	▪ BI: 38%	▪ BI: 26%	▪ BI: 10%
Performance	Operational data and metrics are displayed in real-time		
	50%	33%	12%
	Operational metrics linked with financial metrics		
	53%	53%	33%
	Analytics are used to provide predictive insights		
	42%	33%	16%

Source: Aberdeen Group, May 2008

Process

The Best-in-Class are differentiating themselves by standardizing processes across the enterprise and incorporating real-time event monitoring and analytics into business processes. Regarding standardization, there are three key processes that the Best-in-Class are standardizing. First, the processes governing exception handling are being standardized. In fact, the Best-in-Class are almost twice as likely as Laggard manufacturers to standardize the ways exceptions are identified and managed. Concrete examples of standardizing these processes include: standardizing the way thresholds for manufacturing metrics are established and standardizing how an exception to these thresholds is managed whether it be the opening of a Corrective and Preventive Action (CAPA), the use of root cause problem solving, or the alerting of a responsible supervisor.

In a related set of processes, the Best-in-Class are also standardizing how exceptions are being escalated. Again, the Best-in-Class are almost twice as likely as Laggard manufacturers to escalate non-conformances in a standardized way. This means, for any given non-conformance event across manufacturing operations, the Best-in-Class have invested the time and energy to establish a pathway and method of escalation up the management hierarchy and across the multiple functional groups that may be responsible.

For example, a check-weigher may be discovered as non-functioning between an operator's rounds. The machine operator would know when and how to contact a supervisor. The supervisor would know what steps to take in regards to holding the affected product. The manufacturing supervisor would also know how and when to contact the responsible individuals within the quality and supply chain departments.

The final and perhaps most critical process capability the Best-in-Class are standardizing is KPI measurement. This means the Best-in-Class have invested in a standardized scoreboard across manufacturing operations with which to measure operational performance. A majority (72%) of the Best-in-Class leverage standardized metrics and are more than twice as likely as Laggards to be doing so. This means, in the case of a global manufacturer, the way one plant on the east coast measures OEE or cycle time will be the same way a plant in Seattle, Mexico, or China measures that same metric.

The other area of import regarding business processes is in the incorporation of real-time data and analytics. Best-in-Class manufacturers are more likely to monitor events and non-conformances in real time, which leads the Best-in-Class to being more likely to optimize production in real time and release production to distribution using real-time data. However, to support the incorporation of real-time data and analytics, manufacturers must look to both technology and the vision of executive leadership.

Organization and Knowledge Management

There is a close relationship between the processes Best-in-Class enterprises have established and how Best-in-Class organizations are architected. The Best-in-Class are more likely to ensure the success of continuous improvement teams by enabling these teams with real-time visibility and event monitoring into business processes. Similarly, the Best-in-Class are more likely to give role-based visibility into adverse events to individuals across the organization from operators to executives.

Foundational to the use of role-based visibility and real-time data across the enterprise is how the organization manages knowledge. We find that to enable the above capabilities, Best-in-Class manufacturers automate data collection from across manufacturing operations and incorporate this data into a historian to be used in enabling analytics.

Performance Management

Effectively managing performance goes a long way to achieving Best-in-Class status. Best-in-Class are not only automatically collecting the data and incorporating this data into business processes but are linking real-time operational data to financial performance. The Best-in-Class understand how operational performance affects financial performance and many use corporate-level metrics such as profitability and revenue growth to govern decision-making at the operational level. To make this connection, the Best-in-Class are more likely to both use analytics and real-time, role-based,

"We have tailored our operational metrics wherever practical to connect to business financial success. Metrics drive our performance improvements at all levels in the organization. Building systems to use those metrics have given the plant operators frameworks in which to make better, more significant decisions which they can see are having a direct effect on business performance."

~ Rod Glover, Manager
Manufacturing,
Osmose

"A delay on delivery time means delay in wages, cost increase and delay in payments/income. This directly affects both profitability and revenue (satisfied customers return)."

~ Adrian Fritz, Director
Boreste

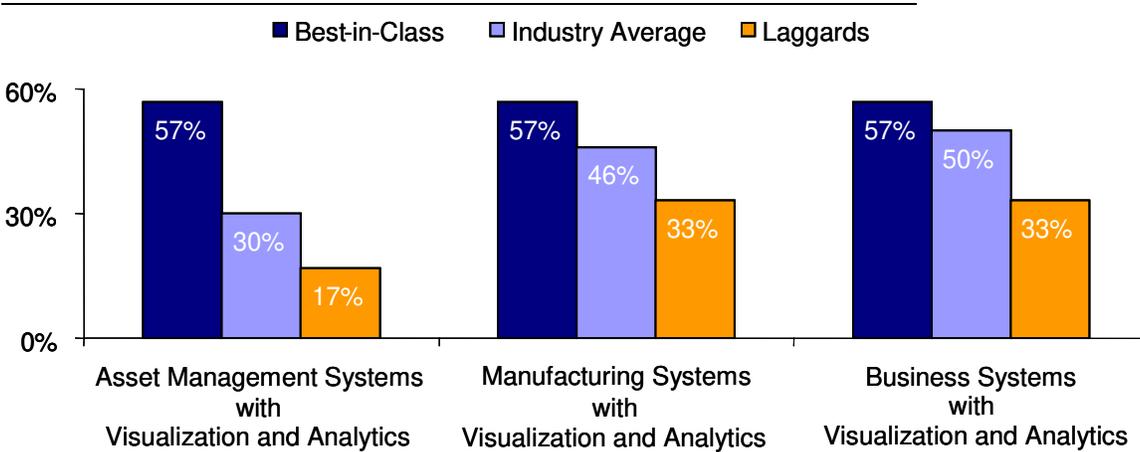
actionable intelligence to optimize decision-making across manufacturing operations.

Finally, this is the first benchmark produced by the manufacturing practice showing a direct correlation between Best-in-Class operational performance across OTD, OEE, and Yield metrics that enables significantly higher profitability. In fact, the Best-in-Class enjoy over 33% higher operating margins than both Industry Average and Laggards. It is also of interest to note that even though the Industry Average significantly outperform Laggard manufacturers in OTD, OEE, and Yield, this is not translating into higher profits, only further highlighting the need of all manufacturers to invest in understanding the relationship between operational and corporate performance.

Technology

Enabling the above processes, organizational, knowledge management, and performance capabilities requires real-time interoperability across multiple technologies. These technologies need to manage operations across maintenance, production, quality, and inventory, while also providing the needed role-based visibility and analytics into each. To start the technology stack, EAM and MES are critical to managing both maintenance and production operations, while QMS manages quality across both and helps improve decision making and collaboration across functional groups. Finally APM, MI, and SPC help optimize performance and can provide the needed analytics across operations, while BI can often deliver the connection between operational and corporate performance

Figure 3: Real-Time Interoperability



Source: Aberdeen Group, May 2008

In addition to investing in these technologies, Best-in-Class manufacturers are investing in establishing real-time interoperability among the visualization and analytical layers of technology (EMI, BI and APM) and other technology layers in the stack. Best-in-Class companies are nearly three times as likely as laggards to integrate visualization and analytical systems with asset

management, and 70% more likely to integrate visualization systems with manufacturing as well as business systems. This is important because to manage manufacturing operations efficiently, it is key to have real-time visibility across all the important aspects of manufacturing, such as production, inventory, asset, and quality management.

Case Study

Hexion Specialty Chemicals is the world's largest producer of thermosetting resins and formaldehyde used in bonding, binding and coating applications for a number of industries, including building products. Hexion was formed in 2005 through the merger of Borden Chemical, Resolution Performance Products and Resolution Specialty Materials, and the acquisition of Bakelite AG. As of the end of 2007, Hexion had more than 100 plants and about 7,000 employees. With revenues of more than \$5.2 billion, it is the third-largest North American-based specialty chemicals company.

A result of Hexion's continued growth through acquisition is a global manufacturing network using completely different control systems and historians. In response, Hexion decided to adopt a single analysis and reporting solution that could integrate all of these systems; resulting in the ability to:

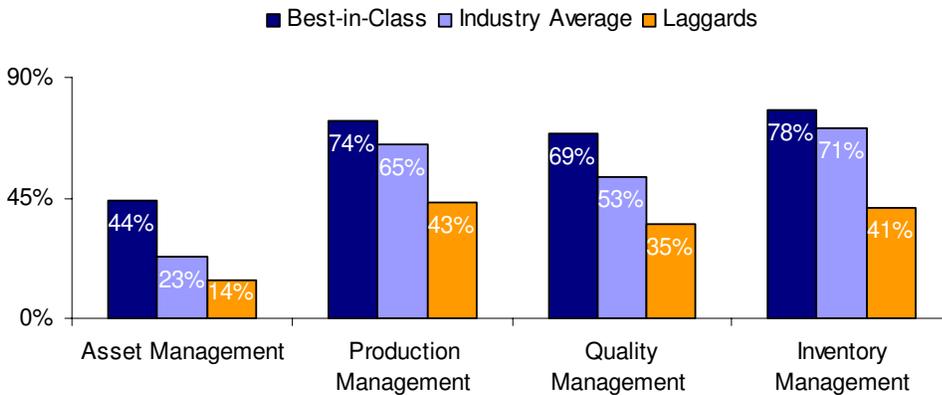
- Aggregate data from all of our disparate control and historian systems
- Produce detailed analyses and reports that can be shared in a portal and made accessible to users via Web browsers
- Build a standard set of reports, dashboards and key performance indicators (KPIs) once and use them everywhere in the division
- Provide a growth path to link plant operations to enterprise computing applications so that corporate staff can make business use of plant data

Many of these capabilities have been shown to differentiate Best-in-Class performance. Hexion is certainly within this category and will continue to build on this success by focusing on aligning corporate IT and process engineering in the future.

Managing Manufacturing Operations

The higher investment of Best-in-Class manufacturers in establishing interoperability among the existing technology investments across manufacturing operations can be clearly seen in the ability to gain role-based visibility and automate workflows across production, inventory, asset and quality management functions.

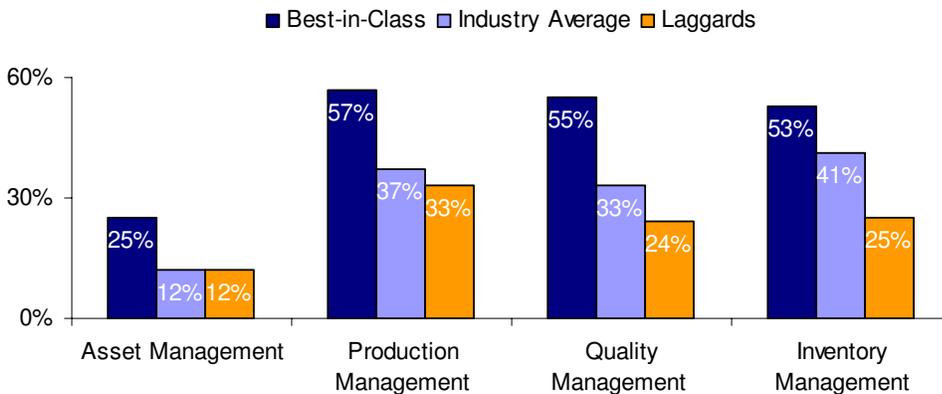
Figure 4: Gaining Role-Based Visibility



Source: Aberdeen Group, May 2008

Best in-Class companies are more likely than Industry average and laggard manufacturers to have role-based visibility across these critical areas of manufacturing operations. This visibility is used to address adverse events, optimize decision making, and effectively manage corporate performance.

Figure 5: Automated Workflows to Manage Adverse Events



Source: Aberdeen Group, May 2008

Best-in-Class manufacturers are finally closing the performance management loop on decision-making processes by investing in interoperability, enabling automated work-flows that map to actual business processes and transcend traditionally disparate functional groups and technologies.

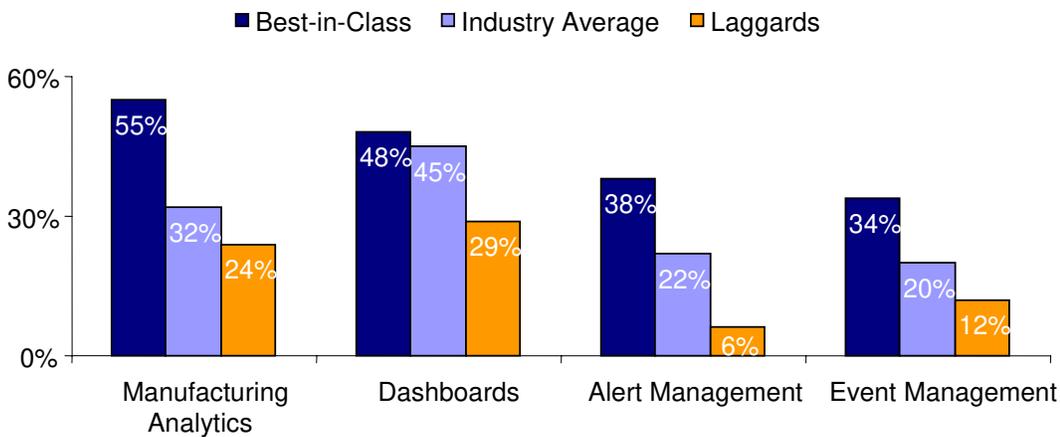
"I work in a very high volume, automated manufacturing plant. It has multiple production lines and all run 24/7 so any units lost due to yield, downtime or cycle time are lost and gone for ever. There are no options to make them up as the plant is already 24/7. Downtime is monitored and analyzed for trends daily. Correct monitoring and categorizing has resulted in a number of engineering projects to eliminate key areas of downtime. Downtime has improved over the years."

~ Tom Murphy
 Johnson and Johnson

Technology Enablers

In addition to benchmarking the technology adoption rates for manufacturers operating at different performance levels, Aberdeen also analyzes the adoption of specific technology modules that differentiate Best-in-Class performance.

Figure 6: Technology Enablers



Source: Aberdeen Group, May 2008

The finding from the above graph is well aligned with the process, organization, knowledge management and performance management capabilities discussed earlier in the chapter. Best-in-Class manufacturers are more likely to utilize all of the above technology enablers to improve visibility into manufacturing operations, monitor non-conforming incidents in real time and use alert management and event management capabilities to escalate non-conformances to appropriate decision makers.

Aberdeen Insights — Closed Loop Performance Management

Best-in-Class manufacturers enjoy an average operating margin of 25%, while Industry Average and Laggard Manufacturers only enjoy profit margins of 19% and 18% respectively. It is not surprising that Best-in-Class manufacturers outperform other manufacturers by almost 33% given the elevated performance in OTD, OEE, and Yield enjoyed. However, it is very interesting that Industry Average manufacturers perform so similarly to the Laggards. In fact, the Industry Average enjoy 18% more on time shipments, a 21% higher OEE, and a 17% higher Yield than Laggards but only a 5.5% higher operating margin. In other words, Industry Average manufacturers are significantly challenged when it comes to translating operational performance to profitability

To address this issue, Best-in-Class manufacturers not only understand how operational performance impacts corporate performance but are explicitly managing operations with corporate metrics. In fact, 33% of the Best-in-Class use Earnings before Interest Taxes Depreciation and Amortization (EBITDA) and 27% of the Best-in-Class use revenue to manage operations, while less than half across the Industry Average and Laggards do the same. To close this performance gap, Industry Average and Laggard manufacturers need to focus on better understanding the link between corporate and operational performance and leverage this understanding to improve decision making.

Chapter Three: Required Actions

Whether a company is trying to move its performance in improving visibility and decision making across manufacturing operations from Laggard to Industry Average, or Industry Average to Best-in-Class, the following actions will help spur the necessary performance improvements:

Laggard Steps to Success

- Automate data collection across manufacturing operations and incorporate this data into a historian to be used in enabling analytics. This helps manufacturers reduce or completely eliminate the errors due to manual data collection and result in time savings.
- Establish standardized processes to handle and escalate exception across manufacturing operations. This ensures that employees at the plant floor as well as corporate level have clear understanding of steps to be taken in case of an adverse event.
- Collect and display operational data in real time and use analytics to understand the value of the data collected for effective decision making. Best-in-Class companies are two times more likely to follow this process.

Industry Average Steps to Success

- Provide visibility across production, inventory, assets and quality to decision makers with real-time, role-based dashboards and automated workflows.
- Invest in enterprise manufacturing intelligence (EMI) and statistical process control (SPC) capabilities to improve decision-making and visibility into manufacturing operations. Manufacturers that have not yet adopted these capabilities should do so to gain early competitive advantage.
- Provide continuous improvement teams with analytics and real-time visibility into operations for improved performance. Best-in-Class manufacturers are twice more likely to enable the success of continuous improvement teams with such tools.

Best-in-Class Steps to Success

- Choose technology capabilities that are integrated through a common solution platform and support all aspects of manufacturing operations: maintenance, production, quality, and inventory management. Best-in-Class manufacturers are more likely to use automated workflows, visualization, and analytical solutions across each aspect of Manufacturing Operations Management (MOM).

Fast Facts

To achieve Best in Class status manufacturers must:

- √ Enable continuous improvement teams with analytics and real time visibility into operations for improved performance
- √ Standardize measurement of key performance indicators across the enterprise
- √ Automate data collection and display operation data in real time to decision makers
- √ Link operational data with corporate performance data
- √ Automate workflows and provide real time role based visibility across manufacturing operations
- √ Utilize manufacturing analytics, dashboards, event management and alert management capabilities to effectively manage adverse events

- Establish event-based, real-time interoperability among visualization and analytical technology solutions and other technology layers across both plant and enterprise levels. This enables manufacturers to seamlessly connect all of the necessary business processes under the MOM umbrella – quality, maintenance, production, and inventory to achieve operational excellence.

Aberdeen Insights — Summary

Event-Driven, Closed-Loop Performance Management requires the adoption of business processes and technologies that incorporate real-time event monitoring, visualization, and analytics to advanced decision-making. To accomplish this Best-in-Class manufacturers are interoperating in real time between the visualization and analytical technology layer and the manufacturing operations management technology layer. By doing this, the Best-in-Class now understand how operational performance affects corporate performance and are making decisions that impact both in positive ways.

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Appendix A: Research Methodology

Between March 2008 and May 2008, Aberdeen examined the use, the experiences, and the intentions of more than 200 enterprises across different industry verticals regarding their manufacturing performance management.

Aberdeen supplemented this online survey effort with telephone interviews with select survey respondents, gathering additional information on performance management strategies, experiences, and results.

Responding enterprises included the following:

- *Job title / function:* The research sample included respondents with the following job titles: Manager (33%); Senior Management (24%); Director (17%); Consultant (14%); Staff (7%) and other (4%).
- *Industry:* The research sample included respondents from Industrial Equipment Manufacturing (9%); Consumer Goods (9%); Automotive (8%); Food and Beverage (7%); Aerospace and Defense (7%); High-Technology (6%) and Metals (4%).
- *Geography:* The majority of respondents (66%) were from North America. Remaining respondents were from the Europe (15%), Asia-Pacific region (11%), South America (4%) Middle East, Africa (4%).
- *Company size:* Thirty percent (30%) of respondents were from large enterprises (annual revenues above US \$1 billion); 35% were from midsize enterprises (annual revenues between \$50 million and \$1 billion); and 35% of respondents were from small businesses (annual revenues of \$50 million or less).
- *Headcount:* Forty Five (43%) of respondents were from large enterprises (headcount greater than 1,000 employees); 34% were from midsize enterprises (headcount between 100 and 999 employees); and 23% of respondents were from small businesses (headcount between 1 and 99 employees).

Solution providers recognized as sponsors were solicited after the fact and had no substantive influence on the direction of this report. Their sponsorship has made it possible for Aberdeen Group to make these findings available to readers at no charge.

Study Focus

Responding manufacturing executives completed an online survey that included questions designed to determine the following:

- √ The pressures driving their focus on manufacturing performance management
- √ The structure and effectiveness of existing technology implementations
- √ Top technology enablers adopted to facilitate manufacturing performance management
- √ The benefits, if any, that have been derived from technology adoption and integration

The study is aimed to identify emerging best practices for manufacturing performance management across the industry, and to provide a framework by which readers could assess their own capabilities

Table 4: The PACE Framework Key

Overview
<p>Aberdeen applies a methodology to benchmark research that evaluates the business pressures, actions, capabilities, and enablers (PACE) that indicate corporate behavior in specific business processes. These terms are defined as follows:</p> <p>Pressures — external forces that impact an organization’s market position, competitiveness, or business operations (e.g., economic, political and regulatory, technology, changing customer preferences, competitive)</p> <p>Actions — the strategic approaches that an organization takes in response to industry pressures (e.g., align the corporate business model to leverage industry opportunities, such as product / service strategy, target markets, financial strategy, go-to-market, and sales strategy)</p> <p>Capabilities — the business process competencies required to execute corporate strategy (e.g., skilled people, brand, market positioning, viable products / services, ecosystem partners, financing)</p> <p>Enablers — the key functionality of technology solutions required to support the organization’s enabling business practices (e.g., development platform, applications, network connectivity, user interface, training and support, partner interfaces, data cleansing, and management)</p>

Source: Aberdeen Group, May 2008

Table 5: The Competitive Framework Key

Overview	
<p>The Aberdeen Competitive Framework defines enterprises as falling into one of the following three levels of practices and performance:</p> <p>Best-in-Class (20%) — Practices that are the best currently being employed and are significantly superior to the Industry Average, and result in the top industry performance.</p> <p>Industry Average (50%) — Practices that represent the average or norm, and result in average industry performance.</p> <p>Laggards (30%) — Practices that are significantly behind the average of the industry, and result in below average performance.</p>	<p>In the following categories:</p> <p>Process — What is the scope of process standardization? What is the efficiency and effectiveness of this process?</p> <p>Organization — How is your company currently organized to manage and optimize this particular process?</p> <p>Knowledge — What visibility do you have into key data and intelligence required to manage this process?</p> <p>Technology — What level of automation have you used to support this process? How is this automation integrated and aligned?</p> <p>Performance — What do you measure? How frequently? What’s your actual performance?</p>

Source: Aberdeen Group, May 2008

Table 6: The Relationship Between PACE and the Competitive Framework

PACE and the Competitive Framework – How They Interact
<p>Aberdeen research indicates that companies that identify the most influential pressures and take the most transformational and effective actions are most likely to achieve superior performance. The level of competitive performance that a company achieves is strongly determined by the PACE choices that they make and how well they execute those decisions.</p>

Source: Aberdeen Group, May 2008

Appendix B: Related Aberdeen Research

Related Aberdeen research that forms a companion or reference to this report include:

- [Manufacturing Operations Management: The Next Generation of Manufacturing Systems](#); January 2008
- [Risk Mitigation in Manufacturing Operations](#); March 2008
- [Compliance and Traceability in Manufacturing](#); December 2007
- [Demand Driven Manufacturing](#); November 2007
- [The Cost of Quality Benchmarking Enterprise Quality Management](#); July 2007
- [Manufacturing IQ: Taking Manufacturing Intelligence to the Enterprise](#); July 2007
- [Benchmarking Enterprise Asset Management](#); June 2007
- [Lean Scheduling and Execution](#); May 2007

Information on these and any other Aberdeen publications can be found at www.Aberdeen.com.

Author: Matthew Littlefield, Research Analyst, Manufacturing,
matthew.littlefield@aberdeen.com
Mehul Shah, Research Analyst, Manufacturing,
mehul.shah@aberdeen.com

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