Ground Up Strategies for Asset Performance Management

September 2007
Executive Summary

This benchmark investigates the ways top performing companies develop corporate cultures of reliability and leverage investments in advanced Asset Performance Management (APM) capabilities to improve operational performance by optimizing asset availability, utilization, and flexibility. Top performing companies are optimizing asset performance and integrating operational metrics with financial metrics for top line and bottom line improvement in performance.

Best-in-Class Performance

Aberdeen used four Key Performance Indicators (KPIs) to differentiate Best-in-Class, and they averaged the following performances:

- 89% Overall Equipment Effectiveness (OEE)
- 96% On-Time Delivery (OTD)
- 97% plant throughput
- 95% asset effectiveness

Competitive Maturity Assessment

Survey results show that the firms enjoying Best-in-Class performance shared several common characteristics:

- Best-in-Class performers are twice as likely as the Industry Average and ten-times as likely as Laggard to standardize asset performance management to optimize asset availability and utilization.
- The Best-in-Class are 6.7 times more likely than Laggards to have established cross-functional teams to create a corporate culture of reliability.

Required Actions

In addition to the specific recommendations in Chapter Three of this report, to achieve Best-in-Class performance, companies must:

- Align management goals, objectives, and metrics across various teams
- Establish cross-functional teams to foster a corporate culture for reliability
- Invest in APM capabilities such as condition based monitoring, reliability centered maintenance, performance monitoring, and analytics
- Focus on driving business process interoperability across functional organizations

“We launched a strategic initiative for asset performance improvement two years ago focused on OEE and Maintenance cost reduction among others. There is executive ownership to each of these initiatives. This is considered a critical success factor in our organization to improve performance. The plant maintenance processes are standardized across the sites with site specific differences. The strategic goal of improving OEE is focused on by both operation and maintenance teams through setup time reduction, increased reliability, etc. We measure our KPIs in real time and the actionable intelligence is used by management and department heads across the organization to influence decisions.”

~ Manufacturing, Large Semiconductor Company
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Chapter One: Benchmarking the Best-in-Class

Manufacturers have been seeking the means to continue on their journey of improving operational performance and shareholder value. They are seeking to understand and invest in capabilities to optimize asset performance. Companies that have embarked on this journey are now at a turning point. They’ve seen the early benefits from investing in asset management capabilities and now are looking for ways to become more advanced in their use of technology to leverage operational metrics in conjunction with financial metrics to optimize performance across the enterprise.

Balancing Customers and Shareholders

The top two market pressures driving manufacturers to continue to seek means to improve asset performance are the need to improve Return on Assets (ROA) and complying with customer demands for higher quality and shorter lead times (Table 1).

Table 1: Market Pressures Driving APM

<table>
<thead>
<tr>
<th>Pressures</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need to improve ROA</td>
<td>63%</td>
</tr>
<tr>
<td>Customer demand for higher quality products</td>
<td>62%</td>
</tr>
<tr>
<td>and shorter lead times</td>
<td></td>
</tr>
<tr>
<td>Increasing demand variability</td>
<td>38%</td>
</tr>
<tr>
<td>Regulatory compliance</td>
<td>19%</td>
</tr>
</tbody>
</table>

Source: Aberdeen Group, September 2007

That these two pressures were cited with almost the same frequency suggests that manufactures are caught in a balancing act. They are attempting to negotiate controlled cost of capital and value to shareholders with the need to provide customer value. Optimizing asset performance is the key to controlling costs (and seeing the return to shareholders) and maintaining product quality (providing value to the customer). Optimizing across conflicting goals and objectives across the maintenance and production teams offers the opportunity to enhance the economic value of their investments.

Maturity Class Framework

To uncover what allows companies to successfully optimize asset performance, Aberdeen classified survey respondents into one of three performance categories: Best-in-Class, Industry Average, and Laggard. The following four key performance criteria were used to distinguish top performing companies from Industry Average and Laggard organizations:

- **Fast Facts**
  - 63% of companies surveyed reported the need to improve ROA as driving them to seek new means to optimize asset performance. Sixty-two percent (62%) listed customer demand for higher quality products.
  - Best-in-Class companies are realizing significant performance advantages over Industry Average and Laggards, performing at a 95% or better average in on-time delivery, plant throughput, and asset effectiveness.
  - Best-in-Class companies are 36% less likely than Laggards to have maintenance as an ad-hoc or break-fix activity and are 27% less likely than Laggards to have maintenance department plan maintenance activity independent of production team’s knowledge.
• Overall equipment effectiveness (OEE)
• On-time delivery (OTD)
• Plant throughput
• Asset effectiveness

Table 2 details the differentiation between Best-in-Class, Industry Average, and Laggard companies across these four metrics.

Table 2: Companies with Top Performance Earn Best-in-Class Status

<table>
<thead>
<tr>
<th>Definition of Maturity Class</th>
<th>Mean Class Performance</th>
</tr>
</thead>
</table>
| **Best in Class:** Top 20% of aggregate performance scorers | • 89% overall equipment effectiveness  
• 96% on-time delivery  
• 97% plant throughput  
• 95% asset effectiveness |
| **Industry Average:** Middle 50% of aggregate performance scorers | • 81% overall equipment effectiveness  
• 89% on-time delivery  
• 92% plant throughput  
• 89% asset effectiveness |
| **Laggard:** Bottom 30% of aggregate performance scorers | • 58% overall equipment effectiveness  
• 81% on-time delivery  
• 72% plant throughput  
• 66% asset effectiveness |

Source: Aberdeen Group, September 2007

Best-in-Class companies are realizing significant performance advantages over Industry Average and Laggards. The Best-in-Class perform at a 95% or better average in three of the four KPIs, with OEE coming in at 89%. While the Industry Average is performing at 91% or lower, with OEE at 81% for Average, the Laggards, however, fall behind significantly, meeting asset effectiveness targets at a 66% average and OEE targets on no more than a 60% average.

These operational performance differentials translate into significant profit opportunity for Best-in-Class compared to Industry Average and Laggards in the form of improved productivity (OEE and plant throughput) and customer satisfaction metrics (OTD). Best-in-Class also enjoy reduction in year-over-year maintenance costs (discussed later in the report). The 8% gains in OEE compared to Industry Average and 31% gains in OEE compared to Laggards translate to significant top line and bottom line improvement for Best-in-Class. Best-in-Class are moving towards incorporating financial metrics with these operational metrics to measure the returns of optimization across the enterprise. The analysis found Best-in-Class are 90% more likely than Industry Average to measure lost profit opportunity as a key metric.
The Best-in-Class PACE Model

Seeing the greatest return on assets requires adopting a plan to optimize production capacity, availability, and flexibility. Accomplishing this entails a combination of strategic actions, organizational capabilities, and enabling technology summarized in Table 3.

Table 3: The Best-in-Class PACE Framework

<table>
<thead>
<tr>
<th>Pressures</th>
<th>Actions</th>
<th>Capabilities</th>
<th>Enablers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve return on assets</td>
<td>Implement advanced APM and analytical capability with business metrics</td>
<td>Enterprise-wide standardized business processes for asset performance</td>
<td>Statistical process control for asset performance</td>
</tr>
<tr>
<td>Customer demands for better</td>
<td>Use continuous improvement programs and teams to improve asset</td>
<td>management strategies</td>
<td>Analysis to calculate and monitor lost profit opportunity</td>
</tr>
<tr>
<td>quality and shorter lead times</td>
<td>performance</td>
<td>Align goals, objectives, and metrics and coordinate with maintenance and</td>
<td>Failure analysis integrated electronically with maintenance system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>production teams</td>
<td>Downtime recording, and analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Asset performance data is used to analyze, predict, plan, and schedule</td>
<td>Condition based monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>maintenance activities</td>
<td>Reliability centered maintenance programs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Real time visibility of factory floor asset states and performance</td>
<td>Asset performance dashboards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stakeholders enabled with key asset performance data as actionable</td>
<td>Predictive maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>intelligence</td>
<td>Preventive maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Automatic link between failure mode analysis and asset maintenance systems</td>
<td></td>
</tr>
</tbody>
</table>

Source: Aberdeen Group, September 2007

Strategy in Action

Strategic actions implemented by the Best-in-Class tend to be focused on optimizing asset availability and utilization. Implementing advanced APM and analytical capabilities was the top strategic action of the Best-in-Class (46%), followed by implementation of continuous improvement initiatives and continuous improvement teams. (Note: APM includes Reliability Centered Maintenance (RCM), Condition Based Monitoring (CBM), APM, and optimization capabilities.) This is followed by improving effectiveness of maintenance operations, which is intrinsically tied to continuous improvement programs.

Industry Average and Laggards also focus on the same top two strategic actions as Best-in-Class. This raises the question on what Best-in-Class are doing differently if they are facing the same top two pressures and focus on the same top two strategic actions as Industry Average and Laggards yet see superior performance over Industry Average and Laggards.

“Our maintenance strategy is highly supported by the management team from top to bottom of the organization. At factory level, the factory manager is the overall responsible of the maintenance performance KPI’s which he regularly reports to the country technical head. The factory engineer for each factory is responsible in ensuring the sustainability of the program which they regularly report to their respective factory management. At dept level, the cost center heads are responsible in ensuring that their people in the front lines are engaged in the maintenance activities. The operators are not only tasked to operate the machines but also to maintain it. While the machine is running, the operators are also tasked to conduct a machine condition monitoring system where they have been provided with necessary tools and training.”

~ Operations Director, Food and Beverage
Balancing asset utilization and availability is a continuing challenge that manufacturers face today. Optimizing asset performance to maximize the economic value from your asset base offers the best path to increasing shareholder value. Basic operational capabilities to monitor, manage, and optimize asset performance is necessary before companies can embark on the next leg of their journey to maximize asset performance. Best-in-Class companies are approaching APM initiatives with a strategic focus that incorporates process, organizational, and knowledge management capabilities in addition to their investment in advanced operational capabilities and technologies. Key in this technology mix is the investment in integration of core technologies to enable real time closed loop decision processes.

Depending on an organization’s resources, size, and even the industry in which it competes, the path to shareholder value is unique and not straightforward. Key to achieving this is the ability to monitor operational performance along with business metrics to optimize at the enterprise level. The path Best-in-Class take is a balance of asset performance and business performance unique to both the company and the industry they compete in to enjoy, what Aberdeen refers to as optimization for maximizing the economic value, through the use of APM strategies. For more information, refer to the September 2007 Research Brief, Unleashing the Economic Value: Asset Performance Management.
Chapter Two: Benchmarking Requirements for Success

Competitive Assessment

In addition to having common performance levels, each performance class shares characteristics in five key categories: (1) process (standardize APM processes across the enterprise); (2) organization (executive ownership and sponsorship for APM initiatives and establishing cross functional continuous improvement teams for asset performance management) (3) knowledge management (historical asset performance data with analytics accessible across departments); (4) technology (selection of appropriate tools such as APM, Enterprise Manufacturing Intelligence [EMI], and real time business interoperability across applications); and (5) performance measurement (capability to measure asset reliability and historical trends). These characteristics (identified in Table 4) serve as a guideline for best practices and correlate directly with Best-in-Class performance across the key metrics.

Table 4: The Competitive Framework

<table>
<thead>
<tr>
<th>Category</th>
<th>Best-in-Class</th>
<th>Industry Average</th>
<th>Laggards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td>Asset performance management and plant maintenance processes standardized across enterprise</td>
<td>60 %</td>
<td>30 %</td>
</tr>
<tr>
<td>Organization</td>
<td>Executive ownership and sponsorship for plant maintenance strategies across the enterprise</td>
<td>76 %</td>
<td>47 %</td>
</tr>
<tr>
<td></td>
<td>Continuous Improvement teams for condition based and reliability centered maintenance activities</td>
<td>63 %</td>
<td>40 %</td>
</tr>
<tr>
<td>Knowledge Management</td>
<td>Cross-functional team including maintenance, productions, and reliability engineering to create a 'corporate culture for reliability'</td>
<td>40 %</td>
<td>28 %</td>
</tr>
<tr>
<td></td>
<td>Management goals, objectives, and metrics are aligned and coordinated with maintenance and production teams to work together</td>
<td>52 %</td>
<td>33 %</td>
</tr>
<tr>
<td></td>
<td>Asset performance data is collected automatically in real time</td>
<td>36 %</td>
<td>27 %</td>
</tr>
<tr>
<td></td>
<td>Failure analysis is integrated electronically with asset maintenance systems</td>
<td>40 %</td>
<td>11 %</td>
</tr>
<tr>
<td></td>
<td>Process and data modeling capabilities are used for automating workflows and interoperability between systems (APM, CMMS / EAM, MES, ERP)</td>
<td>50 %</td>
<td>23 %</td>
</tr>
<tr>
<td></td>
<td>Historic asset data available and easily accessible by different departments</td>
<td>74 %</td>
<td>41 %</td>
</tr>
</tbody>
</table>

“We maintain a historic database for asset performance metrics and make the analysis available across department. Every month the Continuous Improvement Team meets to review the data and discuss opportunities to make improvements based on the analysis.”

~Atilio Gallitelli, Director, Instituto Tecnologico de Buenos Aires
## Technology Investment Strategies

<table>
<thead>
<tr>
<th>Best-in-Class</th>
<th>Industry Average</th>
<th>Laggards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>APM</strong> (reliability centered maintenance, performance monitoring, statistical process control, etc.)</td>
<td><strong>APM</strong> (reliability centered maintenance, performance monitoring, statistical process control, etc.)</td>
<td><strong>APM</strong> (reliability centered maintenance, performance monitoring, statistical process control, etc.)</td>
</tr>
<tr>
<td>46%</td>
<td>26%</td>
<td>25%</td>
</tr>
<tr>
<td>22%</td>
<td>13%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>EMI</strong></td>
<td><strong>EMI</strong></td>
<td><strong>EMI</strong></td>
</tr>
<tr>
<td>46%</td>
<td>26%</td>
<td>0%</td>
</tr>
<tr>
<td>22%</td>
<td>13%</td>
<td>0%</td>
</tr>
</tbody>
</table>

### Performance

| Maintenance overtime costs measured in real time | 23% | 9% | 6% |
| Unplanned downtime measured in real time | 35% | 26% | 21% |
| Asset reliability, historical and trends measured monthly | 63% | 56% | 43% |
| Spares holding cost measured monthly | 70% | 65% | 55% |

Source: Aberdeen Group, September 2007

## A Culture of Reliability (and Responsibility)

The Best-in-Class are more likely to organizationally align on four critical areas: executive ownership of APM; cross functional continuous improvement teams for condition based and reliability centered maintenance activities; management goals, objectives, and metrics that are aligned and coordinated between maintenance and production teams; and cross functional teams driving a corporate culture for reliability (Figure 2).

### Figure 2: Supporting a Culture of Responsibility

Our maintenance organization and the Consequence Driven Maintenance (CDM) team is composed of production people, engineering people, and [Quality Assurance] QA people. The team meets regularly each week to address issues of line stoppages, conduct a [Root Cause Failure Analysis] RCFA to eliminate the problem from happening again. Our CDM strategy has adapted the [Total Productive Maintenance] TPM and [Reliability Centered Maintenance] RCM concept. For TPM all our people in the manufacturing, engineering and QA are all involved in maintenance. For RCM, each machine in our manufacturing sites has undergone an RCM study. We always take particular emphasis and consider the consequences to the business.

~Director, Consumer Goods Company
These organizational capabilities combine to form a culture of reliability (and responsibility) across the enterprise. Best-in-Class companies are aligned all the way from the corner office to the plant floor to support APM initiatives. By encouraging a unified focus on APM, these companies are seeing a tangible bottom line impact. Aberdeen found that Best-in-Class companies enjoy a significant year-over-year reduction in maintenance costs (Figure 3). Perhaps most significantly, the Best-in-Class were over twice as likely as Industry Average and 1.25-times as likely as Laggards to see a large reduction (>10%) in maintenance costs. These savings in maintenance cost reductions are in addition to the performance improvements and resulting benefits Best-in-Class enjoy as discussed in Chapter 1. This combination of operational performance improvements coupled with the bottom line cost savings drives shareholder value for Best-in-Class.

**Figure 3: Year-Over-Year Reduction in Maintenance Costs**

![Graph showing year-over-year reduction in maintenance costs for Best-in-Class (BIC), Industry Average, and Laggards.]

Source: Aberdeen Group September 2007

**Standardized and Reflexive Processes**

The key area where a culture of reliability becomes critical to a company’s performance is in the standardization of processes across the enterprise. Best-in-Class organizations are twice as likely as the Industry Average to deploy best practices for APM initiatives across the enterprise in a formalized and standardized manner. The gap widens tremendously when the Best-in-Class are compared to Laggards, finding the Best-in-Class ten times more likely to standardize on APM capabilities (60% versus 6%).

It may be less contributive to Best-in-Class performance that these companies are standardizing these processes, than that they are adapting these processes to drive changes on the plant floor. They show as more likely to track key data as actionable intelligence. Knowledge management is critical to APM initiatives. The Best-in-Class are tracking and analyzing performance metrics such as maintenance overtime cost, unplanned downtime, asset reliability, quality non-conformance due to equipment, Lost Profit Opportunity (LPO) among others to anticipate and plan ahead the operational needs of the enterprise.

"We use several Asset Performance Management tools and capabilities. Specifically, Condition Based Monitoring and we are starting a continuous improvement reliability process which include Reliability Centered Maintenance (RCM), Root Cause Analysis (RCA) and others methodologies. Right now we have integrated CMMS/EAM and ERP with APM; next we are incorporating MES & APM. By the end of the next year we are going to have MTBF, MTTR, Uptime, and Reliability Statistics as key performance indicators to drive improvements. The primary result of our use of APM is that failure occurrences have gone down and we have more asset uptime for scheduled work."

~Jose Edgardo Rodriguez, Medina Consumer Products Group
The Best-in-Class are over 2.5-times as likely as the Industry Average and over 12-times as likely as Laggards to integrate failure analysis electronically with their maintenance systems (Figure 4). They are also twice as likely as the Industry Average to utilize process and data modeling capabilities to automate workflows and drive interoperability across systems. Once all of this is done, they make historic performance data available to all stakeholders. Tracking performance in this manner allows Best-in-Class organizations not simply to react intelligently and expeditiously to problem areas but continuously improve the operational performance using a systematic approach and leveraging technology investments.

![Figure 4: Performance Measurement](image)

**Specialty Chemical – Oil & Gas Industry**

A specialty industrial chemicals manufacturing company with over 7,700 employees, operating in 30 countries and supplying to over 30 different industry segments faced with external pressures had an immediate need to improve operational performance or risk losing market share. The company looked at the business challenges and addressed it with an enterprise wide Asset Performance Management (APM) initiative. The program linked APM metrics from their ERP, CMMS, and Business Intelligence (BI) systems into a cohesive unified dashboard for different levels of management in all business areas (sales, planning / scheduling, manufacturing, logistics, and warehousing). Each department has their respective dashboards to manage the daily, monthly, and yearly metrics that drove business performance.

When starting on this initiative, the executive mandates were:

- Lower operating expenses
- Ensure financial benefits hit the bottom line
Specialty Chemical – Oil & Gas Industry

- Improve production equipment availability
- Increase plant uptime

To address these challenges, the company established a cross-functional Reliability Improvement Program (RIP). First, they allowed repeat failures to rest in peace. Then they started with a cross-functional team to put in place the basic operational components for an asset management system. They started with a pilot program which initially tracked high dollar equipment failures on a frequent and regular basis.

The pilot program yielded interesting results. For the 100 equipments included in the pilot program, they were able to (in less than one year) reduce their annual maintenance costs by $500,000. Encouraged by this result, they expanded the program to include all equipments across the enterprise in order of priority.

The program helped reduce annual maintenance costs by over 60%, increasing equipment life span from six months to over five years on average. The company found that achievements were sustainable as they focused on operational errors and system design issues through a programmatic approach.

Once the basic asset management and reliability programs were put in place, it yielded maintenance cost reduction successively for three years and started leveling off during the fourth year. At this time the program expanded in scope to capture additional operational metrics and linking them business metrics—effectively moving the program from asset management to APM capabilities.

The project leader on this initiative noted, “We developed several performance metrics that were deployed across the enterprise. The results have been great as some of the production facilities that were running at partial capacity and we were able to bump them to full capacity. Others were expanded, consolidated and/or rationalized in the bigger scheme of things.”

Technology is a Key Enabler of Performance

Central to the formalized organizational and procedural components that the Best-in-Class have in place are the technologies they are using to enable and foster this culture of reliability. They are investing in technologies that go beyond standard maintenance management capabilities such as Computerized Maintenance Management System / Enterprise Asset Management (CMMS / EAM) and investing in APM and Enterprise Manufacturing Intelligence (EMI) capabilities. Best-in-Class are investing in capabilities such as condition-based monitoring, reliability centered
maintenance, asset performance monitoring, asset optimization, and statistical process control, among others. For asset performance management, Best-in-Class outperform Industry Average and Laggards in the adoption of APM and Enterprise Manufacturing Intelligence (EMI) technologies (Figure 5).

Specifically, the Best-in-Class show as 77% more likely than the Industry Average and 84% more likely than Laggards to invest in APM capabilities such as CBM, RCM, performance monitoring, and Statistical Process Control (SPC) tools. Further, Best-in-Class are 69% more likely than the Industry Average to implement EMI to gain visibility and intelligence around operational performance and metrics; Laggards are yet to get on the score board with use of EMI to drive asset performance.

**Figure 5: Investment in Technology**

![Figure 5: Investment in Technology](image)

Interoperability

The element that Aberdeen found as most relevant to Best-in-Class performance wasn’t just what technologies companies use, but how they were integrated (Figure 6).

**Figure 6: APM Integration**

![Figure 6: APM Integration](image)

“We have just commissioned a brand new facility with a 110,000 item an hour sort system, with a two and half hour sort window, which is the central air hub for our organization. We need fast up to date machine information to keep our planes flying and subsequently our customers happy. We have just implemented a brand new sorting machine, the second biggest in the world. We have a live visualization system of the whole plant that updates all data in 5 minute intervals so we can collect data on any part of the plant including IT….Fact is we have daily management briefing across all functions and all KPI are published and acted upon on a daily basis.”

~Technical Manager, Leading International Freight Carrier
The Best-in-Class have invested in the integration of APM capabilities with CMMS / EAM, Manufacturing Execution System (MES), and Enterprise Resource Planning (ERP). Further, they are more than twice as likely as Industry Average and Laggards (Figure 5) to leverage the use of process and data modeling capabilities to automate workflow and build business process interoperability across these applications. This integration of APM capabilities with CMMS technology provides support for maintenance operations, followed by MES for production tracking, and finally with the ERP for business process interoperability. The research data showed Laggards are more likely to focus on integration of APM capabilities with ERP and MES, which will enhance benefits if they were to integrate APM capabilities with CMMS as well. What is important is to have the architectural stack integrated at all levels. The Best-in-Class invest in real time integration with core technologies to systematically optimize asset performance, maintenance activities with production systems and linking operational metrics with business metrics.

Those Laggards invested in APM capabilities (Figure 6) are limiting their value realization from this investment by being short sighted and not investing in integrating APM capabilities with CMMS / EAM.

### Aberdeen Insights — Technology

The research findings indicate Best-in-Class are more likely to have invested more in technology than Industry Average and Laggards. Specifically, related to the topic on APM, the analysis indicates that Best-in-Class companies are significantly more likely to invest in advanced capabilities and technologies in support of their APM initiatives in capabilities such as CBM, RCM, SPC, and EMI. Laggards are yet to embrace EMI capabilities as indicated in Figure 5.

In addition to investing in core technologies, the analysis shows that the Best-in-Class are also investing in real time interoperability across multiple applications using advanced process and data modeling tools to automate workflows. Best-in-Class companies have approached integration across applications in a systematic way, consistent with the ISA95 architecture stack. By approaching integration in this manner, Best-in-Class are able have real time closed loop sense and respond capability to drive operational improvements.

Whereas Laggards have failed to integrate APM capabilities with CMMS / EAM system, they have invested in integrating APM to other application layers such as MES and ERP. By not investing in the integration of APM capabilities with their CMMS system, they are realizing limited value in their investments in APM capabilities.

When the time comes to integrate different application stacks, companies must demand and leverage standards based interoperability from their application vendors and systems integrators. Ensure integration drives true business and process interoperability across core functional groups.
Chapter Three: Required Actions

Whether a company is trying to move its operational performance 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

- **Establish cross functional continuous improvement teams to focus on APM initiatives**
  Only 6% of Laggard companies have implemented cross functional teams aligned across departments. The Best-in-Class are 6.6-times more likely to have these in place, a key to developing corporate culture for reliability and addressing asset performance management at an enterprise level.

- **Utilize asset performance data to analyze, predict, plan, and schedule maintenance activities**
  Best-in-Class performers are twice as likely as Laggards to leverage historical performance data in order to coordinate maintenance activities. In particular, they are 6.7-times more likely than Laggard performers to integrate failure analysis electronically with asset maintenance systems.

- **Deploy process and data modeling capabilities to automate workflows and enable interoperability between systems**
  The Best-in-Class are twice as likely as Laggards to deploy data modeling capabilities to automate workflows and enable system interoperability. When investing in integration capabilities across applications learn from the Best-in-Class and integrate technologies in the right order.

Industry Average Steps to Success

- **Establish cross functional continuous improvement teams to focus on APM initiatives**
  Twenty-eight percent (28%) of the Industry Average have cross-functional improvement teams in place. While this is a significant improvement over Laggard performance, Industry Average performers still have a long way to go meet Best-in-Class levels. They must continue to foster a culture of reliability across the enterprise.

- **Integrate failure analysis electronically with asset maintenance systems**
  Industry Average performers are ahead of the Laggards in their use of performance data to coordinate maintenance activities. In fact, the Industry Average is nearly on par with the Best-in-Class (39%
versus 42%). These companies must now take the next step and integrate failure analysis electronically with asset maintenance systems. In this area, they linger near Laggard performance at 13% currently integrating failure analysis, distant from 40% of the Best-in-Class.

- **Utilize process and data modeling capabilities to automate workflows and enable interoperability between systems**

  Automating workflow and providing real time interoperability between key applications is a key strategy for Best-in-Class companies. Forty-seven percent (47%) currently do so, while 80% of Best-in-Class will have implemented these capabilities in 12 months. Meanwhile, only 22% of Industry Average performers have them in place.

- **Invest in technology and interoperability – specifically capabilities such as CBM, RCM, SPC, and EMI**

  Aberdeen’s research shows a direct correlation between technology investment and process and organizational capabilities to performance. Continuing to invest in APM capabilities will ensure the Best-in-Class are continuing on their journey to improve asset effectiveness. Research indicates Best-in-Class is leveraging real time integration to gain intelligence into operational metrics and linking those with business metrics to drive operational improvements.

- **Align goals and metrics across maintenance and production teams**

  When it comes to getting the maintenance and production teams working together, the Best-in-Class are 58% more likely to have goals, objectives, and metrics aligned across these two teams. Getting aligned and measuring performance based on common corporate objectives is a lot easier if the technology supports it. Industry Average companies are at a stage they can leverage their early investments in technology to put in place.

### Best-in-Class Steps to Success

- **Measure meaningful metrics that links operational performance with business performance**

  Best-in-Class companies are 90% more likely than Industry Average to measure Lost Profit Opportunity (LPO) as a key metric. However, only 40% of Best-in-Class are measuring this metric. To continue on this journey to improve operational performance and shareholder value, Best-in-Class must measure operational metrics in conjunction with business metrics and enhance real time close loop decision making capability within the enterprise.
• **Invest in technology – specifically capabilities such as CBM, RCM, SPC, and EMI**

Aberdeen’s research shows a direct correlation between technology investment and process and organizational capabilities to performance. Continuing to invest in APM capabilities will ensure the Best-in-Class are continuing on their journey to improve asset effectiveness. Research indicated Best-in-Class adoption of EMI only at 22% and APM at 46%. There are companies that are performing at the lower end of the Best-in-Class spectrum that would benefit from this focus.

• **Establish a cross-functional team including maintenance, productions, and reliability engineering to create a corporate culture for reliability**

The Best-in-Class are well ahead in establishing cross functional teams for fostering a corporate culture for reliability. Those Best-in-Class companies not yet focused on this should do so. Establishing such a corporate culture across multiple disciplines will ensure focus and continuous improvement.

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**Aberdeen Insights – Summary**

In today’s competitive global manufacturing environment manufacturers are caught in a balancing act trying to meet customer demands and increasing shareholder value. The need to improve ROA is at the forefront of majority global manufacturer’s mind.

Leveraging investments in advanced technical capabilities such as CBM, RCM, SPC, asset performance monitoring, and optimization, Best-in-Class manufacturers are putting in place process, organizational, and knowledge management capabilities to stay ahead of the game – both in top line revenue growth opportunity and bottom line cost reductions related to asset maintenance. They are monitoring and measuring key operational and business metrics in real time and investing in technology to drive business interoperability using standards and following the ISA95 stack.

Best-in-Class manufacturers see significant reduction in year-over-year maintenance costs (more than twice as likely as Industry Average and Laggards to see >10% reduction) while enjoying improved OEE, OTD, and throughput.

These savings and operational improvements translate to increased shareholder value while meeting customer demands for improved quality and shorter lead times.
Appendix A: Research Methodology

Between July and September 2007, Aberdeen Group examined the use of APM in the manufacturing industry, the experiences, and intentions of more than 230 enterprises in a diverse set of manufacturing enterprises. Responding manufacturing executives completed an online survey that included questions designed to determine the following:

- The degree to which companies rely on APM capabilities to monitor and manage their asset performance.
- The structure and effectiveness of existing asset performance management capabilities
- Current and planned use of APM to assist in asset performance improvement to help improve ROA
- The benefits that have been derived from APM strategies and investments

Aberdeen supplemented this online survey effort with telephone interviews with select survey respondents, gathering additional information on APM strategies, experiences, and results. The study aimed to identify APM usage in manufacturing and provide a framework by which readers could assess their own manufacturing performance. Responding companies included the following:

- **Job title/function**: The research sample included respondents with the following job titles: CxO or president (11%); vice president (6%); director (11%); manager (37%), staff (13%), consultant (17%), and other (4%).

- **Industry**: The research sample included respondents from multiple industries. The following industries were represented in the research study: high technology (24%), automotive (14%), industrial equipment (14%), and pharmaceutical (12%). Food and beverage, consumer packaged goods, and oil and gas were each at 11%. Other sectors representing in the research included companies from utilities, aerospace and defense, and chemicals, plastics, and other industry segments.

- **Geography**: The majority of respondents (61%) were from North America. Remaining respondents were from the Asia-Pacific region (17%), EMEA (15%), and Latin America (7%).

- **Company size**: Large enterprises represented 35% of respondents (annual revenues above US$1 billion); 33% were from midsize enterprises (annual revenues between $50 million and $1 billion); and 32% of respondents were from small businesses (annual revenues of $50 million or less).
Solution providers recognized as sponsors of this report were solicited after the fact and had no substantive influence on the direction of the Ground Up Strategies for Asset Performance Management Benchmark Report. Their sponsorship has made it possible for Aberdeen Group to make these findings available to readers at no charge.

Table 5: PACE Framework Key

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<th>Overview</th>
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<td>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:</td>
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<td><strong>Pressures</strong> — external forces that impact an organization’s market position, competitiveness, or business operations (e.g., economic, political and regulatory, technology, changing customer preferences, competitive)</td>
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<td><strong>Actions</strong> — 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)</td>
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<td><strong>Capabilities</strong> — the business process competencies required to execute corporate strategy (e.g., skilled people, brand, market positioning, viable products/services, ecosystem partners, financing)</td>
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<td><strong>Enablers</strong> — 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)</td>
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Source: Aberdeen Group, September 2007

Table 6: Competitive Framework Key

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<th>Overview</th>
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<td>The Aberdeen Competitive Framework defines enterprises as falling into one of the following three levels of practices and performance</td>
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<td><strong>Best-in-Class (20%)</strong> — Practices that are the best currently being employed and significantly superior to the Industry Average, and result in the top industry performance.</td>
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<td><strong>Industry Average (50%)</strong> — Practices that represent the average or norm, and result in average industry performance.</td>
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<td><strong>Laggards (30%)</strong> — Practices that are significantly behind the average of the industry, and result in below average performance</td>
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In the following categories:

| **Process** — What is the scope of process standardization? What is the efficiency and effectiveness of this process? |
| **Organization** — How is your company currently organized to manage and optimize this particular process? |
| **Knowledge** — What visibility do you have into key data and intelligence required to manage this process? |
| **Technology** — What level of automation have you used to support this process? How is this automation integrated and aligned? |
| **Performance** — What do you measure? How frequently? What’s your actual performance? |

Source: Aberdeen Group, September 2007

Table 7: Relationship Between PACE and Competitive Framework

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<th>PACE and Competitive Framework How They Interact</th>
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<tr>
<td>Aberdeen research indicates that companies that identify the most impactful 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.</td>
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</table>

Source: Aberdeen Group, September 2007
Appendix B:
Related Aberdeen Research

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

- *Benchmarking Enterprise Asset Management*, June 2007
- *Manufacturing IQ: Taking Manufacturing Intelligence to the Enterprise*, July 2007
- *Driving Enterprise Performance with Asset Information*, July 2006
- *Collaborative Asset Maintenance Strategies*, December 2006

Information on these and any other Aberdeen publications can be found at [www.Aberdeen.com](http://www.Aberdeen.com).

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