

Business Process Management in Manufacturing

Paving the Way for Effective Collaboration

November 2010

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~ Underwritten, in Part, by ~

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Executive Summary

Manufacturers today are struggling with pressures from many different stakeholders. Regulators, shareholders, customers, and suppliers all impact operations. The ability of an organization to quickly sense and adapt to these pressures can be a source of great competitive advantage. Unfortunately, most legacy applications, as well as the supporting IT infrastructure, are inherently inflexible and rigid. The call for creating more flexible operational systems is not new but the supporting technology enablers are finally starting to match the need. This new research, based on over 275 survey respondents, will examine how Best-in-Class manufacturers are leveraging Business Process Management (BPM) in manufacturing operations to improve performance and achieve a competitive advantage.

Best-in-Class Performance

Aberdeen used the following four key performance criteria to measure maturity in BPM; Best-in-Class companies averaged the following:

- 89% Overall Equipment Effectiveness (OEE)
- 94% On-time and complete shipments
- 94% Successful new product introductions
- +5% Operating margin versus corporate plan

Competitive Maturity Assessment

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

- Best-in-Class manufacturers are nearly twice as likely as Laggard manufacturers to have the ability to deploy and re-use business processes globally
- Best-in-Class manufacturers are over three times as likely as Laggard manufacturers to have the ability to manage the complete lifecycle of business processes

Required Actions

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

- Establish an executive led vision of flexible and integrated manufacturing operations as a true competitive advantage for the organization
- Create a coherent BPM strategy for manufacturing that connects people and applications from across traditionally disparate groups and that leverages tools such as master data management, a service oriented architecture, event management, and real time alerting

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

How Does Your Performance Compare to the Best-in-Class?



- Compare your processes
- Receive a free, personal PDF scorecard
- Benefit from custom recommendations to improve your performance, based on the research

[Take the Assessment](#)

Receive Your Free Scorecard

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Chapter One: Benchmarking the Best-in-Class

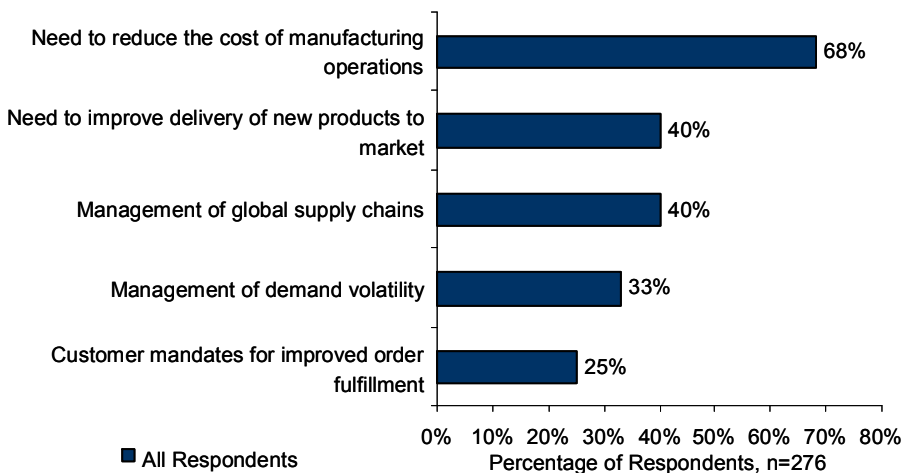
Business Context

Given the implications of many recent events surrounding new product introductions, product quality, demand volatility, and sustainability, manufacturers are facing a quickly evolving marketplace. At the same time, products, the overall value chain, and the IT ecosystem have all been subject to an unprecedented growth in complexity. To help manage this complexity, organizations are re-architecting static, rigid, form fit processes to create an organization that can quickly adapt to changing market conditions. To accomplish this, Best-in-Class organizations are taking a Business Process Management (BPM) approach to their manufacturing operations as well as incorporating Manufacturing Operations Management (MOM) into enterprise level BPM strategies.

Cost Cutting is Still Top of Mind in Manufacturing

When asked which market pressures are driving organizations to focus on collaboration and interoperability in manufacturing operations, the number one choice by the large majority, is the need to reduce costs. This finding provides further evidence that no matter what area of the business is being contemplated; cost is still top of mind in manufacturing. Because of this finding, much of the analysis contained within in this report focuses on how manufacturers are better managing business processes in manufacturing to reduce redundancy, increase the speed of decision making, and eliminate waste.

Figure 1: Market Pressures Driving Focus on Operations



Source: Aberdeen Group, October 2010

However, even though cost tops the list, it is important to note that cost is not the only story. Most manufacturers will always be on a continuous cycle

Fast Facts

Best-in-Class companies significantly outperform their competition in all four KPI's. These organizations enjoy:

- √ 94% New Product Introductions
- √ 89% Overall Equipment Effectiveness (OEE)
- √ 94% On Time and Complete Shipments
- √ +5% Operating Margin vs. Corporate Plan

Defining a "BPM Approach Manufacturing Operations"

A "BPM Approach to Manufacturing Operations" involves taking a new look at how manufacturing processes are defined and supported by enabling technologies. For process definitions, organizations must analyze how work is performed, break down this work into the smallest repeatable steps possible, standardize these repeatable steps across the organization, and build all work processes out of these process steps.

On the enabling technology side, organizations must develop a processes orchestration platform to define, model, and execute these work processes. The platform must also ensure that the necessary data sources, applications, events, and stakeholders are integrated into the process; preserving the value of legacy IT investments but also allowing for innovation and continuous improvement.

of improving efficiency and reducing cost. This is, after all, the basis of continuous improvement, but for most this does not form the core of their competitive advantage. It is important for every organization to understand how the market is pressuring them, what the market expects from them, and what they can do better than any other firm.

In some cases this will be in distribution and supply chain execution, in other cases it will mean introducing innovative products first to market, and yet for others it is about leading with a quality product and protecting brand image. In each of these cases, manufacturing operations plays a critical part in the overall business process and hence the creation of competitive advantage. Therefore, as organizations look to take a business process approach to operations, understanding the levers of competitive advantage and how manufacturing plays into the process is a key to success.

“Collaboration across our suppliers, product developers and our 'system' is not easy. We are challenged with the ability to provide alerts and visibility at the appropriate time to appropriate decision-maker. Indeed, having visibility into this data is key to enhancing collaboration across our organization.”

~Director of Business Development, High Tech Manufacturer

The Maturity Class Framework

In this study Aberdeen uses four key performance criteria to distinguish the Best-in-Class from Industry Average and Laggard organizations:

- **On-time and complete shipments** - products delivered on time and complete as compared to total original commitment, with no re-promise dates
- **OEE** - composite metric accounting for availability, performance, and quality averaged over all assets (no penalty for unproductive assets when the asset has scheduled down time)
- **Successful new product introductions** - measured as the average share of new product introductions that hit quality, time, and volume targets
- **Operating margin versus corporate plan** - measured as operating margin realized relative to the corporate goals established

Respondents were divided among three categories based on their aggregate performances in these four metrics. Table I displays the average performance of Best-in-Class, Industry Average, and Laggard organizations.

Table I: 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"> ▪ 94% New Product Introductions ▪ 89% OEE ▪ 94% On Time and Complete Shipments ▪ +5% Operating Margin vs. Corporate Plan
Industry Average: Middle 50% of aggregate performance scorers	<ul style="list-style-type: none"> ▪ 78% New Product Introductions ▪ 82% OEE ▪ 90% On Time and Complete Shipments ▪ +2% Operating Margin vs. Corporate Plan

Definition of Maturity Class	Mean Class Performance
Laggard: Bottom 30% of aggregate performance scorers	<ul style="list-style-type: none"> ▪ 48% New Product Introductions ▪ 73% OEE ▪ 84% On Time and Complete Shipments ▪ -2% Operating Margin vs. Corporate Plan

Source: Aberdeen Group, October 2010

The Best-in-Class PACE Model

Effectively cutting costs in manufacturing operations, ensuring finished product quality, responding to economic conditions, or successfully delivering new products to market can be a daunting task. Table 2 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"> ▪ Need to reduce the cost of manufacturing operations 	<ul style="list-style-type: none"> ▪ Synchronize metrics and performance management across the organization ▪ "Build in" compliance and traceability to business processes across operations 	<ul style="list-style-type: none"> ▪ Business processes are largely reusable and deployed globally across operations ▪ Ability to manage the complete life cycle of industrial business processes ▪ Business processes are dynamically updated as new best practices emerge ▪ Executives have real-time visibility into the performance of global operations ▪ Mature Lean or Operational Excellence program that extends across a broad footprint in the organization ▪ Real-time visibility between manufacturing operations and customer orders ▪ Real-time visibility between manufacturing operations and supplier performance (quality, inventory and WIP) ▪ Engineering Change Orders (ECOs) are easily delivered to manufacturing operations from engineering ▪ Quality testing and inspection data easily flows between engineering and manufacturing systems ▪ Standardized measurement of KPIs across the enterprise 	<ul style="list-style-type: none"> ▪ Master Data Management for Industrial Operations ▪ Manufacturing Operations Management (MOM) ▪ Business Process Management (BPM) for Industrial Operations ▪ Service Oriented Architecture (SOA) enabling interoperability between plant systems to other enterprise applications ▪ Business Intelligence integrated with Industrial Operations data ▪ Business Process Modeling ▪ Business Process Optimization ▪ Business Process Visualization

Source: Aberdeen Group, October 2010

Best-in-Class Strategies

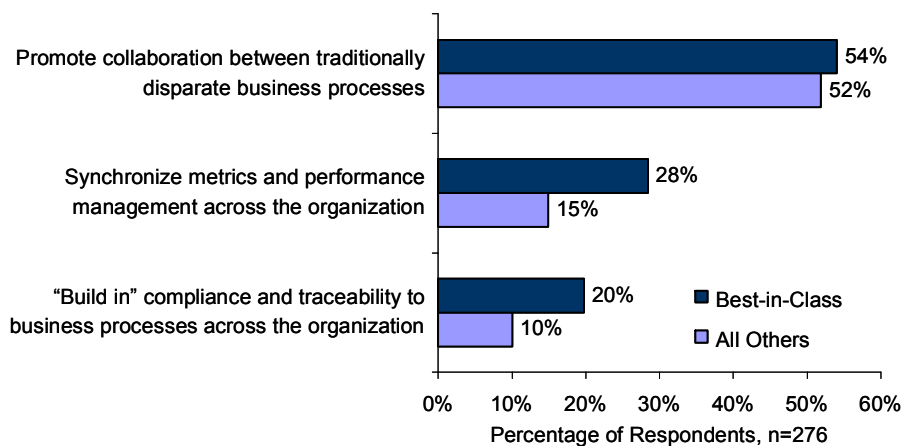
Regarding the strategic actions executives are taking in response to the market pressures faced, "promoting collaboration between traditionally disparate processes" is the most widely adopted strategic action and is being adopted by the majority of both Best-in-Class as well as underperforming manufacturers. Unfortunately, adopting this strategy alone will not improve an organization's chances of becoming Best-in-Class. When attempting to improve performance through this strategy, it is important that the collaboration efforts are focused on bringing together the right processes and that it is supported by the right technology.

Disparate business processes that are often ripe for promoting this collaboration can be found at the intersections of manufacturing and maintenance, manufacturing and engineering, manufacturing and quality, or manufacturing and distribution. Again, it is important for an organization to first understand where its competitive advantage originates from and then center its collaboration efforts on this point.

"Our company has implemented BPM for workflow management. We've discovered that implementing BPM this way greatly improves process visibility and communication, reducing manufacturing cycle time and manufacturing errors."

~IT Manager, Food and Beverage Industry

Figure 2: Best-in-Class Strategies



Source: Aberdeen Group, October 2010

Aberdeen Insights — Strategy

There are two additional strategic actions worth analyzing, both of which have much lower adoption rates than the collaboration strategy, but are much more likely to be adopted by Best-in-Class manufacturers. The first is synchronizing metrics and performance management across the organization and the second is building in compliance and traceability to business processes. Synchronizing metrics across the organization is an important strategy, especially when attempting to manage business processes that transcend traditional boundaries in a manufacturing organization.

continued

Aberdeen Insights — Strategy

For example, it is important for engineering to understand how design changes in products or processes impact quality, efficiency, and performance. Similarly it is important for manufacturing to understand how missing production schedule attainments or releasing poor quality product to market impacts the supply chain and service organizations. Often, the foundation for creating this understanding can be found in an agreed set of metrics that all groups have visibility into.

Building compliance and traceability into processes can also have profound effects on how well an organization manages holistic business processes. Compliance is a major area of concern for many organizations and it is often an issue that impacts multiple areas of an organization; immediate examples include when: engineering must ensure that ingredients and components are properly labeled and comply with regulations, manufacturing must ensure the good manufacturing principles are adhered to, the supply chain must ensure that products are traceable both forward and backwards from customers to suppliers.

In each case, many different players in the processes have countless opportunities to make a mistake and just one can be very costly. However, if compliance to these regulations and mandates are built into these processes, it can be traced back to ensure compliance was achieved. Similarly, if there is an adverse event it is escalated to the proper decision maker. This will enable to reduce the non-compliance risk for the entire organization.

In the next chapter, we will see what the top performers are doing to achieve these gains.

Chapter Two: Benchmarking Requirements for Success

The way in which manufacturers implement the business processes designed to manage manufacturing operations is highly correlated to the achievement of Best-in-Class performance.

Case Study — NGK Spark Plug Co., Ltd

NGK Spark Plug Co., Ltd (NGKNTK) is a leading Tier I automotive supplier. NGKNTK is based in Japan, manufactures and sells spark plugs, glow plugs, various automotive sensors, ceramic engine parts and other automotive components, and had fiscal year 2009 revenues of ¥243,914. According to NGKNTK's [Annual Report](#) for fiscal year 2010, the automotive division had a highly volatile year. The first half of fiscal 2009 saw sales continue to lag from the 2008 global recession, while the second half of fiscal 2009 experienced growth above expectation due to the start of the global economic recovery. To address these macro-economic issues as well as the rapidly changing automotive landscape, NGKNTK has launched a new mid-term strategic initiative called the "Evolution of NGK Spark Plug." Highlights of this new plan are focused on both strengthening global manufacturing capabilities and developing new products under a next-generation cross-functional R&D structure.

With a backdrop of highly volatile economic conditions, the need for new product development, and a new mid-term strategic initiative; NGKNTK announced in October 2010 that it had successfully deployed a BPM platform in Manufacturing along with a new MOM system across three manufacturing facilities and several suppliers. This BPM platform is managing the life cycle of manufacturing processes, including: collaboration between production processes and billing, real-time production process visibility, and controlling production and packing while ensuring inventory levels are minimized to support Lean initiatives.

According to the General Manager of the Systems Promotion Department, Ceramic Sensor Division. "NGKNTK's BPM and MOM implementation has enabled us to realize greater visibility across each production line, resulting in improved operational performance. We now see actual production performance to plan, helping to raise people's awareness, even causing an attitude change on site."

Fast Facts

As compared to Laggards, Best-in-Class companies are:

- √ Twice as likely to have the ability to deploy and re-use business processes globally
- √ Over three times as likely to have the ability to manage the completely lifecycle of business processes
- √ 85% more likely to have real-visibility between manufacturing operations and supplier performance

Competitive Assessment

Aberdeen Group 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 approaches they take to execute daily operations); (2) **organization** (corporate focus and collaboration among stakeholders); (3) **knowledge**

management (contextualizing data and exposing it to key stakeholders); (4) **technology** (the selection of the appropriate tools and the effective deployment of those tools); and (5) **performance management** (the ability of the organization to measure its results to improve its business). These characteristics (identified in Table 3) serve as a guideline for best practices, and correlate directly with Best-in-Class performance across the key metrics.

Table 3: The Competitive Framework

	Best-in-Class	Average	Laggards
Process	Business processes are largely reusable and deployed globally across operations		
	32%	27%	18%
	Ability to manage the complete life cycle of industrial business processes		
	26%	18%	9%
	Business processes are dynamically updated as new best practices emerge		
	19%	15%	11%
Organization	Executive sponsorship for initiatives on improving operations through process improvement, collaboration, and technology interoperability		
	72%	59%	52%
	Mature Lean or Operational Excellence program is in place and extends across a broad operational footprint in the organization		
	40%	32%	29%
Knowledge	Executives have real-time visibility into the performance of global operations		
	43%	27%	18%
	Real-time visibility between manufacturing operations and customer orders		
	37%	35%	23%
	Real-time visibility between manufacturing operations and supplier performance (quality, inventory and WIP)		
	37%	30%	20%
	Engineering Change Orders (ECOs) are easily delivered to manufacturing operations from engineering		
	67%	44%	42%
	Quality testing and inspection data easily flows between engineering and manufacturing systems		
	36%	34%	27%
Work instructions are easily delivered to manufacturing operations from manufacturing process design			
	67%	49%	44%

	Best-in-Class	Average	Laggards
Performance Management	Standardized measurement of KPIs across the enterprise		
	45%	44%	25%
	Drill down and aggregation in KPIs by geography, product line, mix, etc.		
	30%	21%	21%
	Scorecard for normalizing performance across operations		
Technology	26%	25%	23%
	Manufacturing Operations Management		
	40%	27%	25%
	Product Lifecycle Management		
	40%	35%	28%
	Standards and IT tools in use for Industrial Operations:		
<ul style="list-style-type: none"> ▪ 35% BI (Business Intelligence) ▪ 30% Master Data Management ▪ 23% BPM (Business Process Management) 	<ul style="list-style-type: none"> ▪ 32% BI (Business Intelligence) ▪ 27% Master Data Management ▪ 15% BPM (Business Process Management) 	<ul style="list-style-type: none"> ▪ 25% BI (Business Intelligence) ▪ 20% Master Data Management ▪ 14% BPM (Business Process Management) 	

Source: Aberdeen Group, October 2010

Capabilities and Enablers

Based on the findings of the Competitive Framework and interviews with manufacturing executives, Aberdeen’s analysis demonstrates that there are a number of different business capabilities and technology enablers driving Best-in-Class performance.

Process

Best-in-Class organizations are more likely than their competitors to take a holistic approach in managing industrial business processes. In particular this means they are more likely to adopt three key capabilities around these business processes.

First, Best-in-Class organizations are almost twice as likely as Laggard organizations to have processes that are reusable and easily deployable. Although implementing such a capability seems relatively benign, achieving such an environment can be quite a challenge. Generally, it requires well defined work processes that have been standardized across the organization. Additionally, for this approach to be effective, the standardized work definitions must be granular. Often going right down to the work itself and what operators, supervisors, and managers do on a minute to minute

basis, including: how they would record down time, define down time, change over a production line, perform a quality test, change a part, or handle work in process just to name a few. It is also important to note, that defining work process in such a way can be quite laborious and requires dedicated personnel. In the most successful instances, these resources come in the form of Lean practitioners and as part of a global Lean initiative.

Second, Best-in-Class manufacturers are almost three times as likely as Laggard manufacturers to have the capability to manage the complete life cycle of an industrial business process. This means these organizations can manage the authoring, deployment, compliance, updates, and end-of-life for all business processes across the organization. Clearly this is a challenge for many and necessitates the support of technology enablers to be achieved in a timely manner and to reduce the errors and version control issues that are inherent with paper based systems designed to do the same.

Finally, Best-in-Class are also differentiating themselves by putting in place the ability to standardize and then update best practices across the entire manufacturing network. Such a capability is the foundation of any effective continuous improvement initiative; with examples of this standardization including: the ability to create and update KPIs across multiple facilities or establishing best practices for optimizing production schedules or inventory levels. When put in the context of the top market pressure of reducing cost, it becomes clear that manufacturers can only accomplish this if best practices and standardized operating procedures are continually improved and then followed consistently and universally.

Organization

Executive support for improving collaboration and the execution of business processes across the organization is crucial for a firm's long term success and the Best-in-Class are nearly 50% more likely than Laggards to have this capability in place. A great example of this type of leadership comes from the CEO of P&G, Bob McDonald, where he made the following statement in the [P&G 2010 Annual Report](#): "Another good example of how we're becoming more productive is the 'digitization' of P&G. With digitization, our goal is to standardize, automate and integrate systems and data so we can create a real-time operating and decision-making environment. We want P&G to be the most technology-enabled company in the world."

Another key capability for organizations is launching and maintaining a long term commitment to Lean or other operational excellence initiatives like Total Productive Maintenance (TPM). Best-in-Class organizations are over 33% more likely than Laggards to have such a mature program in place, where achieving maturity can often take three to five years, or longer, as was established in previous Aberdeen research on [Lean](#). The rigor of these programs demand attention to detail and a well documented understanding of work processes in manufacturing and as stated above, this understanding can form the basis of automating these work processes and connecting them to higher level business processes that connect multiple job roles and job functions outside of manufacturing.

"We are currently implementing more electronic and automated tools to improve performance (reduce operation times) for many of our business practices. The greatest benefit has been a thorough review of all business policies. What a great way to Lean out the waste."

~ Engineer, Aerospace and
Defense

Knowledge Management

Outside of Process Management, Knowledge Management is perhaps the most important set of capabilities for an organization to focus on in trying to achieve Best-in-Class performance in BPM for manufacturing. Within Knowledge Management there are two main sets of capabilities that have helped Best-in-Class manufacturers achieve the performance they enjoy, the first set revolves around visibility and the second set revolves around interoperable business processes.

Regarding real-time visibility, Best-in-Class manufacturers are more likely to have real-time visibility between executives and global manufacturing operations, between suppliers' performance and manufacturing, and between customer orders and suppliers. Such architecture allows for improved decision making in a number of different ways. It gives executives an unadulterated view into what is happening in operations and how the product supply decisions made will impact manufacturing. It also allows for manufacturing operations to have an unadulterated view into the flow of demand and goods through the supply chain. This generally allows for the reduction of buffer stocks, creates a more demand driven operation, and gives each node in the supply network a better perspective on how the decisions they make impact the rest of the system.

Regarding interoperable business processes, Best-in-Class manufacturers are more likely to have connected processes between engineering, quality, manufacturing, and distribution. These processes include, but are not limited to, quickly and easily delivering: engineering, recipe, and Bill of Material (BOMs) changes to manufacturing, quality testing procedures and changes to manufacturing, and delivering work instruction to manufacturing. In each of these cases, disparate groups, often operating in multiple locations have to collaborate, come to a common understanding of processes, and transmit back and forth large quantities of data. As was the case with Process Management capabilities, without the use of technology enablers to support these capabilities, the overall system is prone to significant timeliness and data quality issues.

Performance Management

Performance Management is all about how an organization measures and improves performance over time. A critical capability the Best-in-Class are leveraging is standardized Key Performance Indicators (KPIs). This means the Best-in-Class have established a standard set of metrics across the enterprise with which to measure operational performance. In fact, the Best-in-Class and Industry Average are nearly twice as likely as Laggard manufacturers to have standardized metrics. To compliment and fully realize the benefits of standardized metrics the Best-in-Class are also more likely to provide analytical capabilities around these metrics in the form of both aggregations and drill downs for a number of different data cuts including: geographies, product lines, customers. The Best-in-Class were also more likely to be able to then display this data in a normalized scoreboard. Again,

all designed to provide the right data, to the right decision maker, at the right time, in an easy to understand format, with analytical capabilities built

Technology Management

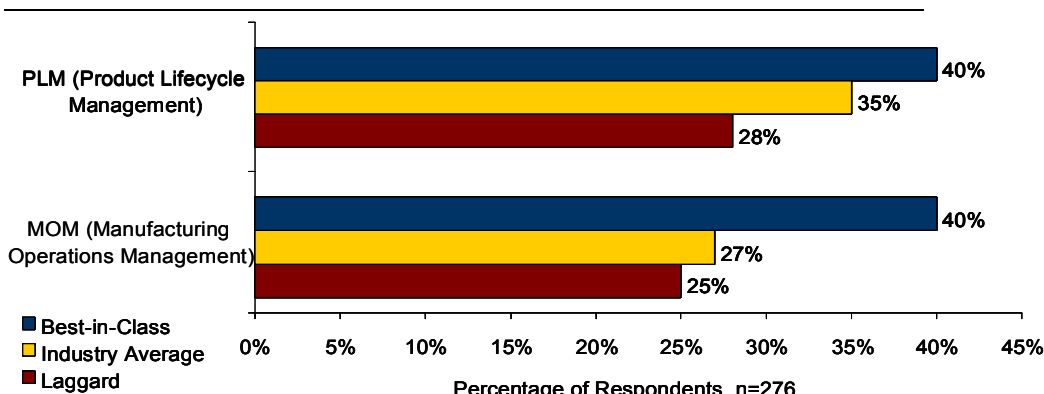
There is a correlation between the technologies a manufacturer adopts, and achieving Best-in-Class performance. The technologies that correlate to Best-in-Class performance span the ISA-95 technology stack; starting at the controls layer, moving up through manufacturing operations management, and ending with enterprise applications focused on the interdependent functional areas of product development, engineering, inventory management, distribution, and production planning. By adopting such a technology strategy, Best-in-Class manufacturers are able to better address the market pressures they face including the need to cut costs, ensure finished product quality, quickly ramping up to demand, and effectively introducing new products.

In regards to the Process and Knowledge Management capabilities highlighted above, there are two technologies that play a particularly important role in enabling success, Product Lifecycle Management (PLM) and Manufacturing Operations Management (MOM). PLM, when implemented correctly, can enable a manufacturing organization to have consistent product data across the organization, manage the complete lifecycle of each product (including: as built, as made, and as maintained data) and can also provide a consistent environment for engineering to develop and author manufacturing processes, work instruction, quality plans and testing, and engineering changes. In the manufacturing world, MOM can provide the platform for organizations to develop consistent manufacturing execution processes across the organization, standardize quality management practices across the organization, effectively manage maintenance and the performance of assets, and optimize the flow of material through manufacturing. In Figure 3, adoption rates of each of these technologies across the maturity class framework are shown.

Definition

The ISA-95 technology stack is a functional model of technology in manufacturing defining 5 specific layers. Layers 0,1,2 represent the actual work, the manufacturing assets that do the work, the sensing and networking equipment that interacts with the assets and work in process, and the software that directly controls the manufacturing process and assets like Human Machine Interface (HMI) and Supervisory Control and Data Acquisition (SCADA). Level 3 is Manufacturing Operations Management and contains software that manages production, maintenance, quality, and inventory. Finally, layer 4 represents the Business systems that manage engineering, finance, and the supply chain like ERP, PLM, and SCM, which layer 3 needs to interoperate with. More information can be found at the ISA or MESA websites.

Figure 3: Adoption of PLM and MOM



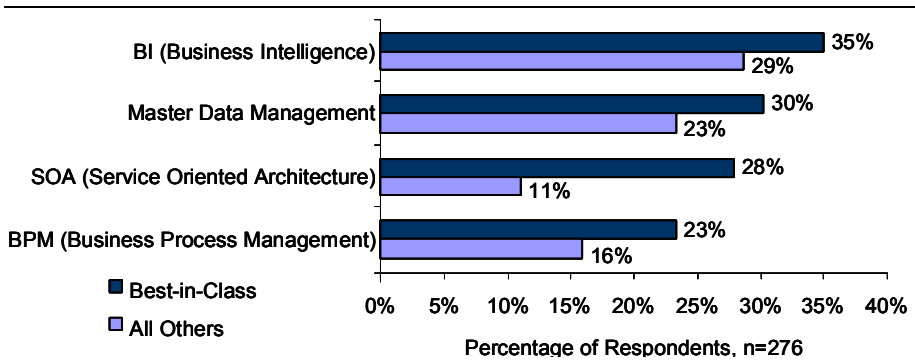
Source: Aberdeen Group, October 2010

Interestingly, many MOM as well as PLM vendors have built BPM capabilities into the solutions they offer to the market, which allows organizations that use these solutions to have a much better handle on building and deploying the processes used within engineering and manufacturing. However, even as important as it is for both engineering as well as manufacturing to have a good handle on business processes within each organization, it is also important to take an enterprise wide view of these processes. For that reason, there are a number of IT tools and architectural approaches that Best-in-Class manufacturers use to better manage the business processes that cross boundaries within an organization.

"We are currently in the process of integrating our Product Lifecycle Management (PLM) and Manufacturing Operations Management (MOM) solutions. Indeed, BPM is a fundamental part of the process. We've uncovered that collaboration across cross functional teams and BPM ownership critical to the success of this integration effort."

~IT Director, Medical Device Company

Figure 4: IT Tools and Architectures



Source: Aberdeen Group, October 2010

The foundation for both PLM and MOM applications, as well as BPM in Manufacturing, is good data. To ensure good data, many of the Best-in-Class have invested in master data management, which in the context of manufacturing must be coupled with an enterprise wide manufacturing data model. Together, this ensures that there is quality data across the organization and the definitions of what is what in manufacturing is consistent across sites and across applications.

One of the top Knowledge Management capabilities of the Best-in-Class is providing executives real time visibility into manufacturing operations. For many organizations this is a great challenge, to help deliver this capability from a technology perspective, many manufacturers today are looking to Business Intelligence. Business Intelligence already has a strong foothold in analyzing sales and financial data but it is increasingly being used in operational contexts to provide visibility into supply chain and manufacturing data. In the case of manufacturing, often ERP systems, which are generally transaction based, do not maintain the needed granularity of data to be useful from a real-time visibility or analytical perspective. For this reason many BI implementations into manufacturing have to go a layer deeper and work with data either in a MOM application or rendered usable from a MOM application through Manufacturing Intelligence capabilities.

One of the main challenges many organizations have faced in managing business processes across disparate groups and applications is the cost of maintenance and lack of flexibility in purpose built integration. To address

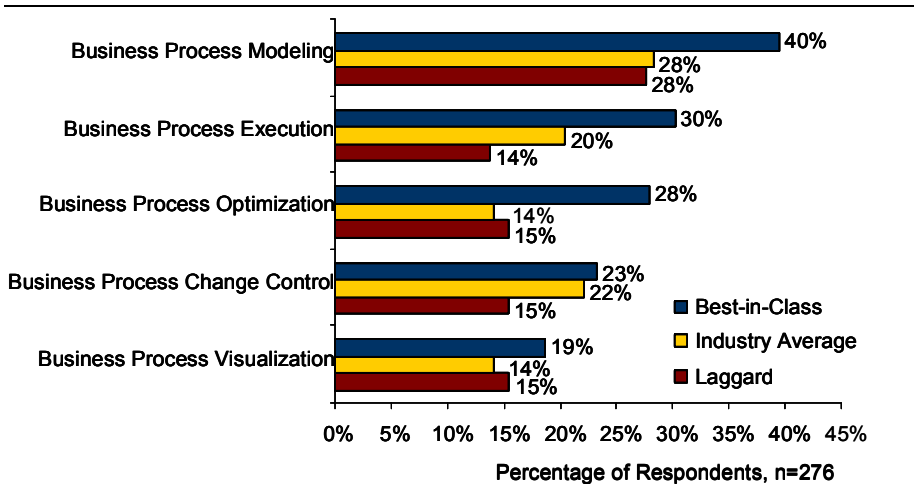
this challenge, many of the Best-in-Class have looked towards implementing a Service Oriented Architecture (SOA). SOA is defined as a system design strategy that provides a suite of loosely coupled services to allow for integrating disparate applications and it is one of the most differentiated technology management capabilities; with Best-in-Class manufacturers being over 2.5 times as likely as underperforming manufacturers to have adopted SOA.

Finally, it is important to note that Best-in-Class manufacturers are almost 50% more likely than underperforming organizations to use BPM. BPM allows these organizations to, from a common platform, model, visualize, and optimize business processes and then integrate these business processes with disparate people, applications, data, and events. In the following Technology Enablers section we will dive into more detail into each of these areas.

Technology Enablers

Effectively managing business processes across an organization requires a full suite of BPM capabilities. Each of these technology enablers plays a critical role in the overall success of an initiative, with some of the most likely to be deployed by the Best-in-Class highlighted in Figure 5.

Figure 5: BPM Capabilities



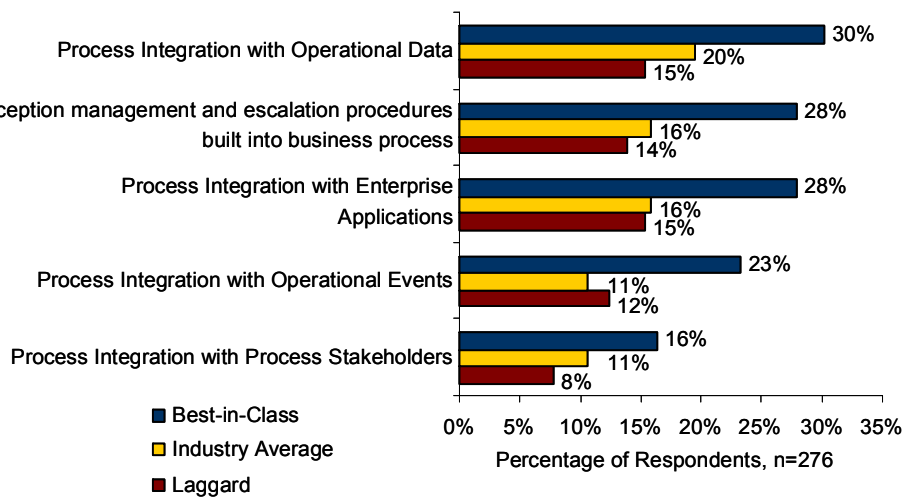
Source: Aberdeen Group, October 2010

The first step is being able to model business processes effectively. Generally this is an interactive extension of the manufacturing data model. Process engineers can drag and drop equipment, people, data sources, escalation procedures, forms, and more to build these processes. However, building the processes model is not enough; it really can't just be a work flow diagram to deliver the value most organizations are looking for. The business processes must be executable in a manufacturing run time environment and the application must be robust enough to handle the work load and uptime pressure of a mission critical manufacturing environment.

As organizations mature in their ability to manage processes, optimization of processes will become more of a priority. The elimination of redundant work, waste, and non-value adding activities will all play into how much value an organization can garner from BPM in manufacturing. It is also important, especially given how many manufacturing organizations work in regulated environments, that there is traceability and control of these changes. Otherwise the entire system can quickly become unwieldy and out of control, exposing the organization to many unintended risks. Finally, as more processes are automated and managed, the ability to easily visualize and understand how processes are behaving both in their model form and as they are being executed can relieve a lot of management headaches for process engineers responsible for maintaining the entire system over time.

Business processes can not exist in a vacuum. For processes to be executable they must interoperate with data, events, applications, and people. The process must also be able to contextualize these different process nodes and activities within the overall business process and account for exception management and escalation procedures when an undesired result or adverse event occurs. These are all additional functions that should be included in any BPM suite being considered for use in operations, and as can be seen in Figure 6, the Best-in-Class are more likely than the Industry Average and Laggards to be using each of these functions.

Figure 6: Interoperating Processes with the Business



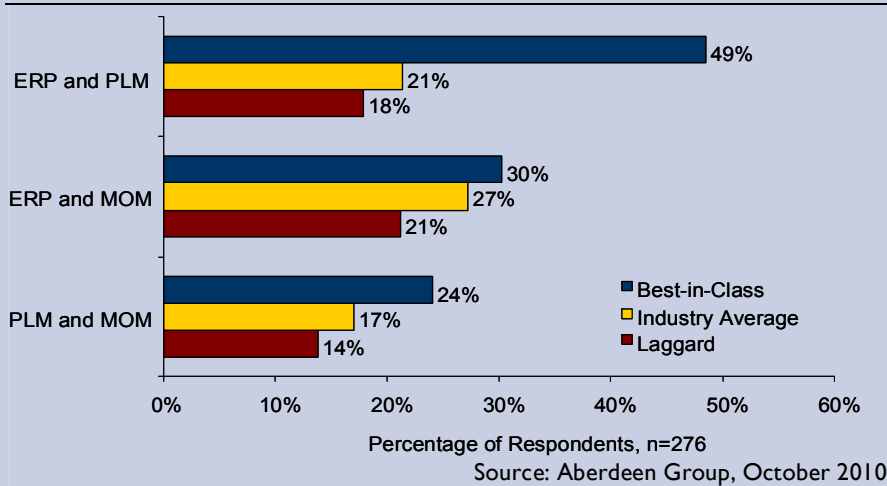
Source: Aberdeen Group, October 2010

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Interoperating across enterprise applications can be a critical component to achieving Best-in-Class performance and to a large extent can be enabled by taking a BPM approach in manufacturing operations. In any interoperability strategy, the centerpiece should be ERP, which in most cases forms the back bone of an organization’s overall application landscape.

The Best-in-Class are then making strategic selections on which systems to interoperate, in general these include: PLM and ERP, ERP and MOM, PLM and MOM, and QMS to PLM, ERP, and MOM.

Figure 7: Application Interoperability



ERP and PLM interoperability allows organization to operate from a single version of the truth when it comes to product data. In manufacturing, it is often important to synchronize multiple engineering disciplines and multiple stages in the product development cycle. PLM enables this synchronization and also provides a single source for product data and changes to product data. However, if PLM is not interoperating with ERP, there will often be multiple version of Bill of Materials which can lead to major inconsistencies in costing or production planning. It can also lead to confusion when trying to execute engineering change orders across the organization or synchronize as designed and as built data. Best-in-Class organizations are addressing these challenges by being over twice as likely interoperate across PLM and ERP systems.

Interoperating between ERP and MOM can often deliver two distinct Best-in-Class capabilities that deliver rapid benefits to the organization. First, such a connection is critical for providing real time visibility between executives and manufacturing. Second, ERP and MOM interoperability allows manufacturers to have real time visibility into customer orders and supplier performance.

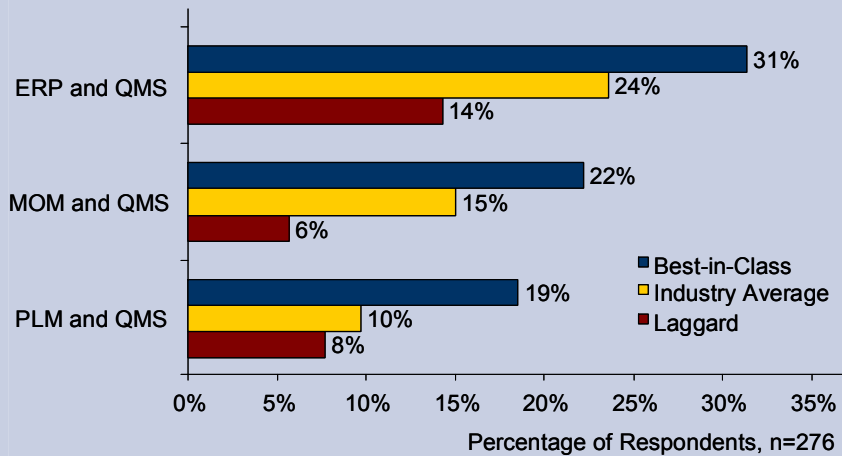
continued

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It also goes beyond just visibility and also allows manufacturing to, in many cases, deliver work instructions and production orders directly to the shop floor. PLM and MOM interoperability allows organizations to bring together product development, manufacturing process planning, and manufacturing operations. In many cases it enables Best-in-Class capabilities like delivering 3D work instructions and part models to the shop floor or smoothing the delivery of engineering changes to manufacturing. It can also improve quality planning and the understanding of failure modes of products within engineering and also makes for much improved collaboration between engineering and manufacturing.

Finally, taking an enterprise level approach to quality management and interoperating QMS with multiple enterprise applications like ERP, PLM, and MOM can have long lasting results.

Figure 8: Enterprise Quality Management



Source: Aberdeen Group, October 2010

Quality can be a powerful competitive advantage but ensuring quality products are delivered to market takes a team effort. Product development must take quality issues into account up front, planning for failure modes and effectively assessing risk. Suppliers also must be effectively managed through collaboration as well as effective measurement of performance. Manufacturing needs strict statistical control of quality as well as established processes for dealing with non-conformances and ensuring root causes are found. Finally, there are a number of processes that need to be managed at the enterprise level, like: audits, corrective and preventive actions, documents, and more.

Chapter Three: Required Actions

Whether a company is trying to move its performance in 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

- **Executives need to focus on improving collaboration and business processes.** Best-in-Class organizations are nearly 50% more likely than Laggard organizations to already have this executive focus established. As is the case with P&G, it should be made a corporate priority, which will focus the attention of many key stakeholders within the organization and greatly improve the chance for long term success.
- **Focus on data quality and consistency.** Best-in-Class manufacturers are 50% more likely than Laggards to have Master Data Management in place. These firms see data as the foundation for all they do in deploying enterprise applications, extending BPM into operations, or interoperating between systems. Points to focus on here are establishing a manufacturing data model and extending the model across all sites.
- **Begin the journey of deploying enterprise applications that are critical for manufacturing success like PLM and MOM.** Many PLM and MOM applications are built on a BPM platform and are a great starting point for building internal capabilities in BPM. The business processes automated within these applications will also work to serve as the building blocks for enterprise level BPM that begins to connect business processes across departments and applications within the organization.

Industry Average Steps to Success

- **Establish real-time visibility between manufacturing and executives and between manufacturing and suppliers/customers.** Best-in-Class manufacturers are more likely than Industry Average manufacturers to have visibility into all of these areas and as the organization matures this visibility will become a key component of how interactions occur and decisions are made with in these business processes.
- **Invest in a SOA for enabling interoperability.** Best-in-Class manufacturers are over 2.5 times as likely as underperforming manufacturers to have adopted SOA. This allows Best-in-Class manufacturers to eliminate rigid points of integration between legacy applications.

Fast Facts

As compared to Laggards, Best-in-Class companies are:

- √ 38% more likely to establish an executive led vision of flexible and integrated manufacturing operations as a true competitive advantage for the organization.
- √ Twice as likely to create a coherent BPM strategy for manufacturing that connects people and applications from across traditionally disparate groups
- √ 50% more likely to have Master Data Management in order to have data quality and consistency across their operations

- **Invest in BPM.** Best-in-Class manufacturers are almost 50% more likely than underperforming organizations to use BPM. BPM allows these organizations to, from a common platform, model, visualize, and optimize business processes and then integrate these business processes with disparate people, applications, data, and events.

Best-in-Class Steps to Success

- **Extend BPM to processes that touch multiple job roles and applications.** Many of the most important business processes in any manufacturing organization rely not only on the actual process of manufacturing. More often than not in processes like order to cash or new product introductions success is determined by how well manufacturing interacts with other parts of the business.
- **Leverage the full suite of BPM capabilities to manage the complete life cycle of business processes.** As companies mature in using BPM for operations it is important to be able to manage the complete lifecycle processes, this includes the authoring, distribution, change control, and end of life for every process. The Best-in-Class are over three times as likely as Laggard manufacturers to be able to this and they do this by effectively modeling, visualizing, and optimizing business processes and then integrating these business processes with disparate people, applications, data, and events.
- **Create real time interoperability between enterprise applications.** With an enterprise-wide BPM platform in place, begin to interoperate in real-time across enterprise applications such as ERP, PLM, MOM, and QMS, and ERP. This interoperability will be a key component in managing business processes that touch multiple facets of the business. Key interoperability points include: PLM and ERP, ERP and MOM, PLM and MOM, and QMS to PLM, ERP, and MOM.

“We have successfully implemented Business Process Management for our company planning including financial planning for manufacturing. We foresee implementing more specific BPM for manufacturing and linking financial, operational and quality metrics.”

~Chief Financial Officer,
Biotechnology Manufacturer

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Aberdeen Insights — Summary

BPM is not a new technology but it is new to manufacturing operations and subsequently many leading MOM and pure play vendors have recently developed or acquired solutions in the space. Best-in-Class companies are leading the charge in using this suite of technologies to better manage business processes and foster collaboration. A line has been drawn in the sand by Best-in-Class manufacturers, a sentiment which is best exemplified by statements like those made by Bob MacDonald of P&G, and executives from every industry should take notice. A key aspect of competitiveness moving forward will be a company's ability to integrate systems, people, and data to make better decisions faster.

Appendix A: Research Methodology

Between July to September of 2010, Aberdeen examined the use, the experiences, and the intentions of more than 275 enterprises using Business Process Management in Manufacturing.

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

Responding enterprises included the following:

- *Job title:* The research sample included respondents with the following job titles: Upper Management (CSO, CEO, COO, CFO, CTO, President, SVP, Managing Director, Partner) (18%); Vice Presidents (6%); Director (15%); Manager (32%); Staff (9%); Other (18%)
- *Industry:* The research sample included respondents from the following industries: Aerospace and Defense (17%); Industrial Equipment Manufacturing (14%); High Tech Manufacturing (12%); Industrial Products (10%); Medical Devices (10%); Chemicals (9%); Food and Beverage (8%)
- *Geography:* The majority of respondents (61%) were from North America. Remaining respondents were from Europe (18%), the Asia-Pacific region (14%), and rest of world (7%).
- *Company size:* Twenty-three percent (23%) of respondents were from large enterprises (annual revenues above US \$1 billion); 48% were from midsize enterprises (annual revenues between \$50 million and \$1 billion); and 29% of respondents were from small businesses (annual revenues of \$50 million or less).

Study Focus

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

- √ The degree to which BPM is deployed in their manufacturing operations and the financial implications of the technology
- √ The structure and effectiveness of existing BPM implementations
- √ Current and planned use of BPM to manufacturing operations
- √ The benefits, if any, that have been derived from BPM initiatives

The study aimed to identify emerging best practices for BPM usage in manufacturing, and to provide a framework by which readers could assess their own management 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, October 2010

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, October 2010

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, October 2010

Appendix B: Related Aberdeen Research

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

- [Manufacturing Operations Management in the Economic Down Turn](#), March 2010
- [A Platform Approach to Manufacturing Operations Management](#), March 2009
- [Global Manufacturing Operations Management](#), August 2008
- [Event Based Manufacturing Intelligence](#), May, 2008
- [Manufacturing Operations Management: The Next Generation of Manufacturing System](#) January, 2008
- [Compliance and Traceability](#) December, 2007
- [The Cost of Quality: Benchmarking Enterprise Quality Management](#), July, 2007

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

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