

QUALITY IN DISCRETE MANUFACTURING: END-TO-END APPROACH TO ENSURE SATISFACTION AND REDUCE COSTS

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Report Highlights

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65% of discrete respondents identified customer satisfaction as the top pressure being felt to improve quality performance.

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Leading discrete manufacturers understand that improving quality comes directly from systematic monitoring and analysis of their processes.

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Most discrete organizations today depend on a global network of suppliers to manufacture their products. Managing these interactions with suppliers is where Leaders truly stand out.

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Leaders combine QMS, ERP, and MES to create a platform for cross-functional communication and collaboration that synchronizes and ingrains quality across the value chain.

Based on the experiences of over 200 respondents, this report will explore how discrete manufacturers approach quality management. Specifically, how Leaders in the industry take an enterprise-wide approach to quality management in order to ensure that their customers are happy while keeping costs to a minimum.

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Ensuring quality is all about keeping customers happy, and that is especially true for discrete manufacturers.

The requirements of quality management systems have evolved significantly over the past several years. Increased complexity within today's products and having to operate in a global business environment are driving companies to rethink the way they approach quality. The pressure to keep customers satisfied while reducing the overall cost of quality is a daunting task for discrete manufacturers today. In addition, growing compliance and regulatory requirements add to concerns around safety, traceability, and auditing / reporting. Poor quality can have a far-reaching impact on the business if a culture of quality is lacking in the organization. As a result, companies are looking to ingrain quality into the DNA of the business, making it an integral part of production. To be successful, manufacturers must stress first time quality, visibility within the supply chain, and compliance throughout the process.

Based on the experiences of over 200 respondents, this report will explore how discrete manufacturers approach quality management. Specifically, how Leaders in the industry take an enterprise-wide approach to quality management to ensure that their customers are happy while keeping costs to a minimum.

You Can't Sacrifice Quality

Manufacturers have historically always been focused on cost: how can I produce the same item for less, how can I eliminate unnecessary waste in my operations? This pushes some organizations to turn to lower-grade materials or outsource for cheaper labor/suppliers. Companies are also striving to differentiate themselves through the production of more complex products. Growing product complexity, combined with cost cutting measures, leads to the risk of poor quality products rising sharply. Combine this with increasing globalization, distributed product development, and multi-echelon supply networks, and it's clear that discrete manufacturers are challenged more than ever before in their goal to deliver affordable, high quality products. The impact of poor quality

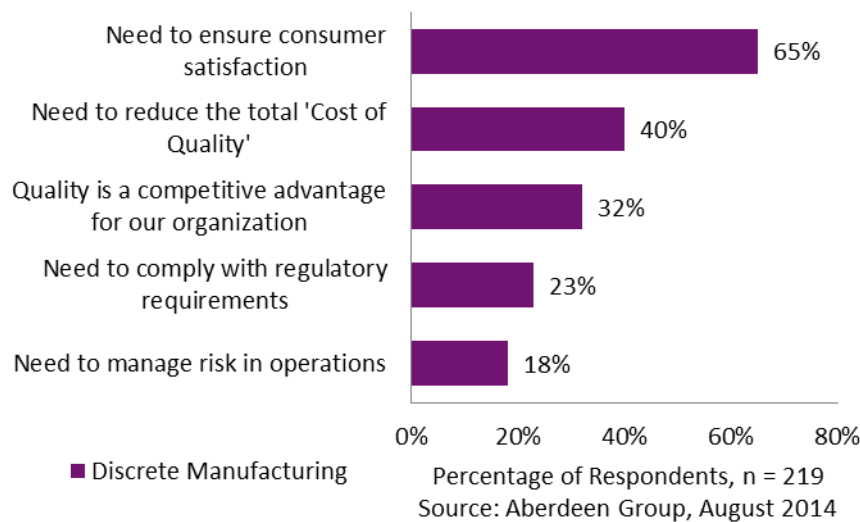
Sector Definition

For the purposes of this report, respondents who indicated that they operated within the **discrete manufacturing** space (which includes aerospace and defense, automotive, industrial equipment manufacturers, medical device, high tech, etc.) were isolated and aggregated for comparison against their peers in Aberdeen Group's performance framework.

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goes well beyond costly rework or returns. Ensuring quality is all about keeping customers happy and that is especially true for discrete manufacturers (Figure 1).

Figure 1: Top Pressure for Discrete Manufacturers



It is no surprise to see two thirds of discrete respondents identify “consumer satisfaction” as their top pressure to improve their quality management. Quality is the best weapon in the fight for strong customer loyalty. It takes only one quality issue to potentially lose a customer for life. This relationship with the customer backs up the idea that quality can be a competitive advantage, promoting a strong brand image (32% of discrete respondents). With the steep competition in discrete industries, a strong brand goes a long way in distinguishing yourself from the competition.

One aspect of quality management that is often overlooked is the risk to the business if quality is not a focus. Compliance and regulatory requirements like REACH, RoHS, the Dodd-Frank Act, ISO/TS 16949, or AS9100 are growing in number and scope. Compliance is a huge risk and the associated costs or loss of business from noncompliance can cripple a company. The

“We are an industry leader in the quality of products and services we provide to our customers. In turn, our customers are our best advocates to others who may also be looking to us to meet their needs. Attaining and maintaining our superior results is a key tenet of our go-to-market strategy and we invest heavily to be sure our people, processes, and products continue to deliver that strategic differentiator for our business.”

~ Managing Director Business Development, Small Computer Equipment Manufacturer

“Our Quality Management system is positively impacting the company’s objective in [the] following ways: Bringing efficiencies by working on compliance to internal and external standards, adapting the standards to meet growing customers’ (internal as well external customers) expectations, and overall end customer satisfaction.”

~ Manish Kumar, Quality Manager, Large Cosmetics Company

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“Proper Quality Management has allowed us to meet on time shipping objectives, where poor quality management has caused product recalls. By continuously improving our quality systems, we are better meeting customer expectations and have significantly decreased customer complaints.”

~ Business Development Manager,
Werth Inc.

complexity of product compliance is sharply escalated when compliance of component parts and materials from the Bill of Materials (BOM) is factored in. At both the finished goods and lower level parts; if enough non-conforming products are released to customers, a recall may need to be administered. The cost of a product recall goes beyond the expense of replacing an order or paying for damage caused by use. There can be significant impact to the brand and customers may have less trust in the company. The automotive industry knows the pain that product recalls can bring, [as 2014 has been among the worst years ever](#) for the number of potential units affected.

Cost is king for discrete manufacturers, and ensuring top quality for your products can be a costly endeavor if not properly managed. Areas often targeted are prevention and assurance costs, as they can be deemed excessive, but this increases the likelihood for failure costs and introduces risk into the business. But in the quest for cost reductions, quality cannot be sacrificed. This can be a daunting task for discrete manufacturers with all of the other issues they face in today’s business environment.

The combination of all of these quality related concerns is driving discrete manufacturers and their suppliers to question both the efficiency and approach of their current quality system. Luckily, there is hope; there are companies in the industry that ensure repeatability and predictability of their processes, while limiting costs.

Defining Leaders Among Discrete Manufacturers

Aberdeen used four key performance criteria to distinguish the discrete Leaders from Follower organizations (Table 1). These metrics measure an organization's ability to respond to pressures around customer satisfaction, efficiency, and overall

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success of the business. Table 2 summarizes the criteria used to define Leaders and the respective performance of each group.

Table 2: Top Performers Earn Leader Status

Maturity Class	Mean Class Performance
Discrete Leaders: Top 30% of Discrete aggregate performance scorers	+20% Operating Margin vs. Corporate Plan 91% Overall Equipment Effectiveness (OEE) 98% On Time and Complete Shipments 96% Successful New Product Introduction Rate
Discrete Followers: Bottom 70% of Discrete aggregate performance scorers	+2% Operating Margin vs. Corporate Plan 82% Overall Equipment Effectiveness (OEE) 90% On Time and Complete Shipments 76% Successful New Product Introduction Rate
All Discrete Manufacturing: All Discrete aggregate performance scorers	+8% Operating Margin vs. Corporate Plan 86% Overall Equipment Effectiveness (OEE) 92% On Time and Complete Shipments 83% Successful New Product Introduction Rate

Source: Aberdeen Group, June 2014

The metrics above clearly indicate the ability of Leaders to manufacture products, and subsequently, get them to market on time, at a higher quality, and at the lowest possible cost – all while streamlining operations across the design, make, and delivery processes. Also, when drilling down solely on quality costs, the Leaders are doing a much better job of reducing their total cost of quality (see sidebar). The question that begs to be asked is what is it that these leading discrete manufacturers are doing to limit their costs while ensuring high quality?

End-to-End Quality Management

The first step to any quality program is getting the organization focused on improvement. This focus must start from the top, as management has direct responsibility for quality improvements within a company. Both discrete Leaders and Followers realize

Reducing Cost of Quality

Discrete Leaders, in addition to performing better as a business, outperform their peers on total cost of quality (percentage of annual revenue).

Prevention costs (quality planning, training, etc.):

- Discrete Leaders – 3.1%
- Discrete Followers – 4.2%

Assurance costs (audits, testing, calibration, validation, etc.):

- Discrete Leaders – 2.9%
- Discrete Followers – 4.1%

Internal failure costs (scrap, rework, re-inspection, etc.):

- Discrete Leaders – 2.7%
- Discrete Followers – 4.5%

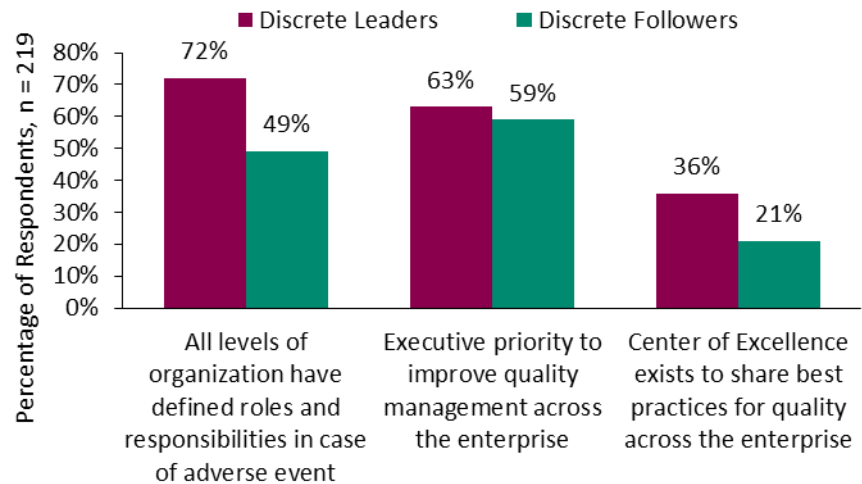
External failure costs (returns, warranty, recall, etc.):

- Discrete Leaders – 2.5%
- Discrete Followers – 3.6%

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this and make sure their executives stress the importance of quality across the enterprise (Figure 2).

Figure 2: A Quality Focused Organization



Source: Aberdeen Group, August 2014

“The ROI of quality management is measured by the need for manager's intervention, the reduction in operator's errors and how we increase corporate compliance.”

~ Quality Manager, Large Pharmaceutical Company

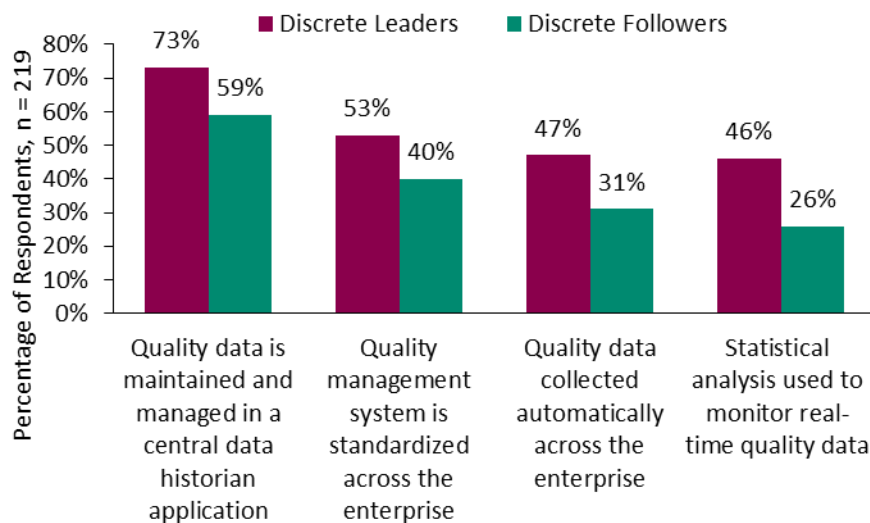
However, it is the Leaders who are more likely to take it a step further and get all levels of the organization focused on quality. It is well documented that a company's ability to quickly respond to quality issues reduces the overall cost of any quality incident. By being 47% more likely than Followers to define roles/responsibilities for their employees, Leaders are better structured to act on any quality issues that may occur. This prevents non-conforming shipments from being shipped and keeps conforming ones on track for on time delivery. It shouldn't depend on what plant or what department has the issues, Leaders have responses well defined beforehand and are quick to act. In addition, centers of excellence are proven tools to improve the culture and gain employee buy-in towards quality. This commitment by Leaders validates the message of quality and gets the workforce focused on accomplishing this goal.

Next, a manufacturer needs to know how they are performing on quality to be able to take action. Effective quality-related

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decisions should be based on data analysis and information, not speculation or conjecture. That is why you see Leaders stressing the proper management and utilization of their quality data (Figure 3).

Figure 3: Getting a Handle on Quality Data



Source: Aberdeen Group, August 2014

Leaders start by being more likely to automatically collect their quality data in a standardized system across the entire enterprise. A standardized system eliminates and harmonizes disparate point solutions for quality, reducing errors in quality information, while collecting quality information in real-time makes quality an integral part of the manufacturing process. In addition, this allows for the opportunity to embed quality documentation as part of automated data collection, which further helps to ensure compliance and traceability throughout the process. Leaders actively utilize this system as they are 77% more likely than Followers to conduct statistical analysis – turning quality data into insight. Analyses like statistical process control (SPC) or failure mode and effects analysis (FMEA) can be undertaken in real-time to improve the reliability and control over manufacturing processes. Further eliminating non-

“Our company has experienced significant growth in the last 6 years (tripling sales). Our systems were not scalable which resulted in an increase to Cost of Poor Quality (COPQ). We have since refocused our efforts on Quality and have begun building in controls to our processes.”

~ Mike Evans, Director of Procurement / Purchasing, Industrial Scientific

CAPA and Quality

Corrective and Preventive Actions (CAPA) processes established to improve performance:

- Discrete Leaders - 91%
- Discrete Followers - 75%

Risk based approach used to prioritize CAPA related to operations:

- Discrete Leaders - 55%
- Discrete Followers - 28%

Risk based approach used to prioritize CAPA related to suppliers:

- Discrete Leaders - 42%
- Discrete Followers - 26%

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How do you Measure Suppliers?

Discrete respondents were asked to select what criteria were used to measure supplier performance:

On Time Delivery:

- **88%** of respondents

Defect Rate:

- **80%** of respondents

Product Quality:

- **73%** of respondents

Product Cost:

- **57%** of respondents

Supplier Responsiveness:

- **46%** of respondents

Number of outstanding supplier CAPAs:

- **41%** of respondents

Effectiveness of Supplier Quality Management system:

- **27%** of respondents

Charge Backs:

- **26%** of respondents

Compliance to Standard Operating Procedure (SOP):

- **25%** of respondents

Ability to collaborate on product design:

- **23%** of respondents

Sustainability:

- **22%** of respondents

Visibility into supplier quality and manufacturing processes:

- **21%** of respondents

conformances in Leaders' processes is their adoption of a risk based CAPA (see sidebar) approach. Conducting analyses like these makes quality an integral part of production execution for Leaders. This information is also stored in centralized data historians to allow for easy access to the critical information operators need to provide traceability and improve their decision-making. From the supplier used, to distribution, to any customer complaints, discrete manufacturers need to be able to track and trace their products from any stage in the value chain. To have a traceability initiative which positively impacts the business, it has to be holistic; these historians provide the means for a company to access the right data should a non-conformance occur.

This control and integration of quality data is a direct result of the software that Leaders employ. Combined enablers like ERP, MES, and QMS are what discrete Leaders rely on for their quality system to be an integral part of production and to be extended across the enterprise. Providing this quality insight throughout the enterprise gives operators the ability to stop quality problems from the onset. They can stop non-conforming products from being shipped, keep customers happy, and eliminate the risk of costly recalls. These issues can have a major impact on the bottom line as mastering quality data goes a long way towards the superior metric performance seen in Table 2. Leaders understand that improving quality comes directly from systematic monitoring and analysis of their processes.

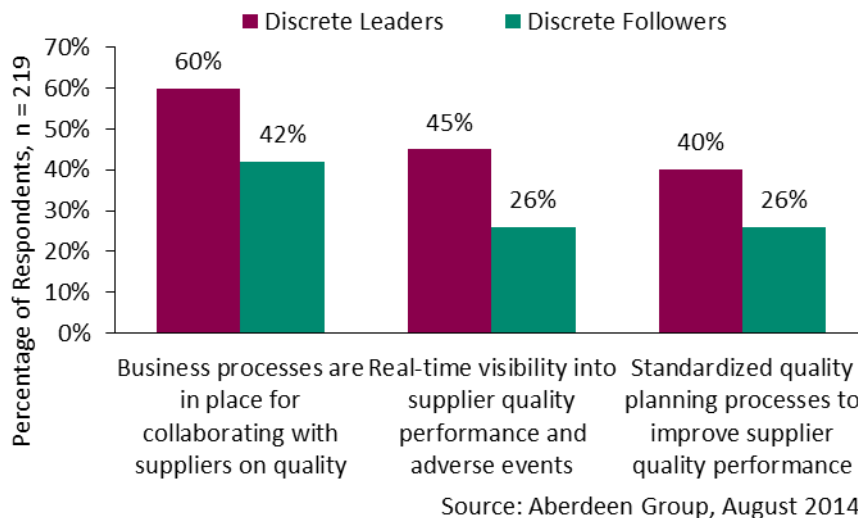
Extending Quality into the Supply Chain

Most discrete organizations depend on a global network of suppliers to manufacture their products. However, this outsourcing brings its own challenges that must be managed effectively – especially in regard to quality. An OEM and their suppliers share the responsibility towards quality performance –

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discrete manufacturers must look for ways to ingrain the supply chain into their quality processes. Managing these interactions with the supplier is where Leaders truly stand out (Figure 4).

Figure 4: Ensuring Supplier Quality



For Followers, the supplier is seen as a necessary speed bump – a third party that can potentially derail an order with one nonconforming or late shipment. For Leaders, suppliers are viewed as strategic partners– key contributors for delivering superior quality. For discrete Leaders, it all starts with a collaborative approach, which is a win-win for all parties involved. Leaders are able to better plan their own resources, while the partners find the Leaders easier to work with, encouraging lower bids and future business.

With this increased focus on collaboration, ideas to improve are bound to occur. Leaders focus on how everyone involved can perform better, and have regular planning sessions to improve quality performance. Followers, on the other hand, are more likely to get bogged down by trying to enforce penalties or fines on their suppliers for any adverse events. This just ends up

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Benefits of Supply Chain Visibility

Supplier defect rate:

- Discrete Leaders – 1.1%
- Discrete Followers – 2.2%

Service cost to the business (e.g. fines, penalties, lawsuits) as a percent of operational budget:

- Discrete Leaders – 2.17%
- Discrete Followers – 2.54%

Operational cost to the business (e.g., delays, supply disruption, rework, and overtime) as a percent of operational budget:

- Discrete Leaders – 3.77%
- Discrete Followers – 5.21%

sourcing what could have turned into a mutually beneficial relationship.

Managing suppliers is more than just measuring performance on items such as on-time delivery or defect rates; it's about being alert and the ability to respond. The critical capability Leaders possess for superior supplier management is real-time visibility into supplier quality performance at the subassembly, parts and materials levels of the BOM. This visibility allows Leaders to discover and fix problems before they escalate, lowering overall costs, and coordinating supplier quality issues throughout field deployment. The Followers rely solely on reacting to problems as they arise, which has a severe impact on the cost and quality of their products. It is this real-time visibility that makes Leaders so successful when managing their suppliers (see sidebar). Sharing information across disparate or siloed systems is always a challenge, especially with suppliers. However, new methods for deployment, like the cloud, help to break down these barriers. The use of supplier portals provides a common platform to collaborate on and provide this needed visibility.

Suppliers are very critical to the overall business performance of discrete companies. This extension of quality into the supply chain is one of the primary reasons that Leaders are able to achieve a 96% successful NPI rate and 98% on time deliveries. Manufacturers that do not take this approach with the supply chain greatly increase risk in the business, especially those discrete companies involved in highly complex or ETO manufacturing processes.

There is Always Room for Improvement

Quality is an ongoing, evolving process within manufacturing – one where there is always progress to make. An important objective, one that manufacturers are very familiar with, for any

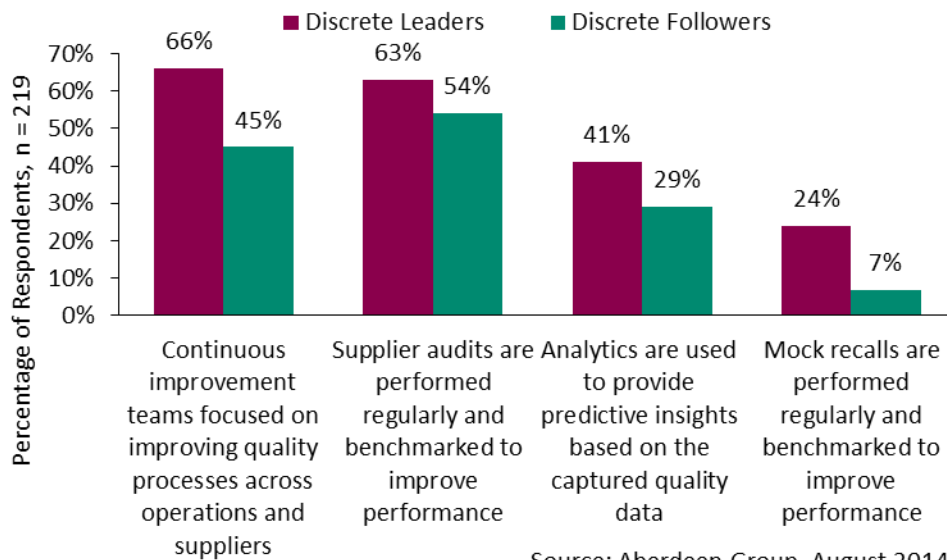
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successful quality management program is to strive for continuous improvement. Discrete Leaders start with cross functional teams aimed at making improvements across the enterprise. These teams are well-proven tools for driving buy-in throughout the organization and helping to change culture. From a supplier perspective, regular supplier audits help companies create a culture of continuous improvement and provide visibility into historic and current performance. This also ensures that suppliers are following processes that are compliant with Standard Operating Procedures (SOP).

“Operating by a Continuous Improvement mentality has allowed our organization to consistently measure quality control objectives, and react in a much quicker fashion to our clients’ rapidly changing business models.”

~ SVP Corporate Management, Small Automotive Supplier

Figure 5: There is Always Room for Improvement



Source: Aberdeen Group, August 2014

While no company likes to even consider the possibility of a recall, it is always good to be prepared. Conducting such events perpetuates focus in the enterprise on issues of product quality and traceability and ensures that the continuous improvement spirit endures within the organization regarding these important issues.

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Discrete Leaders are more likely than Followers to have their Quality Management System (QMS)

integrated with their enterprise systems:

- 44% more likely to integrate with their Enterprise Resource Planning (ERP)
 - 38% more likely to integrate with their Manufacturing Execution System (MES)
-

Finally, since we know that Leaders are already more likely to have control over their quality data they can take their analysis a step further and move towards predictive analytics. Leaders are 41% more likely than Followers to utilize these forward looking analytics to perform trending on quality data for further continuous improvement and better decision making in the future. This continuous improvement approach is the reason why discrete Leaders are able to achieve 9% higher OEE and +18% higher operating margins compared to Followers. These capabilities build a strong end-to-end quality management program that is extended across the enterprise and the supply network.

The Importance of Having the Right Tools

All of the capabilities that Leaders are more likely to possess are critical to getting control over their quality processes, but what enables the Leaders to have these capabilities? The answer reveals itself when examining their approach to technology and a connected enterprise (see sidebar).

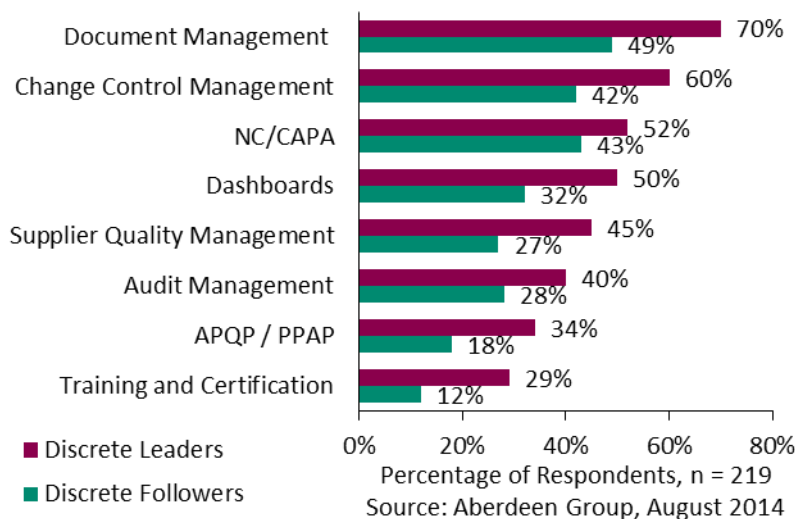
These enterprise systems go a long way towards creating the needed foundation in processes control and automation that Leaders use to enable enterprise quality management. It's all about the breaking down of silos between functional groups that standalone solutions can bring. Combining QMS, ERP, and MES into one overall solution or system creates a platform for cross-functional communication and collaboration that synchronizes and ingrains quality across the value chain. Leaders also automate their processes with technology to ensure that quality initiatives can be effectively carried out (Figure 6).

Document management helps remove inefficient, paper-based systems from both manufacturing and quality processes. This is crucial for quality management, especially when dealing with

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supplier certifications and compliance. Failure to satisfy supplier certifications can result in audit failure, suspension, and potentially, loss of business. In fact, for some discrete industries like Automotive and Aerospace & Defense, most companies require certain certifications as a condition of doing business with them. Complying with industry-specific quality standards can be exceedingly time consuming on paper-based systems. The paperless approach Leaders are taking to document management, audits, and certifications helps maintain compliance with quality standards, including ISO 9000, TS 16949, AS 9100, etc. (see sidebar)

Figure 6: Discrete Leaders turn to Automation



Further, managing data from 100s, or even 1,000s, of suppliers is an intimidating task and creates roadblocks to effective decision-making if not managed properly. A manual or paper-based system is not accurate and simply cannot provide the real-time visibility needed to manage suppliers or to manage quality of parts and components, product by product. Leaders are 67% more likely than Followers to provide suppliers and employees with a single automated platform. Adopting this technology

Compliance with Quality Standards

ISO 9000:

- Discrete Leaders are 50% more likely to comply with ISO 9000

ISO/TS 16949:

- Discrete Leaders are 160% more likely to comply with TS 16949

AS 9100:

- Discrete Leaders are 39% more likely to comply with AS 9100

“Our QMS application allowed us to take the TS16949 framework, along with APQP, as an internal continuous improvement tool. When we managed APQP manually, it was always as a compliance process. QMS applications, if done right, can free a plant from the drudgery of managing all the quality compliance processes as an automotive supplier.”

Plant Manager, \$16B tooling supplier to automotive

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“Quality is a central element of PLM (Product Lifecycle Management), APQP (Advance Product Quality Planning) and PQIT (product Quality Improvement Team) processes. Quality tools to support these processes are available to all employees and it’s communicated regularly.”

~ Quality Manager, Medium Telecommunications Manufacturer

enables discrete manufacturers to proactively manage relationships with suppliers and understand the long term value suppliers are delivering from a quality perspective.

To truly control product quality, it is important to start right from the product development stage. Discrete manufacturers need to adopt technology to automate quality planning and the quality assurance aspect of quality management (APQP/PPAP). While discrete Leaders have an advantage in automating this process, which directly correlates to their 96% successful NPI rate, it is an area both groups should look to in the future for improvement.

Employees who have traditionally spent excessive amounts of time in paper chases can now focus their attention elsewhere, further supporting continuous improvement efforts. Automating processes is a powerful enabler that Leading companies are turning to for success. The lesson here should be that each company should assess their own situation, determine where their biggest gaps are in their quality management program and look to adopt the corresponding technology or tool.

Key Takeaways and Recommendations

Quality management is an evolving journey. It takes the right organizational structure, real-time visibility into manufacturing and quality processes, and a strategic partnership with suppliers. Discrete Leaders facilitate this program by implementing a QMS that is integrated with their other enterprise systems. Putting a formal quality program in place is not the end goal either; to truly be successful you must assess your performance and continually strive to improve. Those discrete manufacturers looking to make quality a differentiator for the business –instead of a hindrance – should take heed of these steps:

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- **Discrete manufacturers feel intense pressures to continually reduce costs, but don't lose sight of the customer.** Reducing costs within your operations does not help if you sacrifice quality to do so. Discrete manufacturers must first get control over their manufacturing and quality processes, then target areas to reduce costs.
- **Improve the flow of quality data between suppliers, manufacturing, and engineering to advance quality programs.** The sooner an organization can address quality issues, the lower the cost of quality will be. A key capability for closing the loop on quality and being more proactive is creating an understanding of how decisions made at one stage of the value chain impact downstream quality. Leading companies understand this and are more likely to turn their quality data into insight.
- **Suppliers are critical to quality – continually monitor/benchmark their performance and stress collaboration.** Understanding how suppliers perform and using this data to improve quality is a key capability for allowing end-to-end quality management. The supply chain continues to pose a major risk for discrete manufacturers who outsource a significant portion of their manufacturing operations. For these companies, it is important to see more than just final test data, but also understand process data from design and for configuration and quality control until products are decommissioned.
- **Take a continuous improvement mindset to quality; there are always areas that can be targeted for improvement.** Small improvements add up over time; the companies that perform the best on quality are the

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ones that are never satisfied. Leaders always strive to improve which is why their OEE rates stay high while their cost of quality stays low.

- **Implement quality management systems at an enterprise-wide level. Minimize disparate systems and harmonize on a single system.** Far too many organizations are still deploying quality systems at the plant level and have many disparate systems. Enterprise-wide adoption of QMS will provide a common platform to connect with other enterprise applications, share best practices, and increase responsiveness in case of an adverse event.

For more information on this or other research topics, please visit www.aberdeen.com.

Related Research

[*Operational Excellence: Lean Manufacturing Profile for A&D*](#); November 2014

[*NPI Velocity in Discrete Manufacturing: The Hidden Cost of Late Products*](#); November 2014

[*The Dodd-Frank Act: Conflicting Approaches Towards Conflicting Minerals*](#); July 2014

[*ERP in Discrete Manufacturing: It's Not What You Have, It's How You Use It*](#); March 2014

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