

By ARC Advisory Group

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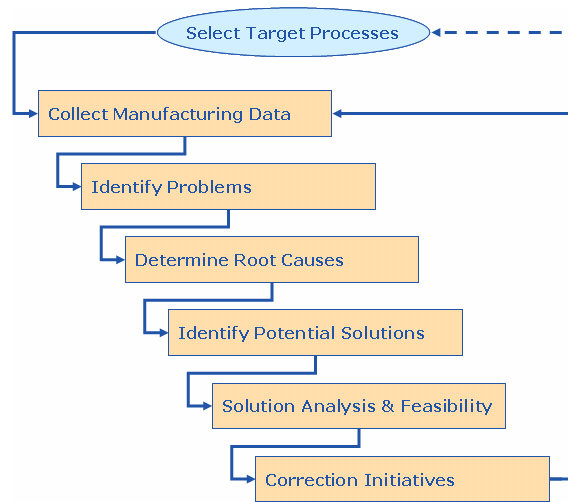
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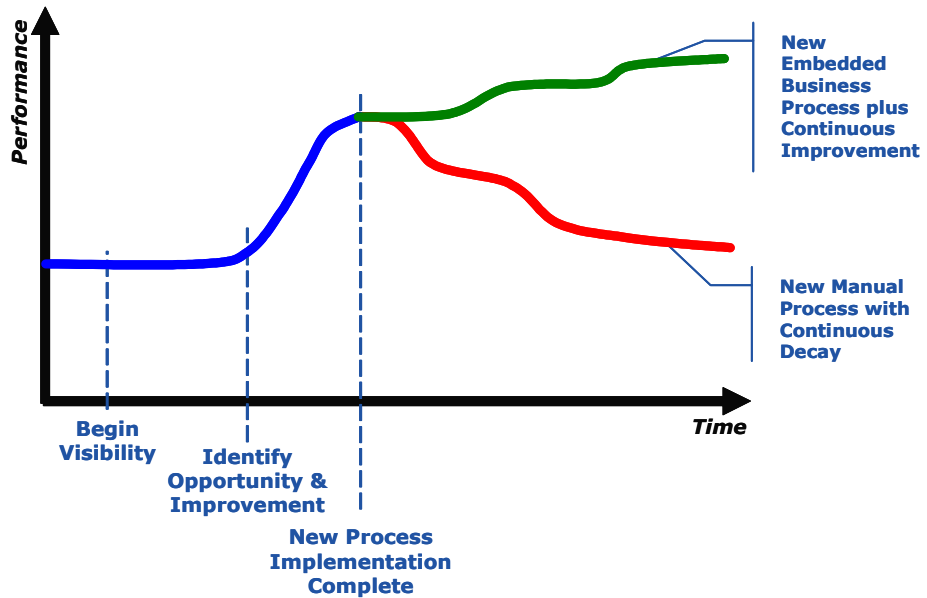
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Data-Driven Manufacturing Performance Improvement Methodology



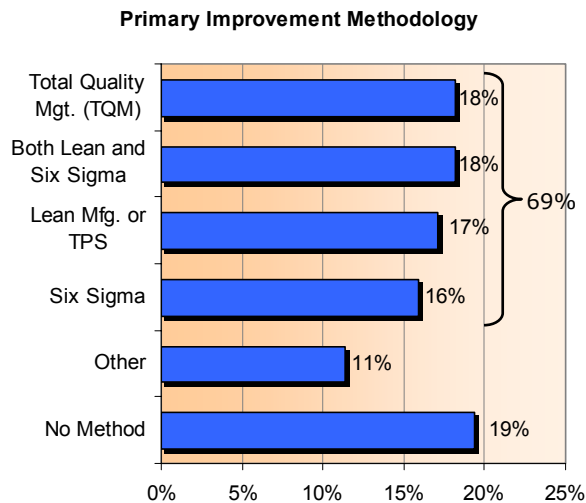
Achieving Step Improvements in Performance

Urgency for Continuous Improvement

Competitive pressures and fear of outsourcing are driving many to look to continuous improvement programs and methodologies to keep their plants local and their jobs intact. Those individuals who can look beyond the 4 walls of their plants will see globalization and gain a clear sense of urgency.

But, a Lean or Six Sigma program is a significant investment. The combina-

tion of 80 hours of training (typical in the first year of a program start-up) and 2 hours per week for team meetings (equals 100 hours per year) totals 9 percent of labor cost. Plus, people are hired to manage the program and consultants are engaged to deliver the training. Though much of this labor is absorbed and not an incremental business expense from a financial accounting viewpoint, the impact is significant. Even with this high initial investment, 69% of discrete and process manufacturers are using Lean Manufacturing, Six Sigma or Total Quality Management as their primary improvement methodology.



Source: ARC Advisory Group Survey of Manufacturers 10/05

The Impasse

Unfortunately, many of these improvement programs are floundering. Over a third of companies state that their program implementation is less than significant. Only a few percent of companies have a complete implementation. Why are they floundering? First, implementation is difficult. Lean and Six Sigma are process-centric and require those most familiar with the process to determine improvements and make changes. By its nature, they require the buy-in and participation by nearly all members of a business – especially those that touch the processes. For analysis and achieving team consensus, projects need accurate and voluminous data collection.

Second, small teams and the continuous improvement approach leads to many small-disconnected projects. Each project appears to have a positive impact, but when reviewed by finance, has little real benefit. For example, a project that saves a tenth of a person has no real savings because the whole

Program Management Issues:

Limited to Manufacturing Employees

Lack of Accurate Data for Analysis

Isolated Project Driven

Lacking High Level Business Goals

**Continuous Improvement
Program Execution Weaknesses**

person is still on the payroll - one cannot reduce staff by a tenth of a person. If it saves 2,000 square feet of space, the company still owns and maintains the building. Executive management will be dubious of the reported vs. real savings because the reported savings by project teams do not show in the company's financial reports. This disconnect between the sum of the projects' savings and the income statement becomes a clear gap. Higher-level goals based on comparable benchmarks are needed.

The Break-Through

Individuals who touch the process (from order entry to manufacturing to shipping) often know how to "do the right thing". They might know for example, which products have a long lead-time, which of the machines runs most smoothly for making a difficult part number, and which components fit well tighter. They also know how to avoid problems and "land-mines." In some cases, the problem areas are identified by direct observation. But, intuition often is just one person's opinion that becomes trial & error guesswork.

In an era of increased competition, rapid product innovation, off-shoring, and outsourcing, this is clearly not enough. Taking business performance to the next level requires a rational methodology. With Six Sigma DMAIC, defects are *defined*, process parameters *measured*, data *analyzed*, process *improvements* are made, and *controls* are put in place so the change sticks. Lean manufacturing focuses on elimination of waste using methodologies like Kaizen, 5S, value stream mapping, set-up reduction, cellular manufacturing and Kanban. These programs require fact-based decision-making using data that contains measurements of process under investigation.

An automated data collection approach helps uncover the causes of performance issues - particularly those that are not visually obvious yet significant. For example, manually recorded downtime may be only a fraction of the actual downtime, because minor delays or stoppages - things like a temporary feed line jam that clears itself - are not collected. These minor events can easily account for up to half of the actual downtime. By taking a different approach and obtaining highly granular, actionable data, manufacturers can discover unrecognized and unknown performance blockers and identify so-

lutions to remove them. The automated approach for data collection provides visibility for activities that are subtle and often overlooked.

Comprehensive Data Feeds Continuous Improvement

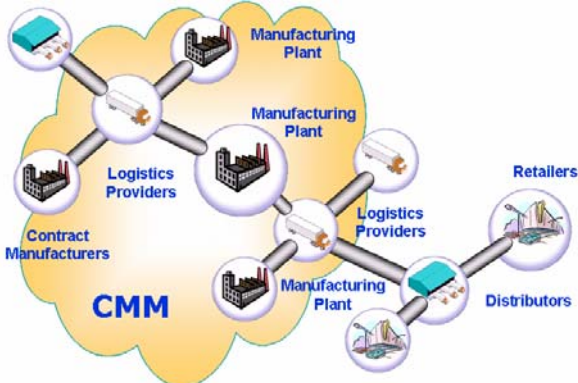
Sigma	Defects per Million Opportunities
2	308,537
3	66,807
4	6,210
5	233
6	3.4

Process Capability

With programs such as Lean, Six Sigma and the like, the goal of continuous improvement becomes an essential part of the corporate culture. Employees throughout the organization participate in teams empowered to make localized decisions and recommend changes. These programs incorporate formal methodologies for understanding the root cause of problems, and depend on access to accurate, timely, detailed data. To identify problems, it is necessary to focus on the performance in a particular area, such as a line. Here, data must be collected and analyzed based on actual product flow and machine statistics.

Most manufacturing processes operate between 2 and 3 sigma. Just measuring a 3 sigma process takes thousands of measurements and transactions. To get to 6 sigma requires millions. Accurately collecting this volume of data requires automation. With appropriate automated data collection and analysis tools, problems and bottlenecks can be quickly identified.

Information Focuses Response to a Dynamic Market



Collaborative Manufacturing Management in the Supply Network

After a long period of cost cutting, manufacturers now face many simultaneous challenges such as very dynamic market conditions, new competitors, opportunities requiring fundamental changes in business models, and the need to find new ways of providing customer service. The rate of change continues to increase in many areas, making it important for manufacturers to monitor and manage performance in real-time. Globalization, outsourcing, and continuing competitive pres-

asures are causing manufacturing companies to refocus on core competencies and the optimization of production processes. Real-time enterprises must build speed and flexibility into business processes and information systems so that they can react faster to market and competitive conditions. In order to do so, they need information from operations in order to build business processes that act seamlessly across business boundaries.

Real-time Performance Management

Losses from minor stoppages add up. In order to identify them, a solution that is simple to install and that can very quickly be up and running is needed. According to Alex Siegal, Senior Consultant at AT Kearney, "With Informance, I see patterns and certain correlations to downstream problems. It starts with getting more actionable data." In some cases, the data confirms what supervisors or operators suspect to be root causes of problems they are experiencing, but other times they point in a different direction. In either case, the power lies in the information, enabling the team to reach consensus faster and execute the appropriate actions.

There are some basic steps to following the Six Sigma DMAIC process:

1. Define what a defect is, survey the operations and select targets
2. Measure the process with data collection tools
3. Analyze the data and identify problems
4. Improve the process after reaching team consensus
5. Control the change by adjusting the company's business processes

It is normally not too difficult to select appropriate target areas, but the next two steps – Measure and Analyze – need consistent data collection.

Benchmarks

This process of problem identification, analysis and improvement is often focused on the performance of a particular production operation. A broader view presents another significant opportunity by comparing operations among plants for benchmarking. Perhaps one plant for a particular operation has a high throughput, yield or inventory turns. Why is that operation performing better? Data collection is the foundation for identifying high performing locations and the comparison for improvement potential.

Capturing Real-time Plant and Defect Information

What should you look for in a packaged solution for collecting and analyzing the data? And, what techniques or processes can be leveraged to speed the implementation of any needed changes? A solution needs to be able to capture real-time information from the plant floor, track defects, deliver alerts and notifications, and provide analysis, enterprise visibility, metrics, and reports. In addition, it should easily handle geographically dispersed assets, multiple plants, and synchronization with other enterprise and plant applications.

At the point of data collection, the event and its significance are recorded together as a transaction. When establishing the data collection system, it is important to achieve the right granularity. Experience shows that a significant amount of losses - up to 50% or more - come in the form of seconds lost through issues that are transitory and recurring. They are typically associated with micro stoppages or minor fluctuations, unseen variations in transitions, shift startup, and similar issues. In order to discover them, detailed data is collected and categorized.

Alerts and Notifications

A critical aspect of any real-time performance management solution is the ability to deliver critical information to those who need it as soon as it happens. Team members need threshold-based alerts, KPI trend data, and notification about certain critical events or developing constraints before they affect production. These events may originate in the data collection system, other plant applications such as MES or EAM, or enterprise applications such as ERP or CRM. Beyond just displaying an alert, the system should be capable of enforcing business rules designed to ensure appropriate corrective actions are taken.

Visual Communication

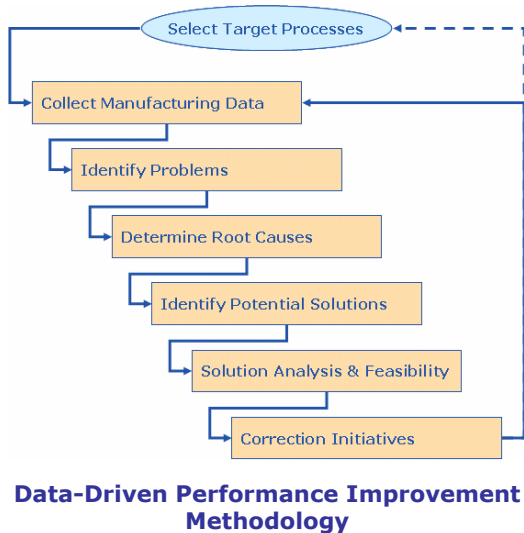
Continuous improvement programs rely on metrics to gauge progress towards achieving goals. The metrics must be based on real-time data, and must be visually communicated throughout operations. In addition to dashboards on supervisors' desktops, prominent electronic message boards can keep the entire involved workforce informed and up-to-date at all times.

Plant to Business (P2B) Synchronization

Many manufacturers can benefit from improved decision-making based on availability of information from the plant floor. This can lead to better supply chain planning and customer support, as well as reduced inventory and enhanced utilization of production capacity. Production status, asset information, order completion, quality information, and the like can benefit enterprise decision makers.

Analysis and Continuous Improvement

As the stream of data becomes available, tools for making sense of the raw data become important. Preconfigured displays such as downtime histograms and timelines, cycle times, and process timelines let you begin to detect patterns and uncover cause-and-effect relationships. Detailed actionable data combined with careful analysis yields opportunities for process improvement. For example, this may start with a focus on Overall Equipment Effectiveness (OEE) to identify capacity losses including those from poor quality. By considering cost as well, high priority targets for continuous improvement programs can be identified.



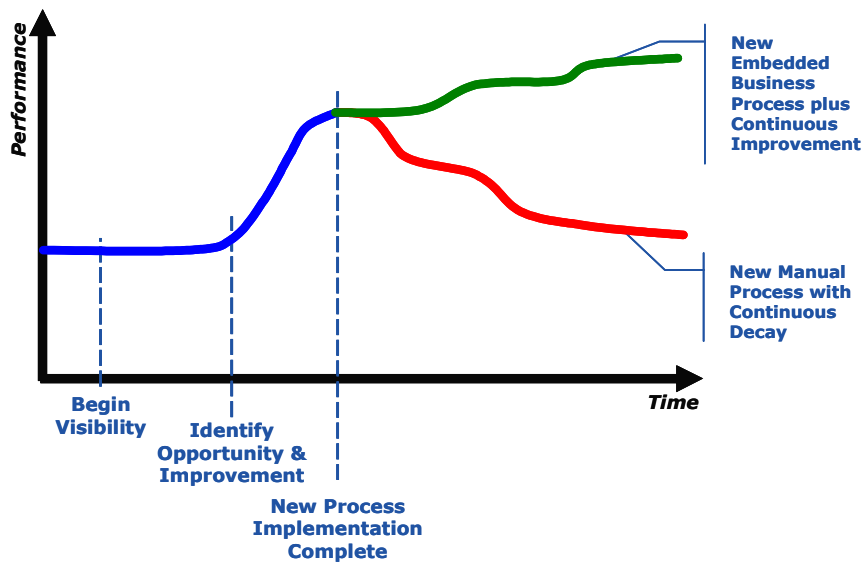
Data-driven performance improvement initiatives begin with selecting target areas and collecting highly granular, detailed manufacturing data. From the data, problem areas are identified. Root causes must then be identified and potential solutions can be generated. Cost-benefit, feasibility, and timing must be carefully considered in selecting a solution to pursue, and then appropriate correction initiatives can be implemented. The process starts again as new data is collected and new problems are encountered. Where a formal continuous improvement program such as Lean, Six Sigma, or Total Quality Management (TQM) is used, this data-driven methodology is articulated in a different

manner. For example, Six Sigma's rigorous process uses a framework known as DMAIC, for Define, Measure, Analyze, Improve, and Control. The important point is that both data collection and an improvement methodology must come together in order to achieve results.

Making Improvement Continuous

Whether the new initiative is as simple as a small procedural change for an operator or as complex as changing a core business process, it is important to make collecting data an inherent part of the new method. By embedding the data collection in this way, the tendency to slip back to earlier performance levels is avoided, because performance information is always immediately available. Inherent checks and balances are then in place.

"Continuous improvement" implies building new improvements on past improvements. This presumes that previous improvements remain in force. The "control" phase of the Six Sigma DMAIC process is for adjusting the company's business processes so that the implemented changes "stick". Unfortunately, if these adjustments are purely manual, people have a tendency to drift back to the old way of doing things and the improvement decays away (New Manual Process).



Keeping Improvements in Performance

By embedding the adjustment into a business system, variation is reduced and the change becomes lasting. Changes to the business processes that are embedded in the business systems insure the improvement becomes continuous. Then, the continuous improvement program is sustainable and can contribute to business performance with broad impact.

Solution Architecture

Technology is at an inflection point and any new application or solution must be considered in light of the technology roadmap ahead. Solutions purchased today should be Web services based and built on a Service Oriented Architecture (SOA) framework. In many cases, it is possible to begin to build a core technology set that can be a platform for solving many critical problems. For manufacturers, this typically includes components that provide visibility by connecting a wide array of existing plant applications and

data sources, establish the manufacturing context for data, and share it with people and systems. This capability is critical for enabling decision support and system integration. Some think of this capability as the manufacturing Information System. Other components frequently include Role-Based Visibility (Dashboards and Mobile Device Support) and Plant Analytics or data analysis tools.

Informance Accelerates Improvement

The Informance Manufacturing Performance Management Solution provides functionality to enable manufacturers to quickly and effectively implement highly granular data-driven process improvement initiatives. Global Performance Management allows users to view reports and metrics for assets across multiple plants, and to monitor in real-time geographically dispersed assets. The Informance Alerts and Notifications Module sends alerts to emails, pagers mobile phones, or marquee displays, and allows the users to configure complex business rules for each KPI with corrective actions. Tracking capability is based on the Informance suite of applications as well as other metrics that may reside in applications such as ERP, MES, or EAM.

Making data-driven performance improvement a reality on the plant floor requires getting the data and making information visible to the workforce. In practice, both of these are greatly simplified with appropriate, cost-effective hardware solutions. The Informance product line supports “getting the data” with the Informance Factory Appliance (IFA), an operator-centric, self-configuring touchscreen providing real-time information, operator input, and the capability of monitoring up to three points of assets, defects, etc. per IFA. For making information visible to the workforce, Informance Visual Performance Displays deliver real-time Key Performance Indicators to the plant floor.

As we have seen, a key component for success in any data-driven performance improvement initiative is establishing and following through on the whole process, including analysis and implementation. To this end Informance IMPACT Professional Services provide manufacturers with expertise in support of their manufacturing productivity goals. IMPACT services provide a framework and active support to help manufacturers quickly identify performance opportunities, take action, and sustain gains.

About the Author:

Ralph Rio: As ARC's Research Director, Ralph is a thought leader in Collaborative Manufacturing and provides clients in a number of manufacturing vertical markets with strategic advice in dealing with boundary-crossing business processes. Ralph's primary areas of focus are Collaborative Production Management and management of continuous improvement programs. He researched and wrote the CPM-D study published in 2005. He brings thirty years of hands-on experience to ARC, with direct experience within manufacturing organizations, as well as extensive experience with suppliers to manufacturers.



Additional Reading:

All Downtime is Not Equal: A methodology for setting priorities in a Lean improvement initiative Whitepaper by John Oskin, Informance CEO

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