



Metrics for Major Initiatives: Practices and Metrics for Lean, Total Quality, and Real Time Enterprise Programs

Conducted by



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Executive Summary: Metrics for Major Initiatives

How well do major company initiatives work? Are they truly strategic, creating deep and wide-spread change across operations and the company culture, or are they a small set of minor process changes that are tactical and may not remain a year after initial implementation? More importantly, are they having the desired impact on business performance?

Getting to those answers requires a company to measure the initiative and areas of intended improvements. Based on responses from this well-balanced group of manufacturing companies, there is varying success and differing levels of penetration for three major initiatives: Lean Manufacturing, Total Quality, and Real-Time Enterprise.

This study shows that most production companies are pursuing strategic initiatives such as Lean and Quality to ensure ongoing improvement. Many have also realized that their environment is dynamic enough that decisions are not sound without Real-Time Enterprise.

However, this study also reveals that many respondents who have declared they are pursuing a program do not make wide use of many of the core practices needed to fully adopt the initiative and realize its potential. So while companies are making progress, the implementation of practices that secure success of these three initiatives are not yet pervasive.

As last year's *Metrics that Matter* study showed, those who improved most have sound performance measurement systems in place, including rapid metrics processing and display. They were in the minority however. Many companies in this year's study are still not using some of the fundamental metrics needed to measure the effectiveness of their Lean, Quality and Real-Time Enterprise programs. Most are not using industry-standard definitions or calculations of metrics. Therefore it's not surprising that fewer than half of respondents are finding the metrics they are using to be effective.

While nearly half of respondents report collecting data for their metrics as often as each shift (sometimes even more frequently), less than 30% display them that often. This means employees cannot see the results fast enough to prevent problems for the next shift in many cases. The #1 obstacle to timely and appropriate use of metrics data, we found, is a lack of vision or understanding of the requirements of a sound metrics program.

The Manufacturing Enterprise Solutions Association (MESA) International can help companies overcome some of the obstacles that this research highlights. MESA is a community of manufacturing end-users, technology suppliers and consultants – focused on improving the flexibility and agility of manufacturing production. The members worldwide have and share a wealth of information about best practices not only on the topic of solving business issues with technology, but also the organizational, business process, and cultural changes that companies require to succeed with major initiatives.

Manufacturers must do more than declare that they are pursuing improvement initiatives; they must implement appropriate practices and then measure them and the associated business results. For most companies, it appears much more work still lies ahead. While many have declared their intention, manufacturing executives must now show the vision and leadership to change processes, mindsets and supporting technologies to reliably achieve ongoing improvements across their organizations.

Study Background

Manufacturing Enterprise Solutions Association International (MESA) is an association of manufacturers/producers, solution providers and industry professionals, promoting innovation and best practices sharing, with a goal of delivering valuable knowledge around operations-centric enterprise solutions. MESA defines industry standard methodologies and approaches that allow manufacturers/producers to bridge execution excellence with enterprise level

requirements.



As expected, the 2006 *Metrics that Matter* study provided a foundational

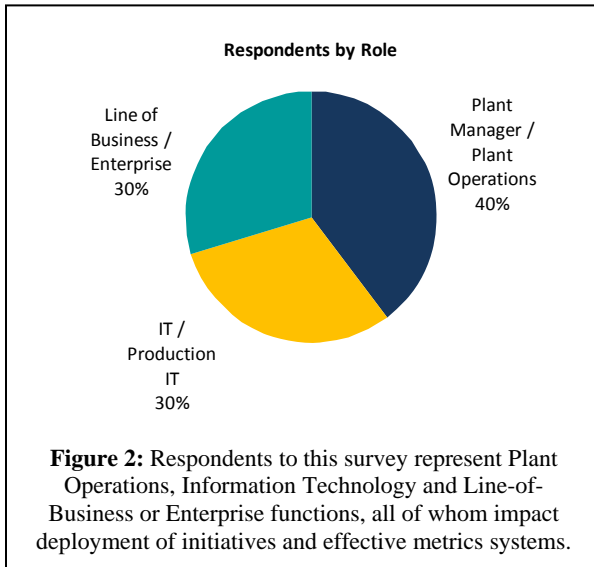
basis that spawned further study and discussion, including the founding of MESA Metrics Working Groups. This findings report, focused on a study of strategic initiatives, is another educational piece led by the MESA Metrics Working Groups' efforts as well as new thinking on the part of the MESA Board of Directors.

MESA's board has developed a model of topics critical for its educational mission. It is based around several strategic business initiatives (see Figure 1). This *Metrics for Major Initiatives* research project grew out of a desire to examine metrics for several of those initiatives as well as the MESA Metrics Working Groups' desire to mine a broader dataset beyond the experiences of its members.

The research for this report was conducted in the summer of 2007 by our independent industry analyst firm Industry Directions. We used an on-line survey to gather quantitative input from manufacturers about their pursuit of Lean, Total Quality, and Real-Time Enterprise initiatives as well as the metrics they use to gauge improvement. Our questions centered on what the MESA Metrics Working Group manufacturing members believed would best further their work and support the new MESA Strategic Initiatives vision.

Response Demographics

We received 133 valid responses from end-user manufacturing or distribution companies. While others such as consultants and solution providers also responded, the charts, graphs and statistics throughout this report reflect only those 133 responses we could validate came from manufacturing or producing companies.



The responses came from practitioners in each of the three major role groupings we provided in the survey who typically need to be involved in successful metrics programs. While 40% of the responses came from individuals in operations or plant management (including quality, engineering, maintenance); 30% came from information technology (IT) or production IT; and 30% represent a line of business (LOB) or enterprise function (see Figure 2).

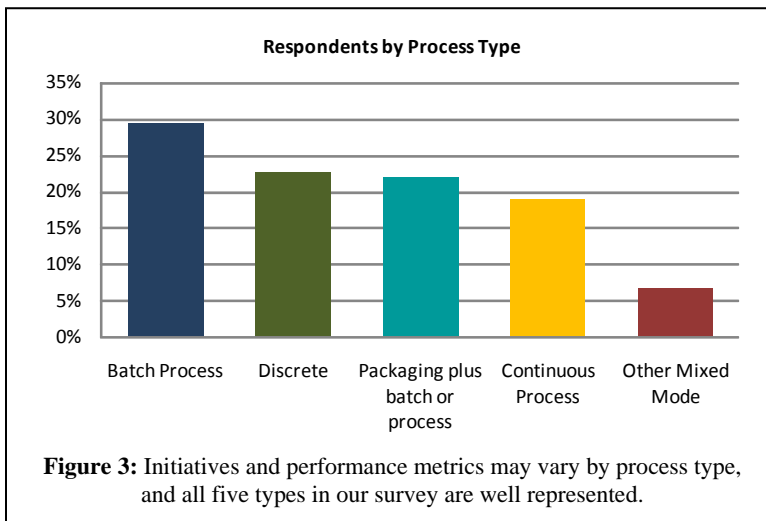
Corresponding fairly closely with these roles, 40% of the responses represent one plant, 27% represent a division, region or business unit;

and 29% represent an entire enterprise. Thus, as we asked about size of the entity reporting, the majority were under \$500M in revenue. Another 20% were \$500M to \$2B, and 29% are over \$2B.

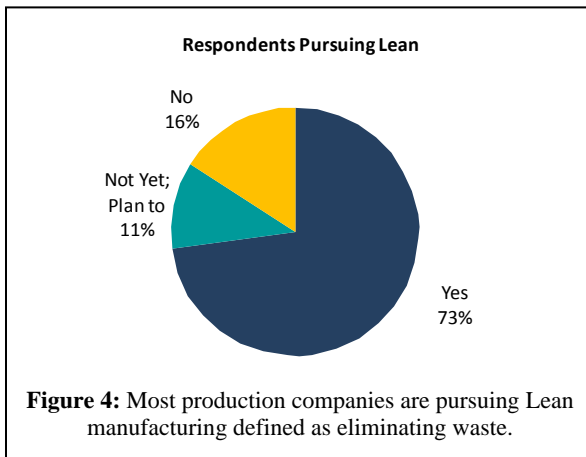
We also gathered responses from all of the 22 major industry segments of interest. No industry represents more than 19% of the respondents. The most heavily represented companies by primary industry segment (they could also list secondary industry segments) are medical devices, automotive, chemicals, electronics equipment, food, pharmaceutical. Beyond those, 10 other industries each account for at least 3% of the responses.

Respondents to the on-line survey encompass all the major process types specified in the survey, including batch, discrete, packaging plus batch, continuous process, or

other mixed mode (see Figure 3). This allows us to determine whether certain initiatives and metrics are more widely used in some types of plants than in others.



We also asked respondents about mix through their production facility. In this base, most are medium to high mix. Fully 44% identified themselves as high mix, while just over one-third indicated



medium mix. Only 12% of the total response base identified their operation as low mix and 10% operate dedicated production lines. Mix can impact the success of a lean manufacturing initiative and which practices are critical and the level of performance it's reasonable to expect on certain metrics. For example, in a high mix environment, equipment changeovers may be more prevalent, leading to benefits from single-minute exchange of dies (SMED). High mix plants not using that practice may experience lower performance to metrics such as throughput and total cycle time.

Lean: Eliminate Waste

Lean manufacturing, focused on eliminating waste in all its forms, is an increasingly widespread initiative. There is good reason for this trend. Lean can optimize an operation's performance and lower costs by reducing cycle times and inventories. Lean is a natural way to ensure cost-competitive operations for those manufacturers competing in a global market

Lean Practices	
In Survey	
Cellular manufacturing	
Error-proofing or poka-yoke	
In-Plant Kanban or pull systems	
Just-in-Time (JIT) production	
Level production, Heijunka or level loading	
Quick set-up or single-minute exchange of dies (SMED)	
Reduction of variation	
Reduction of waste (muda)	
Small lot sizes	
Standardized work or methods sheets	
Value Stream Mapping	
Workplace organization or 5S	
Others Respondents Use	
A3 analysis: categorizing activities as value-creating, incidental, or waste	
Hoshin Kanri or Policy Deployment	
Jidoka or automation with human intelligence i.e. andon	
Kaizen or events to eliminate waste	
PDCA – plan-do-check-act	
Six Sigma – a statistics-based method of identifying and reducing process variations	
Supermarket or single line-side location for parts or WIP	

Figure 5: A large number of practices are involved in supporting Lean manufacturing.

In this response base, nearly three-quarters of respondents (73%) report that they are pursuing a Lean initiative (see Figure 4). Another 11% are planning for a Lean initiative. That leaves only 16% of respondents not involved in or considering a Lean program.

One of the major challenges in gaining the full benefits of Lean manufacturing is that there are so many practices involved. In this survey, we asked about 12 Lean practices that the MESA Metrics Working Group felt were most widely used, Figure 5 lists these as well as others respondents report using.

Any one of these practices may provide some fairly immediate and, for some companies, dramatic benefits. We have seen manufacturers gain benefits from just a few practices and never put any other Lean practices into place. This is unfortunate, and can cause a Lean initiative to plateau, since many

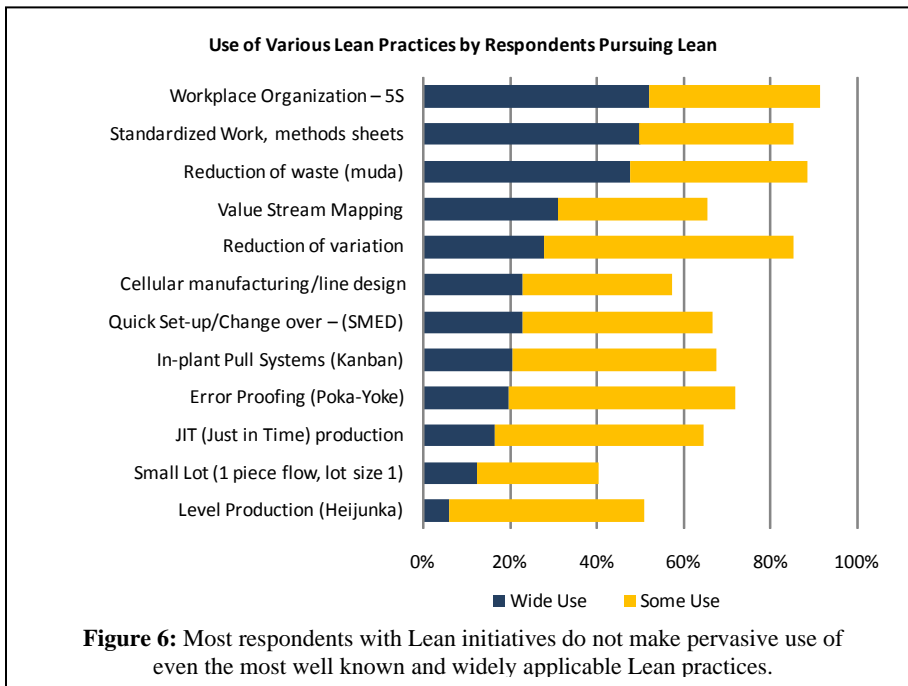


Figure 6: Most respondents with Lean initiatives do not make pervasive use of even the most well known and widely applicable Lean practices.

practices are interdependent and will enhance each other. The relationships between various Lean practices do not appear to be well understood by many companies currently pursuing Lean initiatives. As a result, no single Lean practice is in wide use by a

majority of respondents. Even among those who have declared that they have a Lean initiative in place, only two practices are in wide use by half or more of respondents: workplace standardization (also called 5S) and standardized work, often represented as methods sheets. As Figure 6 shows, most of those with a Lean initiative in place use some sub-set of the Lean practices, and many not widely.

Those most widely used are also some of the most universally applicable or easiest to translate into every production operation. Nearly any company and any operation can improve by organizing and standardizing work, reducing waste, mapping the value stream, or reducing variation.

In contrast, re-organizing into work cells with one piece flow is a major challenge in

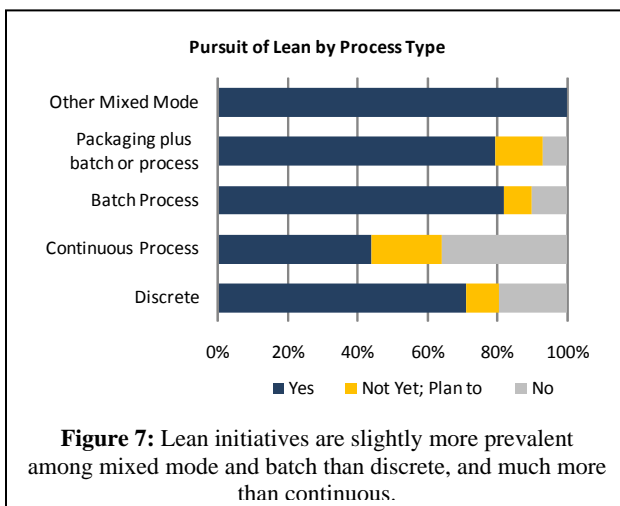
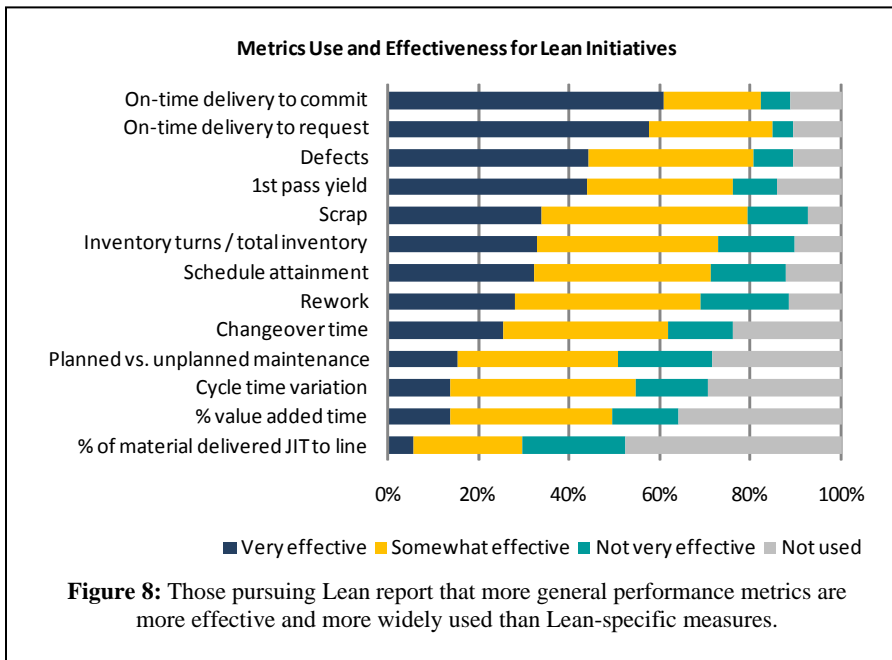


Figure 7: Lean initiatives are slightly more prevalent among mixed mode and batch than discrete, and much more than continuous.

environments where certain operations are designed either for batches or where a wide variety of products needs to go through that operation. Common examples are heat treating, painting, certain types of machining or finishing, and batch operations such as mixing or baking. Less than one-third of respondents have implemented one piece flow, and only 13% widely.

The percentage of companies pursuing lean varies by process type (see Figure 7). Use of

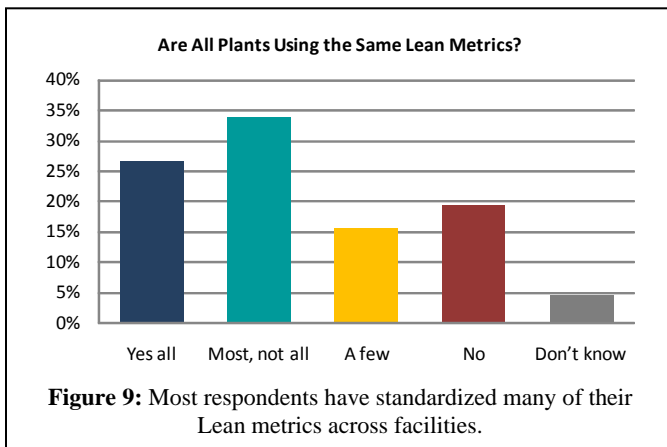


specific Lean practices also varies greatly by process type. For example, discrete and continuous are more likely than others to make wide use of in-plant pull or Kanban systems. A larger percentage of continuous process respondents widely use JIT production, small lot sizes, and level production

than other types of operations. More of those in batch process or packaging plus batch widely use the practice of reducing variation.

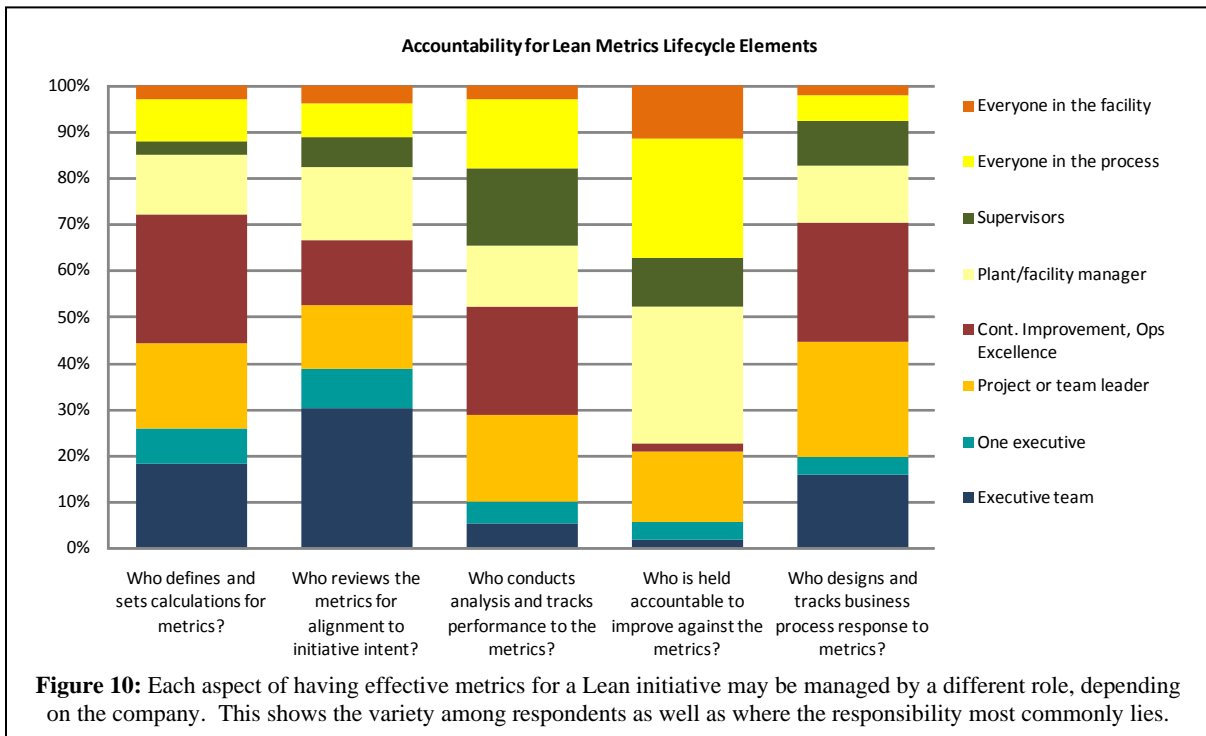
Companies pursuing Lean measure these initiatives primarily with general performance metrics (see Figure 8). Our respondents report that Lean-specific measures such as reduction in variation, portion of material delivered JIT to line-side, and percentage of value added time are not nearly as widely used nor as effective as basic on-time delivery, quality, inventory, and schedule measures.

The majority of the respondents also report that the use of Lean metrics is consistent across most or all of their plants (see Figure 9). Clearly, this can help companies compare performance among plants and set appropriate targets for metrics to the degree facilities have common processes, product lines and mix. In addition to the benefits to the enterprise, plant employees also have an easier time transferring their



knowledge with common performance measurements.

Unfortunately 80% of the respondents do not base these metrics on industry standard definitions or calculations. As supply chain and outsourcing activities take on more importance, this situation may eventually change so that companies have a more standardized view of partners' performance.



Multiple roles are responsible for various activities in the lifecycle of Lean performance metrics, and roles vary considerably across organizations (see Figure 10). For each activity, the role that most commonly performs it could be expected.

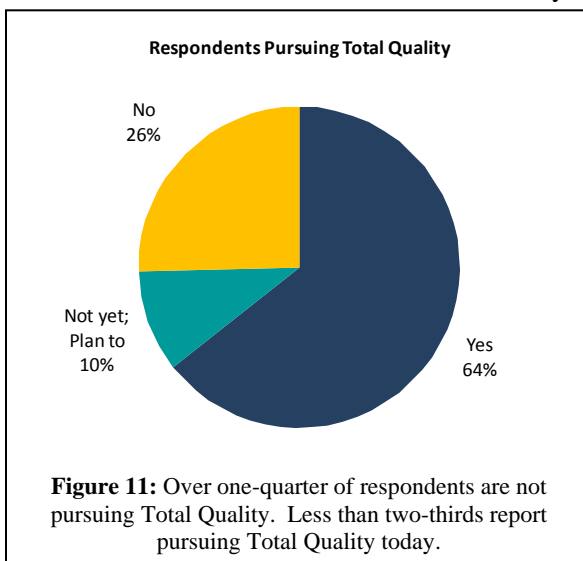
- The continuous improvement or operational excellence team defines and sets calculations for Lean metrics (28%), followed by the executive team (19%).
- The executive team reviews the metrics to assure alignment of intent to the initiative (31%), followed by the plant manager (16%).
- The continuous improvement team also conducts analysis and tracks performance to the metrics (23%), followed by the project or team leader (19%) and then the plant manager (17%).
- The plant manager is held accountable for performance to the metrics (30%) followed by everyone involved in the process (26%).
- Either a project leader (26%) or the continuous improvement team (25%) designs and tracks business process response to the metrics.

Depending on the company and its organizational structure, any of the responsibilities for metrics may be appropriate and effective. The key is to have all of these processes in place with clear accountability for each stage of the lifecycle. Those who measure results are likely to find that standardizing on more Lean practices will also maximize the performance improvements.

Total Quality: Prevent Problems During the Process

Quality is free. Industry learned that over 25 years ago with Philip Crosby's book of the same name. He posited that if you build reliability into your processes to do things right the first time, and if everyone pays attention to quality, it can actually lower the cost of production. Managers need to commit to quality, and ensure that their dictates and policies support that goal. Unfortunately, it appears some of the respondents to our study did not take this message to heart.

Less than two-thirds of the study respondents are pursuing Total Quality. We



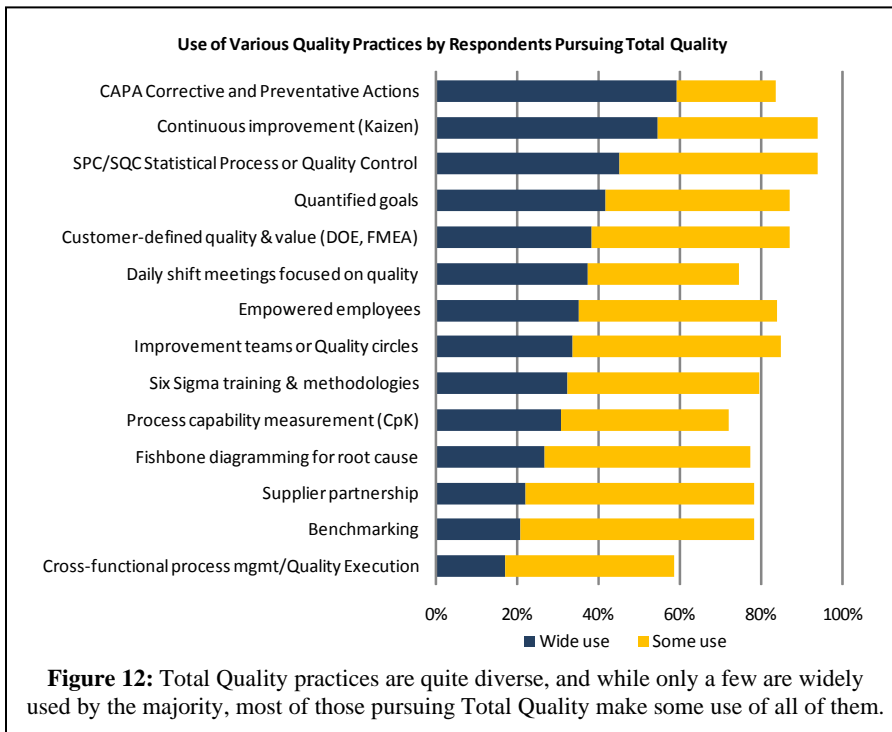
defined this as quality measured not simply by end-of-line defects but measured during the process or as a process capability (See Figure 11). In this study base, 99% measure defects, and over half perceive it as a very effective metric. It's difficult to believe that more companies are not working to prevent quality issues during the production process rather than only inspecting or testing at the end of the line.

However, one of the reactions that many employees (at least in the US) had to Total Quality Management (TQM) programs in the past was it was boring, just another rah-rah training session or self-evident. If those

employees of the 1980s are the managers today, they clearly would not advocate an initiative called Total Quality.

Interestingly, there appears to be a correlation between those pursuing Total Quality with those practicing Lean by process type. Those with continuous and discrete processes are less likely to be focused on Total Quality and Lean than others.

- Only about one-third (35%) of continuous process industry respondents report pursuing Total Quality. These plants have highly automated processes, and they are often finely tuned to attain highest product yield. So while they don't claim pursue Total Quality, they deploy these practices more widely than other segments and may simply not use the term Total Quality.
- While over half of discrete industry respondents report pursuing Total Quality (57%), this is dramatically lower than batch at 72%, other mixed mode at 75% or packaging plus batch or process at 83%.



Like lean, there are many practices that can contribute to Total Quality. The 14 we listed in the survey actually have a wide range of origins. Some are common to the original TQM practices that Japanese manufacturers practice widely, while Six Sigma originated at Motorola and many others come from quality management

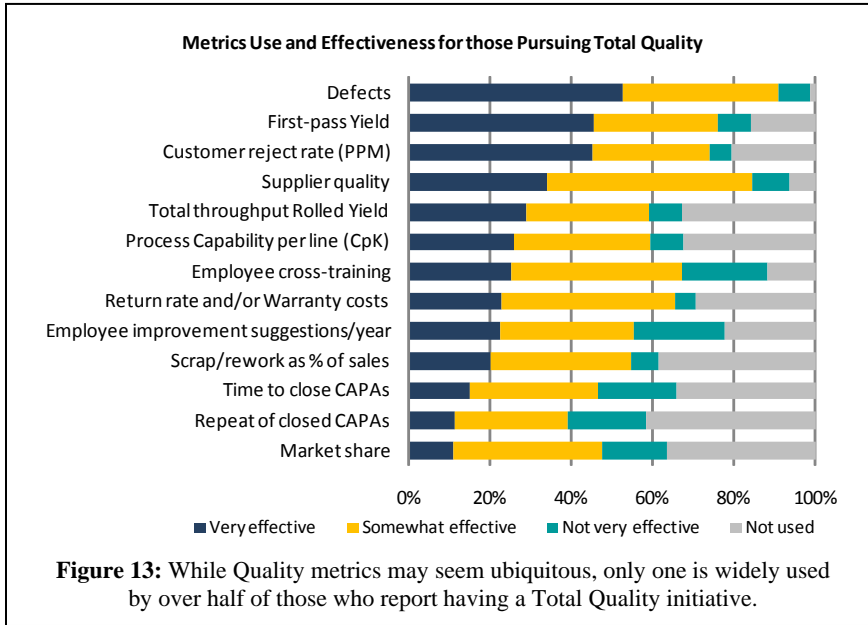
practices or compliance requirements in specific industries. Some are just common sense.

As with Lean, only two of these practices are in wide use by more than 50% of the respondents: corrective and preventative actions (CAPA) and Kaizen or continuous improvement (see Figure 12). It is puzzling how a company pursuing Total Quality would not at least have quantified goals. Another surprise is the limited use of Customer-defined quality and value practices, which are a foundation for ensuring that quality programs are implemented in areas that matter to the market. Companies not using these practices most likely lack executive leadership committed to quality.

Averages can be somewhat misleading. Certainly the most used practices are in use by at least 50% of every process type. However, while firms using continuous and discrete processes are less likely to declare they are pursuing Total Quality, a significantly higher proportion of these companies use some of the Quality practices than those in other types of operations. This confirms our earlier comment that the term “Total Quality” may not be commonly used in these operations. Significantly here means the percentage is at least 10% higher than those with other process types.

- A significantly greater portion of discrete companies widely practice Kaizen (86%), Six Sigma, daily shift meetings focused on quality (both 71%) and supplier partnership (43%) than others.

- Significantly higher percentages of continuous process firms make wide use of process capability or CpK measurement (75%), customer-defined quality and value (63%), fishbone diagramming for root cause (50%), and cross-functional process management (38%) or quality execution across every step of the process.

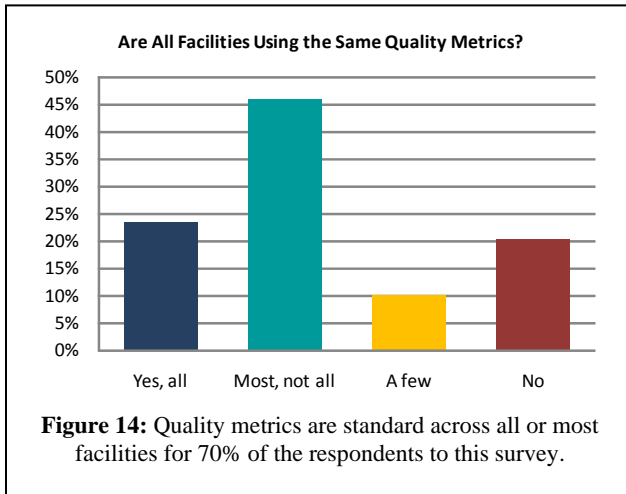


Some of the most widely known metrics in production industries come from the quality arena. Yet Figure 13 shows that only one metric is considered very effective by over half of those who report pursuing Total Quality: defects. Defects are also nearly universally measured. More tightly defined

measures of product quality such as first-pass yield, and customer reject rate in parts per million (PPM) are also widely used and relatively effective.

One of the possible issues that this ranking of Quality metrics effectiveness presents is that many respondents appear to be tightly focused on product quality. While that is the desired outcome, many Total Quality programs – and certainly Six Sigma – gain strength from improving the processes and human mindsets behind the processes. Examples that might cause some concern include:

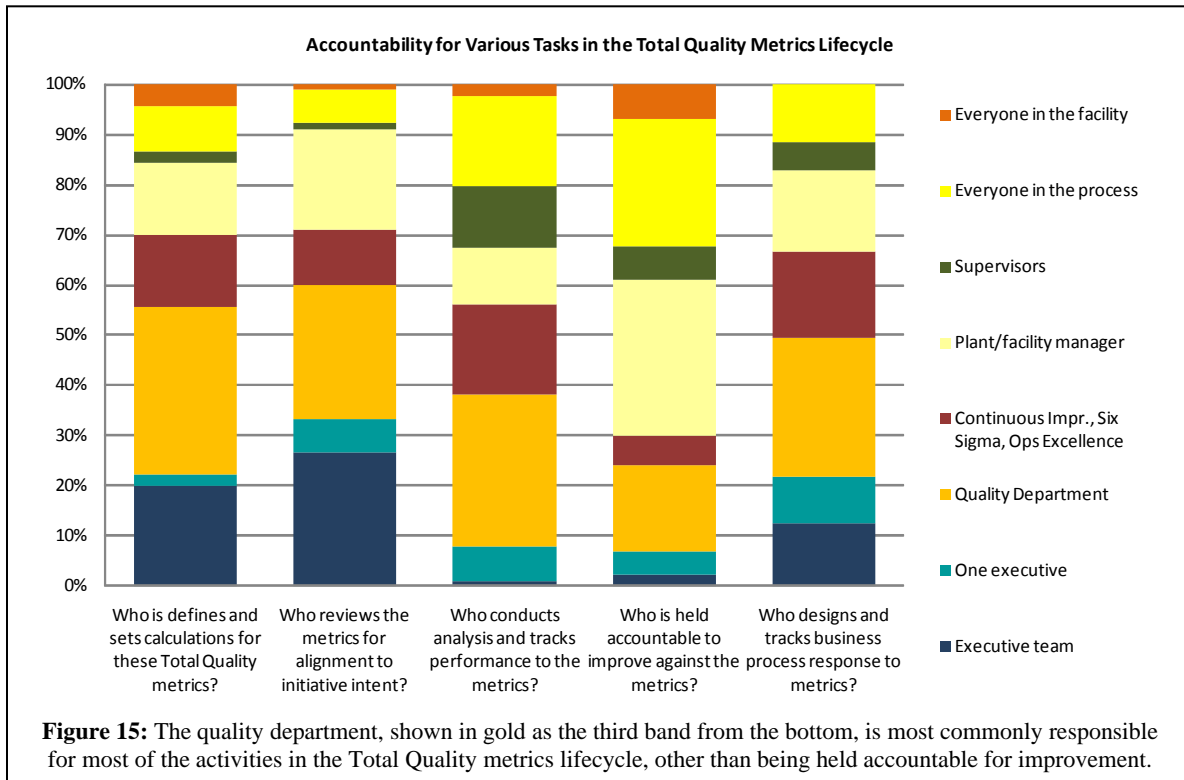
- Total throughput rolled yield and process capability measurements can be used to determine the ability of a process to consistently put out high quality products. Yet about one-third of respondents do not even use these metrics.
- Measuring the cycle time and effectiveness of CAPAs or corrective and preventative actions in eliminating a problem are not considered effective metrics by a large portion of the respondents. This is despite the fact that CAPA is the Total Quality practice most commonly in wide use.
- While some companies report major great gains from employee suggestions, empowerment and cross-training, these are some of the metrics respondents often find not to be effective in measuring a Total Quality initiative.



- Supplier quality is a major factor in Total Quality and the vast majority of respondents use it. Unfortunately, Figure 12 shows less than a quarter of respondents make wide use of supplier partnership to help ensure quality.
- Market share, return rate, and warranty costs can certainly result from factors other than product quality in the production plant. However, in the concept of Total Quality, any process that contributes to those problems would be targeted for improvement.

Quality metrics are shared by all or most facilities of these respondents (see Figure 14). While 20% report that their quality metrics are not shared across all facilities, seven of 10 reports that most or all of the facilities are using the same metrics for quality. As some of the recent product recalls show, having and monitoring strict quality standards – throughout production, design and supply can be critical to a company’s brand reputation. Quality should be a given, but if everyone measures it differently, companies and the supply network they rely on will struggle to ensure it.

Crosby’s essential message in *Quality is Free* is that everyone, not just the quality



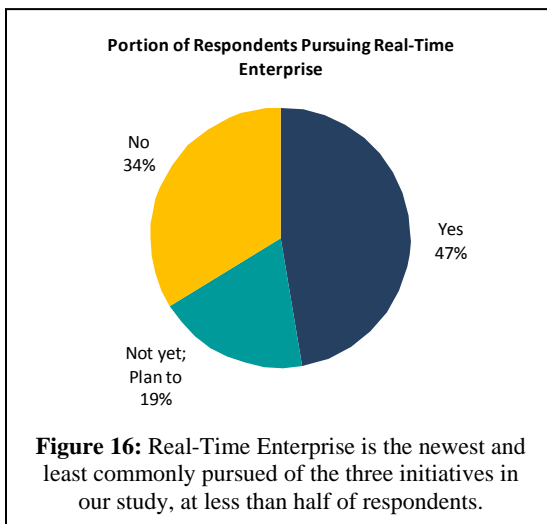
department, must be responsible for quality. Figure 15 shows how that is playing out today. Among our respondents, either the plant manager (30%) or everyone in the process (25%) is primarily held accountable for achieving quality metrics. However, for most of the major activities in the lifecycle of Total Quality metrics, the quality department is still the predominant owner of responsibility.

For reviewing metrics for alignment to the intent of the initiative, the executive team is as commonly responsible as the quality department (27% each). However, for the three other areas of the quality metrics lifecycle, the quality department still takes a leading role. This is not necessarily a bad thing, since quality professionals do have extensive training.

High quality and low costs are the baseline for competing today – and what a Total Quality initiative can deliver. Based on this survey response, quality consultants still have fertile ground for educating manufacturers about effective use of quality practices and metrics. The lessons of the 1980s quality movement seem to be lost on many manufacturers. Finding defects is not free – creating and managing processes that prevent them is what makes quality free.

Real-Time Enterprise: Flow Data to Manage by Fact

The third initiative covered in this survey is Real-Time Enterprise, which we defined as near real-time manufacturing information flow. Real-Time Enterprise is a more recent concept than either Lean or Total Quality. Most of the work on this topic has been done in the past 10 years. The basic concept has been described in various ways, but what matters is the timeliness of data in its usefulness to making sound decisions based on actual conditions. In the MESA context, it also involves ensuring that information flows between plant and enterprise rapidly, reliably and accurately.



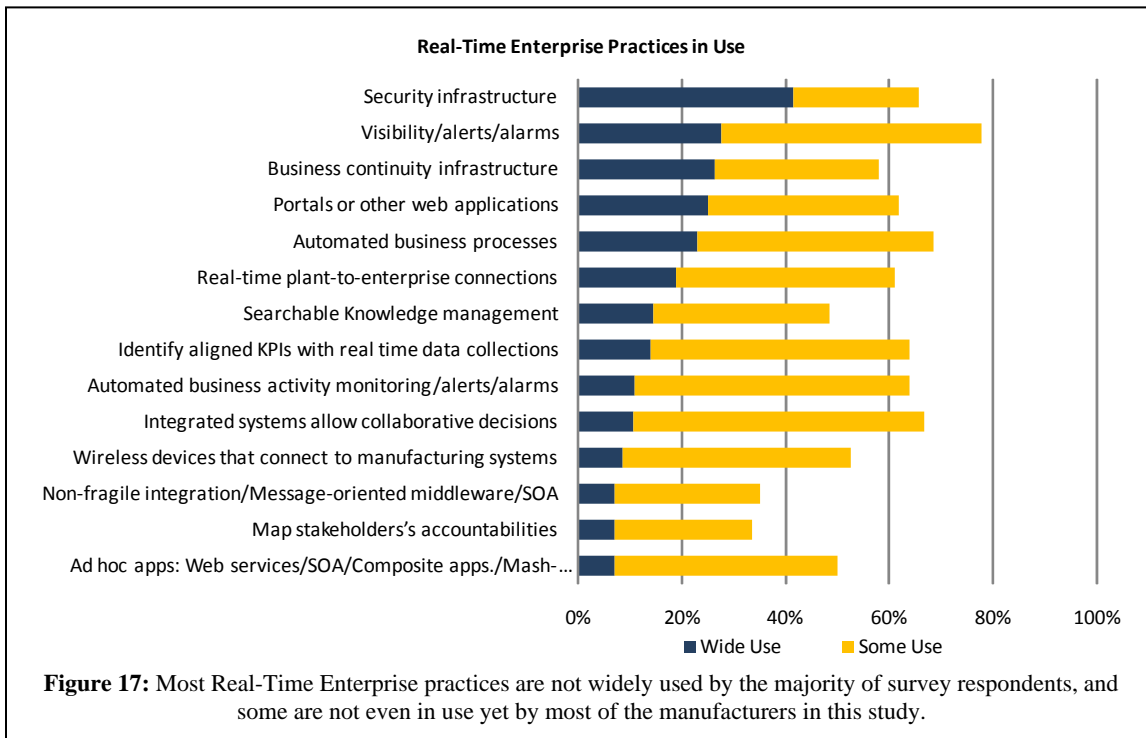
Slightly less than half of the respondents report pursuing Real-Time Enterprise (see Figure 16). Since this is a less mature area, the lower adoption rate is not surprising. However, more than a third of these companies have no plans to move toward a Real-Time Enterprise. It may show the relatively slow adoption of new IT thinking among manufacturing companies. It could also be that the respondents simply aren't versed in the technology or aware of IT plans.

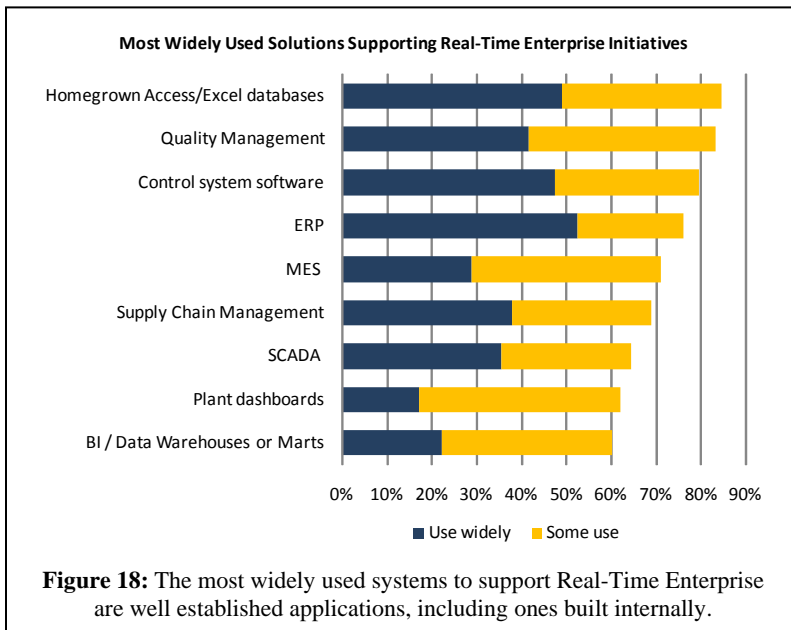
“A real-time system is one in which the correctness of the computations not only depends on their logical correctness, but also on the time at which the result is produced. In other words, a late answer is a wrong answer.” This explanation by Carnegie Mellon University’s Dr. David Stewart works with their three levels of real-time computing:

- Hard, where late information can be dangerous or catastrophic to the organization as in an automated process control system for a refinery or chemical process where a sensor fails and a leak or explosion occurs
- Firm, in which late data poses a significant loss of service as when demand skyrockets but the production plan is not updated resulting in shortages, or when a defective product design is corrected, but plant personnel do not see those latest engineering changes, resulting in rework or recalls
- Soft, in which late data is less relevant, as when managers ask production to fix a problem based on the last month’s report, but it’s already corrected

Most manufacturing companies have suffered from some of these problems. With today’s technology in place, they do not need to.

However, it appears most respondents still have corners of their enterprise lacking the foundation practices to prevent these problems. Figure 17 shows that none of the



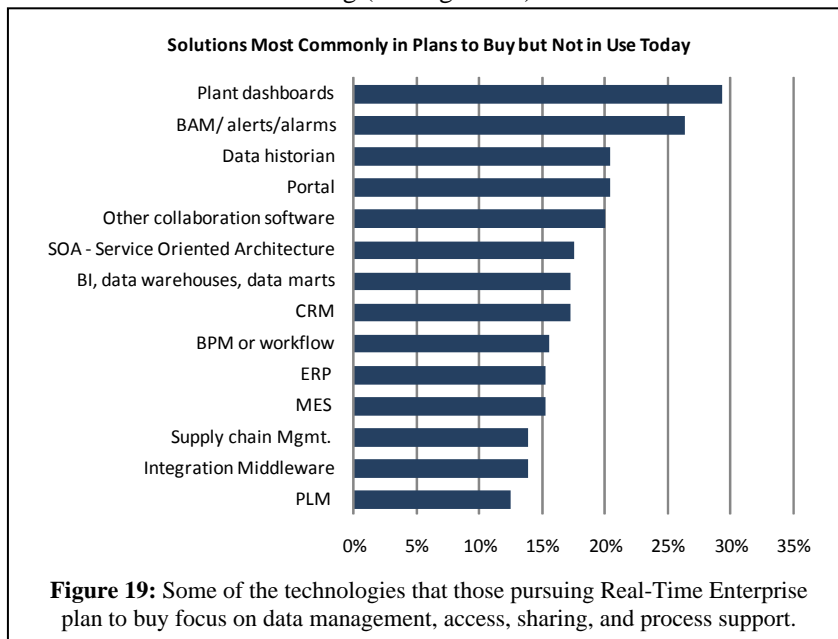


practices in this part of the study are widely used by even half of the respondents who report pursuing a Real-Time Enterprise initiative. It appears companies are early in their journeys toward a Real-Time Enterprise.

The Real-Time Enterprise practices most commonly in wide use are security and continuity. These are the basis for reliable information systems and a good place to start developing a Real-Time platform. Process-focused

tools such as alerts and automated business processes are also gaining ground, along with portals and web-based applications.

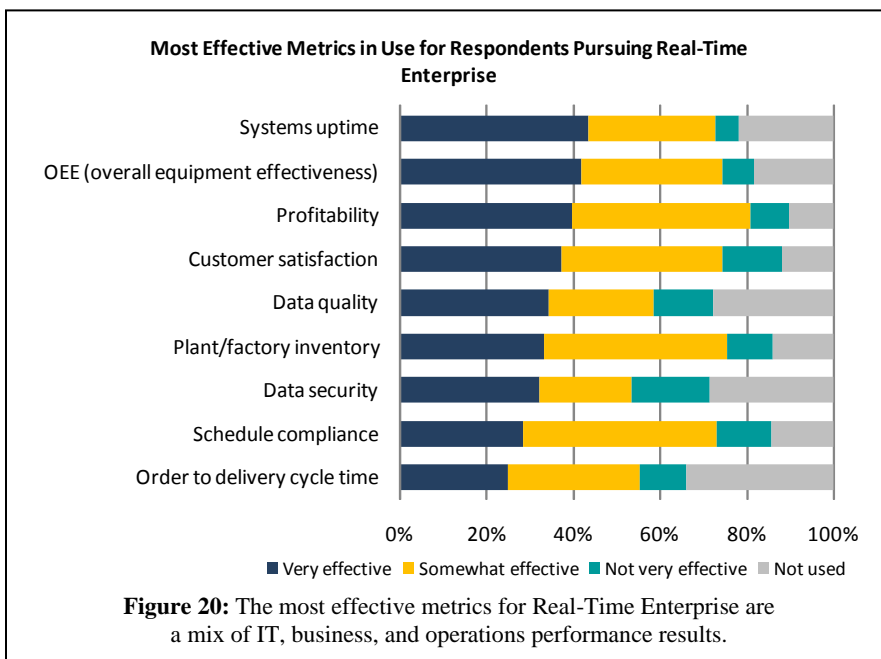
Pursuing a Real-Time Enterprise infrastructure can take a significant investment in IT technologies and personnel. Respondents to this study are starting with established systems, including some that are homegrown (see Figure 18). Certainly these applications can help people make sound decisions within their own task areas. What may change the game are some of the technologies planned for acquisition which could significantly propel the use and success of Real-Time Enterprise in manufacturing (see Figure 19).



A Real-Time Enterprise must get beyond any particular application's scope to ensure rapid, accurate and reliable information flows throughout the enterprise to support fact-based decisions. That is where some of the technologies these companies plan to buy can provide high value.

- Plant dashboards, which also were the most widely planned application to buy in last year’s MESA *Metrics that Matter* Study, provide a dynamic view of performance in the plant – where value is added.
- Business application management (BAM) provides a similar dashboard service across a range of computer-supported business processes.
- Data historians are a key tool for putting controls and plant information into context, to correlate between various events for cause and effect or to identify the range of time in which a particular issue was occurring.
- Portals allow users to see multiple applications’ data in a single location, and often in ways tailored to their specific job function or role.
- Collaboration software has been a missing link in many application areas. Helping people work together – whether from the same or different departments and companies – can vastly increase decision reliability.
- SOA helps make specific data streams useful in new applications. It is encouraging to note that this has overtaken integration middleware as a planned purchase, particularly since it provides a more flexible path forward.
- BI, data warehouse and data marts all allow data analysis and customized views to support decisions.

We could go on, but the picture is clear: many companies don’t have all of the systems they need in place to enjoy a Real-Time Enterprise. Those who invest could leap ahead by enabling data flow and sound business decisions at all levels.



It turns out, the most effective metrics for manufacturers pursuing Real-Time Enterprise include IT, operations, and business metrics (see Figure 20). That is logical, since the desired outcome of Real-Time Enterprise initiatives is sound business decisions and thus improved company and facility performance.

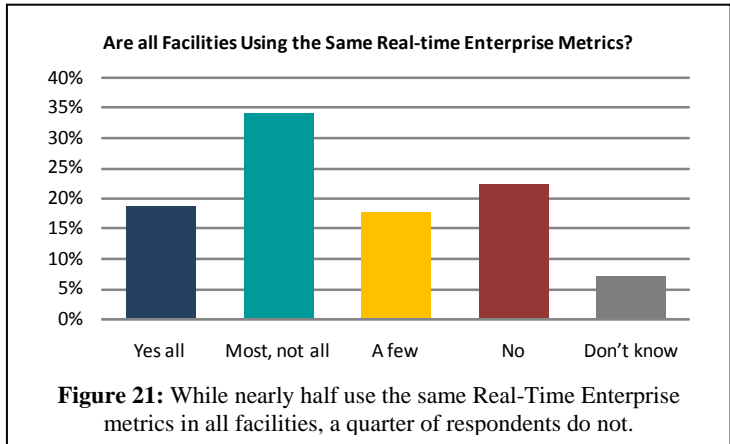


Figure 21: While nearly half use the same Real-Time Enterprise metrics in all facilities, a quarter of respondents do not.

Since Real-Time Enterprise is a less mature area than Lean or Total Quality, the metrics are less standardized across facilities. One in five companies says their plants do not share Real Time Enterprise metrics (see Figure 21). Over a quarter also report that the metrics

themselves are not standardized even at a company level, but vary from one facility to another.

As for ownership of various phases of the Real-Time Enterprise metrics lifecycle, the IT group clearly does not own them. Figure 22 shows that a project or team leader is likely to be responsible for most of the metric tasks around Real-Time Enterprise. The clear exception is that the plant manager is held accountable to improve against the metrics. Yet in one of five cases, the project or team leader is held accountable for improving. Responsibility for two of these tasks, reviewing alignment and analyzing results, varies widely among these respondents.

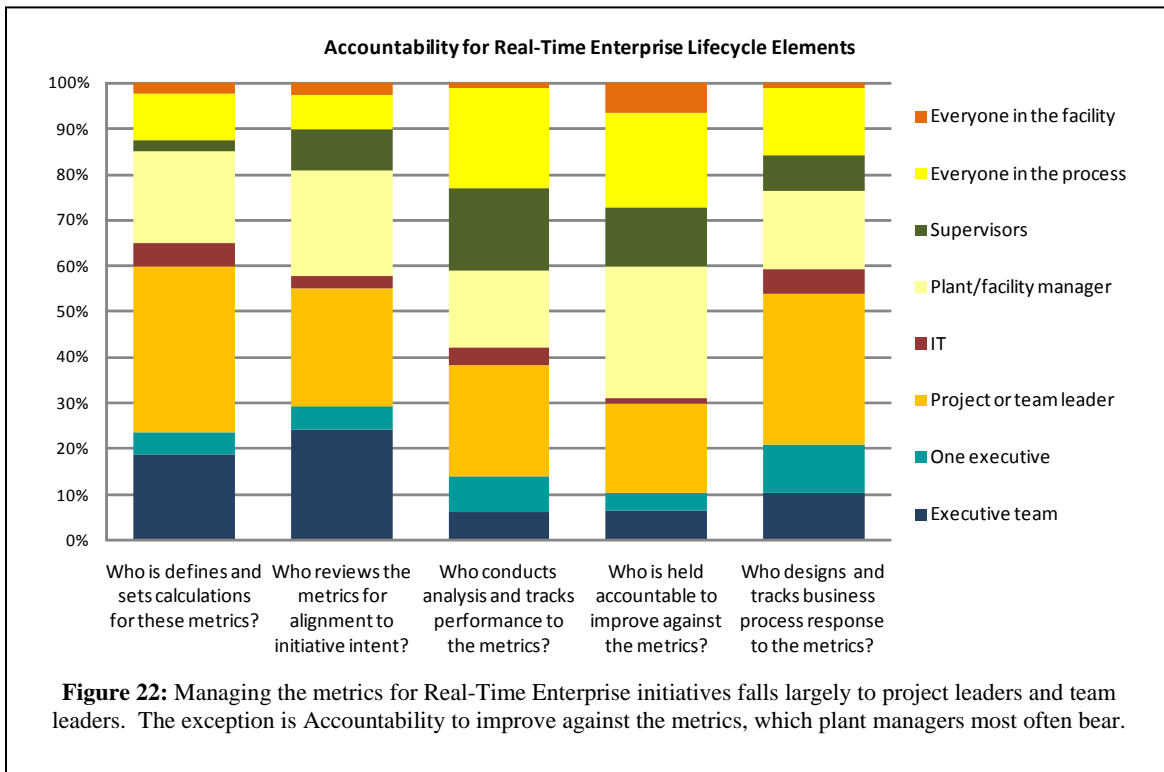


Figure 22: Managing the metrics for Real-Time Enterprise initiatives falls largely to project leaders and team leaders. The exception is Accountability to improve against the metrics, which plant managers most often bear.

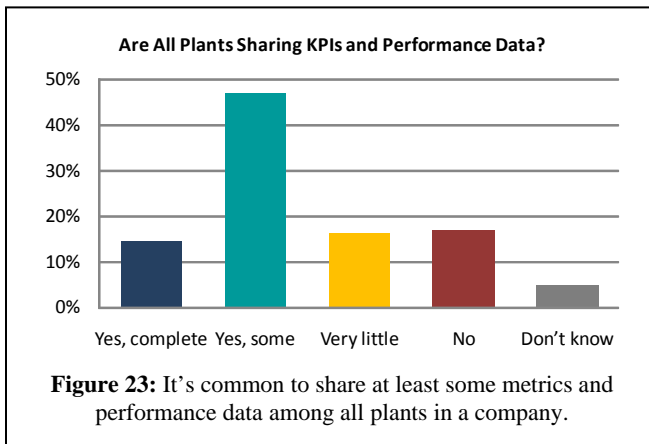
- Reviewing the Real-Time Enterprise metrics for alignment to intent falls to the executive team or a plant manager nearly as often as to a project leader.
- Everyone in the process conducts analysis and tracks performance to Real-Time Enterprise metrics in nearly as many cases as the project leader. Supervisors often take on this task as well.

Real-Time Enterprise is a relatively immature initiative. Many companies have considerable work to do for their programs to be effective. To determine the effectiveness and impact of real-time information flows, companies need specific and standardized metrics. Today, measuring the impact of Real-Time Enterprise is not clearly differentiated from core business and operations performance metrics. Those who succeed at Real-Time Enterprise should improve across a broad array of metrics. They should also be able to handle new business situations more readily than those with less capable information architectures.

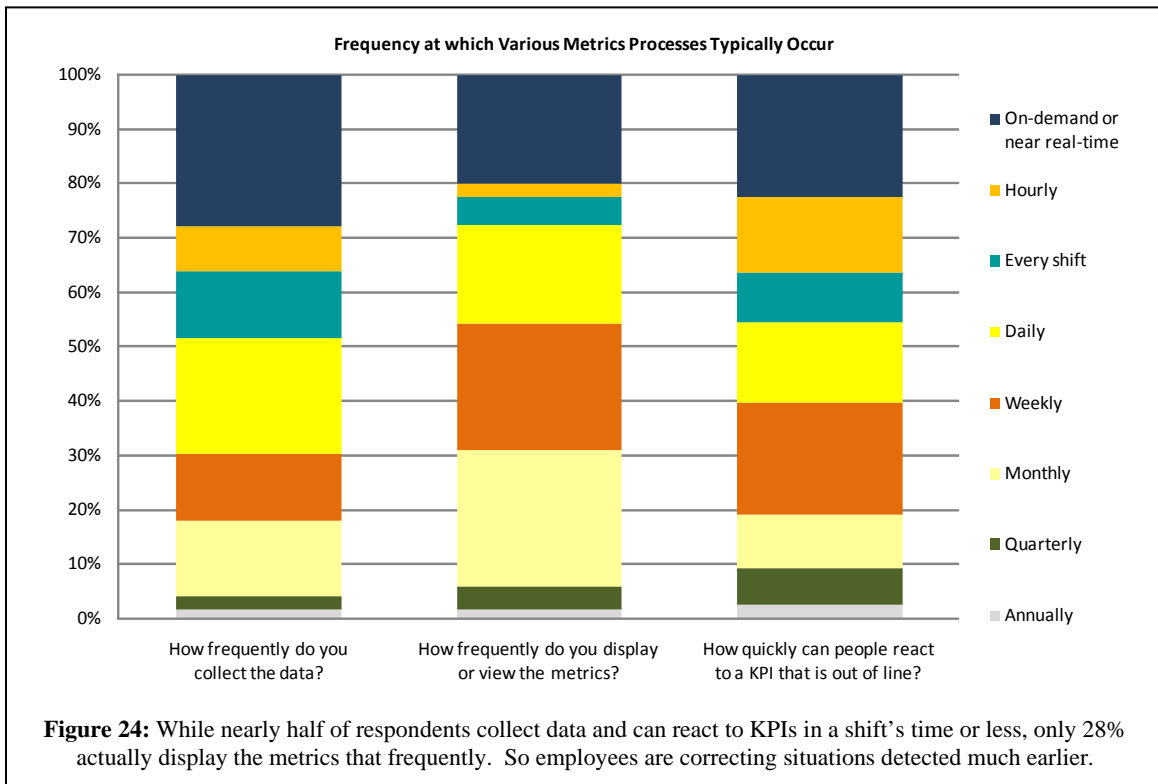
The Shape of Metrics Programs

As last year’s *Metrics that Matter* study revealed, companies who improved the most dramatically on business performance metrics had faster and more effective metrics processes than others. To develop a metrics program that actually improves performance, a number of elements must come together. Respondents to this survey told us about the many aspects of program design, some of the challenges and their ongoing review processes of the metrics program.

One of the key benefits of a metrics program is the ability to change behavior. Most employees truly want to perform well and help the company succeed. Many are also competitive. So viewing the data and sharing it among departments and plants can accelerate results. Most of our respondents do share at least some Key Performance Indicators (KPIs) and performance data among all their plants (see Figure 23).

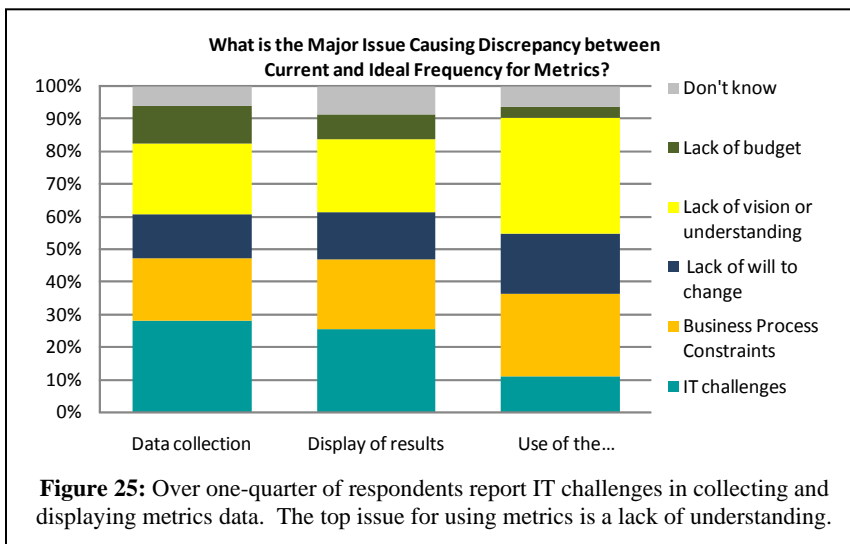


Clearly, the best opportunity to improve performance is by providing employees rapid feedback to correct any issues as they arrive. Last year’s study examined that in some depth. This year, respondents reported on the frequency of a few of the elements in a rapid or real-time metrics program that includes data collection, display of metrics, and ability to react to metrics.

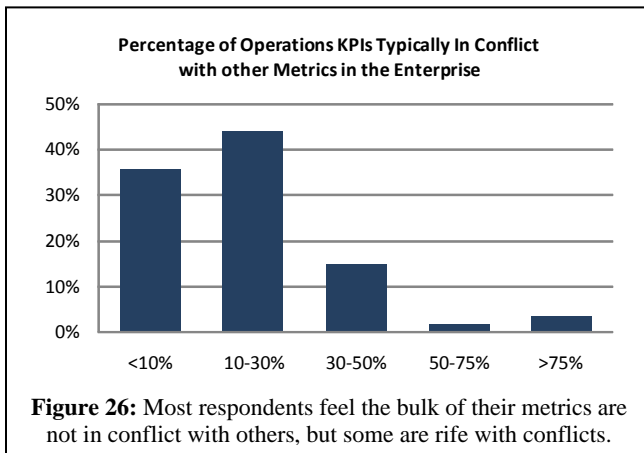


As Figure 24 illustrates, most companies display metrics results less frequently than they collect data and more slowly than employees' can react. This is a failure of a real-time system. Companies don't get full value from timely data collection because the metrics data has aged before being displayed to indicate performance issues to employees. Still, rapid data collection is critical for enabling the metrics to be displayed more frequently in the future.

Most study participants recognize that faster metrics processes are better.



Respondents reported that a number of things are preventing them from conducting metrics processes at the ideal frequency. The problems in data collection and the display of results most commonly suffer from IT challenges (see Figure 25). The issues in using the data effectively are more



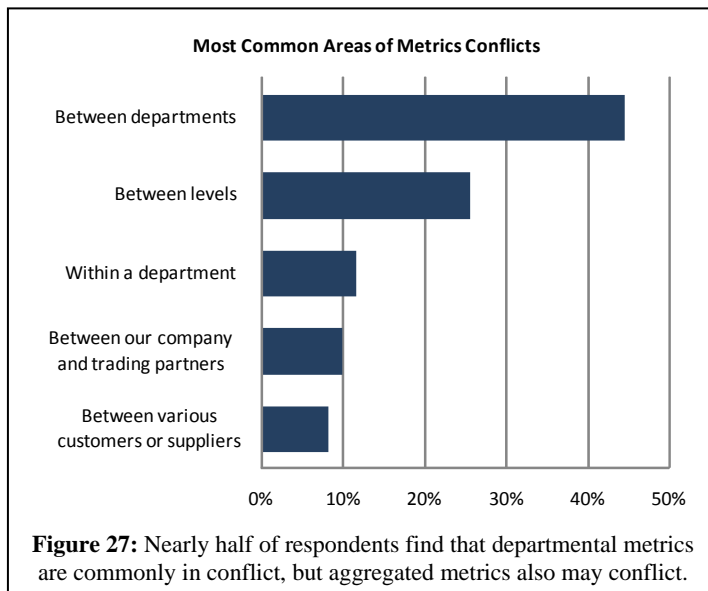
commonly due to a lack of vision or a business process constraint. Lack of understanding and business process constraints are also significant factors impacting other areas, ranking just below IT challenges.

Interestingly, these companies are not claiming to have inadequate budget to spend on improving metrics programs – but instead suggest that the current IT investments are limiting the speed of data

collection and metrics display. This may be in part because enterprise systems are the #1 source of metrics data for these initiatives, and some of the older ERP systems run in a batch mode. Also, only 20% of companies make wide use of plant dashboards in this respondent base. In total, 59% make some use of manufacturing intelligence, but this leaves a large portion without that display capability designed for real-time performance management.

As with the quality initiative, it appears that management may be a problem in creating effective metrics programs. A lack of vision and willingness to change is what accounts for slower than ideal metrics reporting frequency for over one-third of respondents. These two factors account for slower than desired data collection (35%), display of results (37%) and use of metrics information (54%) of respondents.

One of the other common challenges with metrics is that they may conflict. While most of the respondents report that the vast majority of their metrics are not in conflict with other metrics (see Figure 26), most believe that at least one in ten of their metrics do have a conflict. The 36% of companies with *less* than one in ten



metrics in conflict may find their operations run more smoothly and that their metrics system actually improves business performance across the board. For the remaining majority of companies, they leave employees in a situation where they may have ill will toward those working toward conflicting goals.

In nearly half of the responding manufacturers, the conflicts come most commonly between

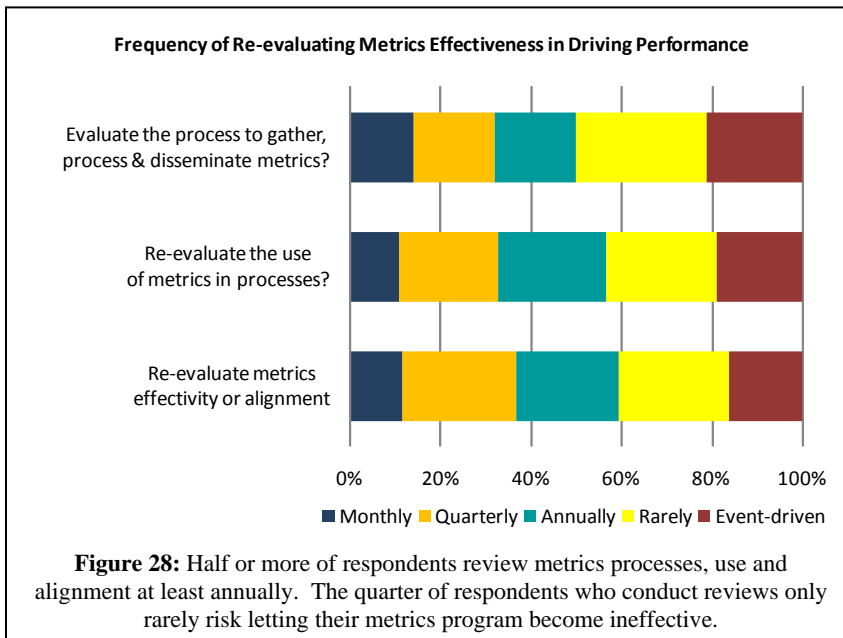
departments (see Figure 27). Examples of commonly conflicting metrics between departments are:

- Warehouse goals to keep low levels of inventory vs. operations goals to utilize expensive equipment
- Sales customer loyalty may go up by agreeing to last-minute order changes vs. operations goals to meet plan and operate efficiently
- Finance goals to lower capital expenditures vs. maintenance being measured on reducing downtime
- Marketing metrics to provide specific leading-edge products for each customer or market vs. operations goals to reduce changeover times as an element of improving overall equipment effectiveness (OEE)

Similarly, the aggregate metrics may conflict with metrics specific to one operation; this is what we mean by conflicts between levels. For example, if the aggregate metric is percentage of revenue from new products, that metric might conflict with a production goal to maximize throughput, since new products take a while to ramp up.

These conflicts and issues raise an important point about metrics programs. They need to be aligned and evaluated for effectiveness. Therefore it is important to understand what makes KPIs effective. There are many factors, and respondents told us which they think are most significant.

- A full 80% of respondents said metrics' alignment with business needs makes them effective.
- Standardized calculations (76%) and standardizing on metrics across the enterprise (73%) are important for meaning and consistency.
- A high level of detail or granularity also contributes to effectiveness (56%), as it can greatly speed root cause analysis.
- Metrics can also be effective if the manager's compensation (55%) or everyone's compensation (50%) rests on achieving those metrics.



Businesses are not static, so keeping metrics aligned with business needs presents an ongoing challenge. Half or more of respondents conduct key metrics reviews annually or more often (see Figure 28). Unfortunately, about a quarter do each of these things only rarely. They risk allowing their metrics program to become irrelevant. Worse, the metrics

system may actually drive behavior that hurts overall business performance rather than improving it. Stories of operations metrics not keeping up with changes in business strategy are commonplace. These can precipitate unwelcome events and poor business outcomes. At that point, it may be too late for a current management team to salvage their positions and hone the focus on improvement programs.

Opportunity Abounds

Manufacturers have tremendous opportunities to improve their operations by pursuing Lean, Total Quality and Real-Time Enterprise initiatives. Clearly, some companies have not yet standardized on many of the practices that make these programs successful. While many practices are easier to apply in certain types of environments than others, modified versions of most practices in these three areas have succeeded in every industry and process type.

Gauging the impact of these initiatives also requires effective metrics programs. The objective is improved business performance, so basic business and operations metrics will always be the critical yardstick by which manufacturers measure program success. However, some specific metrics may also gauge how well the basic cultural changes that sustain each major business initiative have taken root.

A recommended approach would be to combine the practices and disciplines inherent in Lean and Total Quality with the infrastructure and manufacturing enterprise IT

solutions at the core of Real-Time Enterprise initiatives. In the past, some Lean educators encouraged companies not to implement software systems. We believe this is outmoded and wrong advice. Operations software systems can accelerate the gains from other initiatives and help keep processes on track.

We agree with the fundamental premise that employees must really learn, understand, and become habituated to core Lean and Total Quality practices. Once employees are fully cognizant of the power of these approaches – and the power that these approaches invest in each employee – the company is more likely to fully and widely employ those practices.

Another major reason why Lean gurus discouraged their students from using software is because enterprise systems at the time (in the 1980s) were not suited for a Lean environment – and some still are not. The system must support a true demand-pull rather than production based on forecasts that push product into the market. The system must also be designed not only for the specific employee to provide needed input quickly – it must also support other aspects of that employee’s job. Plant operations software such as Manufacturing Execution Systems (MES) can do that today, with a combination of barcode and automated data collection, and feeding operators “standard work” or work instructions as they need it and guidance for complex operations and exception situations.

Companies that have not begun to identify a streamlined process with minimal waste who implement software could also expect their first implementation of software to be inappropriate for use as the initiative worked and processes changed in the past. A system can show where the problems and bottlenecks are, and until recently many were not flexible enough to easily model a re-configured process. With the advent of services oriented architectures (SOA), systems can move forward much more flexibly as processes and information streams change.

MESA expects to publish another paper about technology support for major initiatives shortly. The survey on which this paper is based had other data that will form a foundation for this next paper. It will cover some of the opportunities with plant dashboards and drill-down analytics. Approaches to unifying plant information systems will be included. Another topic for which we received responses is sources of data for metrics that indicate the success of major initiatives. While SOA was not a survey topic, this new approach to software will also be included, since it is critical to supporting improvement initiatives, changing processes, and appropriate metrics.

Global competition for manufactured goods raises the bar for everyone. Those companies consciously focused on reducing waste, ensuring quality in the process, and making sound business decisions in a dynamic environment will have a

competitive advantage over others. Some of the business strategies that these capabilities support include:

- **Growth:** Both Lean and Total Quality raise the effective capacity of manufacturing facilities, and real-time enterprise ties those facilities with other departments and trading partners more effectively to respond better to revenue opportunities.
- **Innovation:** Manufacturers with better information flows can more quickly develop profitable new products and value-added services and solutions. Those with Lean and Total Quality operations will also have the opportunity to ramp up production of those new products more quickly and profitably.
- **Global procurement:** Many companies buy materials from all over the world. Certainly, Real-Time information can support that, and Lean level loading is designed to provide a more constant demand signal to suppliers, allowing them to be more reliable wherever they are.
- **Offshoring & Outsourcing:** To the degree companies standardize on sound Lean and Quality practices and metrics, they will also have better success in opening new locations and working with new partners. A Real-Time Enterprise internal data flow also enables effective plans with other locations and suppliers.
- **Employee Skills:** Many production industries are suffering from a current or looming shortage of skilled employees. Both Lean and Total Quality focus on empowering employees. Making workers accountable – and measuring their results – can lead to greater job satisfaction and employee retention.

Most of the executives, investors and employees in manufacturing companies want to be able to do all of those things. Building a foundation for future success is also part of the opportunity. These programs are fundamentally a way to structure business processes and mindsets for ongoing improvement and business performance improvement. The fittest and nimblest companies will survive.

Those undertaking these initiatives and measuring significant improvements will be setting ever higher standards that others must meet. Clearly, most companies have not adopted all of the practices they could and are not making the best use of metrics to gauge and drive performance. It's not too late to become a market leader.

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