

Pursuit of Performance Excellence

Business Success through Effective Plant Operations Metrics

Summary Report

Significant improvements in financial performance are the result of a multi-faceted effort: this report includes selected highlights from a survey of manufacturers and producers that focuses on the role of plant performance metrics programs. The results illustrate approaches, business processes, and software technologies used today – and which ones correlate to dramatic business performance improvement. This report includes two of the top six take-aways about what works.

A MESA Metrics Research Study – Public Report

February 2012

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INTRODUCTION

In the very volatile “new normal” economy, old ways of working cannot keep up with change to deliver market and financial success. To remain competitive, companies are increasingly relying on fact-based management to drive appropriate focus and action. One of the most potent manifestations of this strategy is the use of performance measurement and analytical software. Manufacturing and production companies are realizing that to get the results they hope for at a business level, they must improve in production plants right down to specific operations. To focus and gauge improvement, companies are implementing performance metrics programs.

MESA Metrics Research Team 2011-2012

Analyst Team – Cambashi analysts and staff in the US and UK devised and conducted on-line and telephone surveys, gathered and analyzed data, managed the project, and wrote this report. A further set of specialized analyses was conducted by MESA Metrics working group member Hadrien Szigeti of Dassault DELMIA.

MESA Metrics Working Group – This MESA sub-committee drove and supported the project.

Industry Council – A select group of MESA Metrics working group members together with manufacturing executives nominated by the study sponsors guided the project to ensure wide appeal and leverage these practitioners’ deep domain expertise.

Industry Leaders – Some respondents with good results participated in telephone interviews and provided thoughts that appear with permission throughout the comprehensive report.

Media Partners – To gain broader participation, a group of manufacturing and production oriented on-line publications notified readers around the world of the opportunity to participate. These include *Automation.com*, *Automation World*, *Cement Americas*, *Compound Semiconductor*, *EuroAsia Semiconductor*, *Food Engineering*, *IndustryWeek*, *Managing Automation*, *Manufacturing Computer Solutions*, *Medical Device and Diagnostic Imaging*, *Medical Device Summit*, *Process & Control Engineering*, *Productivity Management*, *Rock Products*, *Solar*, *Solar UK*, *Technews Publishing*, and *Works Management*.

Sponsors – Solution providers Camstar Systems, Rockwell Automation, SAP, Solarsoft, and Tata Consultancy Services are Premium Sponsors; IQity Solutions is a Supporting Sponsor in funding the study. Experienced employees of each sponsor helped to guide the research and formulate the study and deliverables based on their field experience.

This paper is the Summary Report of research findings about that process. It is the result of a joint effort involving Manufacturing Enterprise Solutions Association (MESA) International, and industry analyst firm Cambashi, an Industry Council of representatives from manufacturers and producers, and a set of solution providers. A group of industry publications also assisted in gaining solid response across many industries worldwide. (See Metrics Research Team sidebar.) During the last quarter of 2011, we conducted an on-line survey and a set of telephone interviews.

This paper presents a small sub-set of the analysis included in the Comprehensive Report of this research study, *Pursuit of Performance Excellence*. The research analysis was conducted on responses from 305 manufacturers and producers representing a wide range of industries, manufacturing process modes, and operating conditions.

About three-quarters of companies who participated in this research have increased revenues and volumes since the peak of the economic crisis, but only about a quarter made dramatic improvements in business performance. We call that quarter the “Business Movers.” How are they different? As in previous studies, the main areas of difference are not demographic, but in their culture, performance measurement processes, and use of IT.

Business success correlates closely with measuring performance in a consistent and aligned way from financials down to operating plants, and to machine and line level operations. The research is full of nuggets that suggest what works well, including six top take-aways or recommendations based on the research. In this Summary Report, we include only two of the top take-aways from the research: 1) be ‘metric centric’ to enable aligned action and 2) give employees training and a gauge to engage. Business Movers are doing those things and more to keep a competitive edge.

STUDY BACKGROUND

By many accounts, manufacturing is a driver behind the rebound from the global economic downturn of 2007-2009. About 70% of respondents to this survey in the autumn of 2011 had seen an increase in both revenues and production volume during the previous three years.

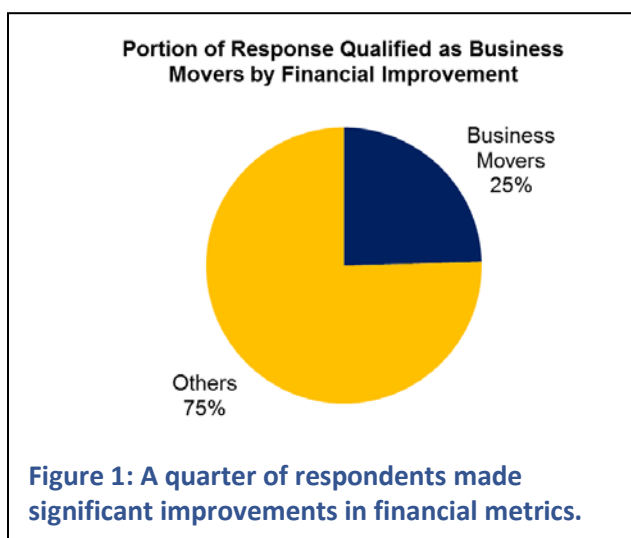
Yet external factors in commodity costs, market and supply base shifts, natural disasters, and regulations have continued to make business uncertain. These factors mean that rules of thumb based on history and peoples' experience may not be adequate to succeed today. Complexity also comes from internal sources. For example, 63% of respondents report that they now manage more products, stock-keeping units, or variants than three years ago. Most respondents have increasing concern about staff and supervisor/manager skills as well.

Many companies are implementing performance measurement programs to help understand the business and focus activity. **As change accelerates, this "fact-based" view from metrics becomes a critical lens on the truth** to accompany staff knowledge and feedback from employees and customers. Even then, it's not always obvious which measurements in the plant or at a production line will be most critical in improving business performance.

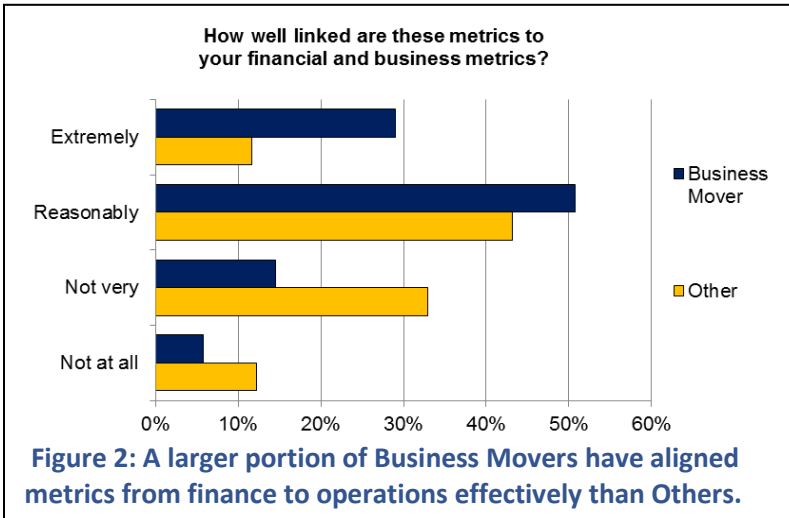
MESA has conducted research into performance metrics since 2006, focusing on relationships between metrics in production and financial metrics and outcomes. In all of these MESA Metrics research studies, there have been consistent themes about best practice processes for measuring and improving performance. This study has added flavor on some of the IT issues as well as some critical factors in line-level metrics.

BUSINESS MOVERS SHOW THE WAY

While most of the respondents grew revenues, the critical financial metrics are earnings and profit. As with all previous MESA Metrics studies, we have divided the response base into "Business Movers" and Others. In this response base, about a quarter are "Business Movers" (see Figure 1) by this definition:



- those who achieved a 10% improvement on average over the past three years in net operating profit or
- those who achieved a 10% improvement on average over the past three years in earnings before interest, taxes, depreciation, and amortization (EBITDA) or
- those who improved at least 1% against over half of the business and financial metrics in the study, in this case seven of 13



So this Business Movers group includes both those who have improved dramatically on one of the two fundamental metrics for profitability or who have improved widely across many business metrics. In addition to these, only Business Movers improved over 10% on average unit contribution margin and revenue per employee.

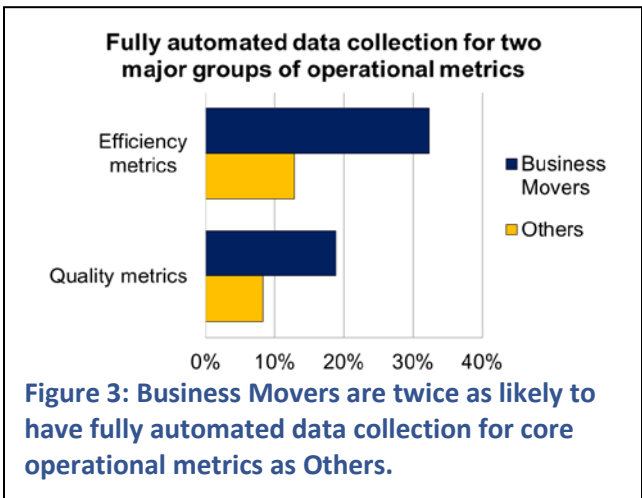
So how are these Business Movers different from Others? There is variation among industries, and some are in high-growth markets while others are in markets that suffered deeply in earlier years. Yet at least one in 10 respondents from every industry is a Business Mover. Similarly, there were some

Business Movers in every size range and every region of the world.

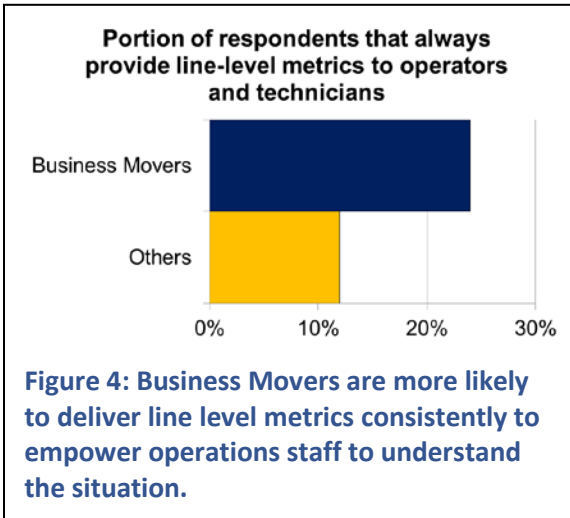
So the difference is not primarily demographic. The correlation, as in past studies, is to their processes and practices. What are some of those best practices? Many are around the performance measurement process itself. In production companies, this means not only enterprise-level, but also plant-level and line-level metrics. Business Movers are much more likely than Others to have aligned metrics from business to plant to line level very effectively, as Figure 2 shows.

Thinking about metrics as the gauges on a vehicle, you want them to display how you are doing right now, and not just report on past performance. Thus, **speed is critical**. The metrics process rests on collecting data from the process being measured, and Figure 3 shows that a far greater portion of Business Movers than Others collects data automatically for issues such as efficiency and quality. They are also more likely to have fully automated data collection for the six other operational metrics areas in the study: customer and responsiveness, inventory, regulatory, asset and maintenance, IT, and flexibility.

The next step of the process is preparing the data for display. Here, all respondents, Business Movers and Others, tend to have a time-consuming process to cleanse, analyze and set up metrics data for display. Yet, at the next step, a much larger portion of Business Movers (44%) show operations staff performance results in real-time or during their shift than Others (30%).



At the production line level, we identified four best practices. **Business Movers are much more likely than Others to use all of these practices consistently.** The basic idea of always providing



metrics to the operators and technicians for line-level performance is just one shown in Figure 4. The other best practices help ensure that these metrics are timely, clear, and actionable.

A larger portion of Business Movers improved by over 10% on all of the 37 operational metrics included in the survey. From our interviews with Business Mover respondents, we can say that they tend to have a different corporate culture as well. This suggests that any company can become a Business Mover if they put best practices into place.

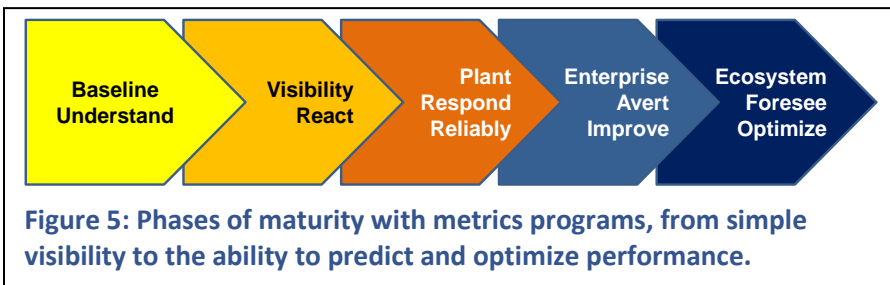
METRICS AND MEASUREMENT PROCESSES

As with nearly any other discipline, improving the performance metrics program is a journey. Companies do not adopt best practices overnight; most take time to mature in understanding, goals, practices, and systems. (See Figure 5.)

At the early stages, companies will use the most common metrics to gauge a baseline from which to measure improvement. The full report lists which operational and financial metrics are most widely used in each production mode: discrete, batch process, continuous process, packaged goods mixed mode, and other mixed mode.

As the metrics program matures, managers will begin to measure and improve on metrics that deliver a multi-faceted view of performance or foresee the performance

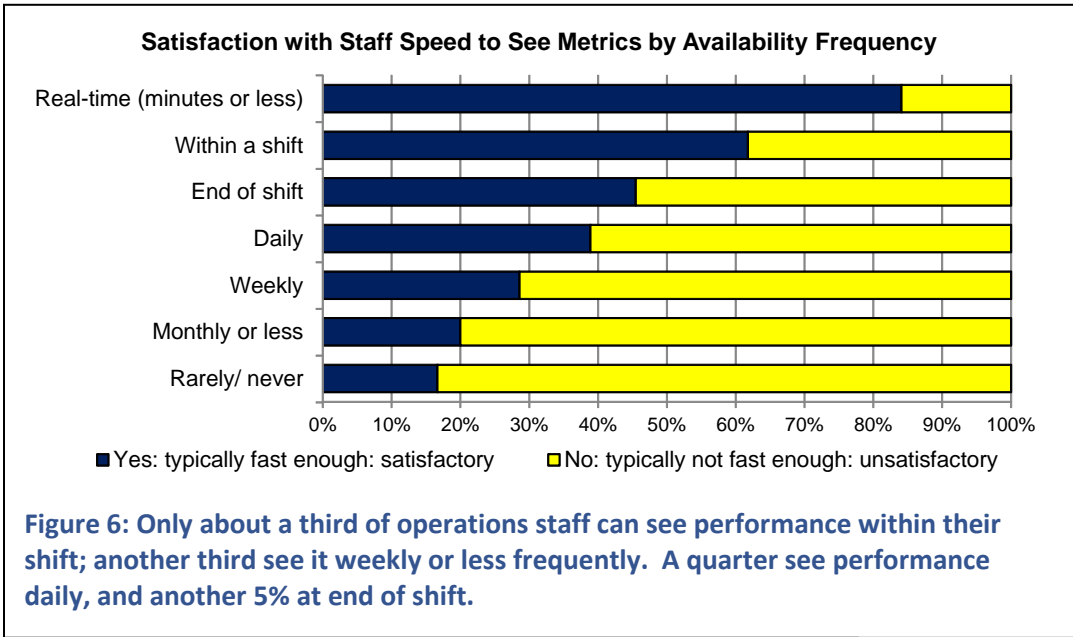
issues. The operational metrics that Business Movers are proportionally far more likely than Others to have improved on help align operational activities to business priorities. The full report lists five specific metrics characteristics with examples of each.



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Beyond the metrics themselves, Business Movers are different in the processes by which they measure performance. We talked about speedy data collection and effective linkage. Speed of displaying performance results to operations staff is also important. In fact, there is a direct correspondence between speed of metrics display to operations staff and satisfaction with that speed (see Figure 6).

When staff members see performance within their shift, they have a much better ability to act in ways that improve performance. Whether the data shows a trend toward a problem that can be corrected, the impact of a new approach, or a problem caused by conditions on equipment or issues with a specific batch of materials, employees can be proactive and create better outcomes when they know what is happening during their workday.



Making metrics available within a shift is easier said than done. Many companies struggle with this, and there are many reasons. We specifically asked respondents whether they think the metrics process is slower than it should be. Then we asked whether the primary issue slowing down various phases of the metrics process is IT, business process constraints, lack of will to change, lack of

Figure 6: Only about a third of operations staff can see performance within their shift; another third see it weekly or less frequently. A quarter see performance daily, and another 5% at end of shift.

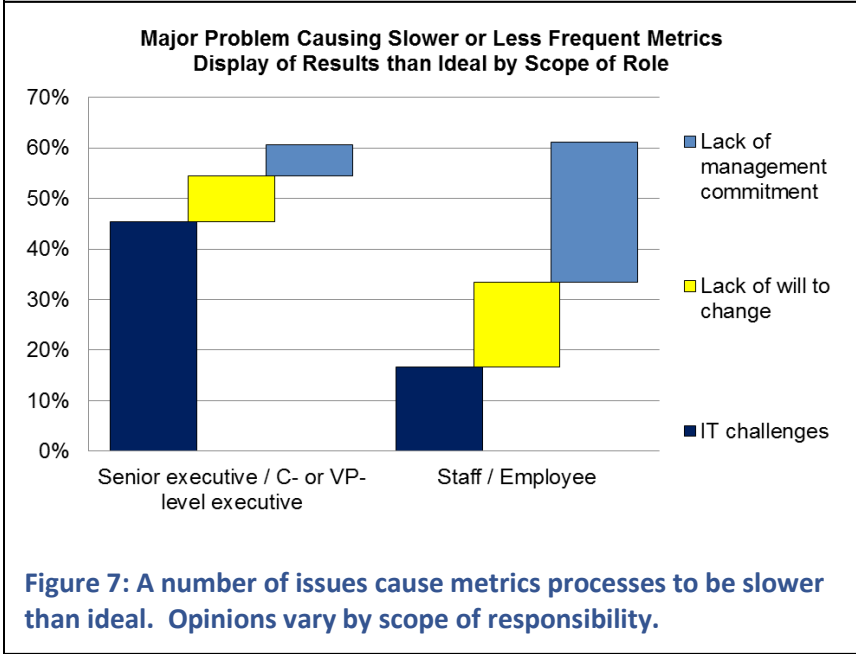


Figure 7: A number of issues cause metrics processes to be slower than ideal. Opinions vary by scope of responsibility.

understanding, or lack of management commitment. All of those issues play a role for at least some of the respondents in each of the main process steps: data gathering, analysis, display and use of the metrics.

In fact, there are different reasons for each stage of the process and different titles perceive the problem differently. Figure 7 shows just the broadest and narrowest scopes of role, and how differently they perceive some of these issues for the display of metrics to operations teams. Mid-level managers and supervisors generally fall somewhere between these two extremes.

This data showing the difference of opinion between senior executive and non-managerial

employees points out another challenge: creating a culture of trust and respect. The Business Movers we interviewed pointed out clearly: **educating employees and getting them engaged in the metrics process is critical to success.** Consistent use of metrics in the plant and up through executive ranks can drive not only involvement, but common understanding and business performance improvement.

IT SUPPORT FOR PERFORMANCE EXCELLENCE

Manufacturing software applications can automate processes to keep quality and productivity high. In this response base, nearly half are automating processes to reduce procedural errors – something that plant floor software can do in many situations.

We included a list of 15 relatively common software application types in this survey. Not surprisingly, most respondents to this study use enterprise resources planning (ERP). It is, in fact, the only application that more than half of respondents (66%) have in wide use today. Figure 8 shows a few examples of current use and near-term plans for various applications.

Manufacturing execution systems (MES) or manufacturing operations management (MOM) software is a plantwide system that delivers information to track, guide, and enforce production operations. Product genealogy, track and trace of materials, is a key

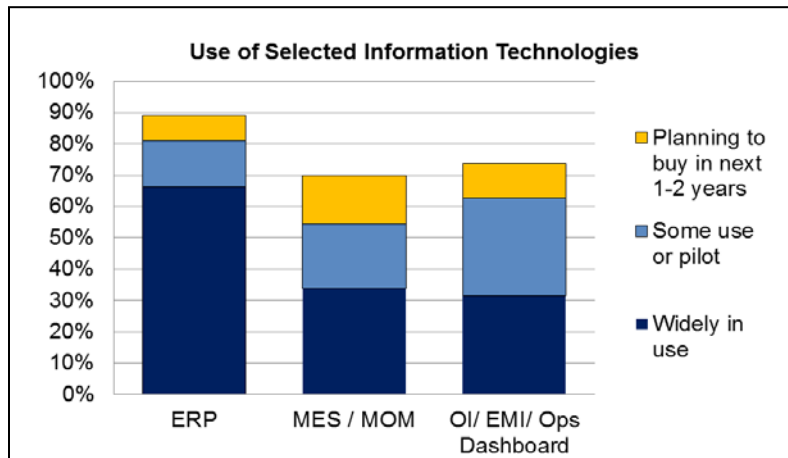


Figure 8: ERP is widely implemented in most respondents' companies; MES/MOM and plant dashboards are in wide use by about a third, but in pilot or plans for many others.

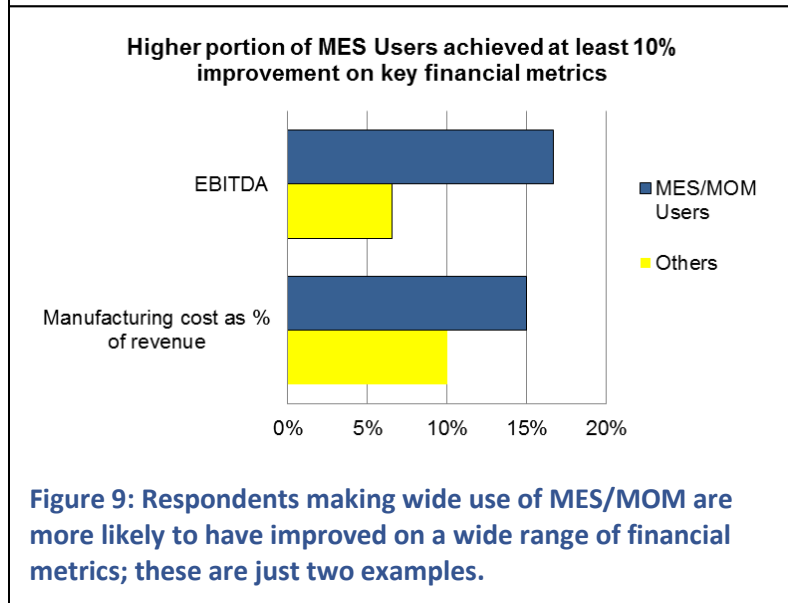
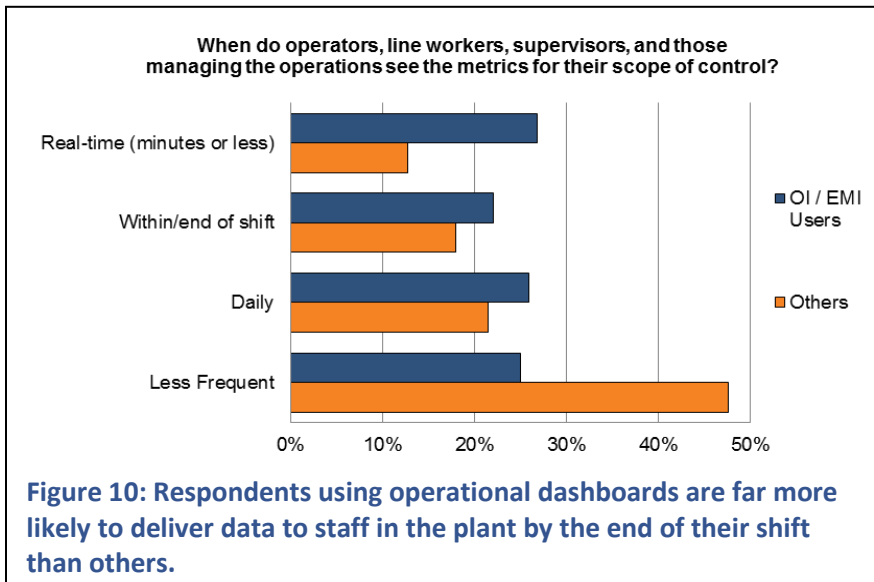


Figure 9: Respondents making wide use of MES/MOM are more likely to have improved on a wide range of financial metrics; these are just two examples.

function. The enforcement capability is a large part of how companies automate processes involving production employees – it can keep people from making incorrect processing steps.

Since MES manages plantwide processes and delivers increased visibility, it often leads to operational improvements. In fact, **more of the respondents with MES widely implemented have improved at least 1% on every operational metric in the study.** Those using MES were also more likely to improve at dramatic levels of 10% per year or more on the vast majority of those 37 metrics. These improvements can quickly result in ROI for such a system through higher efficiency and lower operating costs.

Those operational gains in MES/MOM users also translate into business and financial success. Figure 9 shows that respondents using MES/MOM widely are much more likely to have improved on earnings before interest, taxes, depreciation and amortization (EBITDA), and manufacturing cost as a percentage of total revenue. These are just two of the many business metrics where this correlation of MES/MOM use and improved business performance is strong. Note that the blue bars represent the *portion* of MES/MOM users who improved on these business metrics by 10% or more; the yellow bars is the portion of Others. This is not a view of relative performance.



As Figure 8 shows, many plants are also using production plant dashboards, also called enterprise manufacturing intelligence (EMI) or operations performance management (OPM) or simply plant dashboards. This software is designed to process and display operational performance metrics to personnel in production and in many cases throughout the enterprise. Some users of these systems have overcome the slow-downs with cleansing data and analyzing it for display, but not all. Figure 10 shows that more than double the portion of Dashboard Users show results to operations staff in

real-time than Others. Three quarters of the dashboard users do manage to display results at least daily.

Those using a dashboard are at least twice as likely as Others to employ the four best practices for line-level metrics as well. Plant dashboard users are more than five times as likely as Others to always provide line-level metrics to operators and technicians to make needed adjustments, and far more likely to automatically analyze and display line-level metrics to keep up with the speed of the operation.

The full report also lists best practices for the use of plant dashboards. These include issues such as enabling drill-downs for root-cause analysis. This capability allows understanding without digging through separate background data, and also helps make the links from an issue at one level clear to the next level.

One potential problem is that some of the respondents have applications installed that are more than 10 years old. These older applications are not likely to accommodate the flexibility required in today's fast-changing environments. Even the improvement processes that a metrics program initiates can be difficult to support with older applications that must be reprogrammed to make changes.

PURSuing PERFORMANCE IMPROVEMENT

Each company will be in a different stage of its maturity journey, and improvement programs never end. So the next step for each company will be different. This research does, however, highlight some areas to consider to drive meaningful improvements that can result in better business results.

Select the right metrics: The Comprehensive Report includes an analysis of which operational metrics are most closely correlated to dramatic improvement on specific business metrics. For example, capacity utilization is the main operational metric factor for those who improved either EBITDA or Net Operating Profit by 10% or more. In fact,



while groups of metrics do correlate to dramatic financial improvements, just one or two are main factors typically.

As with other MESA research, this group of respondents is more focused on historical and actual metrics than leading or predictive metrics. The benefits of leading or predictive metrics at the line level can be significant. Figure 11 shows the correlation between use of leading or predictive metrics at the production line level and ability to improve cost of quality.

Selecting metrics is not just a matter of understanding this generally across production industries, but also of mapping specific plant and line activities to business objectives and metrics. The Comprehensive Report also points out that the Business Movers improved across the entire array of operations metrics. Note that the *MESA Metrics Guidebook and Framework Second Edition* is designed to help readers craft a sound program with

strong linkages between financial and operational metrics.

Focus on speed, automation, and consistency: Throughout the MESA Metrics research series, speed of the process to collect, analyze, and display the data has been a clear differentiator for those who improve their business results. Business Movers are far more likely to be satisfied with the speed of the process by which operations personnel see the metrics for their area. Nonetheless, with a common need for an analyst and time-consuming processes to prepare data for metrics display, many are not satisfied with the speed of their metrics displays.

One way to achieve speed is to automate processes such as data collection. Automation with software systems can also help reduce procedural errors. This can be critical in an environment that most respondents have where employee skills are a concern.

Consistency can be particularly challenging for companies with multiple production facilities, and those who have grown through acquisitions or mergers. While some plants will have different targets than others based on their operating parameters, having the same metrics calculated and defined the same way can be very beneficial.

Perhaps more critical is engaging employees at every level and gaining a common cultural expectation that employees will use metrics and be accountable for outcomes. Culture and incentives – along with metrics themselves – will drive behavior. The critical factor is whether the behavior will improve or hurt business outcomes.

Two of the top take-aways: The Comprehensive Report has key take-aways called out throughout the document, as well as a list of six top take-aways as a conclusion. In this Summary Report, we share two of those top six.

1. Align metrics from business to plant to line and through the supply base

- Train and communicate in all levels critical to business success.
- Use metrics consistently as part of the company culture.
- Employ sound practices in performance measurement.

2. Engage, educate, and empower employees

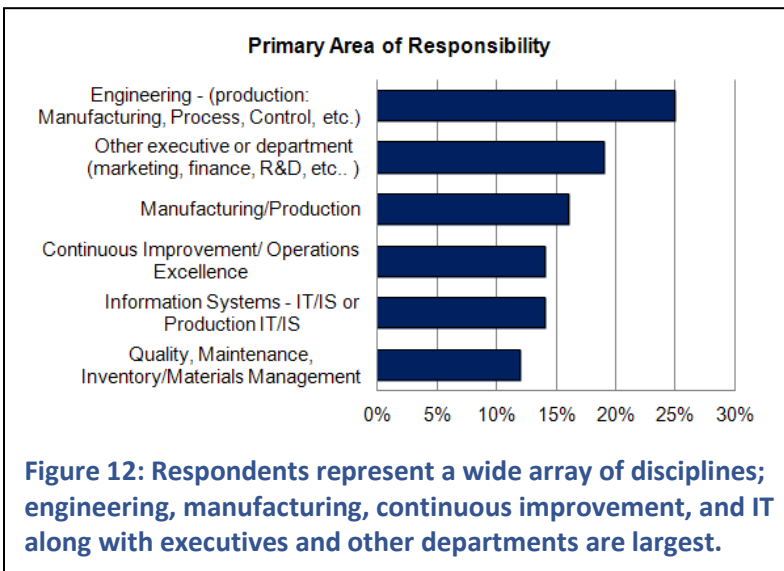
- Understanding metrics enhances operators’, supervisors’, and managers’ skills: structured thinking and seeing business impact lead to better decision-making.
- Provide line-level metrics during the shift to help operators and technicians make adjustments.

RESPONSE DEMOGRAPHICS

The graphics throughout this report represent 305 responses from a very wide range of manufacturing and production companies across the globe. They are in all size bands, all of the 26 industries listed, and represent continuous process, batch process, discrete, packaged goods mixed mode, and other mixed mode manufacturing styles. This is representative of MESA International, which seeks to serve manufacturers and producers of every size and industry across every region of the world. In fact, the demographics represent these industries relatively well.

The individual respondents are from each of the five primary regions in the world. The majority of respondents work in North America, but Europe, Asia, Latin America, and Middle East and Africa are all represented. While about 15% are senior executives and a

similar portion is non-managerial staff, most are mid-level directors and managers. Most respondents have multi-site responsibilities. Figure 12 shows the area of responsibility for respondents, across a range of domains or departments.



MORE INFORMATION AND ANALYSIS

If you find this topic interesting, please download the *Pursuit of Performance Excellence Comprehensive Report*. This 40-page study has over 35 charts and graphs with much more detail on the research findings. *The Comprehensive Report* is available to premium MESA members from the website, www.mesa.org, in the Resource Library. That report includes key take-aways throughout, quotes from Business Movers interviewed as part of the research, and a list of most commonly used operations and business metrics for different process types. It is also prescriptive with regard to best practices based on data analysis, research interviews, and illustrating what those who have improved financial performance do differently than others.

If you are not a premium MESA member, consider becoming one to get access to the report and a wealth of other information and resources. Previous MESA studies and papers about performance metrics are also available to Premium Members, including the *MESA Metrics Guidebook Second Edition* (and original), *Correlating Plant Performance to Business Performance*, *Metrics that Matter Revisited*, *MESA Metrics for Major Initiatives*, and *MESA Metrics that Matter*. In addition to this research series, MESA offers a number of white papers, presentations, and recorded webcasts on Metrics topics.

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- Collect, share, publish, and education best practices and guidance to drive greater productivity and the overall profitability of the manufacturing enterprise.
- Education of manufacturing operations best practices through the MESA Global Education Program.
- Facilitate innovation and collaboration to enable the real-time enterprise and Plant to Enterprise (P2E) integration.
- Enable members to connect, contribute, cultivate understanding, and exchange strategies to drive operations excellence.

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