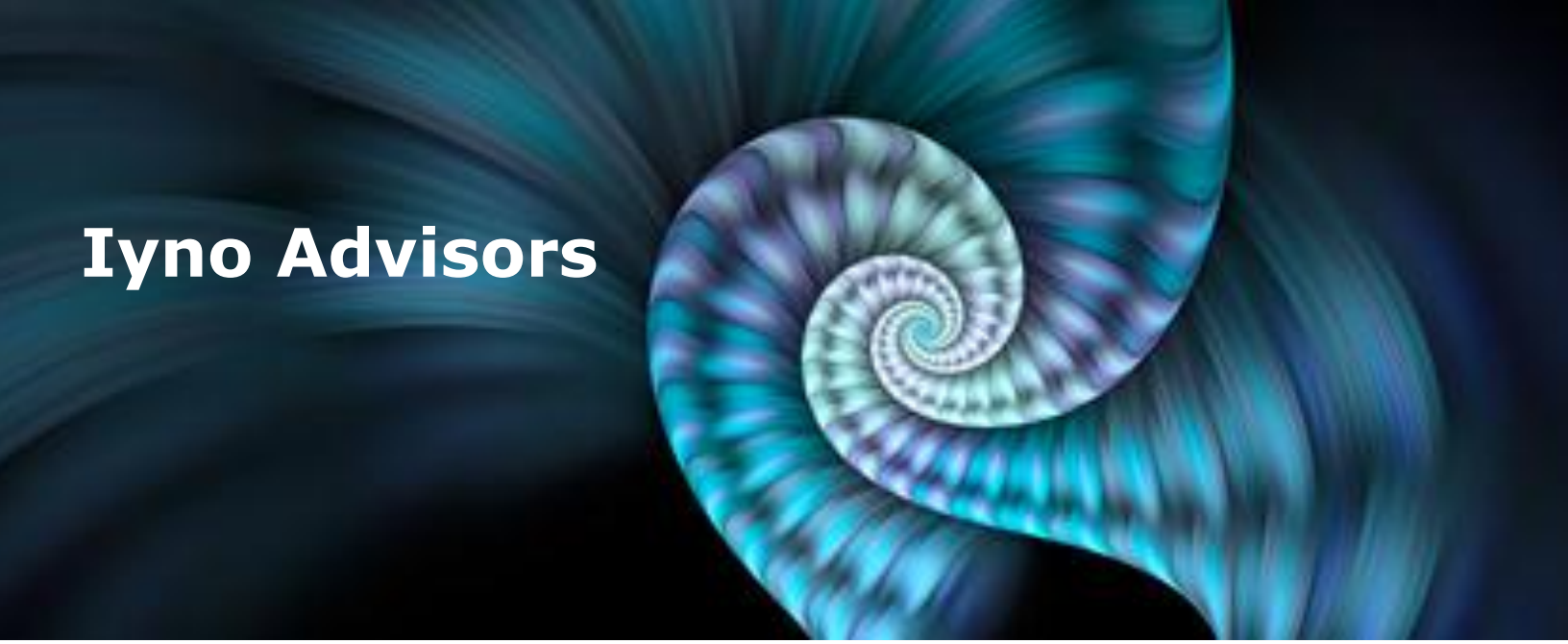

How Global Manufacturers Leverage Intelligence to Sustain Market Leadership

10 ways to engage in better decision making

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February 2013

Abstract

Manufacturers cannot expect to sustain success with traditional decision making when facing unprecedented shifts in markets, demands, technologies, and opportunities. While many manufacturing enterprises have the core data they need, leaders are adopting new systems and approaches to leverage both business and operational intelligence faster and with improved precision. This results in better decision-making. Specifically, leaders are converting data into not just information but intelligence their people can engage with to generate actionable insights. These ready insights enable confident decisions anytime, anywhere by employees and executives at every level of the company – across the globe. These early adopters are now achieving results, indicating their adoption of this new approach is paying off for both operational and financial improvement.

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Executive Summary

To keep a leadership position, companies must differentiate themselves by responding wisely to more frequent, more drastic and faster change. Some change is external, some comes from core business strategies to innovate, partner, expand into new markets, and set market trends. Sustained agility requires that people make sound decisions quickly and accurately, at every level across an organization, and often in completely new situations.

In the report *Manufacturing the future*[1], McKinsey and Company states: "The new era of manufacturing will be marked by highly agile, networked enterprises that use information and analytics as skillfully as they employ talent and machinery to deliver products and services to diverse global markets." Fortunately, most enterprises have already invested in software infrastructure – so the data is there. Most also have business intelligence (BI) systems, but these often are not capable of gaining insights to drive action in a complex production environment.

Typically BI is missing:

- real-time global manufacturing data
- integrated business context from other systems
- alignment to the business strategy
- inclusion of all sites and trading partners
- easy-to-consume screens
- on mobile devices

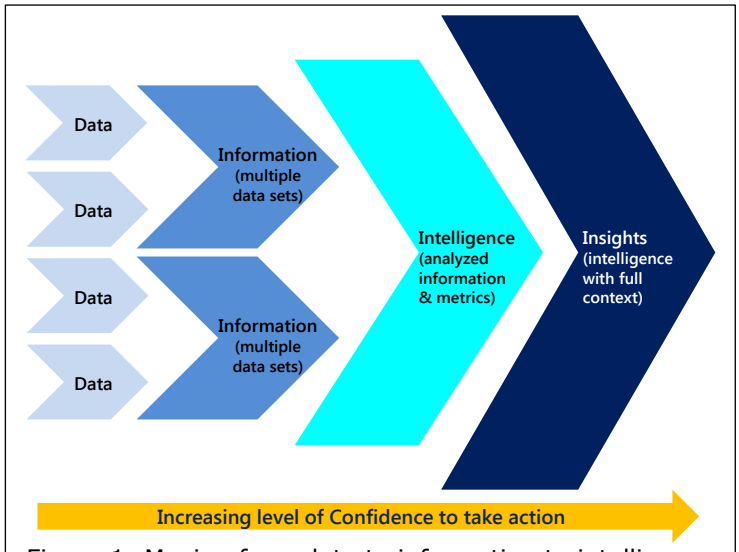


Figure 1: Moving from data to information to intelligence and on to insights allows greater confidence to act in the best interests of the company.

Leaders have resolved these issues. They use not only data and analyzed intelligence, but also full context. This allows them to gain insights to make better decisions, and then take timely action with greater confidence – at every level in every location. (See Figure 1.)

Achieving this level of decision support not only requires granting timely global access to all manufacturing and business intelligence, but also means being able to locate knowledge and effectively collaborate. As change occurs, it must be easy to update and improve these processes. To deliver this environment, manufacturers typically must enhance their business processes and supporting information systems. Leading companies fully leveraging intelligence to generate actionable insights are now reaping the benefits of this investment.

[1] *Manufacturing the Future: The next era of global growth and innovation*, © 2012 McKinsey Global Institute

Productivity in the New Workplace

Many manufacturers are very innovative, and new business models are flourishing. These may involve adding more services, collaborating with other companies, or other means of improving customer value over the products' lifecycles. Many companies are also looking to penetrate markets in new customer segments and emerging economies. Each of these elements adds new dimensions to an already complex workplace for the people central to executing management strategies.

A recent *Vertical View Survey*[2] by IDC Manufacturing Insights indicates that the top priority for manufacturers is to improve productivity. Automation can help to do that, but people are central. Managers and employees must make sound decisions collaboratively or on their own every day, every hour. They must be able to guide rapid action for their scope of control based on the current situation in each sub-segment the company serves.

With new products, customers, markets and situations, strategies that worked in the past soon will be obsolete. Further, customers have now grown to expect greater responsiveness. This means conventional process structures and business strategies have become increasingly risky. According to the McKinsey study *Manufacturing the Future*, this strategy transformation will require companies to "match granular insights with granular operations strategy." In other words, people need real-time situational insights they can act on right away to drive improvement.

People need real-time visibility to operations and situational insights they can act on right away to drive improvement. This means accurate information on the current situation and guidance to make changes.

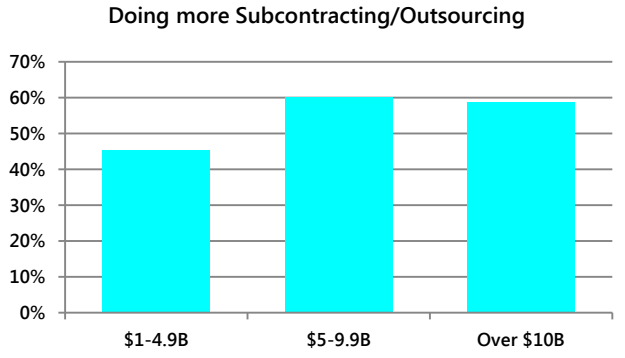
Some companies are already accomplishing this objective, all the way to the factory level. IDC finds that 18% of those polled are putting into place what IDC calls the Level 3 "People-intensive" Factory of the future. This goes beyond both Level 1 "Automation-intensive," the focus in the developing world, and Level 2 "IT-intensive," the focus in developed countries. With automation and IT already in place, people become central.

In some cases, people possess the knowledge to make decisions, but no means to see accurate information on the current situation in real-time. In others, they can decide, but not actually make changes in the systems and processes at the optimal time. Some employees are disconnected from systems to perform any type of interactions. Many other employees are less experienced and need guidance to act with confidence.

A recent MESA International research study[3] shows that the majority of manufacturers are concerned about the skills of plant employees, both operators and supervisors. Expanded insights at their fingertips can boost effectiveness.

Employees face many volatile situations that require quick decisions based on deep, complete data. For example, does it make sense to switch to making a

[2] *IDC Vertical View Survey* cited in IDC Predictions 2013: Manufacturing webcast December 6, 2012 © 2012 IDC Manufacturing Insights
[3] Source: *Pursuit of Performance Excellence* © 2012 MESA International and Cambashi Inc.



Source: *Pursuit of Performance Excellence*

Figure 2: Most large manufacturers are doing more subcontracting and outsourcing and must include trading partners in key decisions.

different product when a material is not available, or is it better to use a substitute material? That depends on the current demand for the products in question, each product's processing characteristics and possibly also the history of the materials and supplier; in other words, it depends on the current situation on hand. Employees making complex situational decisions are critical to:

- allow factories to be more responsive to variety, volatility and change
- foster supply chain responsiveness and resiliency
- design products for manufacturing (DFM) and the supply chain (DFSC)
- improve value to customers by engaging in ongoing business model transformation to deliver new, exciting products and services to market

Since most large companies are outsourcing more than ever (See Figure 2), these complex decisions involve a whole information network across companies. To gain effective insights, intelligence must be derived from data gathered across that network of disciplines, locations and partners. At the same time, IT must also distribute out requests for action to each node in the network including those that may be away from a workspace but could be on a mobile device.

Insights to Support Better Decision Making

The business question around big data is: "How do you generate more than just data and information, but leverage intelligence for insights based on the full business context so each individual can respond quickly with the right action?" By some estimates only 7% of big data captured is meaningful to humans today.

Manufacturing has significant big data issues and tight timelines, since in addition to usual market and business data there is a production process that changes moment-to-moment. Figure 3 shows that production is central to the supply chain and product lifecycle management. Typically, production information systems serve just one site and are somewhat standalone. However, connecting more plants into the intelligence flow can have exponential benefits for a global manufacturer. That multi-plant intelligence MUST flow into the enterprise information view, and vice versa. Each provides critical context for the intelligence of the other to become insights.

With more products, variants and end user markets, manufacturers have dramatically more data than ever. Further, each department or discipline has its

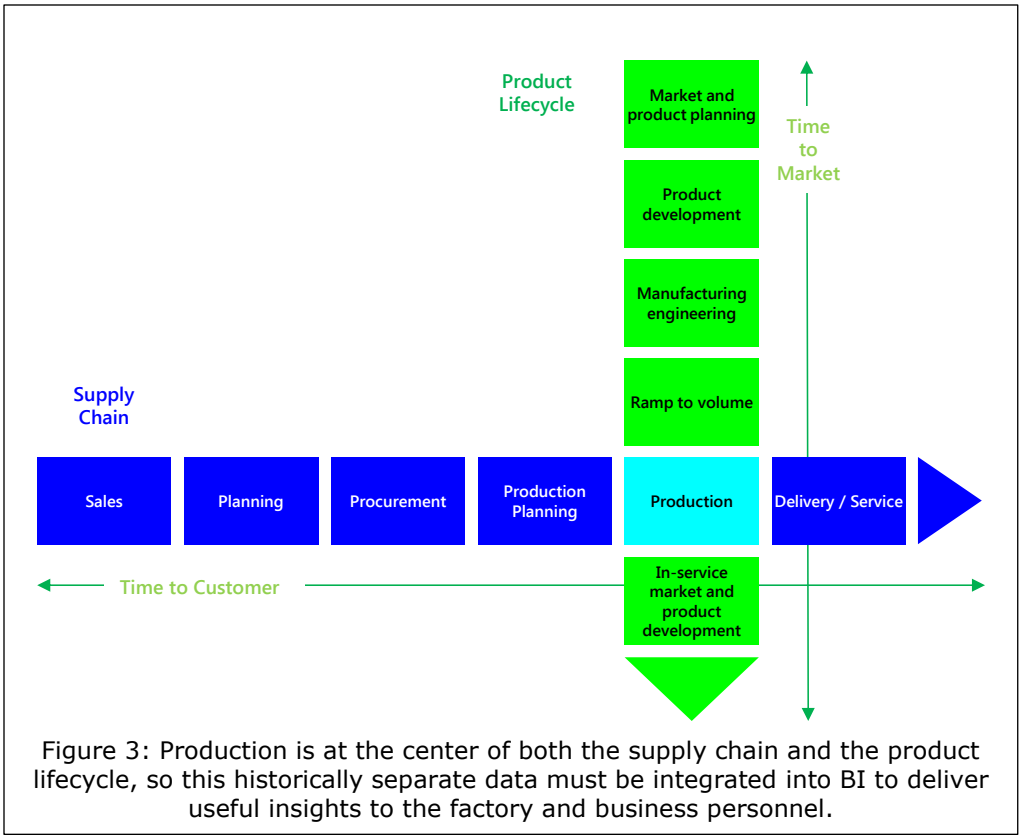


Figure 3: Production is at the center of both the supply chain and the product lifecycle, so this historically separate data must be integrated into BI to deliver useful insights to the factory and business personnel.

own data sets. These massive volumes of structured and unstructured data are challenging to use for decision making when processes and systems are designed for much simpler and more stable environments. With global operations and distribution, new data is coming in 24/7. Most companies are simply not capable or fully equipped to make good, data-supported decisions at this pace.

The production data issue is only growing. The urgency is greater and with the internet of things e.g., machine-to-machine data exchange, the volume is growing rapidly. Companies need to better manage, contextualize and translate factory floor data into business information. Systems must do this faster and in a more personalized way than ever in order to make it useful. Author and consultant Geoffrey Moore suggests moving beyond Systems of Record to add Systems of Engagement[4] that deliver a collaborative, interactive environment for discovery and insights.

Companies must transform data to information, analyze it to build intelligence, and convert that to insights that enable profitable action.

Companies must transform data to information, analyze it to build intelligence, and convert that to insights that enable profitable action. Some of the key requirements for this are:

- Transforming data into information requires incorporating multiple disparate yet related data sets into a single view of a particular activity or task.

[4] *Systems of Engagement and The Future of Enterprise IT: A Sea Change in Enterprise IT*, © 2011 AIIM, by Geoffrey Moore, Managing Director TCG Advisors

- Transforming information into intelligence requires analysis, often creating a trend or status against a performance measurement or metric.

- Creating a thorough understanding of the situation requires identifying the intersection of a part (or product), the material to build it, the individuals and other resources involved in that step in the process, and the time at which an event takes place in a near real-time view.

- Transforming intelligence into insight requires full business context from every site across the globe, allowing an employee to make a sound decision or collaborate with others to arrive at a good course of action.

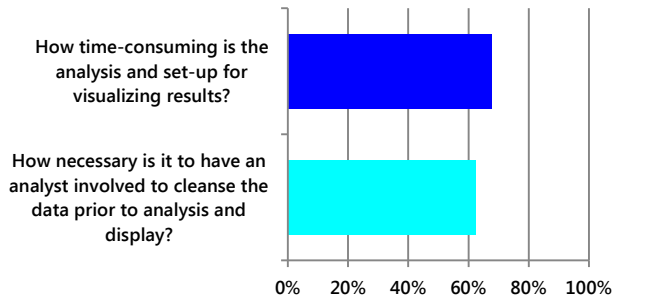
- Consistently taking action requires that business processes be managed to incorporate these decisions as the best course of action changes.

Most enterprise-scale manufacturers have an existing "baseline" of IT applications. The question is whether the employees involved can clearly see the best decision and take action.

This might all sound obvious, but each stage requires particular IT support as well as business processes that enable these transformations.

IT Foundations for Insights

For each of the blocks in Figure 3, the company needs at least one software application set with data flowing and strong business process support. Fortunately, most global manufacturers have these applications, including many modules of enterprise resource planning (ERP), supply chain management (SCM), product lifecycle management (PLM), customer relationship management (CRM), quality management (QMS) and manufacturing operations management or manufacturing execution systems (MOM/MES).



Source: *Pursuit of Performance Excellence* © 2012 MESA International and Cambashi Inc.

Figure 4: Most manufacturers have built-in delays in their data analysis processes.

Most companies use business intelligence (BI) against an array of applications data and unstructured data. An increasing number of companies have access to specialized manufacturing intelligence (MI). The question is whether the employees involved can clearly see the best decision and take action. Key IT foundations to deliver insights are:

Timeliness: Ad hoc decisions require immediate access to in-context intelligence. Does your plant data need to be cleansed and analyzed manually? Figure 4 shows that in the same MESA study, nearly two-thirds of respondents need an analyst to cleanse data, and

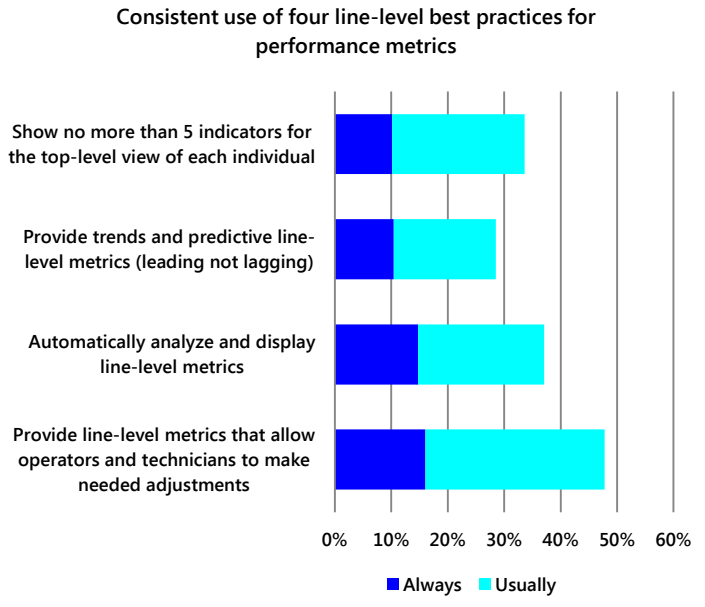
that they find it time consuming to prepare metrics data for display to employees. Are your processes fast enough for employees to make insightful decisions?

Consistency: The information must be predictable, trustworthy, and always have the same characteristics. Are your metrics and intelligence defined and calculated the same way across all locations or business units? A multi-site MI is a good approach.

Context availability: Is the manufacturing plant floor data flowing across sites and out to the greater BI system? Do the materials, engineering, manufacturing, metrics and demand data all come together "cleanly" to support actionable insights across the global enterprise? Is the historical data set complete for traceability and genealogy so out-of-conformance quality events can be contained quickly to minimize the cost of a potential recall?

Displays that empower employees: Most BI systems focus on mid-level decisions, but executives also need specific data presented in a user-friendly format. Also, commonly neglected are people in the plants where quick decisions are critical. For them, displays must be consistent, pre-calculated, predictive and simple. MESA specifies these four best practices for line-level metrics. As shown in Figure 5, most manufacturers do not consistently apply these.

Collaborative capabilities: For each situation, the right people to make decisions must easily collaborate, even if they are in different departments, sites, or partner companies. This means using consistent data with personalized views for each individual involved, available at any time and in any location, including leveraging mobile capabilities. Does your technology support horizontal operations where cross-functional performance metrics drive decisions?



Source: *Pursuit of Performance Excellence*

Figure 5: Most manufacturers do not regularly use best practices in displaying performance to plant employees.

Familiarity of system operation: Most people have personal technologies and will resist using systems that are unfamiliar. Do your systems use PCs and mobile devices as user interfaces?

Prediction: Ideally insights deliver ways to foresee not just current but future outcomes. Can you prevent future problems; e.g., quality misses, and ensure improvements can be sustained over the long haul?

Accessibility: The intelligence to support decisions must be available

anywhere, at any time, for individual use or collaboration. Is insight available 24/7 anywhere in the world, even to employees and partner personnel who are not at a workstation or company location?

Connection for action: In addition to delivering intelligence, systems must be integrated so that employees can transform their decisions quickly into directives for action elsewhere in the company or network.

To achieve the global, timely, complete situational insights these new business models require, companies must ensure focus on core IT capabilities. People need ready access to **big data** that is contextualized and consistently available on **mobile** devices, anywhere in the world, including via the **cloud.** Add a **social** component for improved collaboration and you can create a "new world order" to access intelligence and act on it.

The IT foundations for big data insights are timeliness, consistency, context availability, empowering displays, collaboration, familiarity, prediction, accessibility, and connection for action. With these plus mobile, cloud and social, you can create a "new world order" to access intelligence and act on it.

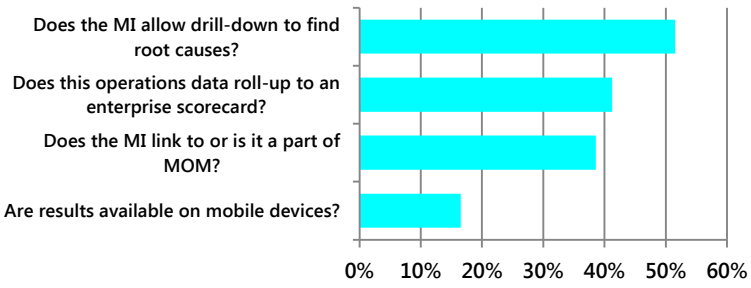
Manufacturing Intelligence: The Missing Link

Managing and converting big data into intelligence is typically the domain of BI systems. However, in the case of global manufacturing enterprises, traditional BI is often not sufficient. With the critical position of manufacturing operations and the real-time nature of decisions that plant personnel as well as manufacturing executives must perform, a category of application called manufacturing intelligence (MI) has been growing rapidly in use and importance. Figure 6 compares MI to BI to explain the difference.

BI and MI have quite a bit in common. Both pull data from various sources to transform it into information suitable for analysis to then gain intelligence to support business decisions. However, BI systems are not intended to handle real-time production data nor support managers and factory-based employees in making minute-to-minute decisions. Companies using MI are twice as likely as all others to deliver real-time metrics to operators, line workers, supervisors and executives managing operations for their scope of control, based on the findings in the *MESA Pursuit of Performance Excellence* study.

Characteristic	Business Intelligence (BI)	Manufacturing Intelligence (MI)
Timeframes	Days/weeks	Minutes/hours
Data sources	Enterprise-wide & network-wide	Plant-wide and multi-plant-wide
Data types	Relational + other	MES, Historian, relational + other
User profile	Data analyst, distribute to offices	Operator, planner, supervisor, manager
Functions	Aggregation, contextualization, analysis, correlation, visualization, propagation	
Applications	Reporting, actual-to-goal, forecasting, network track & trace	Plant metrics, line status, in-plant track & trace

Figure 6: MI has the same core functions as BI, but is different from traditional BI and complements it.



Source: *Pursuit of Performance Excellence*

Figure 7: The users of MI are not yet mature in making the information actionable and available to employees at both plant and enterprise level.

MI is a relatively young application, so companies are just learning how to use it effectively and incorporate it into enterprise information flows. Figure 7 shows that most companies using MI have drill-down capabilities to see root causes of problems or exceptions. However, fewer than half of these plant dashboards roll up to enterprise metrics or are an integral part of a plant-wide, enterprise MES/MOM. Currently, only 17% have MI available on mobile devices, limiting the situations in which employees and executives can gain insights to make timely, informed decisions.

Clearly, companies are painstakingly gathering and analyzing data, but not necessarily leveraging it to be available anytime, anywhere. Part of this shortfall is an inability to have ready access to the intelligence on mobile devices. Another factor is the challenge to obtain insights from MI that delivers multi-site or global intelligence to all situations that could benefit from this information, such as a comparison of performance across plants or continuous process improvement at a division or enterprise scope.

The Path to Actionable Insights

Software automation is the key to success for larger enterprises to achieve accurate, complete data, visibility in a timely fashion and enterprise-wide consistency. There are several aspects to this:

- **Automated data collection, MI and MOM systems in plants that serve them as well as feeding into the enterprise BI**
- **Data cleansing by a standardized enterprise-wide system that ensures each metric uses clean data without an army of analysts**
- **BI for the enterprise with seamless integration, broad visibility and user-driven views**
- **Social tools for collaboration among various stakeholders**
- **Delivery of visual, graphical and actionable insights to each group and individual 24/7 on demand from any device**
- **Business process IT support to help ensure people make decisions and take appropriate action quickly using best practice work flows**

A Joining of Forces: MI+BI

So how can the full array of employees and partners gain actionable insights on a regular basis? The short answer is: by ensuring that business and manufacturing information support and provide context for each other.

To gain the full advantage for a business, companies are integrating MI together with BI. This correlates real-time production data to shifting business realities and informs business

decisions about operations and actions. Thus, it yields far greater insights for more informed decision support.

This type of comprehensive intelligence system is a foundation for the Level 3 People-intensive Factory of the future, which IDC says leaders are using to deliver decision-making support. The challenge is often how to deliver it and keep it simple for each person's scope of control but make it consistently available so as to support intelligent business process improvement. What many companies now lack is sufficient automation of all their processes and infrastructure to support people where and when they need to collaborate, make decisions and take action. (See box: The Path to Actionable Insights.) Today's cloud technologies also mean that the new systems can often be implemented in a matter of weeks or days – and later updated without delay or major disruption.

Actionable Insights to Gain and Sustain Leadership

Sustaining a leadership position is an age-old problem. In the new era, the key is to ensure situational data quickly turns into information, then intelligence and then actionable insights. This means high-fidelity comprehensive information must be personalized and distributed to those in a position to confidently apply it. Results must be easy to build into daily work processes for the business' success. Without this, decisions cannot consistently lead to actions that deliver good business results.

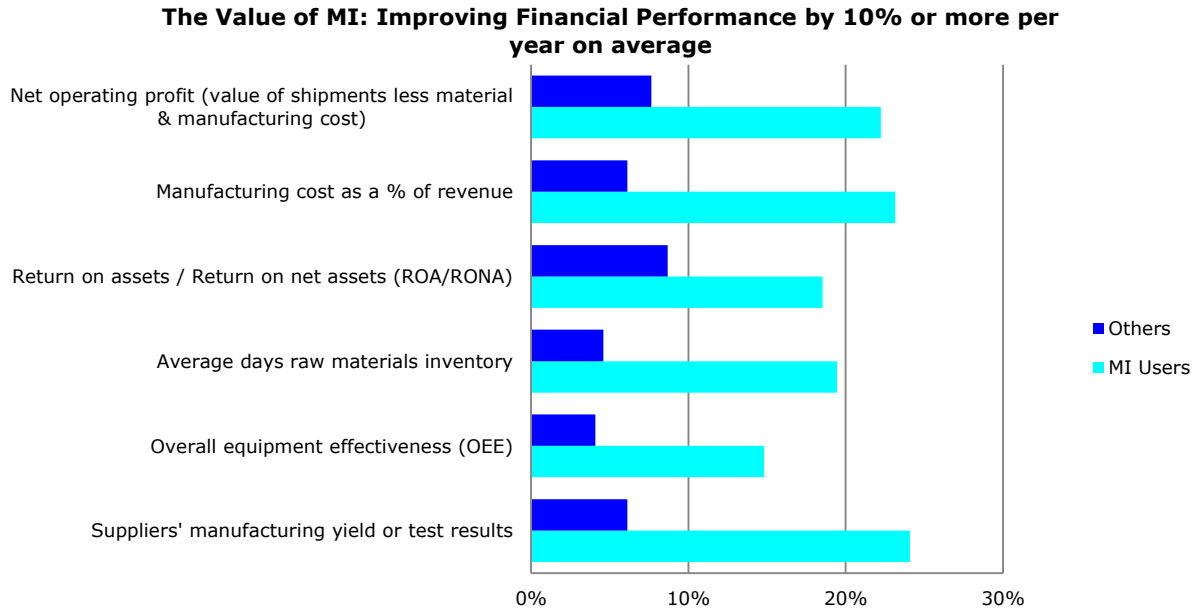
Sustaining a leadership position is an age-old problem. In the new era, the key is to ensure situational data quickly turns into information, then intelligence and then actionable insights.

MI can foster timely processes to collect, analyze and display data to operations staff, supervisors, and plant managers. Companies using MI are not only more likely to use best practices for line-level metrics, but also far more likely to improve operational and financial performance, as Figure 8 shows. These are examples of how companies using MI are better able to increase profits, returns, productivity and supplier quality while lowering costs. Clearly improved knowledge on manufacturing performance is highly correlated to greater financial performance.

Other business benefits also come from flowing MI information into the enterprise BI system. Adding context from the plant to enterprise decisions makes them more realistic, and conversely seeing enterprise context in production can be very powerful to ensure decisions align with strategy.

Examples where BI and MI can be combined for more robust decision-making capabilities include:

- Plant personnel deciding how to best cope with a materials shortage – Note that adding manufacturing operations systems into the mix allows this change to also be quickly distributed for action by employees throughout the plants



Source: *Pursuit of Performance Excellence* © 2012 MESA International and Cambashi Inc.

Figure 8: Manufacturers using MI are two to four times as likely as their peers to improve dramatically on both business and operational metrics.

- Enterprise executives making operational decisions about which product lines to emphasize based on total profitability
- Product design and innovation decisions based on issues in production and in suppliers' facilities such as suitability to run on current equipment
- Traceability of materials and containment of problems that could cause a customer problem or recall across the global enterprise and supply chain
- Sales or customer service promises order due dates and/or quantities based on actual capacity and progress of in-process work and orders
- Crafting a new production plan when disaster such as a hurricane or tsunami strikes a supplier's facility
- Reacting to unexpected demand patterns such as new products gaining traction in different markets or geographic regions than initially expected

Companies using MI are far more likely to improve operational and financial performance than others.

All of these cases can also benefit from running in the cloud to ensure worldwide access and consistency, mobility to reach people wherever they are, and social to allow collaboration and knowledge sharing. All of this can further improve productivity for big data analysis and timely decision making that is the core of intelligence and insights.

10 Ways to Engage in Better Decision Making

Every enterprise is at a different point in developing their process for converting data to information and leveraging intelligence to develop insights. Based on recent market studies, in person interviews and our perspectives of the industry, it is clear that significant opportunities await those who better align and integrate manufacturing and business intelligence systems. Those electing to make this investment will most likely be rewarded with improved operational and financial performance, allowing them to differentiate from competitors.

Significant opportunities await those who better align and integrate manufacturing and business intelligence systems.

Regardless of where you are in your company's evolution, here are ten ways to help achieve progress along your lifecycle and engage in better decision making:

1. Evaluate and renew your business processes holistically, on an end-to-end basis, so as to support more intelligent decisions and improvement

2. Automate data collection and cleansing through plants and enterprise

3. Implement global manufacturing intelligence, and consider implementing it as an embedded component of an enterprise MES or MOM

4. Expand your operations management capabilities to be more global in nature, to support process improvement and quick action across more functions and locations including partners and suppliers

5. Ask production & other line of business teams what decision support they most need to succeed, and then begin to add this capability to your existing MI / BI systems

6. Craft information flow so MI feeds "cleanly" and quickly into BI

7. Consider what self-service reporting capabilities you could provide directly to end users to empower them with better intelligence

8. Leverage mobility, social, and cloud technologies to make data capture and intelligence distribution more efficient

9. Create collaboration opportunities based on integrated MI/BI data

10. Renew business processes and support them with your software to fully leverage the power of business insights

Conclusion

Choose what is right for your enterprise, depending on where you are now and begin to move. Today's world and business strategies ensure more volatility and variety than ever before. Those who do not create a foundation for actionable insights will no longer be able to compete consistently. They will miss new opportunities for process improvement and productivity gains.

As leading manufacturers begin to run their business on actionable insights they are raising the bar with customers, shareholders and employees, creating a viable business strategy for sustained competitive advantage.

In contrast, those with granular, actionable insights into their current situation will be the winners. They will learn and benefit from these insights. As leading manufacturers begin to run their business on actionable insights they are raising the bar with customers, shareholders and employees, creating a viable business strategy for sustained competitive advantage.

The critical question to ask is, what path will you follow and what will be your next step?

About Iyno Advisors

Iyno Advisors is an independent advisor on how manufacturing and production companies can best benefit from software applications. Julie Fraser, the Principal, has over 25 years of experience and passion in driving healthy understanding of opportunities that can add to profitability and success. We are experienced enough to add significant value and insights to the projects we undertake. Contact Julie directly at +1 508-362-3480 Julie@iyno.com website and blog: www.iyno.com

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