Enterprise Manufacturing Intelligence Architectures Still a Work in Process

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Demand for manufacturing performance visibility and enterprise manufacturing intelligence (EMI) continues to grow, and vendors from all corners of the market have joined the fray. However, depending on where you sit within your organization, the phrase *enterprise manufacturing intelligence* evokes everything from production and asset performance indicators displayed as web parts in plant-level **Microsoft** SharePoint portals to higher level intelligence and integration frameworks like **SAP's** MII (formerly xMII).

Users get the highest returns from their EMI investments when they take an architectural approach that blends these very different applications to take full advantage of their respective strengths. As such, prospective users and implementation groups need to recognize that achieving manufacturing performance visibility isn't as simple as buying a one-size-fits-all software application, despite claims made by large software providers. Instead, users should focus on roles, use cases, and the design of an information architecture that can be tapped at multiple levels to serve up what's needed by the various consumers, in a form that's easily digestible and role appropriate. Today, there is no single vendor software application that satisfies these criteria.

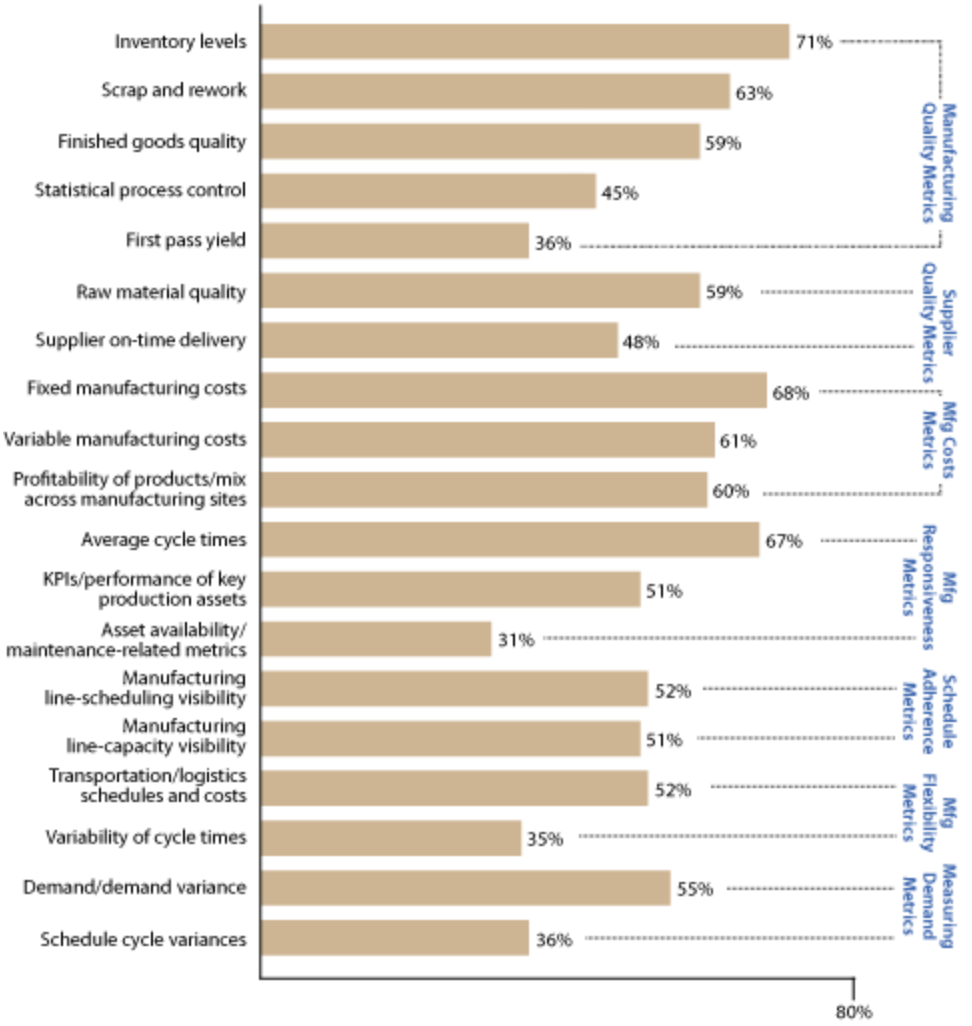
Today's EMI architectures are a work in process

We've been covering the evolving EMI arena in depth since 2003, and during that time have watched a variety of application providers come and go, as in **IndX's** early acquisition by **Siemens** and SAP's later acquisition of **Lighthammer** (now SAP's Manufacturing Intelligence and Integration). This early spate of acquisition activity led us to predict market consolidation, but we admit now that we jumped the gun. Recent research as well as interviews with EMI vendors and their manufacturing users for our upcoming Report on the operations intelligence landscape indicate a market that is still in its early stages. Why has this market been so slow to evolve?

Performance measurement strategies are still in their early stages

Most manufacturers are still grappling with how to align plant-floor performance measures (often expressed in terms of feeds, speeds, and overall equipment efficiency) with corporate measures like return on capital expenditures, working capital, profitable revenue, EBITDA, or more granular measures like profitability by SKU. A mid-2006 AMR Research study into manufacturing metrics revealed that of the 19 metrics studied (see Figure 1), respondents generally employed only a subset (roughly nine), and the specific subset utilized varied widely by company with no correlation to industry vertical served.

Figure 1: Many metrics, but few in common between organizations



Q: Which of the following manufacturing metrics do you track today in your manufacturing operations?

Percentage of responses, n=100

Download Larger Version *Source: AMR Research, 2008*

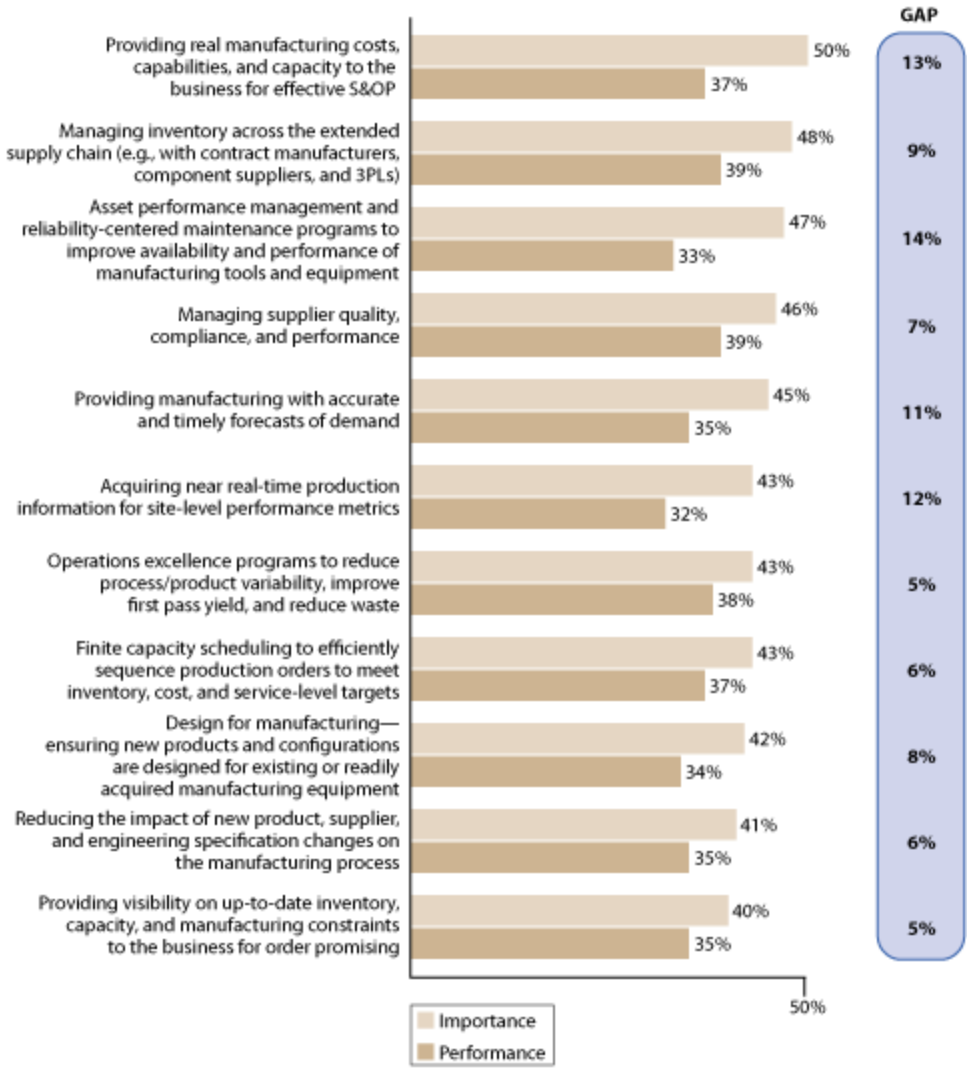
In other words, there was little agreement within our survey group about which set of metrics made up a best practice. Current research coupled with the increasing number of inquiries we field regarding what constitutes industry best practice for manufacturing to enterprise—or supply chain metrics hierarchy definition—leads us to conclude that best practices are just now beginning to take shape, and will likely be influenced more by business strategy and organizational maturity than other factors.

Manufacturing IT infrastructure basics are weak

Organizations that have started down the manufacturing performance measurement path have encountered the data availability stumbling block. They've identified the measures they'd like to employ. Yet capturing the foundational data that's needed to get to the next step has required catch-up investments in plant-level IT fundamentals like historians, SCADA systems, SQL databases, and even in basic data collection strategies to automate and error-proof the capture of basic production data related to inventory levels, material movements, parts produced, and parts scrapped, just to cite a few examples.

Our 2007-2008 manufacturing operations spending survey highlighted this weakness in fundamentals, as "acquiring near real-time production information for site-level performance metrics" was perceived by survey participants as a significant capability gap.

Figure 2: Users recognize data acquisition fundamentals are weak



For importance: Top 2 scores based on 9 and 10 ratings on a 1 to 10 scale (1=not important and 10=extremely important)

For performance: Top 2 scores based on 9 and 10 ratings on a 1 to 10 scale (1=not important and 10=extremely important)

Percentage of respondents, n=197

Download Larger Version *Source: AMR Research, 2008*

The plants say "show me the money"

Plant-level business owners need to see tangible and significant ROI before enthusiastically devoting resources to IT projects whose effect on the plant P&L may not be clear. As a consequence, the entire organization may agree in principle that IT investments designed to link plant-level performance to supply chain benefits are desirable, but the plants still need to build a compelling business case.

As such, many site-level organizations invest in highly targeted performance monitoring projects as a low-risk way to size up ROI potential before they commit to the risk of more sweeping approaches. The good news is that, almost without exception, the ROI from these projects is so significant that follow-on projects meet much less resistance. The manufacturing organizations we've interviewed generally find that tactical EMI projects, like packaging line OEE, pay for themselves in a matter of months on improvements in asset reliability and utilization alone. Manufacturers that have taken this walk-before-you-run approach are now folding these initial investments into larger intelligence architectures.

Tactical EMI applications are alive and well, and they have a role to play in strategic intelligence architectures

Despite SAP's highly visible and successful foray into the space with MII, MII still relies on other applications to

provide manufacturing data and intelligence. We've written about this in the past (see "Architecting the Next Generation of EMI: Operations Intelligence Meets Business Intelligence"), and our initial analysis has not changed. MII is not a substitute for an operational data store or a historian, as it does not provide a manufacturing data model or the tools for manufacturing master data management. Without a repository to persist the data you're interested in, you can visualize ephemeral data in a dashboard, but have no basis for analytics, root-cause analysis, or discovery techniques like ad hoc correlative analysis and inferential model development.

This gap leaves plenty of runway for other participants, many of which are ideal partners in architectures that utilize MII for broad visibility and orchestration, yet rely on local intelligence applications that are better aligned with the specific manufacturing styles, assets, and information requirements of the plant. This is especially true in high-speed environments where operators rely on real-time machine performance data and live visualization to understand how their assets and processes are behaving against targets.

We've suggested a variety of additions to MII's intelligence ecosystem in the past, and continue to advise users to look to providers like **Aegis Analytical** (in life sciences) **Citect** (part of **Schneider**), **Incuity**, **Informance**, **Parsec**, **Pavilion** (part of **Rockwell**), and **Zarpac**, among others. These providers can help enhance the value of existing investments in MII, particularly when plant processes demand the analysis of high-speed, high-fidelity data or industry-specific visualizations, or where ad hoc data analysis capabilities are needed to discover performance relationships (see "SAP Plus Lighthammer Equals xMII"). Over time, even **Oracle** may become such a partner. We'll be examining specific use cases and best-fit scenarios based on vendor capabilities and user experiences in the aforementioned Report.

When it comes to the architecture, take a page from the enterprise playbook

If you're new to manufacturing, you may just be coming to grips with the reality that the manufacturing landscape is just as complex in its own right as the enterprise applications arena. That said, plant-focused IT organizations can always to look to their enterprise counterparts for examples of how to efficiently harmonize multiple data stores and sources. At the enterprise level, operational data stores, specialized analytics databases, datamarts, and portal frameworks are standard fare when it comes to visibility and analysis of data from disparate applications. Look for ways to mirror these architectural elements within the manufacturing environment.

We advise organizations dealing with complex manufacturing environments, either in terms of number and variety of data sources, manufacturing styles (blending, filling, and packaging under one roof), or legacy application landscape, to seek inspiration from the well-worn information management constructs that are employed at the enterprise level to deal with cross-application harmonization and normalization. Layered data architectures, service oriented or not, provide an excellent vehicle for managing in-plant and cross-plant complexity because they allow for abstraction, normalization, and extraction of pertinent information needed by business level systems.

This approach, which may include plant-level operational data stores, datamarts, and analytics databases, also serves to insulate runtime operational systems (in high data volume, high-performance environments) from the performance penalties associated with analytical data-crunching activities. We see an increasing number of manufacturing organizations implement plant-level operational data stores or warehouses (some use historians, others use relational databases) specifically to address the normalization and analytics issue. For SAP MII users, this also offers a handy solution to the data store gap we mentioned earlier.

In the final analysis, it's often more expedient to install an abstraction layer built on a plant-level data store than to reengineer the plethora of existing applications to achieve normalization. We see this approach rapidly emerging as a best practice among our base of manufacturing clients, and expect to see a similar approach adopted for manufacturing master data management.

Data model, data model, who's got the data model?

At the moment, the playing field is wide open for pure-play software providers with specialized intelligence capabilities to make valuable contributions to emerging manufacturing intelligence architectures, regardless of who provides the platform and framework.

Microsoft is the dominant platform in manufacturing. EMI approaches that take advantage of Microsoft's increasingly sophisticated set of analytics, workflow, and visualization capabilities—either by proxy through an ISV-provided application, or through homegrown approaches that use Microsoft's capabilities in their raw form—offer cost-conscious plants the ability to model enterprise-style architectures at plant-level prices.

But let's not forget the Oracle factor. While SAP has captured tremendous marketing mindshare with MII, it's a dead heat between Microsoft and Oracle when it comes to plant-level databases. And, since data model design and architecture is at the heart of the EMI matter, let's take a look at what Oracle brings to the table.

Oracle is well positioned to cash in on its database acumen and enterprise experience to create its own version of a manufacturing intelligence platform. In fact, between Oracle's Daily Business Intelligence, Sensor Edge Server (a souped-up OPC Server with data caching capabilities), Oracle Business Intelligence Enterprise Edition (OBIEE), and Fusion SOA middleware components, Oracle already possesses the ingredients needed to bring a comprehensive EMI framework to the plants, whether the enterprise is running Oracle applications or not.

We also hinted in "Market Outlook: Manufacturing Master Data Management—The Time Is Now" that these same data management strengths make Oracle an obvious contender in advanced manufacturing master data management architectures. Can a plant-level Asset Hub for equipment master data be far behind? We'll discuss the merits of this idea in future installments on the topic of manufacturing master data.

Positioning the vendors: look for our upcoming Report

Our upcoming Report positions these vendors and more against an expanded set of criteria we've identified for operations intelligence, a next generation of EMI that's matured to include sophisticated discovery, ad hoc analysis, simulation, and modeling capabilities. In short, it's an evolution of EMI that brings it one step closer to traditional enterprise-level business intelligence applications.

We've already hinted that no one vendor does it all, but users will find the positioning graphics in the Report a useful tool for identifying capability gaps and the various combinations of applications that can be woven together to provide complete coverage.

In the meantime, we always welcome your thoughts and comments. Send us an e-mail at sno@amrresearch.com, or contact me directly at asmith@amrresearch.com.

Related research

- "Manufacturing 2.0: Defining Next-Generation Manufacturing"
- "Integrating EMI With ERP: A Tale of Two Vendor Strategies"