

TREND REPORT

Market Overview: Manufacturing Execution Systems

More Options Emerge To Support Global Deployments

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Summary

Manufacturing process and applications professionals often see their choice of available manufacturing execution system (MES) software whittled down by specific vertical orientations, as vendors have historically focused on plant-specific challenges. However, large manufacturers are increasingly seeking the benefits from multisite standardization — a longtime MES challenge now made manageable by several key technology enablers. Recognizing the demand to globally standardize MES processes and applications across sites, MES vendors are repositioning their offerings along one of two viable strategies: flexible, horizontally robust solutions or vertically tailored solutions. Meanwhile, emerging enterprise manufacturing intelligence (EMI) players offer a lower-cost alternative for dashboard visibility. Business process and applications professionals seeking to deploy MES globally must take a firm stand on big decisions like architecture and process governance to make such a large-scale initiative a success.

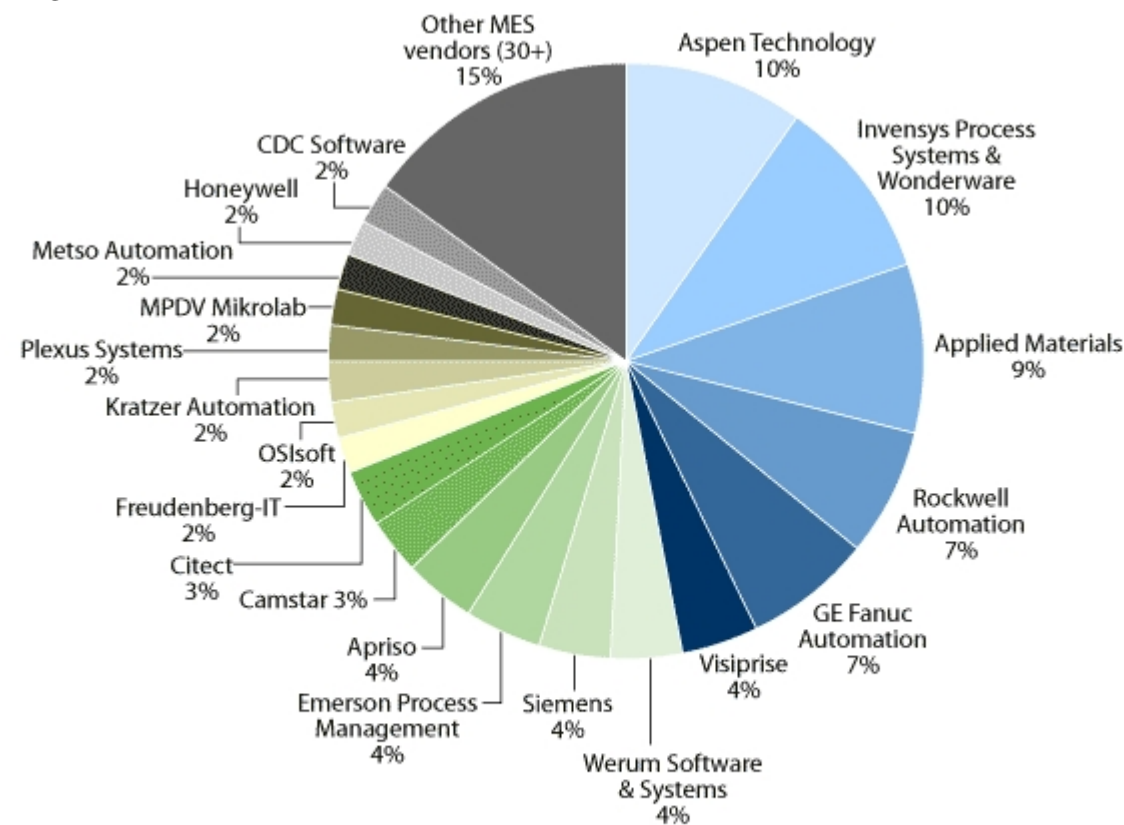
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SINGLE-PLANT DEPLOYMENTS FOSTER A HISTORICALLY FRAGMENTED MARKET

Starting in the late 1990s, manufacturing process and applications professionals have sought out manufacturing execution systems (MES) to bridge the management gap between transaction-oriented business systems and real-time production operation decisions. (see endnote 1) Recognizing the challenge of fitting shop-floor execution software within the unique operating characteristics of a given plant, MES vendors have delivered solutions that integrate to specialized automation systems and support specific production process types. This focus has resulted in a fragmented market full of specialist vendors (see Figure 1). In fact, nearly half of the existing MES vendors support three industries or fewer (see Figure 2). The combination of specialized requirements and limited support has left manufacturers with limited options to choose from, which has led many to pursue custom development as a de facto MES approach. (see endnote 2)

Figure 1: The Market for MES Software Remains Highly Fragmented

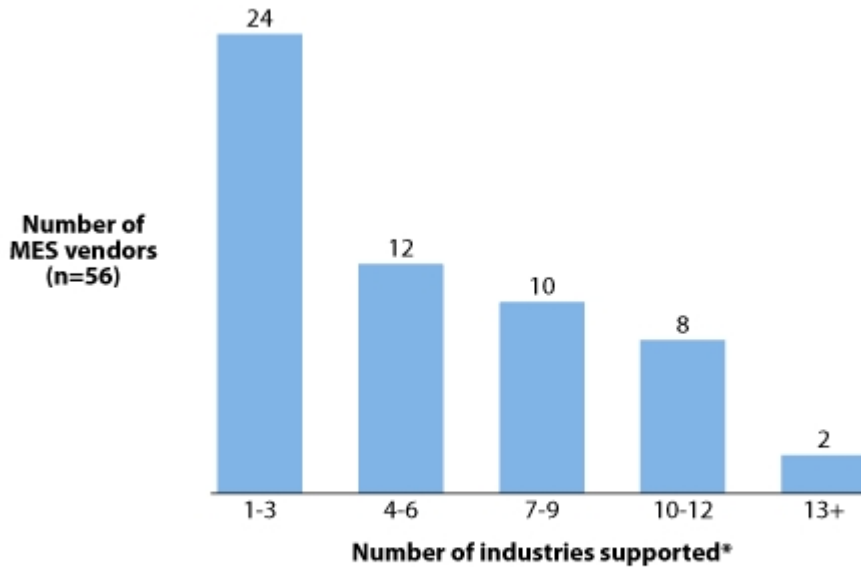


Note: All percentages are based on US\$ million revenue figures and are Forrester estimates. Revenue figures were obtained from company reports, Hoover's, and Forrester estimates.

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Source: Forrester Research, Inc.

Figure 2: MES Vendors Maintain Strong Industry Alignments



*Industries categorized as automotive, aerospace and defense, chemicals, CPG, electronics, food and beverage, industrial equipment, metals, mining, paper and pulp, petrochemicals, pharmaceuticals, semiconductor, and utilities and public sectors.

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Source: Forrester Research, Inc.

PLANT STANDARDIZATION AND TECHNOLOGY ENABLERS FUEL GLOBAL MES

Today, large manufacturers are increasingly recognizing the benefits of standardizing production process globally. Meanwhile, several key technology enablers have lowered the longstanding hurdles of multisite deployments — creating a sound environment for global MES.

Plant Standardization Emerges As A Business Imperative

Leading manufacturers like Intel have pursued and proven the value of running multiple sites identically to a lead or standard plant. (see endnote 3) While the value and rationale for standardizing production processes will always vary by industry and individual operations, today's manufacturing firms face a number of drivers propelling this approach as a "must-do": (see endnote 4)

- **Excess inventory and capacity costs persist.** Despite significant investments in ERP and SCM applications, most manufacturers still struggle to respond to sudden changes in demand without burdensome inventories. Process standardization helps manufacturers globally identify and pool individual plant capacities into a

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"virtual factory," providing more strategic flexibility to demand changes as well as higher capacity utilization rates.

- **Efficiency improvements must be scaled.** In heavily automated industries like chemicals and petrochemicals, equipment-based improvements can only be replicated out to multiple sites with a standard set of process parameters and equipment types. In worker-based environments, production best practices can remain isolated unless common terms, methods, and sources of data are available to provide context and allow improvement opportunities to be exchanged across sites.
- **Compliance mandates dictate common procedures.** Regulatory audiences favor the global standardization of mission-critical quality processes such as hazard analysis and critical control points (HACCP), corrective and preventative action (CAPA), and traceability records. To control these shop-floor processes globally and protect company brands from brand-tarnishing recall events, manufacturers of automobiles, foods and beverages, pharmaceuticals, and other consumer products need an efficient way to replicate approved quality procedures across entire plant networks. (see endnote 5)
- **IT maintenance costs proliferate with disparate systems.** CIOs know that each separate manufacturing application or instance demands more customized interfaces and costly support resources. For example, a manufacturer with 20 production sites may need at least 40 interfaces between MES and ERP components. If each is individually programmed and maintained at an estimated cost of \$20,000 annually, the total costs over a five-year period can climb to about \$4 million. (see endnote 6)

Technology Advances Offer Better Support For Multisite MES Deployments

As pressures to standardize increase, MES vendors are delivering more and more capabilities that support a global MES blueprint across multiple production sites:

- **Automation code is more accessible.** Many controls vendors have increasingly standardized their products around the object-oriented OPC specification, making integration more cost-effective and allowing IT to more easily abstract equipment-specific parameters into the MES layer. Additionally, vendors like GE Fanuc are working to deliver smarter MES logic with rules to contextualize technical PLC

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events in terms of common business processes like serial number control, quality specifications, and downtime analysis.

- **Code versions can be controlled across decentralized architecture.** With dedicated servers and application instances often located at each site, vendors like Apriso now offer global versioning functionality that allows testing and rollout of new functionality to be coordinated at different sites at different times.
- **Dashboards aggregate disparate data sources.** Where production line data was once limited to isolated historian databases, data integration and analysis functionality now allows everyone from COO to operator to view a common history of production orders, inventory, and equipment across multiple production lines and plants. For example, Cabot leveraged AspenTech's InfoPlus.21 solution to create a universal data access point across its 40 carbon black plants to enable setting and tracking singularly defined KPIs on product quality and variability. (see endnote 7)
- **Shop-floor apps can be delivered centrally as a single instance.** While system interruption concerns have historically kept centralized deployments out of favor, improvements in network and server reliability have enabled companies like GE Health Care to deploy one instance of Rockwell Automation's FactoryTalk software across 20 sites and 1,400 clients running on a single cluster of centralized servers. (see endnote 8)
- **Hosted deployments lower upfront capital requirements.** CFOs can balk at large capital outlay for enterprise software that doesn't translate to ROI. But SaaS vendors like Plexus Systems are helping clients overcome this challenge by offering MES functionality as a subscription service over the Web.

TODAY'S MES VENDORS OFFER MORE OPTIONS FOR GLOBAL DEPLOYMENTS

Recognizing the demand to standardize processes and visibility across a network of plants, MES vendors are repositioning their offerings while emerging manufacturing intelligence players offer a lower-cost alternative for dashboard reporting.

MES Vendors Align By Flexible Or Specialized Development Strategies

The trend toward global MES deployments — and the reality of aligning to varying site requirements across the plant network — has generated new positioning among the major MES vendors to support products that offer either (see Figure 3):

- **Flexible, horizontally robust solutions.** Large automation vendors like GE Fanuc, Rockwell Automation, and Siemens are working to blend configurable components with libraries of standard functions to allow their software to be adaptive to a wider range of production modes — thereby being flexible to both plant-by-plant differences and a broader range of new growth industries (see Figure 4).
- **Specialized, vertically tailored solutions.** Conversely, pure-play vendors like Visiprise and Werum have tailored their out-of-the-box software and database structures to offer deep support for specialized industry functions so that any given plant will be able to deploy required items off the solution menu. Although SAP has announced its intent to acquire Visiprise, the other large specialist players will continue to bolster select vertical spaces (as well as their candidacy for acquisition) while smaller vendors with limited resources will rally around second-order industry subsectors — like brewing or dairy within food and beverage — in an effort to differentiate. (see endnote 9)

Figure 3: Leading MES Vendors Face Flexibility Versus Specialization Tradeoff

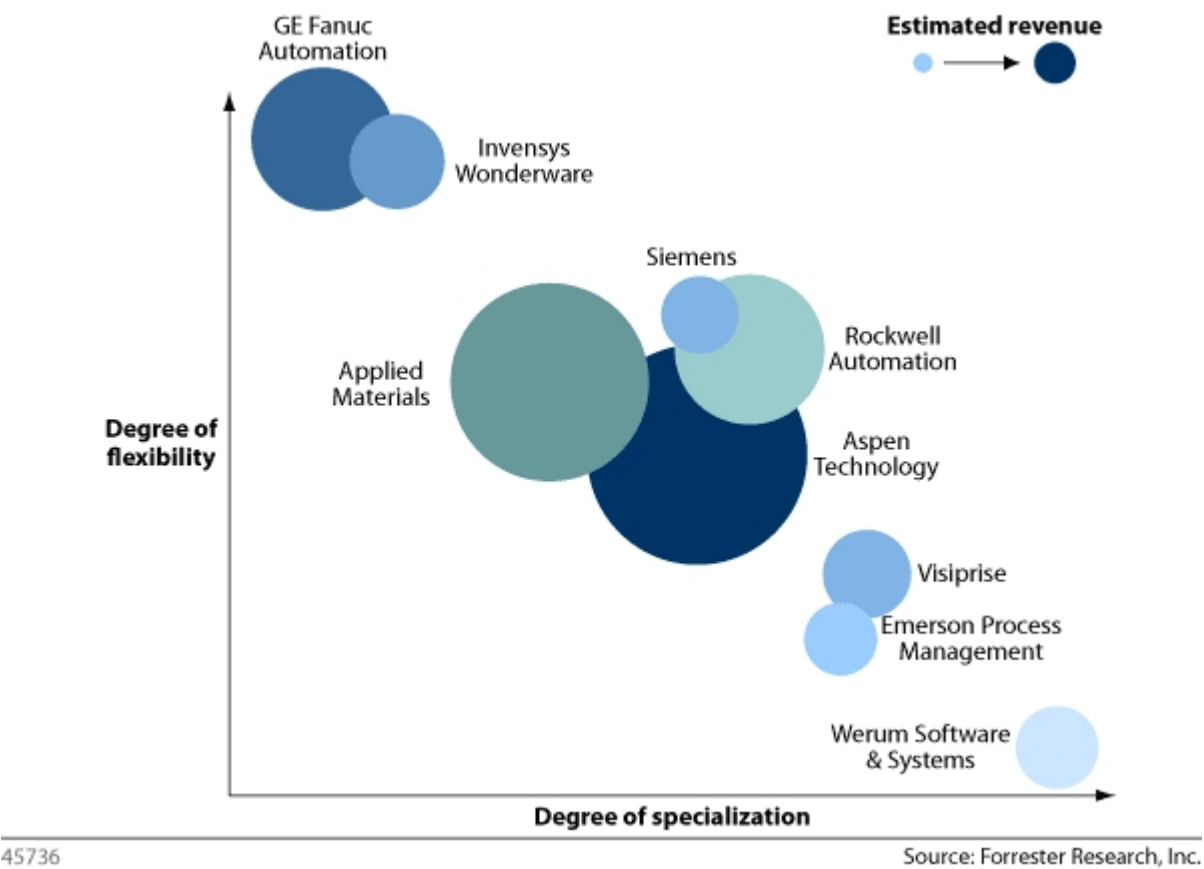
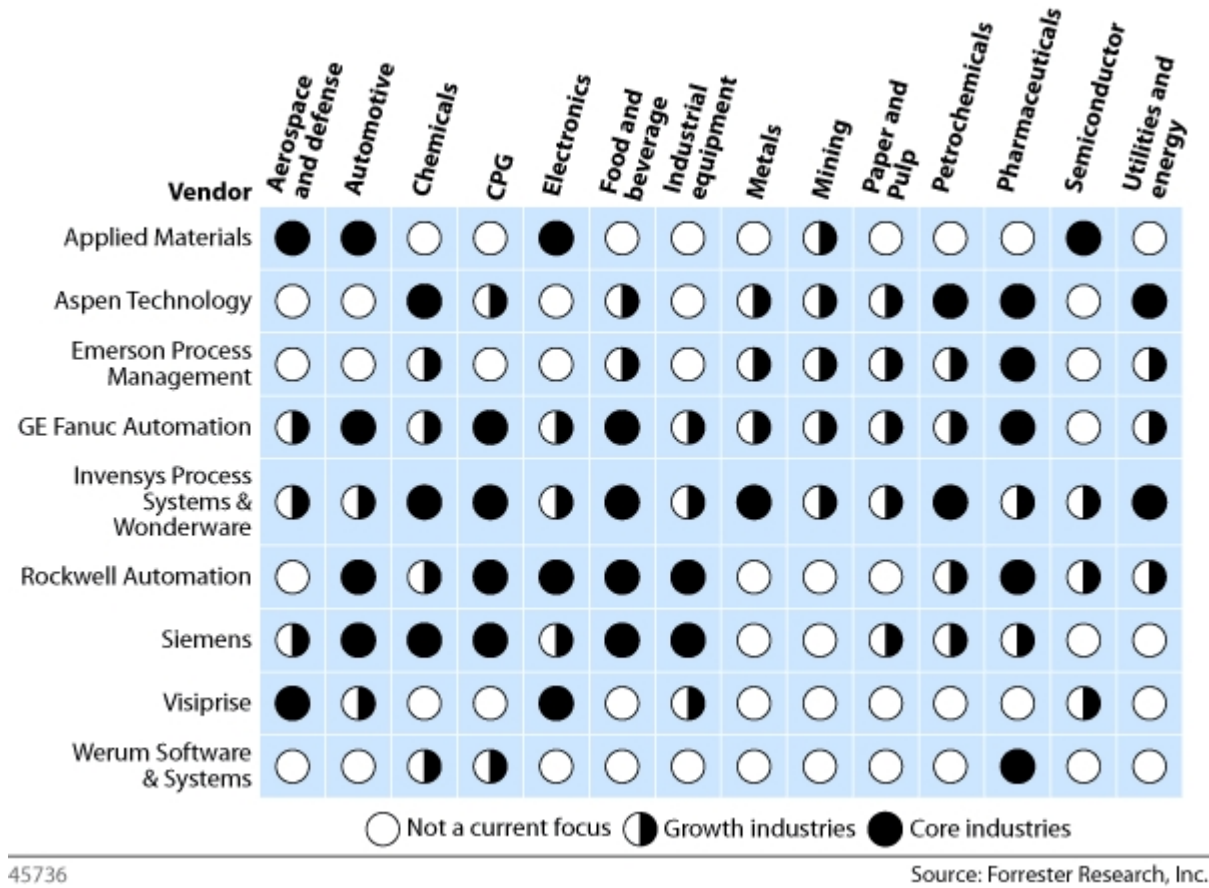


Figure 4: Leading MES Vendors Seek Horizontal Growth



Manufacturing Intelligence Software Emerges As a Lower-Cost Alternative For Reporting

With global MES implementation costs and timelines approaching those of enterprise ERP programs, enterprise manufacturing intelligence (EMI) vendors have emerged as a relatively low-cost way of aggregating and contextualizing shop-floor information for management. For example, shops running SAP's ERP applications are increasingly evaluating the business case for deploying SAP's MII integration tool kit to get the dashboard views they're seeking without the full deployment of MES production management functionality. And niche vendors like Aegis Analytical are seeing record revenue growth from helping life science companies apply best practice analytics to consolidated data sets that were previously trapped in disparate data sources. But while EMI solutions provide a no-frills means to create quick, centralized views on manufacturing performance, companies must also account for the necessary corrective processes and mechanisms to close the improvement loop. As one contrarian says, "What's the good of a dashboard without a brake pedal or accelerator?"

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RECOMMENDATIONS

initiate program structures to make global mes a success

Business process and applications professionals seeking to globally deploy MES — regardless of the horizontal flexibility or vertical specialization of their software — need to account for the significant additional program structures necessary to make such a large-scale initiative a success.

- **Consider a centralized architecture (carefully).** CIOs seeking to cut the maintenance costs supporting a decentralized custom MES environment may be tempted to immediately standardize on a single instance. Before committing to that vision, make sure that reliability concerns and communication delays can be addressed — possibly by locating smaller backup servers at each site.
- **Invest the upfront time to blueprint a realistic model.** Unlike ERP initiatives, blueprinting MES requirements demands enormous attention to detail on the day-to-day activities in the plant. Be prepared to have process owners and SIs spend considerable time at each site to make sure the planned functionality meshes with operational reality.
- **Plan for strong ongoing process governance.** The technical challenges of global deployments are minor compared with the process challenges. Make plans to have a strong joint-control board comprised of the VP of manufacturing, the VP of engineering and their IT counterparts in place after go-live to broker change requests across sites and resolve the "my problem is a problem for entire team" reality.

WHAT IT MEANS

mes adoption correlates with erp maturity

In researching the regional differences in the MES market, we found that ERP maturity is the single biggest factor in predicting MES adoption. MES investment will continue to be hot in Europe, but look to the American and Japanese markets to heat up as hotbeds of global MES deployments and/or overhauls in the next two to four years. Developing countries in Asia will lag several years behind.

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SUPPLEMENTAL MATERIAL

Companies Interviewed For This Document

- Apriso Corporation
- Aspen Technology
- CapGemini
- CDC Software
- EDS
- GE Fanuc Automation
- HighJump Software
- Infosys
- Logica
- Plexus Systems
- Rockwell Automation
- SAP
- Siemens

Related Research Documents

- [Forrester TechRadar™: The Extended Supply Chain Application Ecosystem, Q2 2008](#)

- [Quality Management Solutions For Manufacturers: Some Assembly Required](#)
- [People-Centric Applications Support Lean](#)

Endnotes

1. The Manufacturing Execution Solutions Association (MESA) defines MES as "Manufacturing Execution Systems (MES) deliver information providing visibility over production activities from order entry to finished goods. Using current and accurate data, MES guides, initiates, responds to, and reports on plant activities as they occur." Source: <http://www.mesa.org/>
2. Many MES vendors we interviewed cited replacing custom MES systems — and thereby lowering the development and maintenance burden on IT — as the primary driver of new business.
3. By "copying exactly" everything from process parameters, equipment sets, and maintenance routines to even training and documentation, Intel is able to dramatically accelerate its device yield performance during process technology transfer from development fabs to full-scaled production fabs.
4. Factors suggesting more plant autonomy include localized product requirements, stability of the process technology (e.g., do new technologies continuously evolve or "leapfrog"), relative levels of market demand, and the diversity of labor-based versus automation-based production modes.
5. A series of high-visibility quality problems, such as Mattel's recall of 9 million Chinese-made toys because of lead paint and tiny magnets that could be swallowed, have raised the importance of process control and traceability. See the November 8, 2007, "[Quality Management Solutions For Manufacturers: Some Assembly Required](#)" report.
6. Programming and maintenance for ERP interfaces have been estimated to cost around \$20,000 per interface point. Source: ABB ECS Enterprise Connectivity Solution (<http://www.abb.com/product/ap/seitp334/515188b3d7838ebcc12572bb003d5e11.aspx>).

7. Singularly defining metrics like off quality and product variability percentage also avoids bias and confusion across the organization. Source: Jeff Branfield, Doug Oliveira, Anthony Phillips, "Building an Integrated MES Architecture Using IP21 as a Foundation," ATIMUS User Conference Houston, Texas, April 8, 2008.
8. Single-instance deployments can also help reduce application deployment times — provided the model is robust to a variety of plant-specific requirements.
9. SAP's announcement about its intended acquisition of Visiprise occurred during the final editing stages of this document; Forrester plans to directly address what this acquisition means to users in a subsequent piece of research.



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