

CRAFTING AN ADAPTIVE ECOSYSTEM

Linking the shop floor, the supply chain, external partners and the executive suite is a core discipline.

Surviving, and even thriving, as a manufacturer has never been more of a challenge. Competitive pressures abound, while the forces of globalization wreak havoc on manufacturing planning and execution. Time-to-market windows are shrinking, regulatory requirements are growing and the ability to maximize asset and workforce utilization and effectiveness continues to be a growing burden. Meanwhile, a highly-efficient supply chain – from raw materials to finished goods – has never been more essential and never more elusive for a majority of manufacturers across a wide range of industries.

While the problems besetting manufacturing may seem daunting, a growing number of manufacturers are rising to the challenge with a combination of new software, new technology and new business processes. These leading-edge companies, in industries as diverse as electricity generation, dairy products and consumer products, among others, are discovering and implementing a next generation of solutions that help them not only meet their competitive challenges, but plan and execute for new markets and new customers.

Central to many of these companies' renewed focus on success are offerings from enterprise software market leader SAP, and its partners, that provide support for what SAP terms "adaptive manufacturing." SAP's definition of adaptive manufacturing is straightforward: "The ability to profitably replenish the supply chain while dynamically responding to unpredictable change." This leads, SAP maintains, to the ability to "run manufacturing at the speed of business and deliver superior performance through higher visibility and responsiveness."

Behind these concepts is a wide range of applications, technologies and business processes that together enable manufacturers to both survive and thrive. Central to SAP's view of adaptive manufacturing is visibility and responsiveness and a direct and powerful linkage between the manufacturing shop floor, the supply chain, external partners and the executive suite. Adaptive manufacturing is also highly focused on enabling and supporting business processes that operate in real time, and in optimizing these processes to the mutual benefit of all stakeholders. The result is that adaptive manufacturing can be applied to a broad range of manufacturing companies and yield an equally broad range of results, from better resource allocation to improved shop floor yields to a more productive workforce. And adaptive manufacturing allows companies to set goals and milestones based on an accurate, real-time and comprehensive view of the plant floor and its interactions with the supply chain, and then execute, modify and rework those goals and milestones in response to rapidly changing market dynamics.

The issues that are driving the adoption of adaptive manufac-

turing are familiar to manufacturers everywhere. The main, overarching issue revolves around meeting the challenge of competition and enabling a company to plan for and execute a strategy for meeting customer needs, growing corporate revenues and succeeding in new markets.

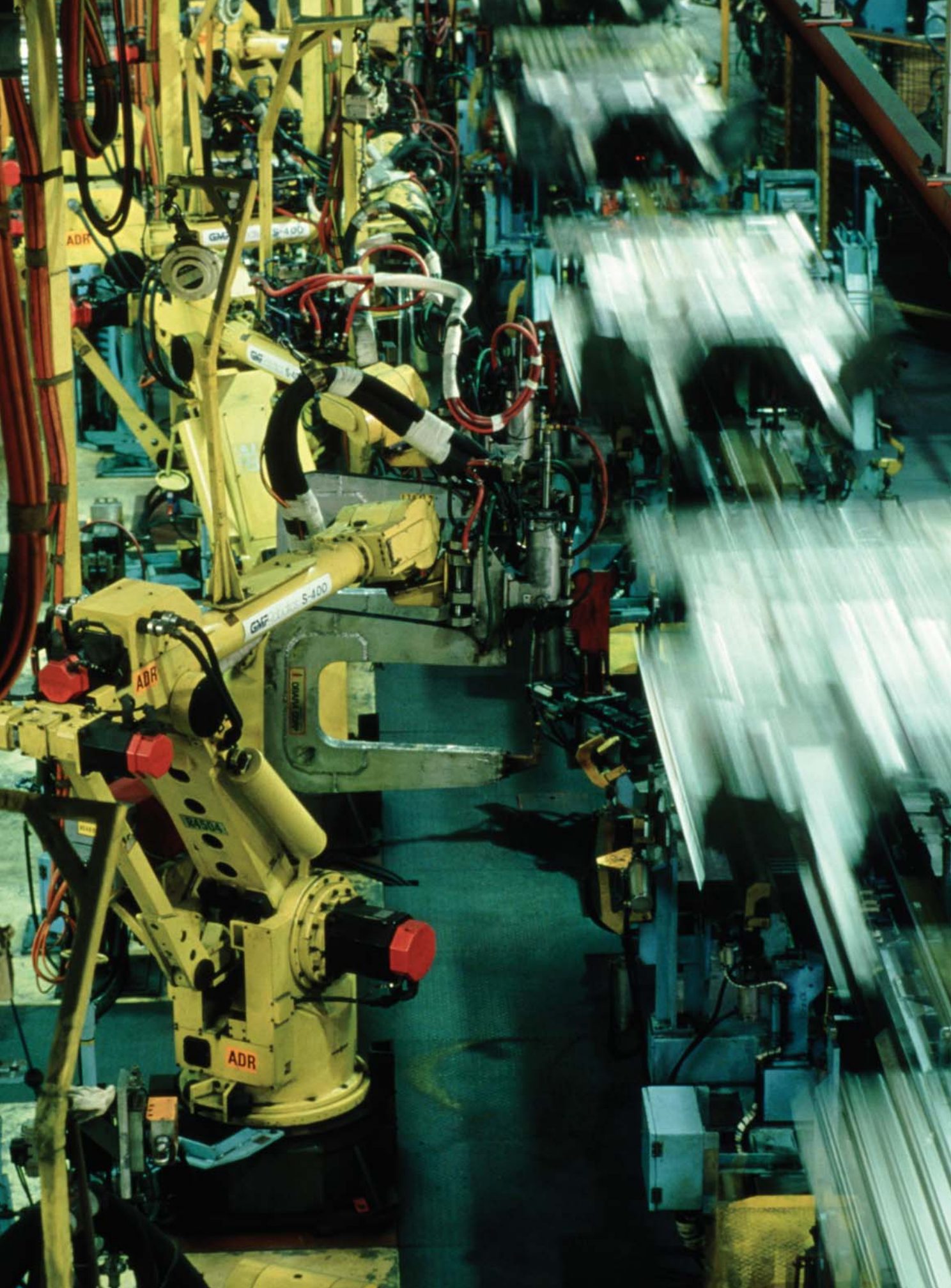
Beneath these macro-issues lies a particular set of challenges that is peculiar to manufacturing in the 21st century. Primary among them is the need to improve the overall information architecture so that information, and processes, can effectively flow between the manufacturing shop floor and the rest of the enterprise. While the shop floor and the back office have been well-automated by manufacturing execution systems and/or shop floor automation systems and enterprise resource planning systems, respectively, there has been little progress toward integrating these two domains. The result is that information and process flow between the shop floor and the rest of the enterprise is inadequate and represents a huge untapped potential for efficiency and effectiveness. Tapping that potential, and leveraging it for efficiency and profitability while responding to unpredictable change, is the hallmark of the adaptive manufacturer.

The Need for Supply Chain Coordination

This lack of integration and coordination between the shop floor and the rest of the enterprise is mirrored in a relative lack of coordination and collaboration between the different stakeholders in the overall manufacturing supply chain. Those stakeholders can be internal employees – machine operators, plant or production managers, and executives, for example – or they can be suppliers in an extended supply chain. The ability to empower plant floor personnel is a particularly important aspect of adaptive manufacturing: by providing these employees with a host of business intelligence, analytics, and exception management functions, adaptive manufacturers are able to further enhance their productivity and the efficiency of the entire supply chain.

Building in closer collaboration and cooperation enables another key capability of the adaptive manufacturer: the ability to respond dynamically to rapid changes in demand and supply. When the lines of communication and collaboration are well-established and well-supported, the ability to manage according to current demand, and real-time exceptions or changes in that demand or supply, can have extraordinary benefits to all members of the supply chain, including customers.

The ability to better manage assets – from machinery to inventory to personnel – is another characteristic of the adaptive manufacturer. Thriving in highly dynamic and interconnected business environments requires a deep understanding of, and control over,



the assets that support manufacturing operations. This isn't just about ensuring the greatest possible output, but about managing maintenance and support for equipment that is highly valuable and strategic to manufacturing operations.

Being an adaptive manufacturer also means being able to more closely manage and leverage human resources. With many manufacturers facing a diminishing and aging workforce, the risk that attrition will result in a loss of not just personnel, but expertise, is a main impetus behind adaptive manufacturing. Much of the valuable expertise in coordinating shop floor processes and overall business goals all too often resides in the heads of a few key individuals. Adaptive manufacturing can allow that expertise to be built into business processes that can be shared throughout the enterprise.

Finally, the need to improve information access for decision-makers and stakeholders is a key driver behind adaptive manufacturing. Managing by exception cannot take place in an information vacuum or in an IT environment that depends on untimely or inadequate information. If real-time information, delivered in a useable format, cannot be delivered to the right stakeholder at the right time, then responsiveness and competitiveness are bound to suffer. An adaptive manufacturer must be able to reap the benefits of improved integration and efficiency, and that can only be accomplished by improving the quantity of information available and the quality of the individual stakeholder's access to that information.

There are three basic means by which a company can become an adaptive manufacturer: adopt an adaptive manufacturing architecture; define, monitor, analyze and control the key performance indicators (KPIs) needed to measure success and prevent failure; and ensure that the manufacturing software solution supporting the underlying business processes is robust, comprehensive and highly industry-specific.

The Importance of Role-Based Functions

For many prospective adaptive manufacturers, the adopted architecture – SAP's NetWeaver and the SAP xApp Manufacturing Integration and Intelligence (xMII) being prime examples – must be able to support a comprehensive manufacturing solution that provides planning, execution, quality, maintenance and environmental health and safety functionality from the shop floor to the executive suite. This solution must also support role-based functionality, which uses a Web browser to provide users with tasks, alerts, KPIs, reports, workflows and information specific to their jobs. Software tools for analysis and decision support are also a requirement.

Having the platform is only half the battle, however. The analytical and decision-support tools needed to gauge and measure and analyze the actions of the end-users must also be in place. An information architecture without the ability to gauge and track important measures of success and failure would be unable to support adaptive manufacturing. That analytical/decision-support framework must also support

the role-based display of the KPIs that drive the business. Too much information, or information that is fundamentally inaccessible or cannot be acted upon, is as bad as not enough information, and just as useless.

Finally, adaptive manufacturing must be based on top-flight manufacturing software that is able to support industry-specific business processes. That software must also come with a strong set of partner products that can be used to extend manufacturing capabilities and provide further support for adaptive manufacturing. mySAP ERP, mySAP Business Suite, SAP xMII and SAP NetWeaver enterprise services architecture precisely fit these requirements.

This report highlights how Whirlpool has embraced the Adaptive Manufacturing strategy to achieve significant improvement in operations, supply chain efficiency and customer satisfaction with SAP ERP and SAP xMII.

As the following sections indicate, adaptive manufacturing isn't just a good idea, it's a practical set of goals that can be achieved today by manufacturers in a wide variety of industries. Surviving and thriving as a manufacturer have never been more of a challenge, but adaptive manufacturing makes them possible as never before.

THE KEY CONCEPTS FOR TOP MANAGEMENT

In many ways, the concept of adaptive manufacturing is as much a business philosophy as it is a marriage of technology requirements and operational processes. Peter J. Kirschbauer, general manager of applications and a corporate officer of SAP, discusses the key questions facing manufacturing business leaders seeking greater agility and flexibility for their companies.

Q: Is the adaptive concept an IT strategy or a business strategy?

A: It is the second. The two key events involved are the lean philosophy and the idea of the demand-driven supply chain. The business must leverage all of the advantages of lean and get much closer to customers and react quickly to demand. Then match IT strategy accordingly. You can only manage well if you have all the information.

Q: What is the role of senior business executives in creating the adaptive business model?

A: The chief executive, and

his or her strategy council; the chief operating officer; and the chief information officer all have to be thinking about this concept. A recent survey by the Economist Intelligence Unit asked global CEOs what their greatest sources of competitive advantage would be in 2010. Almost 60% said it was most important to focus on adaptive

models versus new products and service development.

But the problem is current spending is not aligned with this view. To support the adaptive strategy, the executive team needs to be aligned around the concept. And IT needs to be at

the table with a true understanding of business processes.

Q: What is the role of partners and suppliers in the adaptive enterprise?

A: What we must move toward is more automated collaboration. To do this, partners must play a role in standardizing the paradigm, and not just in the software, but also in processes

and communication protocols. It's about how companies collaborate, the semantics of exchanging information. It's much more of a business network than a sequence of events.

Q: Does the adoption of the adaptive idea require a shift in IT architecture, such as to SAP's ESA?

A: I think so. It's not the only thing, but it is key to the realization of the business network model. Much IT integration has been done today, but most is point to point. The issue is that there are proprietary connections. SAP's Enterprise Services Architecture (ESA) will help to improve and accelerate standardization, provide more flexibility at the shop floor and enable better decisions for customers.

An adaptive network can only be successful if connections are standardized. IT can go on the offensive here by, for example, consolidating resources to free up budget for establishing adaptive business models. The adaptive concept requires a proactive IT organization, and this is where ESA can help.



Peter J. Kirschbauer



CASE STUDY: WHIRLPOOL

Standardizing IT Assets

For Whirlpool, a \$13 billion manufacturer and marketer of home appliances, being a major global brand brings with it global responsibilities. At the corporate level, the company's focus on brand excellence and customer loyalty means that Whirlpool must continually respond to customer demand with new products and innovative processes for bringing them to market. At the plant level, translating those corporate goals into reality requires an adaptive manufacturing operation that is highly efficient and cost-effective and tightly integrates ERP, shop floor and other key functions.

When Whirlpool's leadership conducted a review of its technology assets four years ago, the results signaled the need for major change. A history of mergers, acquisitions and decentralized decision-making had left Whirlpool with over 120 legacy systems that performed the functions handled by today's ERP systems spread across the company's global enterprise. Over 100 different ERP legacy systems made up the company's IT landscape in North America alone.

The complexity of managing Whirlpool's myriad systems was an impediment to the company's strategic goals, and the cost of maintaining those 100-plus systems and the silos of information they represented was a significant impediment to success. A major change in strategy needed to be executed, and it had to start with reducing Whirlpool's infrastructure costs, says Jim Shimp, Whirlpool's senior director for Global Application Development. "We had to get our costs in line," Shimp recalls. "We had to start by simplifying."

Simplifying meant throwing out the old and bringing in the new, in the form of a corporate ERP standard based on SAP's ERP, which was one of the major systems already running at Whirlpool. The company's experience with SAP's ERP had shown it to be ideal for the task

The consumer products giant uses SAP's ERP as its corporate backbone coupled with SAP xMII to transform and link the shop floor.

ahead. Moreover, while SAP was an under-leveraged asset within Whirlpool, "SAP's ERP was built on best business practices and already had 20,000 users," says Shimp. "Our past experience showed us that it was flexible enough to meet Whirlpool's needs."

That realization started a major shift in Whirlpool's global IT operations toward an adaptive manufacturing infrastructure: SAP's ERP became the company's global standard; SAP's supply chain management, plant maintenance, and CRM software, among others, were installed in Whirlpool plants worldwide; and a new organizational structure to support SAP's ERP standard was defined for the company's IT group.

Whirlpool's shift from dozens of systems to standardization on SAP's ERP, however, was only the beginning. Whirlpool also needed to simplify and improve its shop floor operations, which suffered similarly from a surfeit of systems and a paucity of integrated functionality. But whereas Whirlpool was willing to replace its legacy ERP systems with SAP, it was reluctant to make a similar standardization effort on the shop floor. "They had lots of custom code and a plant database that captured data in a standard way," Shimp says. "They weren't ready to make the shift to SAP."

And yet the shop floor needed as much change as the rest of the enterprise. The ability to track orders, move them into production, measure defect and quality data, provide key links from the shop floor to SAP, and otherwise manage by exception, were largely lacking. But without those capabilities, Whirlpool's ability to meet its short-term efficiency needs and its longer-term strategic brand and customer loyalty needs would be severely limited.

Whirlpool's solution was to turn to Lighthammer, which is now owned by SAP but at the time was an independent vendor of manufacturing intelligence software. Lighthammer's Illuminator prod-

uct, Shimp realized, would be able to link up to SAP's ERP and support his shop floor users "without upsetting their infrastructure," Shimp reports. "SAP xMII became the leverage point for transforming the shop floor."

The savings for Whirlpool started rolling in even before Illuminator – which was re-branded as the SAP xApp Manufacturing Integration and Intelligence (xMII) after SAP's acquisition of Lighthammer – was hooked up to SAP's ERP system. SAP xMII gave the company's plant operations greater visibility into shop floor operations, and the ability to track defects and quality issues yielded significant savings for the company.

Part of the benefit came from being able to define and track key production processes using SAP xMII; data from PLCs and other shop floor systems were used to monitor over 45 individual processes tracked by SAP xMII.

The results gave a significant boost to Whirlpool's efficiency and cost-cutting efforts. "Our people could see the defects and react to quality issues while a production run was going on," says Shimp. "They could start dissecting the problems in past runs and figure out what to fix before they ran the project the next time." In short, the visibility that SAP xMII provided into line operations and quality issues provided Whirlpool with a relatively rapid payback that, Shimp reports, reached well into the millions of dollars.

But that was really only the beginning for Whirlpool. Even more savings and value were to come from using SAP xMII as an interface



Jim Shimp

into SAP's ERP. The main design goal was to provide shop floor users with access to key ERP data without requiring them to become experts in SAP's ERP functionality.

SAP xMII's use in support of plant maintenance is a good example. Maintenance engineers use SAP xMII to not only flag a maintenance problem but also query what replacement parts – managed in SAP's ERP system – are available. That data, Shimp explains, isn't necessarily easy for an engineer inexperienced in SAP's ERP to find. "The information in SAP's ERP can come from seven different screens. SAP xMII can put it into one screen."

That capability allows Whirlpool to extend the value of SAP's ERP without having to train personnel in its use. And the flexibility of the interactions between SAP's ERP and SAP xMII made it easy to use one or the other system as the preferred interface for Whirlpool's users, depending on their needs and level of experience. "We wanted to be able to control how the user interacted with SAP," says Shimp.

The use of SAP xMII as an alternative interface to SAP's ERP transaction data also allows Whirlpool to provide a degree of redundancy for SAP's ERP system on the shop floor. By driving important ERP data into SAP xMII, and using xMII as the main interface for end-user interactions on the shop floor, Whirlpool is able to manage key transactions from the shop floor using SAP xMII even if SAP's ERP system is down. This fail-safe capability is a key value-add for Whirlpool, Shimp explains. "Our plants need to operate 100 percent of the time. If something happens on the ERP side, we still need to make product. SAP xMII can pick up the transactions and be the back-up system if SAP's ERP is down."

SAP xMII can also play a role in the executive suite as well. Whirlpool executives plan to use SAP xMII to track plant operations by displaying key performance indicators (KPIs) in the form of dashboards and reports that draw directly on shop floor and SAP's ERP transaction and Business Warehouse data.

Moving forward, Whirlpool sees great possibilities for SAP xMII and SAP's ERP. Understanding the relationship between work in progress (WIP) and inventory is a key capability that the two products can have a significant impact on: SAP xMII can track work in progress on the shop floor and synchronize it in real time with inventory data stored in SAP's ERP. This will allow Whirlpool to understand its precise inventory levels as a job progresses down the assembly line, rather than just when the individual product is ready to ship.

This capability to leverage WIP data will have another important impact as well. One key area that Whirlpool sees as ripe for change in the near future is the relationship between work in progress and the disposition of working capital. Manufacturers like Whirlpool can reap enormous benefits by using knowledge about WIP to better manage finished goods inventory and link that directly to customer demand. "SAP xMII can let us look at working capital differently," says Shimp.

Whirlpool also sees opportunities to use its SAP xMII and SAP's ERP systems to better integrate engineering and design with marketing and production, and use the two systems to improve Whirlpool's product pricing strategy.

In sum, Shimp concludes, the combination of SAP xMII and SAP's ERP provides Whirlpool with the ability to take its "mountains of data" and turn them into information. It's an important step in the on-going process to becoming, and remaining, an adaptive manufacturer, and an important one for a major global competitor with a strong global brand. "To drive customer loyalty we need to get closer to what the customer desires," says Shimp. "This partnership between Whirlpool, Lighthammer, and SAP lets us use our different data sources to meet these needs."

HOW XMII TIES IN THE SHOP FLOOR

The goal of SAP xMII is to provide real-time information, in the form of a wide range of analytics, that can support the management of shop floor processes in conjunction with enterprise-wide processes and business goals. SAP xMII, which came to SAP in June 2005 as part of the acquisition of Lighthammer, has a manufacturing services layer that can draw real-time data from plant automation and MES systems and use that data to drive a broad range of KPIs, alerts and other analytics. SAP xMII also includes visualization and workflow tools that allow users to develop and manage best practices based on SAP xMII's analytics.

Connectivity to SAP's ERP and mySAP Business Suite product family as well as SAP's NetWeaver enterprise services architecture is an essential part of the functionality provided by SAP xMII. SAP customers can use SAP xMII out of the box to connect their shop floor systems to their SAP environments without deploying a third-party middleware product. Support for key standards such as S95 is built into SAP xMII.

The analytics offered by SAP xMII allow manufacturers to track essential KPIs such as order status, charge rates, yields, completions

and usage, start and stop times, and rework scrap rates. Users can drill down into any analytic in order to perform root-cause analysis, and SAP xMII can also allow users to spot exceptions to established best practices and track overall efficiency. This means that SAP xMII can be used to support Six Sigma and other quality management programs. Direct visualization of shop floor assets is a key feature of SAP xMII, allowing users to visually track and manage specific machinery and its performance against business requirements. Role-based analytics are also supported, meaning that supervisors can see "rolled up" versions of the analytics delivered to shop floor managers.

The linkage to SAP's ERP and mySAP Business Suite also means that individual plants and their assets can be closely managed according to plans established in the SAP system. A common set of metrics can then be deployed across a plant or plants that can be used from the shop floor all the way up to the office of the vice president of operations, thus ensuring that all stakeholders are functioning based on a single version of the truth.