

Expert advice for optimizing your manufacturing operations with research from Gartner.

Contents

Steps to Collaboration for Asset-Intensive Enterprises3

By Kristian Steenstrup and Dan Miklovic

Building Collaboration Capabilities to Impact Your Bottom Line5

IPS: Balancing Manufacturing Collaboration With Execution8

By Kenneth Brant

Asset Management's Role in Integrated Plant Systems11

Utilities: First the Power Grid, Then the Collaboration Grid . . .12

By Kristian Steenstrup

Power Lean: A Practical Approach to Achieving Operational Excellence13

Feedback Form16

Gartner

Value-added from Rockwell Automation: Flexibility, Collaboration and Customized Solutions

By Don Davis
Chairman and CEO
Rockwell Automation



Welcome to the first issue of *Global Manufacturing Solutions*, a publication with expert advice for optimizing your manufacturing operations. We're investing in this industry-leading research to help you get the most out of your manufacturing investment, drive out inefficiencies, and impact your bottom line. Our Global Manufacturing Solutions group is dedicated to helping you



- optimize your manufacturing operation,
- reduce time to market,
- improve plant uptime, and
- drive regulatory compliance.

This issue focuses on how the discipline of asset management and our Power Lean initiative support these goals.

In today's electronic world, manufacturing is still a fundamental element of business. And it's a huge untapped source of value in most companies. At Rockwell Automation, we're focused on helping our customers capture that value. Our goal is to help manufacturers achieve success through customized solutions with enterprise-wide impact. We have a singular focus on the automation industry and are a leading provider of industrial factory automation products and services. We've extended our focus on automation to include the value-added power, software and services solutions that our customers need to be more productive and competitive. We are expanding our capabilities beyond our traditional support of a company's control engineer to now serve broader operations and financial needs.

Working Flexibly with Each Customer

To help achieve that goal, we recently created Global Manufacturing Solutions, the Rockwell Automation business group charged with helping customers make quality products faster and at a lower cost, and optimizing manufacturing by

**Rockwell
Automation**
Global Manufacturing Solutions

Asset Management: What Is It?

The term "Asset Management" is commonly used to describe a multitude of practices, processes, products or solutions. This discipline encompasses all the activities associated with managing capital investments and knowledge — including: Maintenance, Repair and Operations (MRO), Return on Net Assets (RONA), inventory management, preventative and predictive maintenance, repairable or renewal parts planning, warranty tracking and employee training, Operating Equipment Efficiency (OEE), lean initiatives and Total Cost of Ownership (TCO). But asset management also includes information tools like condition-based monitoring (CBM), computerized maintenance management systems (CMMS) or enterprise asset management (EAM) packages.

Information access and availability are at the core of total asset management. As integrated condition monitoring equipment gathers information at the machine level, the information is routed through the CMMS and then shared at the EAM and ERP levels to facilitate company-wide decision-making. Individually these tools provide measurable benefits, and together they build on each other to produce a comprehensive plant asset management solution.

New service technologies and outsourced collaborative maintenance solutions are now providing manufacturers with the information and opportunity to move to a more cost-effective maintenance model based on predictive, rather than scheduled preventative maintenance. Information can be extracted and shared vertically and horizontally throughout an organization, with asset management solutions that can communicate with an automation platform's intelligent devices, extract predictive maintenance information and link it to different areas of the organization.

Source: Rockwell Automation

implementing multi-vendor automation and information systems. Our goal is to work flexibly with each customer, to create customized solutions that meet specific needs.

Our Global Manufacturing Solutions group is led by Ron Wichter, an executive with a strong track record for building service groups in manufacturing as well as services, solutions and e-business. Having served in leadership roles at General Electric and Digital Equipment, Ron has deep experience in managing worldwide manufacturing operations. He has assembled a team of first-class talent with service expertise and decades of experience in selling

manufacturing solutions. And they have organized the Global Manufacturing Solutions group into the following seven core capabilities.

- **Asset Management** provides manufacturing asset management solutions through customer-driven, world-class, multi-vendor products, software, services, contracts and consultation capabilities.
- **Consulting Services** seeks to optimize the interaction of human, equipment, production, and execution performance of the manufacturing operations to improve financial performance.
- **Engineering Solutions** takes advantage of our knowledge of clients' operational requirements

to provide control, automation, power and related information system integration.

- **Process Solutions** involves global industry-focused Process Automation and Information Solutions that optimize plant operations, improving competitiveness and profitability.
- **Customer Support** offers world-class technical support programs, services and products for installing, operating and maintaining industrial automation equipment.
- **Training** includes performance services such as competency validation and performance analysis, standard and custom systems training, management services, support tools, electronic media, simulators and workstations.
- **Software** includes applications for data acquisition and integration, factory automation, manufacturing operations performance improvement and analysis, and shop floor scheduling.

The value Rockwell Automation now provides includes support for higher throughput of production, better utilization of assets, lower costs and better collaboration between our customers, their suppliers and their customers. In one recent example, we helped a customer generate U.S. \$100 million of profit by reducing the time it took to start up a new production line.

We're achieving these kinds of results by developing the resources necessary to ensure the very best in value-added services, for example:

- Our acquisition of Entek® IRD™ Corporation, a leader in providing plant floor condition-based monitoring solutions.

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- Our strategic partnership with MRO Software™, a leading provider of computerized maintenance management software (MAXIMO®), to provide the vital link between plant floor production systems, business systems and the supply chain.
- Building blocks to help customers transition to an e-manufacturing environment — like RSBizWare™ to capitalize on our rich knowledge of plant floor data, and connect that data to our customers' business systems. Embedded in such solutions are the leading-edge proprietary capabilities from the Rockwell Scientific Company (formerly the Rockwell Science Center).
- A comprehensive network of

motor and mechanical service centers with more than 95 years of experience in repair and overhaul to exacting standards. Included are predictive and preventative solutions for on-site reliability challenges.

And we're leveraging our traditional strength of partnering with others, to provide an even broader portfolio of services, expertise and capabilities through both existing and new alliances.

Collaborating to Impact Customers' Bottom Lines

Today our commitment to value-added services means many things — including capabilities to

provide the kind of collaboration needed for a successful asset management program. But it also encompasses much more — collaborative capabilities we are already providing for customers in several other manufacturing and information technology venues.

Manufacturing is a crucial component of your business. As a business that is singularly focused on industrial automation, we're ready to provide you with real solutions to your problems. And we look forward to sharing these solutions with you in future issues of *Global Manufacturing Solutions*.

Source: Rockwell Automation

RSBizWare is a trademark and Entek is a registered trademark of Rockwell Automation. MRO Software is a trademark and MAXIMO is a registered trademark of MRO Software, Inc.

Steps to Collaboration for Asset-Intensive Enterprises

By Kristian Steenstrup and Dan Miklovic

Industries that rely on asset availability to process raw materials should add collaborative capabilities in three stages in such areas as MRO, supply chains and open-market natural resource planning.

Asset-intensive industries, one of five previously defined enterprise resource planning (ERP) II segments, maximize revenue and profit by keeping their physical assets at the ready, with minimum downtime and cost. Globalization, open markets for commodities and increased availability of collaborative interconnection tools have driven the emergence of a new standard for collaboration in asset-intensive industries. Many — including utilities, mining, transportation, defense, infrastructure and high-capital processing plants (e.g., refineries, paper mills and desalinization plants) — were not previously known for collaboration.

Enterprises in these industries should build collaborative-commerce (c-commerce) capabilities in the following areas:

- Resource planning
- Equipment management
- Indirect material — maintenance, repair and operations (MRO) procurement
- Collaborative staffing
- Market pricing
- Transportation

For each category, asset-intensive enterprises can improve their c-commerce capability in a series of three steps. Type A enterprises (i.e., rapid adopters of technology) can skip a step or two.

Resource Planning

How visible are the natural resources? Collaborative processes that encompass resource planning may be in place, although time delays are common

with faxed or mailed information. C-commerce improves long-term planning by including all available information in economic calculations on a zero-latency basis. Enterprises should rise through the following levels of collaboration:

- **Low:** At this level, there will be enterprise-only connections (i.e., within the enterprise) for viewing resource availability, natural resource calculations and market access to bulk raw materials.
- **Medium:** This level involves linkage with statutory or regulatory agencies or other noncompeting sources of information (e.g., government surveys).
- **High:** At this point, there is heavy interaction with commercial and competitive entities to secure long-term resource access, such as sourcing from adjoining mining properties, sharing

refinery and smelting facilities, and sharing generation facilities or natural resource access. Moreover, these enterprises show a great deal of visibility and advice between retail units and distribution groups.

Equipment Management

How visible is the equipment that is used?

C-commerce among vertically specialized global enterprises enables equipment manufacturers and distributors to more frequently engage their customers in the management and use of equipment. Enterprises should rise through the following levels of collaboration:

- **Low:** Equipment manufacturers and providers electronically provide support information (e.g., design and maintenance data that support owners' obligations).
- **Medium:** Electronic updates of information are periodically refreshed. The manufacturer will reload the ERP II system with more current advisory or instructional information. The user entity provides the equipment manufacturer with operational data (e.g., failure, maintenance and productivity).
- **High:** The user and the manufacturer maintain an electronic connection with minimal latency to exchange event data and action advisories. Real-time equipment performance information exchange occurs. (This may be accompanied by the equipment manufacturer or a delegate — dealer or leasing agent — as stipulated in a performance-based contract.)

Indirect Material (MRO Procurement)

How visible is the supply chain for indirect MRO goods? Within

Cement Manufacturer Uses Predictive Maintenance to Increase Profits

Australia-based Adelaide Brighton Cement is in the enviable position of being able to sell all the product it can produce. To allow it to expand its export business and enter new markets, Adelaide Brighton modernized and expanded its plant.

Because plant availability is critical in a continuous process such as cement production, an important part of this plant upgrade was implementing a new approach to maintenance based on predictive maintenance technology from Rockwell Automation. For Adelaide Brighton, reduced failure costs mean increased productivity and higher profits.

In 1990, the Adelaide Brighton plant was available 65-70 percent of the time for production. By applying new maintenance styles and implementing a predictive maintenance program, the company has realized a 15 percent improvement in plant availability, now at 80-82 percent. That improvement has meant \$5 million more per year to the bottom line.

Previously, unplanned maintenance on a continuous process line was resulting in lower production. Now, the operation has one planned shutdown per year, with four or five minor stops and starts in between. Using predictive maintenance, the company now resolves six to ten potentially critical situations a year that would have otherwise caused the plant to shut down.

Condition-Based Maintenance Results

- 15 percent (\$5M) improvement in plant availability
- Avoidance of six to ten unplanned kiln shutdowns per year
- Reduced the cost of outside maintenance consultants by \$30,000 per year
- Saved \$125,000 per year by reducing time-based maintenance schedules
- Reduced spare parts inventory, resulting in savings of approximately \$130,000 per year

Reprinted with permission from *Control Solutions*, March 2001.

asset-intensive industries, transactions for indirect goods purchased to maintain operations are dominant. MRO e-procurement is more complex than the frequently automated white-collar MRO, or even direct commodity purchasing. C-commerce will reduce outages and minimize inventory holding value. Enterprises should rise through the following levels of collaboration:

- **Low:** Collaboration occurs only between the asset managers and materials procurers (e.g., "every part in the catalog is stocked in a warehouse" vs. "buy as needed" is resolved through internal collaboration).
- **Medium:** This involves the automatic electronic

procurement of required parts. A schedule is based on operational characteristics, and latency is removed from the system by linking suppliers.

- **High:** This level includes two-way visibility of parts requirements and availability. Suppliers collaborate by seeing what the expected requirements are directly, rather than waiting for an order, and they may use vendor-held stock.

Collaborative Staffing

How visible are the outside staffing resources? Collaboration with providers will be a more effective management technique when external special

skills (e.g., nuclear facility refurbishment teams) or unique, nonowned facilities (e.g., dry dock facilities) are required. Collaborative planning of plant outages (e.g., in power generation) will minimize unexpected power shortages due to plant shutdowns. Defense entities will benefit as more rebuild and maintenance is outsourced. Enterprises should rise through the following levels of collaboration:

- **Low:** At this level, there is enterprise-only linkage of operational planning to repair and shutdown. Enterprises use integrated systems to coordinate activities.
- **Medium:** Enterprises link electronically with external providers to aid planning of shutdowns (e.g., there is visibility of the available external workforce and facilities to be used and the event plan for the external resource providers).
- **High:** External providers link to pool information to facilitate long-term planning. Competing enterprises will need to protect proprietary operational information.

Market Pricing

How visible is the outside market? Collaboration will be influenced by statutory and legislative control

over enterprises' markets. In many industries, price fixing and collusion are subject to antitrust regulations. Natural resource and raw material refining enterprises with flexibility in production rates will be aided by electronically linking production to market prices for raw materials and output product. Enterprises should rise through the following levels of collaboration:

- **Low:** At this level, there is linkage of commodity pricing for materials or output product to production planning. This link determines favorable conditions and whether production should be adjusted to suit conditions.
- **Medium:** Customer and supplier enterprises are linked to advise or request a change in material shipments to take mutual advantage of market changes.
- **High:** Enterprises, suppliers and customers collaborate to address pricing and production changes based on market forces.

Transportation

How visible are transportation providers? C-commerce promotes visibility and extends the planning horizon, while increasing planning confidence. Transportation collaboration opportunities also exist for movement of MRO goods, which is critical to remotely located

operations (e.g., mining or defense). Enterprises should rise through the following levels of collaboration:

- **Low:** This level involves viewing possible transportation providers.
- **Medium:** This level includes viewing the capacities and schedules of transportation providers.
- **High:** At this point, there is interaction between the enterprise and transportation provider to optimize availability and cost of shipments, taking into account contracts, transportation and market prices.

Bottom Line: The traditionally independent nature of asset-intensive enterprises is changing. Deregulation, vertical specialization and global visibility create new opportunities for successful collaboration. Asset-intensive enterprises should promptly implement low-level collaboration in key functions. As enterprises adopt new IT architectures and technologies based on ERP II concepts, they will seize a competitive advantage by implementing mid- and high-level collaboration capabilities.

Gartner's Manufacturing Applications Strategies Commentary COM-13-4091, 29 May 2001.

Building Collaboration Capabilities to Impact Your Bottom Line

According to Gartner's Research Note COM-13-4091, entitled *Steps to Collaboration for Asset-Intensive Enterprises*, published 29 May 2001, "The traditionally independent nature of asset-intensive enterprises is changing...As enterprises adopt new IT architectures and technologies based on ERP II concepts, they will seize a

competitive advantage by implementing mid- and high-level collaboration capabilities." The Commentary also identifies several key functions in which enterprises should build such collaborative capabilities. Staff members in Rockwell Automation's Asset Management Business heartily agree, and offer some insights from their experiences here.

For example, in the areas of Collaborative Staffing and Equipment Management, "We've found that outsourcing using Web-based predictive maintenance technology is an attractive solution for many companies," says Howard Mars, director of marketing for Rockwell Automation's Asset Management Business. "That's because it allows companies access to information

without adding to the organization's infrastructure. More machines are being built with online data collection devices so they can be queried remotely and regularly. This information is then downloaded via the Internet, to an outsourced service provider like Rockwell Automation's Integrated Condition Monitoring Solutions (ICMS) division, which specializes in machine condition monitoring products branded with the Entek name. There, experts analyze the data and e-mail maintenance recommendations back to the customer."

On that same topic, Mike Laszkiewicz, vice president of Rockwell Automation's Asset Management Business, reports, "Optimizing maintenance, repair and operations (MRO) methods and processes results in improved machine availability, which in turn yields greater productivity, reduced downtime and increased earnings. Yet many businesses have not invested in the systems and technology that will enable their maintenance organization to become more proactive. And it's costing them more than they know. In many operations, maintenance expenses significantly exceed the annual net profit of the facility."

Laszkiewicz says it's estimated that:

- 15 to 40 percent of the indirect costs of a manufacturing facility are devoted to maintenance.
- About 50 percent is unnecessary corrective maintenance, costing 10 to 15 times more than predictive maintenance.
- 25 percent of maintenance is preventative, which is three to five times more expensive than predictive maintenance.

Laszkiewicz continues, "An effective e-manufacturing strategy uses predictive maintenance techniques to estimate equipment wear and predict failure. But it also

goes beyond routine maintenance, to allow MRO managers to proactively correct problems before failure occurs, thus maximizing the use of machinery and personnel while minimizing the amount of preventative maintenance required.

Leading-edge manufacturers know that success requires more than ensuring system uptime and meeting productivity demands. To compete globally, facility and operations managers are quickly realizing that every maintenance decision they make impacts the bottom line."

Remote Outsource Capability: Supporting Collaborative Equipment Management and Staffing

Online predictive maintenance is changing the way companies do business — because it's allowing manufacturers to approach maintenance equipment and staff differently.

When a company first buys a system, there are capital expenses (hardware, software, wiring and installation), the costs of training personnel to run it, and the cost of paying the maintenance person's salary. In smaller facilities, running a system is not a full-time job — it may only take one week a month — so it's not cost-effective to carry a trained employee on staff.

One example of a solution to this dilemma is Rockwell Automation's remote online solutions — collectively called "Reliability Online" in the marketplace — which allow customers to lease equipment to alleviate high capital costs, and take advantage of remote analysis. They not only outsource maintenance, but they do so with a company that's been in business for a long time, and has senior, experienced staff. Although many suppliers are just now coming out with new remote services, Rockwell Automation has

been selling it for three years, and has an installed base around the world, including a maritime driller with a sizeable presence in the industry and a major oil producer's pipeline.

Recently, the maritime driller had a drawback motor making violent noise. Staff ordered a new motor, but after it arrived and the company scheduled the change-out, the regional service manager stopped the process to contact Rockwell Automation — as he recalled that the supplier already had a maintenance agreement with other machinery on the ship and could access information remotely. Rockwell Automation analyzed the data and recommended the customer keep the old motor, because the problem was actually a bearing. As a result, the customer saved the cost of a new motor and replacement fees, as well as lost production time.

Asset Management Program: Supporting Indirect Material Collaboration

Most companies looking for maintenance, repair and operations solutions are doing so within an existing environment. So it's critical that they find a collaborative maintenance supplier that can integrate software and procedures with current applications. Following is a case where a food and beverage customer and the Rockwell Automation Asset Management Portfolio Program (RAAMP) were able to do that — by integrating new solutions with an existing system, instead of replacing it.

The customer needed to make its MRO storerooms more efficient. Staff evaluation had found that time spent looking for lost spares, and not having those spares work, caused a tremendous loss of productivity. So Rockwell

Automation analyzed storeroom operations, space and environmental conditions at 12 locations. One finding: it was common practice to take a part (like a circuit board for a drive) from the storeroom, and use it to try to fix a problem. If this solution didn't work (it was either the wrong part, or damaged in the process), the user just returned it to the storeroom shelf or even the floor — without repackaging, labeling or testing.

In collaboration with this customer, Rockwell Automation rewrote the storeroom operating procedures, trained personnel on how to use them, worked with personnel who clean inventory areas, certified materials that were in working order and resealed them, and installed tracking software (RAAMP/es) to address repairable assets (the source of most of the problems).

The customer calculated the savings in reduced MRO storage inventory at US \$3.1 million.

This application shows how Rockwell Automation is driving the convergence of IT and

manufacturing systems. Storeroom operations are not traditionally IT-rich environments. Toolsets applied are traditionally brought in from inventory management systems that handle direct material. But those types of systems drive up costs when operated in an MRO storeroom, particularly with repairable assets. That's because a part checked out of inventory typically triggers a re-order to maintain a specified "on-hand" quantity. The system doesn't acknowledge that the asset will eventually return to the storeroom. While Purchasing has successfully replenished the item, the system loses visibility of the part that was checked out (which may or may not get returned to its rightful place). If this happens with enough inventory over enough time, it creates a large and potentially expensive problem.

A related service that many companies are now leveraging is the **parts management agreement**. It provides ready access to the spare parts a manufacturer needs, while reducing operating costs to maintain and manage this inventory. Benefits of such agreements include asset control

(avoiding unnecessary build-up of inventory over time), cash management, reduction in some of the expenses associated with carrying inventory, and support for equipment with a limited life cycle (as spares leave with decommissioned equipment).

Although the focus here is on collaboration from a maintenance standpoint, there's a direct link to the production environment. In a larger frame of reference, solutions like RAAMP, Reliability Online, and parts management agreements are helping customers with production-related issues. As a result, customers have told Rockwell Automation that they are garnering a strategic advantage from a competitive standpoint — so much so that they typically will not allow the supplier to release specific success stories. For example, Rockwell Automation was recently named a major consumer products manufacturer's supplier of the year, but was prohibited from publicizing the award in any way. Hence, asset management is a best-kept secret at Rockwell Automation.

Source: Rockwell Automation

How RAAMP Impacts RONA (Return on Net Assets)

RONA =	$\frac{\text{Sales - Expenses (Net Income)}}{\text{Net Assets}}$						
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↑ Productivity	Inventory ↓						
↑ Uptime	Asset Base ↓						
↑ Cash Flow	Repair Cost ↓						

Source: Rockwell Automation

Programs like RAAMP can impact bottom-line results. RAAMP impacts Return on Net Assets (RONA) — determined by dividing net income by net assets deployed. By working with customers to reduce MRO inventory (a component of net assets deployed), RAAMP can reduce inventory costs. Then, by more effectively utilizing and tracking repairable assets, RAAMP can reduce the amount spent on those assets. The bottom line effects include cost savings and higher net income.

IPS: Balancing Manufacturing Collaboration With Execution

By Kenneth Brant

Integrated plant systems (IPS) are more relevant than manufacturing execution systems (MES) in an increasingly interdependent manufacturing environment. We define the functions and application interfaces that manufacturers should assess in their “to be” model.

Changing business models, coupled with an explosion of demand-side and supply-side production information requirements, have forced manufacturers to rethink their plant systems deployments. In response, manufacturers will seek to extend their applications model beyond the execution focus within the “four walls” of the plant, enabling greater visibility and collaboration in product value chains across the enterprise and its trading community.

E-Business and Process Specialization Drive Manufacturing Collaboration

E-business has heightened business and consumer expectations regarding product customization, delivery terms and competitiveness (quality/price) of manufactured goods. Simultaneously, manufacturers are

striving for focus on product and process competencies, yielding more interdependent business processes that frequently involve multiple business units and/or external trading partners in collaborative commerce (c-commerce) business models (see Note 1). These trends have raised the enterprise's need to provide visibility into manufacturing operations and action-oriented plant/production information to its trading partners in the context of shared business processes.

The Plant Systems Dilemma: “Islands of Automation”

Most manufacturers do not possess the plant system infrastructure to facilitate collaboration across the enterprise or with members of the manufacturer's trading communities. Collaboration presumes that relevant parties share information in the context of their roles and work in common media toward a shared objective.

However, in the manufacturing environment, process automation and information management spending to-date have yielded disparate plant systems

characterized by insular areas of functionality. MES, DCS, SCADA and PIMS contain functionality primarily aimed to drive production efficiencies and gain control of manufacturing processes within the four walls of the plant. Furthermore, these prevalent applications were often deployed as point solutions in a project-oriented mode of application development. As a result, plant systems have not been developed and deployed to affect business intelligence or business processes across the enterprise and its trading community. Viewing and coordinating production operations across the enterprise — much less collaborating and trading on the enterprise's production capability — is generally not supported.

Integrated Plant Systems (IPS): Functionality and Integration Facilitate Collaboration

IPS dictates balancing the plant's traditional focus on manufacturing execution and process control with functionality that enables information flow and collaboration, taking a holistic application development approach and giving consideration to the

Key Issues

How will users deploy plant operation systems?

How will E-business impact plant operation systems?

Strategic Planning Assumption

Through 2005, 70 percent of manufacturers with successful collaborative business models will deploy relevant IPS functionality in harmony with product design, enterprise and supply chain management applications (0.8 probability).

Note 1

C-Commerce Defined

Collaborative commerce (c-commerce) is a new model for business driven by an explosion of commercial demands and opportunities, enabled by the Internet, software component and integration technologies. C-commerce achieves dynamic collaboration among internal personnel, business partners and customers throughout a given trading community or market. Enterprises harness the power of the Internet to gain revenue and profit improvement by going beyond static supply chain models and information sharing. Although a few enterprises will remain only slightly affected, most will face dramatic change as many mission-critical business processes — such as sourcing, product design, selling and production — will be transformed. The corresponding changes in business processes will drive a whole new generation of business applications that will require enterprises to change their fundamental IT architectures.

Source: Gartner Research

linkage of plant systems to design, engineering, and enterprise and supply chain management systems. This will ensure that production operations are visible across the extended enterprise and connected with key (inter-) enterprise business processes and collaborative initiatives. Although manufacturers must continue to deploy plant systems functionality that supports the efficient execution of production orders and control of the process, the current business environment requires plant systems to address communities of users beyond the point of process operations. Manufacturers should temper their objectives for increased throughput with a strategy for agile execution in synch with customer demand/requirements and supply chain operation. Here, collaboration can generate value in manufacturing on an intramural, intraenterprise and interenterprise basis (see Note 2).

We have refined our IPS model (see Figure 1) to reflect the role of manufacturing in an increasingly interdependent, e-business world. Key functional elements in the core IPS modules are listed below (see Note 3).

IPS Core Modules

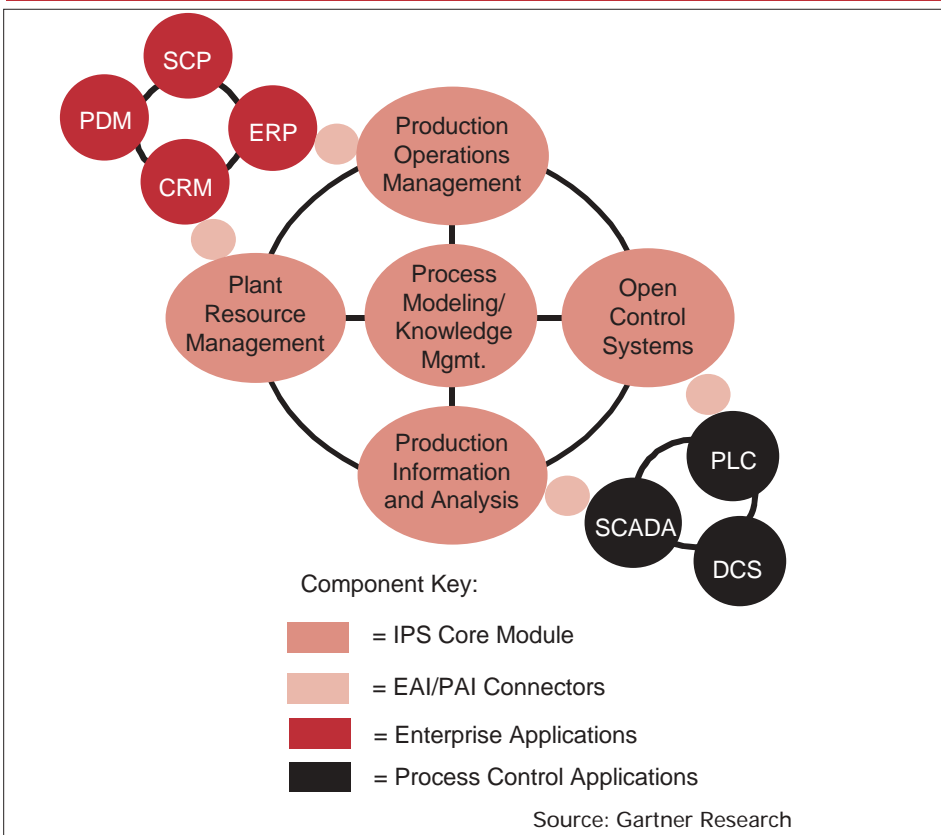
1. **Plant Resource Management:** “ERP for the plant manager” and operations management. A more granular view of resources specific to plant operations and the tools to manage them effectively in synchronization with enterprise objectives and resources.
2. **Production Operations Management:** Tools to mount production campaigns, execute them with proper control of shop floor operations and enforce process/test parameters, product genealogy and quality.

3. **Open-Control Systems:** Process control and data acquisition built on open-systems standards to enable the flow of data from the most fundamental point-of-product transformation/assembly through the value-adding chain.

4. **Production Information and Analysis:** Recording and archiving of process/test parameters, product genealogy and quality measures plus the data transformation methods and analytical techniques to turn raw process data and parametric measures into useful information consumable by enterprise business transaction and decision support systems.

5. **Process Modeling and Knowledge Management:** Manufacturing and business process modeling tools and templates linked via shared knowledge management practices to relevant business units and commercial partners.

Figure 1
IPS Functions: A Logical View



Note 2
Three Domains of Collaborative Manufacturing

1. **Intramural:** Among multiple departments across plant-specific business processes (e.g., across order management, production planning, manufacturing, test and trim operations within a paper mill).
2. **Intraenterprise:** Among multiple facilities/sites across enterprise business process, e.g., across production (well head), processing (refinery), and logistics (pipelines, terminals and transportation) operations at an integrated oil company.
3. **Interenterprise:** Among multiple enterprises within a trading community (e.g., across design, parts manufacture, sourcing, assembly and fulfillment in the automotive value network).

Source: Gartner Research

Note 3
IPS Functionality (Not Comprehensive)

1. Plant Resource Management
 - Plant-to-Enterprise Integration Management
 - Plant Capability and Performance Portal
 - Plant-Specific (Finite Capacity) Scheduling
 - Plant-Specific Material Management
 - Plant-Specific Asset and Maintenance Management
2. Production Operations Management
 - Production Order Management
 - Work Routing and Enforcement
 - Work Instructions Delivery
 - Unit/Lot Tracking
 - Regulatory/Quality Assurance
3. Open Control Systems
 - Controls-to-Plant Integration Management
 - Data Acquisition
 - Process Control (Regulatory, Batch, Logic and Motion)
4. Production Information Management
 - Process Data Archive
 - Production Data Archive
 - Product Genealogy and Quality/Test Analyses
 - Production Cost Analysis
 - Production Data Reconciliation and Yield Accounting
5. Process Modeling and Knowledge Management
 - Process Modeling and Optimization
 - Process Simulation
 - Product Specification/Recipe Management
 - Bill of Material (BOM) Synchronization and Management
 - Bill of Process (BOP) Synchronization and Management

Source: Gartner Research

Consideration of Enterprise Systems

The majority of e-business and collaboration activity will occur over the enterprise's IT backbone. Thus, IPS core modules are planned and deployed in concert

with enterprise back-office systems, driven by an understanding of what process and production data is needed to clarify/support collaboration and informed commercial practices.

Integrating Legacy Process Controls

IPS accommodates integration of legacy proprietary process control systems where critical time series and event-specific data is acquired. These data types are accessed via either the supervisory control and data acquisition functions of open-control systems (OCS) or the data acquisition capabilities within the production information and analysis module.

Bottom Line: Return on many e-business and collaborative manufacturing investments will be suboptimized without commitment to a manufacturing applications model that synchronizes production operations with larger (inter-)enterprise initiatives. Through 2005, 70 percent of manufacturers with successful collaborative business models will deploy relevant IPS functionality in harmony with product design, enterprise and supply chain management applications (0.8 probability). Manufacturers should adopt the IPS model and begin defining the functionality required to facilitate success in the relevant domains of manufacturing collaboration. IPS justification includes increased effectiveness of plant assets in increasingly demanding product markets. Pooling intellectual capital across engineering, operations, marketing, sales, distribution and service communities in a networked economy creates value by enabling greater levels of customer service and faster time to market.

Gartner's Manufacturing Applications Strategies Research Note TU-12-1967, 3 July 2001.

Plant Asset Management systems assist maintenance personnel in answering the following questions:

"What equipment may fail if it does not receive maintenance intervention?"

"What intervention should we take and when?"

"What parts should I order and how many?"

"What is the optimal mix of parts?"

"Should I make any adjustments now to prolong the life of assets critical to my process?"

"To what extent can I increase my process output without incurring an unacceptably high risk of unexpected process slowtime, downtime, quality problems, or safety shutdowns?"

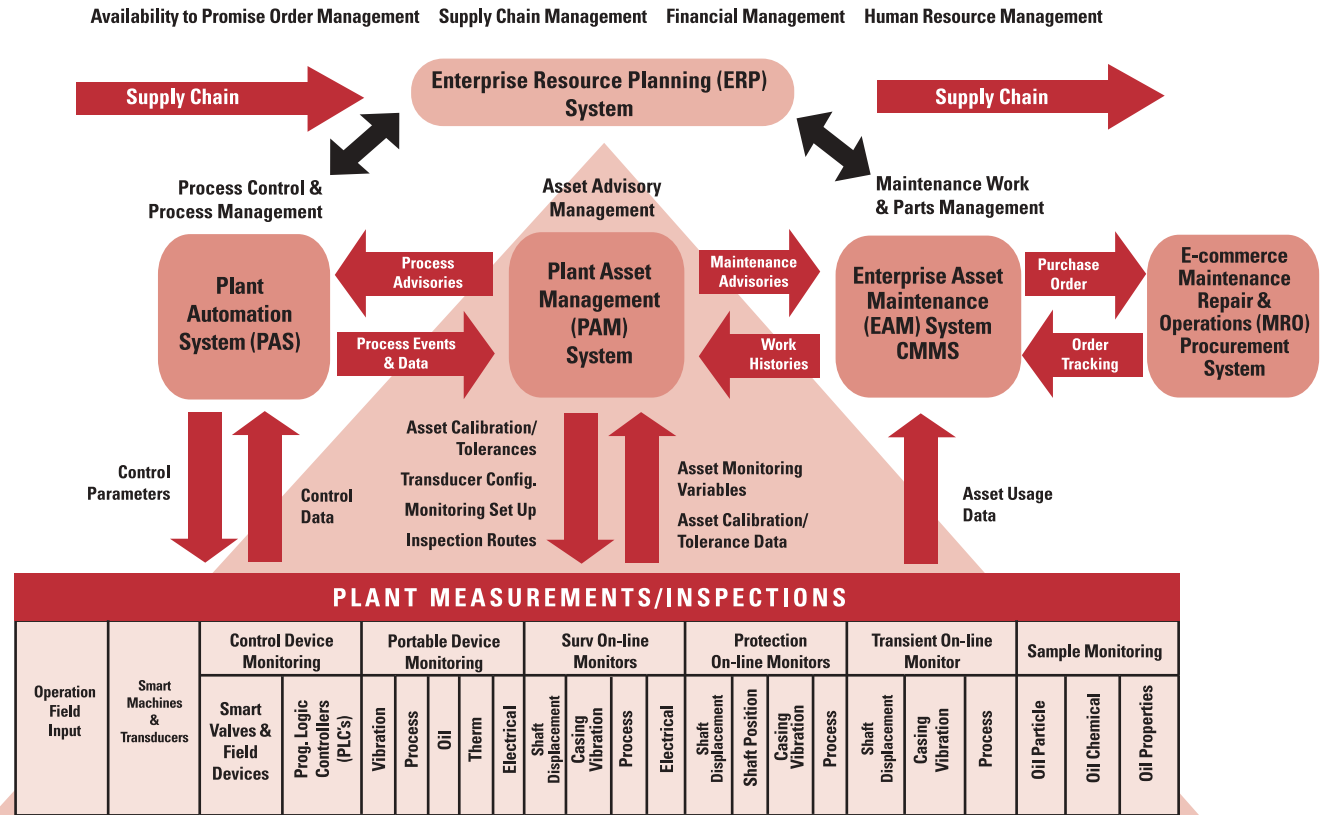
"What is the risk of successfully producing X amount of product next week given a projected process utilization rate of Y?"

Source: Rockwell Automation

Acronym Key

DCS	Distributed control systems
CRM	Customer relationship management
ERP	Enterprise resource planning
MES	Manufacturing execution systems
PDM	Product data management
PIMS	Plant information management systems
PLC	Programmable logic controller
SCADA	Supervisory control and data acquisition
SCP	Supply chain planning

Typical Plant Asset Management System Information Architecture



Source: Rockwell Automation

Asset Management's Role in Integrated Plant Systems (IPS)

According to Gartner's Research Note TU-12-1967 entitled *IPS: Balancing Manufacturing Collaboration with Execution*, published 3 July 2000, "Through 2005, 70 percent of manufacturers with successful collaborative business models will deploy relevant IPS functionality in harmony with product design, enterprise and supply chain management applications (0.8 probability)." As a result, this Tutorial recommends that manufacturers adopt the IPS model.

Managing complex horizontal and vertical information flow in a manufacturing environment is challenging. But it is happening.

For example, today asset management solutions are communicating with automation platforms' intelligent devices, extracting predictive information, and linking it to different areas of the organization.

Rockwell Automation integration solutions providers help manufacturers address this difficult task. And as Brant points out, such action has great potential for creating value, by enabling greater levels of customer service and faster time to market.

One of the keys to the relatively new ability to cost-effectively distribute data from the

manufacturing environment into higher levels of the organization is the standardization of communication network protocols such as DeviceNet™, ControlNet™ and EtherNet™. These standardized networks make it possible for the maintenance, repair and operations (MRO) organization to gather critical information from plant floor machinery and controls and communicate it throughout the organization.

As revolutionary as these advances have been, they are only the beginning. Howard Mars, director of marketing for Rockwell Automation's Asset Management Business, indicates, "We predict information flow enabled by

integrated condition monitoring technology, web-based predictive maintenance tools, computerized maintenance management systems (CMMS), Manufacturing BusinessWare, and enterprise asset management (EAM) and enterprise resource planning (ERP) decision support tools will pave the way for an integrated

manufacturing environment. By seamlessly integrating manufacturing business systems, companies will further shorten their supply chains, have more precise control of their assets and earnings, improve their overall efficiencies and maximize bottom line profits."

DeviceNet is a trademark of the Open DeviceNet Vendor Association. ControlNet is a trademark of ControlNet International, Ltd.

Source: Rockwell Automation

Utilities: First the Power Grid, Then the Collaboration Grid

By Kristian Steenstrup

Power utilities can reduce equipment management costs with e-business collaboration. Providing links between the equipment and its manufacturer will optimize maintenance and replacement schedules.

In power utilities, the biggest cost that can be affected by e-business is equipment management. The key to achieving benefits is collaboration. Driven by globalization, deregulation, open markets for power and the ubiquitous connectivity of the Internet, collaboration between power utilities worldwide and their heavy equipment manufacturers is possible and desirable. Collaboration improves the efficiency and cost-effectiveness of power utilities in regulated markets, as well as improving their financial results in deregulated environments.

Equipment Costs Can Be Managed

The cost of equipment upkeep, including staff, amounts to between 30 percent and 40 percent of operational costs for generating plants. (The figure is even higher for nuclear facilities, because greater importance is placed on the reliability of the equipment.) Manufacturers and distributors of generating plants are increasingly collaborating with their customers to help them manage the reliability of their equipment. This is attractive for major manufacturers

because it enhances the value they provide to their customers and helps justify the premium prices they hope to charge.

The concept of managed equipment is starting to be implemented by power utilities linking their enterprise resource planning (ERP) and equipment asset management (EAM) systems to supervisory control and data acquisition (SCADA) and programmable logic control (PLC) systems. Such linkages are mainly used within the utility company, but the Internet makes it possible to link directly from the equipment to the manufacturer.

Direct Links From Equipment to Back-Office Systems and Manufacturers

There is a growing demand in the heavy equipment industry for plant automation products that link directly with back-office systems to process data captured by monitoring systems. This data can be used to identify abnormal operations, calculate projected wear rates and predict failures. Examples of industrial equipment manufacturers that have commercial agreements with suppliers of back-office systems include Siemens divisions with Ivara and Datastream Systems, ABB with Industrial and Financial Systems (IFS), and Rockwell with MRO Software. Invensys, through its acquisition of Wonderware,

Marcam Solutions and Baan, is also capable (in theory, if not yet in practice) of linking data from monitoring systems to back-office systems and, from there, to the board room.

The next stage will be to use the Internet to link the monitoring equipment to the manufacturer. The advantage of doing this is that critical information can be passed to the manufacturer's sales, service and R&D departments. This will enable the manufacturer to feed back maintenance and replacement advice, be proactive in the sales and distribution of parts, and alter future designs.

Power utilities often balance maintenance costs against reliability by adopting a "run to failure" strategy. As this term implies, it is based on the assumption that the cost of installing back-up equipment used only in the event of a failure is less than the cost of proactive, preventive maintenance. However, deploying real-time links between the equipment and its manufacturer tips the balance in favor of proactive, preventive maintenance.

There are three stages to the implementation of real-time links:

- **Stage 1:** Equipment manufacturers and distributors electronically update the utility's ERP system with the design and

maintenance information required to enable the utility to carry out its ownership obligations.

- **Stage 2:** The manufacturer reloads the collaborative ERP or EAM system with more up-to-date advice or instructions derived from failures at other sites. In return, the utility provides the manufacturer with operational data, including information about failures, maintenance and productivity.
- **Stage 3:** The utility and the manufacturer exchange event data and recommendations for action in real time.

Collaborative Equipment Management

An early example of collaborative equipment management is provided by Caterpillar, which supplies heavy equipment used for mining operations. Caterpillar worked with EAM vendor Mincom and communications/global positioning system (GPS) specialist Trimble to introduce the MineStar initiative. MineStar has produced significant savings for the first commercial customer (a U.S. coal-mining operation). The amount

of equipment needed by the operator has been reduced, because downtime has been minimized to a level where a backup or reserve plant is no longer necessary. The coal-mining company's investment has paid for itself in three months, the savings have already amounted to more than 10 percent of operational costs and the production capacity has increased through reduced downtime because of unplanned failures.

Fully collaborative equipment management requires real-time, two-way telemetry, with the information being used to vary the manufacture or design of components for equipment in production. Caterpillar is now looking to take the electronic feeds from equipment in the field directly back to its design offices.

The concepts underlying MineStar are equally applicable to the management of other types of heavy equipment. Using reliability-centered maintenance (RCM) or total productivity maintenance (TPM) techniques, users and manufacturers can begin to plan how to leverage in-usage measurements in equipment. The full development of this potential

requires standardized XML message formats for the new types of information that will be passed between equipment and manufacturer. For generating companies, real-time links between the equipment and manufacturer will provide the customer with details of exactly what maintenance work needs to be done during a planned shutdown or a refueling stoppage. In addition, such links will, through collaborative planning, enable the shutdown time to be reduced by up to 20 percent.

Bottom Line: Power utilities should seek out opportunities to establish collaborative systems with the manufacturers and distributors of their heavy equipment. This will enable them to make substantial reductions in the costs of operating the equipment. Competitive advantage will be achieved by creating a symbiotic relationship between users of equipment and equipment manufacturers. This relationship will be enabled by a virtual "collaboration grid" founded on new architectures and technologies based on the Internet and second-generation ERP II concepts, which are focused on collaboration.

Gartner's Manufacturing Applications Strategies Commentary COM-13-5358, 6 June 2001.

Power Lean: A Practical Approach to Achieving Operational Excellence

Operational excellence is a concern on the minds of every manufacturer. We all strive to maximize efficiencies and increase productivity daily. But what separates the successful from those who fail? Possible answers are training, mobilization and involvement of the workforce, and also focusing on critical processes and business opportunities.

The most effective way to deliver superior products consistently and on time, at a price that represents

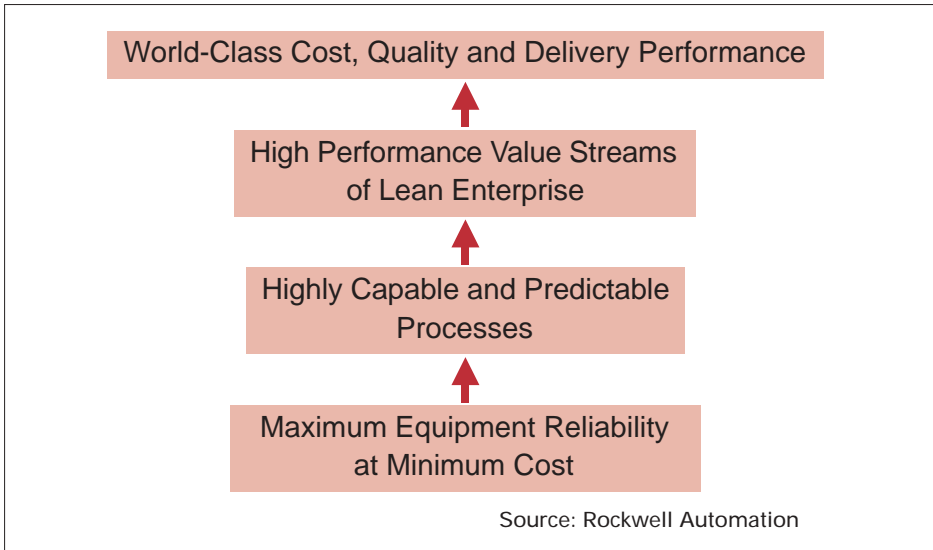
value and a cost that provides return to our shareholders, is to understand our value streams. We must then work relentlessly to eliminate waste and enable flow within those value streams. A value stream is flowing when material moves from raw to finished goods without being queued, stacked, stored, reworked, transported or excessively handled.

Prerequisites to high performance value streams are high equipment reliability and capability to

consistently meet specification requirements. This requires a thorough understanding of critical processes and their key control requirements, whether manual or automated.

Rockwell Automation has adopted a value stream approach to operations excellence. This approach involves the application of lean principles supported by capable and dependable processes achieved through Six Sigma and maintenance excellence. The

Prerequisites to Operations Excellence



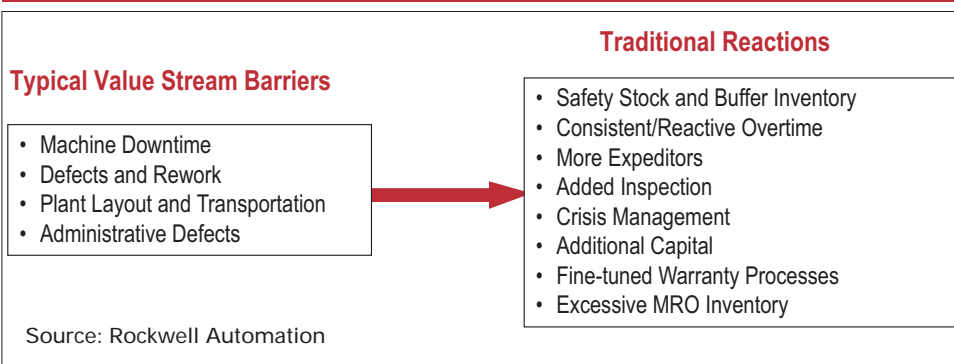
organization (5S), set-up reduction — and variability reduction, to support processes such as customer orders, billing, and new product development.

The success that we have had is apparent and easy to document. For example, as the economy has become more global, our plant in Rogersville, Tennessee, began to face some tough foreign competition. To survive, they knew they had to cut costs dramatically without jeopardizing the superior quality of our products or service. By embracing Power Lean, employees conducted a value stream analysis, which documented their current process. This then became their road map to discover ways to eliminate waste and cut costs while maintaining quality. Rogersville has cut those costs and improved their throughput time from three weeks to one day, while dramatically reducing direct labor requirements.

In addition, at our plant in Athens, Georgia, Power Lean initiatives are being used to establish and optimize flow between manufacturing cells, reducing unnecessary inventory and throughput times. Improvement teams have reduced inventory of critical motor components by up to 80 percent. Throughput time has decreased by eight days.

So, what is Power Lean, and how did we accomplish such outstanding results through its use at our manufacturing facilities? Power Lean consists of three levels of training: executive overview training, comprehensive Power Lean Master training, and champion training for department and site leaders. Concurrently, site assessments, product family analysis and value stream mapping are used to document current states and identify improvement opportunities. Value

Barriers Within the Value Stream



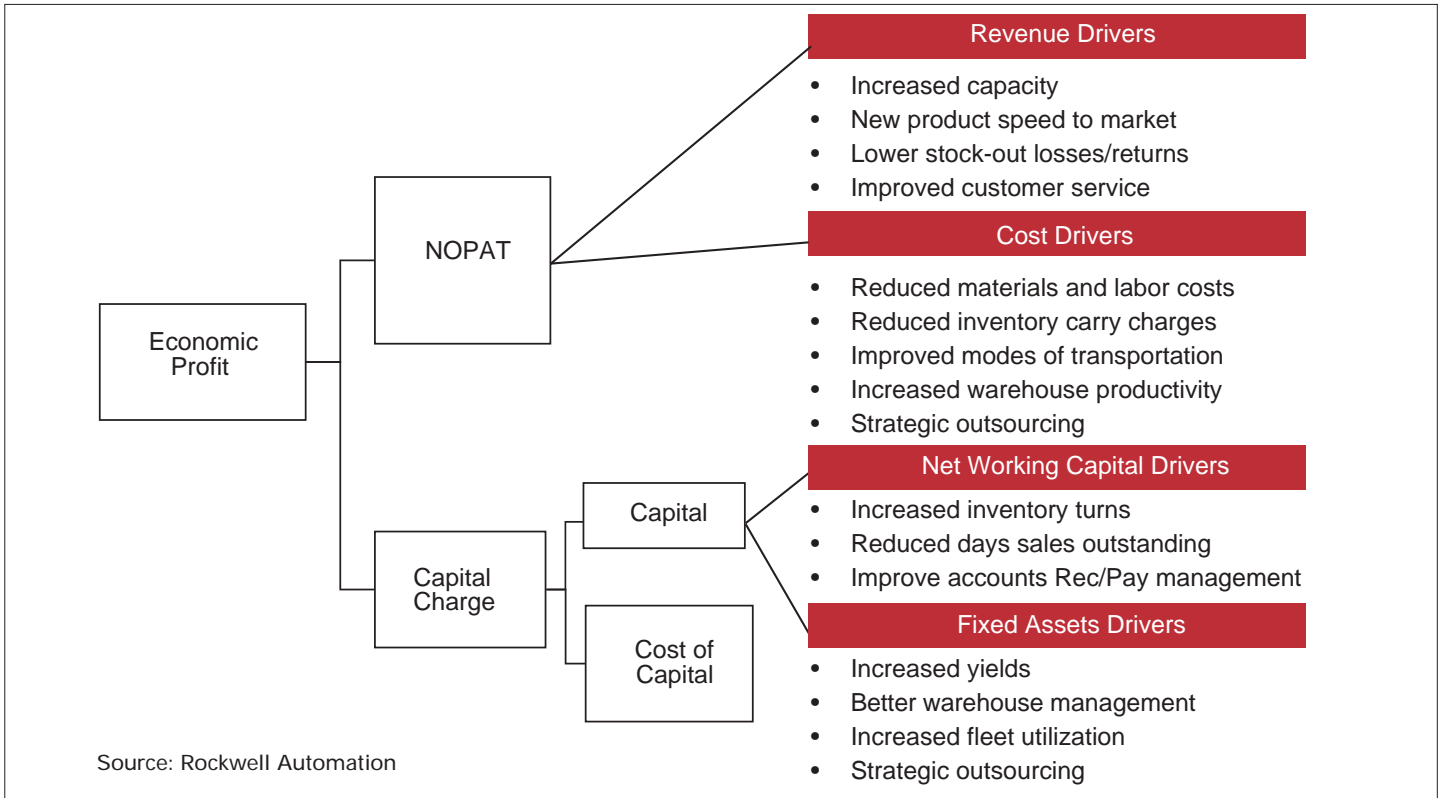
successful integration of these methodologies through Power Lean has provided critical prerequisites to operations excellence and has generated results far beyond the independent application of any one of these strategies alone. Through Power Lean, Rockwell Automation has obtained a better understanding of how we generate value, exposing opportunities for improved cost, quality, and delivery performance.

“Our investment into the development and implementation of Power Lean has been particularly rewarding,” states Joe Swann, president, Rockwell Automation Power Systems. “The

investment is yielding financial, quality and delivery performance improvements beyond expectations. Equally important is the organizational momentum achieved within our operations and support departments.”

Power Lean has provided fast, bottom line results, as well as the cultural and business transformation required to accelerate and sustain business improvements. It has also provided a structured program to expand and support previous and ongoing operations improvement initiatives. Representatives from all departments have participated in training with projects ranging from shop floor workplace

Focus on High Leverage Drivers



stream mapping of strategic products and services provides a true understanding of how we generate value and identifies important barriers to flow and associated waste. This process is critical to the selection of improvement projects and the appropriate tools and methodologies to achieve high leverage results. Transforming the current state to future state is accomplished through strategic applications of a variety of kaizen events to selected projects.

Projects and kaizen events focus on specific economic value drivers of strategic products and services with the appropriate tools and methodologies. Generating short-term gains that are visible and communicated to all employees is key to success.

But Power Lean isn't just a tool for Rockwell Automation to use in its pursuit of operational excellence.

Power Lean can be an invaluable resource for our customers and partners. Through our consulting and training services, Rockwell Automation can help virtually any business achieve greater efficiencies and enhanced operational flow with the application of Power Lean.

Consider, for example, the Timken Company, a long-time supplier to Rockwell Automation. Joe Berecek, Manager of Lean Manufacturing — Industrial, comments, "The Timken Company has been doing business with Rockwell Automation for 76 years. We were so impressed with the Power Lean approach, that we contracted with Rockwell to have their Power Lean core team train our first wave of 15 Lean Masters for our Industrial Manufacturing Business. The comprehensive approach of classroom and hands-on training that they've developed is the most effective

way to transform a corporation into a Lean/Six Sigma organization. We are confident that the high leverage value streams that we're focusing on will yield significant results to our business."

Power Lean has proven to be an effective method to increase operational efficiencies. It provides an implementation roadmap that can help you achieve your performance objectives.

Source: Rockwell Automation

View this newsletter online at www.gartner.com/webletter/rok/index.html

For more information on Rockwell Automation, Global Manufacturing Solutions and our Total Cost of Ownership solutions, visit:

www.rockwellautomation.com
www.rockwellautomation.com/solutions
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Source: Rockwell Automation

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Topics I would like to see explored in future issues _____

Topics/information that I found of most value in this issue _____

Additional Comments _____

Rockwell Automation has long been recognized as a global leader in factory automation. To extend the value we deliver to our customers, we've established the Global Manufacturing Solutions group. This division is dedicated to providing solutions focused on manufacturing excellence — from the factory automation level throughout the entire enterprise. Our goal is to give our customers the ability to aggressively pursue a competitive advantage against increasing earnings pressure, while maximizing returns on internal investments.