



The Next Generation of ERP Software:

Technology as a Means for Thriving in the
New Manufacturing Economy

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Abstract

With the revitalization of the manufacturing economy our technology choices must be the right ones – choices that will provide the necessary infrastructure to support the techniques, software and facilities that are destined to emerge in the near future. The next generation of advanced enterprise resource planning (ERP) – a new standard – is now coming to market that takes advantage of the latest technologies and builds on the legacy of application development that has made extended ERP the standard for manufacturers that are not just content to stay in business and stay competitive, but to grow and thrive.

Changing customer expectations and demands, coupled with economic uncertainty and political unrest, have caused manufacturers large and small to take a hard look at all aspects of their operations and processes. The next generation of ERP software is built for these conditions.

Manufacturers have always faced these kinds of challenges, and through the years a great deal of investment has gone into information systems designed to help manage and improve performance. Technology investments have continued to improve performance. While rapid advances in technology may diminish the long-term effect, however, sound technology choices can lead to sustainable advantages.

Whereas the focus in previous years was primarily on the improvement of internal processes, a more global view reveals the need for improved interactions and strengthened interdependencies between internal needs and actions and the greater supply chain and demand chain. Today's business challenges inevitably call for real-time coordination across multiple locations (owned, contracted, business partners and service providers). New technology, such as a service-oriented architecture (SOA) fulfills these needs by making systems open to any user, from anywhere, on any platform.

The next generation of ERP – the new standard designed for the new manufacturing economy – harnesses the technology required to optimize performance in the globally extended manufacturing enterprise. This is much more than just one more incremental improvement in a long line of evolutionary steps. This new class of ERP technology is an essential link to gaining a leadership position in the manufacturing economy of today and tomorrow.

To promote a fuller understanding of the causality between operational performance and the use of advanced manufacturing technology, an examination of the challenges facing manufacturers in the global economy will be followed by an assessment of the market conditions and manufacturing strategies necessitating the requirement for new manufacturing software technology. SOA will be related to the integration of globally and domestically disperse organizations and trading partner networks. Finally, the relationship between new best in class operational metrics, and the new generation of ERP software that businesses are putting to use as an enabler, will be presented.

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Overview

There's no doubt that the last several years of the 20th century and the first years of the 21st have been extremely challenging for manufacturers throughout the world. As a matter of fact, "while overall GDP for the U.S. edged up by 0.3 percent, manufacturing production fell sharply by 7 percent."¹ This economic uncertainty and political unrest, coupled with changing customer expectations and demands, has caused manufacturers large and small to take a hard look at all aspects of their operations and processes.

The business slowdown and growing recovery have put further pressure on manufacturers to operate as efficiently and effectively as possible. Cost cutting and re-sizing efforts in the early stages of the slowdown may have had the desired effect at the time but the emerging expansion demands that companies increase output without equivalent increases in costs. In other words, companies are faced with conflicting priorities – increase capabilities to exploit increasing business potential but avoid committing too much in case the recovery stalls. There are plenty of opportunities out there; they can be found in increasing market share as much as in increasing markets.

To increase market share, a company must be better than the competition. That competitive edge may be in operational excellence leading to lower cost-to-produce and therefore lower prices, or it could be in higher quality, or innovative product design. In most markets, however, the winning competitive edge comes not from these capabilities – all competitors must now meet stringent expectations in price, quality, and product – but the critical success factors are more often lead-time, agility, and customer service. Given equivalent product, quality and price, the supplier that can deliver on time and is better able to respond to changing demand is the one that will win market share and dominate its market.

Price/cost economics is still an issue, however, especially in a global environment where outsourcing and offshoring practices are more prevalent and where product is being brought in from other areas of the world with lower labor costs. Domestic manufacturers can fight this labor cost differential in one of two ways: reducing labor content through automation and other efficiency/productivity improvement methods, or through outsourcing labor-intensive activities. Either of these alternatives increases the need for, and the challenges in, gaining and managing information and knowledge for business control.

What worked in the 1980s and even the 1990s is not sufficient to keep a manufacturer ahead of the competition today. The rules are changing. The good news is that technology and process improvements are available to any company wanting to excel.

In support of that assertion is a recent report describing "a growing body of evidence that suggests that investment in and use of IT has played a role in the recent, strong labor productivity growth. It further suggests "in addition, since the mid-1990's popular consensus has held that businesses that invest in IT are more productive and perform better than businesses that do not invest in IT."²

To become and remain competitive, companies have to operate at peak performance levels in all aspects of their business from customer relations and service through procurement and manufacturing to distribution, administration, engineering, support and management. But new operational metrics – customer-facing, internal, and supply chain-facing – are giving life to the need for exceptionally visionary implementations of manufacturing software for process changes, improvements and monitoring across the value chain.

Information systems are a key contributor to a company's ability to remain competitive in these demanding times. The next generation of manufacturing software is built on an architecture and technology that provides manufacturers with the flexibility needed to respond

¹ The Facts About Modern Manufacturing, National Association of Manufacturers, 6th Edition

² Digital Economy 2003, Economics and Statistics Administration, U.S. Department of Commerce, December 2003

quickly to these challenges. It makes technology layers invisible; it accelerates the real-time flow of information regardless of physical barriers between organizations and facilities; it allows access to all those who need information, when they need it; it allows information to be sent to or from smart devices; and it allows information to be exchanged between systems irrespective of the technology deployed.

The Same...But Different

Manufacturers have invested in manufacturing software to face industry challenges through the years. On the positive side, these efforts and investments have paid off handsomely in productivity improvements, increased agility, and cost effectiveness. However, technology evolves at an extremely rapid pace and any competitive advantages gained through technology investments and process improvements can be fleeting if a company stagnates in its technological currency.

In truth, most past process improvement and technology investments have been inwardly focused, primarily aimed at cost reduction through higher efficiency, lower cost of quality, higher production rates and throughput, reduced administrative and indirect costs, and the like. That's all well and good but a company cannot save its way to prosperity. Internal process improvements and controls must be coupled with increased attention to the outside world – customers, distributors and representatives, service providers (transportation, warehousing, import/export, etc.), and suppliers.

A more global view of processes reveals the interactions and interdependencies between internal needs and actions and the greater supply chain / demand chain. The solution to today's business challenges inevitably includes real-time coordination across multiple locations (owned, contracted, business partners and service providers) including:

- **Globalization in all its many manifestations** – As the world becomes a smaller and smaller place, it is increasingly important to collaborate with suppliers and customers on other continents to reduce response time and increase agility.
- **Outsourcing strategies** – Outsourcing is a key mechanism for dealing with the disparity between costs and capabilities. Today's transportation and communications abilities make outsourcing a much more viable alternative than it ever was in the past. Outsourcing, however, means relinquishing control. The best way to maintain a level of control is through close communication and collaboration to bring the contracting organization as close as possible to the decision-making center of the enterprise for maximum coordination of effort.
- **Cross-enterprise performance management and process automation** – As the enterprise becomes more dispersed due to mergers and acquisitions, partnerships, industry consolidation, tighter trading partner relationships and outsourcing, there is a growing need for performance measurement and management systems that can effectively cross functional, administrative and geographic boundaries to bring disparate information together for senior management attention and use. And this can extend to plant floor data in the case of closely managed outsourcing arrangements.
- **Lean manufacturing and the reduction of waste throughout the value chain** – The benefits of lean manufacturing are rapidly spreading from the automotive industry where it originated through a wide variety of industries throughout the world. And where manufacturers are going 'lean', the face of competition changes. Lean manufacturers cut lead-time, improve quality, and reduce costs such that competitors that don't 'lean up'

are left in the dust. As lean ideas spread throughout the supply chain, it becomes imperative to pursue lean strategies in order to remain viable.

- **Visibility, integration and optimization of the supply chain** – The supply chain is itself like another entity within your realm with inventory, lag time, and information transfer responsibilities. Optimization seeks to develop the best combination of resources and actions to maximize customer service and profit, putting the available resources to the best use at all times.
- **Integrated and accelerated product lifecycle management** – Product cycles get shorter every year – in all industries – due to intense global competition. Product lifecycle management systems are key tools for faster management of new product development and release, end-of-life considerations, and all other product life stages and transitions.
- **Customer intimacy, responsiveness and service orientation** – Customers expect more today... because they can get more by ‘shopping the world’ and using that leverage to demand more from suppliers. What a supplier delivers is more than just product – its service, being able to anticipate and respond to demands, information when requested, and cooperation in planning, forecasting, development, and more.
- **Anticipating and being proactive to rapidly changing market conditions** – A company can improve its reaction time by getting a head start – by anticipating the demand and preparing for it before it is realized. This is proactivity.
- **Increased regulatory and reporting requirements** – Sarbanes-Oxley has gotten a lot of headlines because it raises the bar (considerably) for public companies. But smaller, private, international, and non-U.S. companies shouldn’t expect to escape completely. Expect customers and governments to pass on some of these more stringent reporting requirements and don’t be surprised if the regulations are extended beyond their current applicability.
- **Innovation and value advantages** – Proactive manufacturers sustain growth and competitiveness by showing customers what they need before they know they need it. In this scenario, innovation itself becomes a value advantage, rather than cost alone.

The next generation of ERP is now coming to market that provides the infrastructure to address the new operating reality. A new standard is being set by software that harnesses the technology required to optimize performance in the current extended manufacturing enterprise. This new generation of ERP is the long awaited technology shift that enables the execution of business strategies to address today’s critical issues.

As the world economy is finally showing strong indications of recovery, we have an unprecedented opportunity to restructure for growth, and position our manufacturing resources to meet new global economic challenges. Our past technology investments have brought us this far and have served us well. We now have an opportunity to build on those past achievements and extend the gains in the future with a strong, flexible technology base that will enable increased collaboration, coordination, and cooperation throughout the supply chain.

What’s Different?

Just as “no man is an island,” no company can operate in a vacuum, without the support and cooperation of trading partners at both ends of the spectrum. As we become more and more dependent on technology to help us carry out our tasks, so do suppliers, customers, and service providers that we deal with every day. Human intervention – manual steps such as

handling paper purchase orders and shipment notifications – impede the free flow of information and bring hard-won efficiencies to a screeching halt. Certainly this is not to advocate the elimination of the human element in the process – far from it. But the human element should be reserved for those tasks and those occasions where it can provide real value to the process. Let the machines and the networks take care of the routine and the mundane.

The next generation of ERP is built on an underlying technology that takes advantage of recent advances in communications and networking to bring disparate facilities and entities together as never before. Closer coordination through machine-to-machine communication and interaction, and enhanced collaboration on the person-to-person side will be the hallmarks of the enabled business in the coming years. The new ERP, built on a service-oriented architecture³, provides efficiencies not previously available and, above all, flexibility to connect to, and interact with, other systems regardless of platform or technologies.

Historically, interacting with other systems and/or passing information between one system and another have been difficult at best and impossible at worst. The state-of-the-art up to this point has been electronic data interchange (EDI) – the passing of documents (purchase order, change order, ship notice, invoice, etc.) in a pre-set format over private networks or, more recently, via the Internet. While EDI does have its successes, the entire approach – that of passing structured, pre-defined documents – is inherently limiting and difficult to accomplish given the disparity between computer architectures, operating systems, programming environments, and application program structures and characteristics. EDI requires a translation on each end of each transaction – from the specifics of the message generating system’s purchasing function, for example, into the neutral EDI format and packaging, through the communications links to a translator on the receiving end that converts the neutral format into something that the receiving system can use. Additionally, EDI standards are not rigidly enforced or adhered to such that suppliers typically have to adapt their procedures and translations to benefit each trading partner’s specific usage. EDI implementation tends to be expensive and difficult.

EDI was a product of its time, and despite its limitations it did bring us to a new level of connectedness between trading partners. The next generation, however, has arrived. Business information can now be exchanged freely, but securely, using Web services to read and write an internally self-described message protocol known as eXtensible Markup Language or XML. Since XML information carries its own identification within the message, rigid fixed formats are no longer needed and the interpretation process is much simpler, more direct, and far more flexible. The other part of the equation is the transportation of messages between systems and that’s where SOA comes in. The common language of SOA service communication is XML.

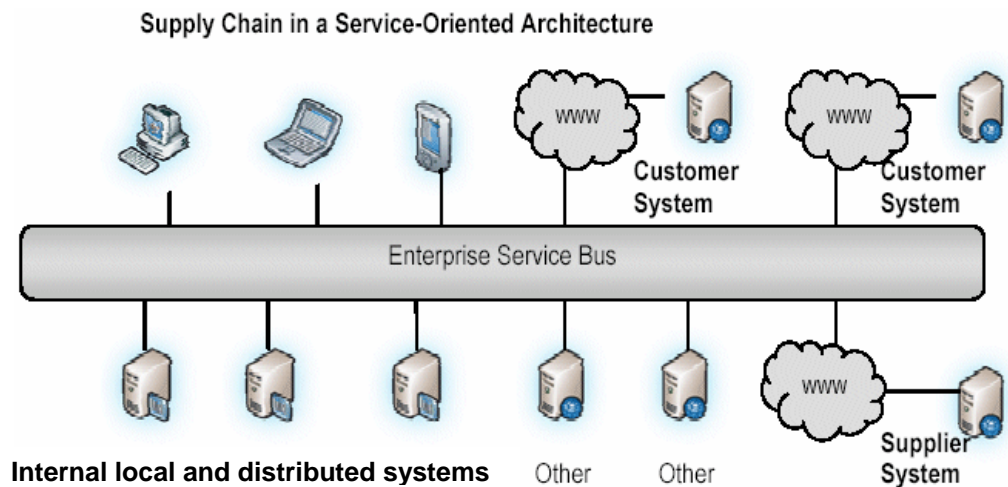
A Service-Oriented Architecture is a framework or infrastructure supporting “services.” While this sounds like a circular definition, it becomes meaningful when you understand that a service is a self-contained piece of functionality – a piece of technology that performs a task. In an SOA, the service is independent and can be located anywhere within the SOA architecture and it can be invoked, that is, it can be activated or used, by any other entities (subject to security, etc.) within the architectural framework.

SOA-based services are self-contained pieces of business process logic (applications) that can be mixed and matched, and called into use by whomever or whatever needs them from anywhere within the architecture. Because they are independent and self-contained, they are available regardless of the details of the user’s operating system, structure, programming language, or any other technical characteristic. SOA services are loosely coupled and modular meaning that they can be swapped in or out, or replaced, with no effect on the users or the environment. This makes developing, structuring and using the system much more efficient and much more flexible. That’s why companies that are embracing SOA confidently say that an SOA-based system is the last system you’ll ever have to buy. You can replace any individual piece with a new, better, or expanded piece painlessly.

The independent nature of services also makes the system and the user invisible to the service. The “user” could be an actual user, working through a browser or desktop screen, another

³ A service-oriented architecture is defined as self-contained modular applications (i.e., services) that can be mixed and matched, are platform independent, and can be dynamically located and invoked.

application on the same computer, another computer within the network, a trading partner accessing the service through the Internet, or a trading partner's application accessing the service from the other side of the world (see figure below). Workflows can invoke services from anywhere, to anywhere, seamlessly and invisibly. Thus, systems are no longer limited to the application set as designed by the developer; no longer limited to the confines of the individual system; no longer restricted to direct users, connected desktop clients, or enterprise boundaries.



Technology to Support Needed Functionality

What does this all mean to the manufacturer trying to compete in a global economy that continually demands better-cheaper-faster? It means advanced, real-time performance management tools are now essential to tightening up the supply chain and the demand chain to a level previously unachievable. With supply and demand communicated instantly, and close coordination (and collaboration) between trading partners, the inherent delays (latency) in responding to changing demand no longer limits the ability to compete in that all-important area of speed and flexibility.

Despite huge advances on the internal supply side – reduced costs and shortened lead-times through ‘lean’ and other efforts – the fact is that manufacturers are dependent on suppliers, distributors, transportation providers, and sometimes additional partners (contract warehousing, third-party logistics, forwarders and consolidators, etc.) to help make and deliver product to customers. While parts and products travel ‘up’ the supply chain, demand and supply information moves in both directions and is a critical link in responding rapidly to demand.

Forward-thinking companies are now using workflow to automate processes and communications throughout their operations. Workflow allows systems to respond automatically to pre-defined conditions or stimuli. In a simple workflow example, a customer order is received and the amount of the order brings the customer's balance above its credit limit. A workflow could automatically place the order in a hold condition and notify the credit manager for review. When cleared by the credit manager, the workflow could notify the sales department and the customer that the order has been cleared, change the order status, and notify planning, production and inventory that the new order is now cleared.

Reaching a pre-determined inventory balance on a critical part, in another example, could trigger a message to planning and the responsible buyer or manager that action must be taken immediately. Receipt of a given item could send a message to the quality department to perform incoming inspection and notify the buyer or production manager that the item is physically on-site and awaiting processing.

SOA provides the environment to extend the workflow idea beyond the company's internal systems. What if that new order coming in is a custom product requiring unique parts or materials not in stock? Through SOA, your system could send a request to a supplier's system asking about availability of the component and get a response confirming when you could receive it. You could then immediately provide a validated availability and ship date to the customer; no guess-work and no delay in making that commitment and securing the business.

And the component that has just reached its reorder trigger? An SOA-based electronic Kanban pull signal could be sent directly to the supplier's system, which can initiate the replenishment action and confirm the action back to the requesting system. The replenishment cycle is shortened by the absence of human-induced non-value-added activities and delays, so the reorder point can be lower, stock-out risk is reduced, and less inventory is needed to supply the desired availability level.

Hockey legend Wayne Gretzky had an uncanny ability to be at the right place at the right time – dominating the game like no other player before or since. When asked about his extraordinary ability, he said he always skated to where the puck was going to be, not where it was.

Successful industry leaders display the same kind of uncanny ability to be where the need is going to be (i.e., foresee future business requirements) – ahead of the competition – time after time. To be ahead of the curve once might be just luck, but to be at the leading edge of a market turn time after time is the result of preparation and effective execution.

Preparation starts with demand management and demand management starts with a good forecast. The best forecasts harness knowledge and information from all available sources – especially those closest to the market including retailers, representatives, agents, salespeople, distributors, the customers themselves, and other sources outside of your immediate enterprise. SOA-based collaboration tools enable participation by any and all of these trading partners in a mutually beneficial network of cooperation. The resulting forecast is more accurate than would be possible to develop by the manufacturer working alone, and it will be able to recognize changes in demand more quickly and react accordingly. Based on this enhanced forecast, the company has more flexibility to gear up for the coming changes and be prepared when they occur.

Likewise, the ability to respond to demand is enhanced when the trading partners are connected and information transfer is essentially instantaneous. Building on the earlier example when the supplier coordinated on the custom part's availability needed to confirm an incoming order's ship date, cutting the communications and reaction time shortens the delivery cycle at all stages of the supply chain. It's not enough, however, to simply communicate demand one way and/or supply the other way. There must be machine-to-machine interaction or, as the technologists call it, interoperability.

That request for availability must move directly into the supplier's system, and that system must recognize the nature of the request, check supplies and schedules, determine the answer, and respond to the requesting system. Only then have we removed the inherent latency preventing the realization of the immediate and effective "frictionless" supply chain.

Transfer of data from system-to-system and collaboration, of a sort, have been available on a limited basis through software developer offerings and custom developed programs. But it

hasn't been easy. With few, if any, widely recognized standards, it's mostly relied on one-to-one connections and those have generally not been interactive. Standards for interoperability through a services-based architecture are evolving and systems developers are enthusiastically embracing these new standards. That's an important factor helping SOA become practical and available now.

In an August 2004 research advisory entitled "Web Services-Oriented Architectures Finally Arriving in the Enterprise Arena", the Yankee Group states "Enterprise applications such as SCM, CRM and ERP have delivered standardization of processes. However, they have failed to deliver flexibility and have maintained a stranglehold on many enterprises. This has hindered the ability of enterprises to respond rapidly to changes in the business environment, integrate increasingly global supply chains and collaborate effectively with suppliers and partners."⁴

Later in the report, Yankee Group notes that Web services are pulling many enterprises out of the dark, especially in manufacturing where there is a clear understanding of the roadmap and how the benefits will be reaped. As standards enable the rapid implementation of services within systems across the supply chain, the benefits quickly follow. The Internet has erased the impact of time and distance and virtually all markets today are global. Competition is tighter than ever with competitive price and high quality as minimum qualifications to even play the game. Today's competitive arena is centered around the ability to respond – lead-time and agility – and product time-to-market, another form of agility. Removing information latency and tying supply chain partners closer together for rapid response are the keys to world-beating performance.

SOA offers advantages for the human components of the supply-demand chain as well. Services-based applications are more flexible, adaptable, and can be tailored more easily than those built with traditional tools and methods. Users are able to adapt the appearance, the usability, and the convenience of their individual workspaces to fit their needs and increase their effectiveness – without putting a burden on scarce IT resources. And workflows greatly reduce the mundane and routine, giving them more time to attend to the tasks requiring their judgment and experience.

Raising the Standard

The next generation of ERP systems, built on an SOA platform, are designed to support current needs for collaboration and connectivity, internally and throughout the supply chain. They are designed to provide unprecedented flexibility and adaptability, and to be able to grow and adapt to new business challenges, new technologies, and a constantly changing business environment. SOA-based systems provide users (of all types: internal, external, human or automated process) with increased visibility to all processes and functions. Data and service requests/responses are passed to, from and through any SOA-enabled resource without worrying about the specifics of hardware or software environments.

The emergence of SOA, and its incorporation within the new generation of systems, introduces a new era of visibility and connectedness that is key to success in today's highly demanding and rapidly changing global business supply/demand chain environment. And it provides the infrastructure to support emerging functions and applications that will drive supply chain innovation in the coming years.

⁴ Web Services-Oriented Architectures Finally Arriving in the Enterprise Arena, Phil Fersht, Research Note, The Yankee Group, July 14, 2004.

About the Author

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Author of the books Computers in Manufacturing, MRP+, Why Systems Fail, among others, Dave is an independent consultant and freelance writer serving both the developers and the users of software and systems for manufacturers. He has extensive first-hand knowledge of manufacturing functions and management practices, enterprise systems and vendor manufacturing software offerings. With over twenty-five years of industry analysis, consulting, teaching, writing, engineering, project management, technical analysis and management experience, he has exceptional analytical and communication skills as demonstrated by his published books, articles, papers and speeches.

Dave has been an independent consultant for the majority of that time, helping users of manufacturing systems to select, implement, and get better results from their systems. In addition, he has performed analyses, written white papers and case studies. He also wrote a number of reports for major analyst firms during this time. Dave is especially attuned to the needs and challenges of the mid-sized manufacturer.

In 1996, Dave and a partner launched Midrange ERP magazine, later renamed Midrange Enterprise, to act as an information and education resource for this community. The magazine, along with the offshoots APS magazine and FLOW Manufacturing report were purchased by Penton Media in 1999, where Dave continued to serve as editor-in-chief.

Dave is a certified Manufacturing Engineer, is certified by APICS at the fellow level in Production and Inventory Management and in Integrated Resource Management, and is a Senior Member of SME/CASA. Dave holds a B.S. degree in applied physical sciences from Rochester Institute of Technology.

About Epicor

Epicor is a global provider of real-time collaborative manufacturing solutions that meet the needs of small to mid sized discrete mixed-mode manufacturing companies. Epicor offers a suite of solutions specifically targeted to the manufacturing industry. The comprehensive Epicor Vantage and Epicor Vista suites of integrated enterprise resource planning (ERP) software solutions include comprehensive solutions for customer relationship management, sales, service, product data management, planning, production, supply chain management, finance and accounting, business performance management, and e-business. Years of industry experience enable us to design highly tuned software solutions that offer ease of use, smooth integration and long-term scalability. Whether it is back office automation or the addition of front-end customer, vendor and employee communications via the Internet, Epicor delivers scalable software solutions that can grow with the success of your firm.

For 20 years, Epicor has been a recognized leader dedicated to providing integrated enterprise resource planning (ERP), customer relationship management (CRM), and supply chain management (SCM) software solutions to midmarket companies around the world. Epicor is a global leader with over 20,000 customers in over 140 countries. Epicor leverages innovative technologies like Web services in developing end-to-end, industry-specific solutions for manufacturing, distribution, enterprise service automation, and hospitality that enable companies to immediately drive efficiency throughout business operations and build competitive advantage. With the scalability and flexibility to support long-term growth, Epicor's solutions are complemented by a full range of services, providing a single point of accountability to promote rapid return on investment and low total cost of ownership.

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