Making Your Enterprise Internet-Ready: E-Business for the Process Industries

As the future of e-business in the process industries comes into focus, manufacturers are beginning to ask themselves how they can make their enterprises "Internet-ready." The answer comes down to people, plants, and business processes. Changes brought about by the Internet will force manufacturing enterprises to become more agile and more responsive. To accomplish this, process manufacturers will need to deploy integrated information systems, which allow them to view the actual capabilities of their plants in real time. Next, they will need to have business processes in place to facilitate rapid decision-making. Finally, they must optimize their extended supply chain by integrating their internal business processes with their partners' business processes.

E-Business Growth in Process Industries

Estimates of the potential for business to business (B2B) commerce are so large they can lose their meaning. Forrester Research predicts U.S. B2B trade conducted via the Internet will nearly double annually, growing from $43 billion in 1998 to $1.3 trillion in 2003. The process industries are expected to grow more quickly, approaching $500 billion by 2003. For some segments of the process industries, nearly 10% of the industry's trade could move online. Forrester predicts that in the petrochemicals industry e-business will move from its experimentation phase today to a "hypergrowth" phase in 2000 and 2001.

Internet Allows All Process Manufacturers to Differentiate

In the short term, the Internet offers all process manufacturers the attractive possibility of differentiating themselves from their competitors in a commodity market. Over the long term, e-business will impact individual segments of the process industries differently. Downstream segments such as polymers, specialty chemicals, and pharmaceuticals will see more demand for customized products and will have more opportunities to sell and market their products directly to end users. Upstream segments, such as refining, will feel the most impact from the close collab-

oration with business partners that e-business demands. The implications for all process manufacturers are the same, however – where you sit in the value chain will determine where you should focus your energies.

The Internet is a Tool, Not a Panacea

The e-business leaders in the process industries will not be the companies that launch the glitziest Web site or deploy the most sophisticated Internet-enabled manufacturing technology. They will be the companies that align their people and internal business processes to gain the maximum leverage from Internet technology and tap into the vast potential of e-business. Companies that ignore their own business processes and skip ahead to forging Internet links with their business partners will, in the words of Michael Hammer, simply be exposing their own poor business processes to the rest of the world. In the hyper-competitive environment of the Internet, that could be a fatal, self-inflicted wound.

This paper outlines the future of e-business in the process industries and explains what process manufacturers can and should be doing today to prepare for the e-business era. This paper does not address each and every issue manufacturers will face, nor does it focus on all of the underlying technologies. Rather, this paper sketches out the broad picture and identi-

Fritz Lescher is marketing communications manager of New Providence, New Jersey-based Aspen Technology, Inc.

Chemicals

fies the major actions process manufacturers should be taking today as e-business in the process industries enters its predicted "hypergrowth" phase over the next two years. E-business has not yet caused the revolutionary change in the asset-intensive process industries that it has in information-based industries such as publishing and financial services. However, it is becoming clear that when the dust finally settles, the changes brought about by e-business will be no less dramatic in the process industries than they have been in information-based industries.

The Internet is Driving Two Fundamental Changes

The Internet – and the telecommunications revolution more broadly – are driving two fundamental changes in the way we communicate and interact: increased connectivity and increased speed. E-business is simply a ripple effect of these two changes.

Increased Connectivity

The simple technology on which the Internet is based has dramatically expanded the ability of individuals and companies to connect with each other. Whereas a customer and a supplier may only have communicated once or twice a month via phone in the past, they are increasingly likely to be directly connected to each other today.

Increased Speed

Faster communications "pipes" allow people to transfer more information more quickly. Limited bandwidth in the past restricted most business interactions to a brief fax or a terse Electronic Data

Interchange (EDI) message. Today, entire databases can be transferred in seconds. And if your products can be converted into bits you can distribute them electronically, too.

Ripple Effect

The ripple effects of the Internet will significantly impact process manufacturers.

The increased speed and connectivity, which the Internet enables, is creating a ripple effect throughout the process industries. At a high level, the Internet is forcing three major changes for process manufacturers: (1) fostering increased intimacy with business partners, (2) automating internal business processes and exposing them to the world, and (3) opening new markets, thereby creating sales opportunities as well as threats.

Increasing Intimacy with Business Partners

Continuous connectivity with customers and suppliers has created new opportunities to collaborate, share information, and provide more customized customer support. The fact that companies can communicate instantaneously is leading to expectations that they should communicate instantaneously. However, the bottleneck usually comes when they get to the "what." What information will they exchange? Will it be accurate? Will it be meaningful? This increased pace of communication with business partners is leading to higher expectations about response times. However, a company's ability to respond ultimately depends on the information they have readily available, the accuracy of that information, and the business processes that support the dissemination of that information.

Automating & Exposing Internal Business Processes

The speed and connectivity of the Internet is affecting business processes on two levels. First, it is accelerating internal business processes. Secondly, it is exposing companies' business processes to their business partners. The increased velocity of internal business processes does not necessarily constitute an improvement. More often, simply performing existing processes

faster highlights the bottlenecks, problems, and inconsistencies of these processes. The increased speed thus acts as a catalyst for change. Likewise, exposing your business processes to your business partners is not good in and of itself. It is only something you want to do if your business processes are worth sharing. Otherwise, the Internet is just exposing your bad processes to the rest of the world. Anyone who has received poor customer service from the Web-based storefront of a bricks-and-mortal retailer has experienced bad business processes attached to the Internet.

Opening New Markets

Changes brought about by the Internet are altering the competitive landscape in the process industries on both the marketing and sales fronts. On the marketing front, virtually every major company now has a Web site. These Web sites provide an immediate international presence – even for small manufacturers. Manufacturers are becoming increasingly savvy about using their Web sites to differentiate their products and to "level the playing field" with respect to their larger competitors. For example, Huntsman has a Web site dedicated to its Spectar co-polymer product (www.spectar.com) while Dow has launched its second-generation Web site to support its Styrofoam and Trymer products (www.styrofoam.com). Monsanto has gone further, creating Farmsource (www.farmsource.com), a site that offers a broad array of news and information to its agrochemical end-users.

On the sales front, Internet trading exchanges are making it easier to link buyers and sellers to facilitate the sale and distribution of products in the process industries – especially for off-spec products and smaller orders. For example, LTV Corp. sold 100 tons of excess steel online in January via Metalsite Inc.'s Web site. By August, LTV had expanded its online sales to six product lines and 50,000 tons a month. A whole host of similar Internet exchanges with names like eSteel and eChemicals are being launched every month to serve specialized segments of the process industries. These exchanges will make it easier for customers
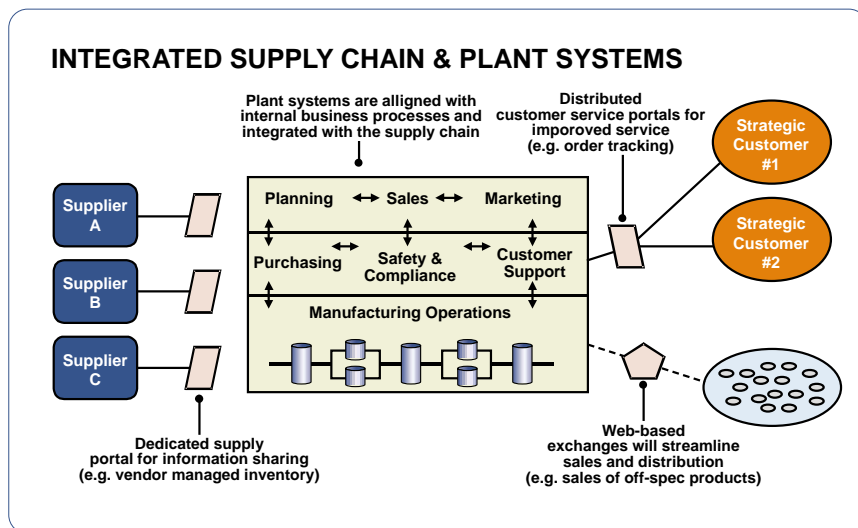
INTEGRATED SUPPLY CHAIN & PLANT SYSTEMS

Figure 1.0 | Integrated supply chain and plant systems

to compare prices. Process manufacturers that are well positioned to plug into these exchanges will benefit. Others may be left holding large inventories of unwanted products.

Process manufacturers – especially manufacturers of downstream products – are also setting up their own storefronts and in some cases attracting new customers. The specialty chemicals division of Ciba, for example, began selling its products via the Web and has since been receiving about two requests from new customers every day.

The Future

The future of e-business in the process industries is coming into focus. Most people working in the process industries are already feeling the ripple effects described above at some level, but they want more specifics. They want to know more precisely what e-business means for them and how they can prepare for it. In short, the future of e-business in the process industries is coming into focus and it looks, in many ways, like e-business in any other industry. Information is created and distributed in real time. The distance between customers and suppliers effectively shrinks and expectations rise. However, there are some important differences.

The main characteristic that sets the process industries apart from other indus-

tries is their asset-intensiveness. Process manufacturing plants are huge and costly. What's more, due to the continuous nature of most processes, product changeovers are more complex and less frequent than in discrete manufacturing facilities. Therefore product customization and improved customer service are less likely to come from make-to-order production than from improved business processes, a better and more accurate understanding of the plant's capabilities, and more accurate product planning via collaborative forecasting. These improvements will allow process manufacturers to meet their customers' rising expectations and serve their individual needs.

The e-business future for the process industries suggests that leading e-business manufacturers will know the true capabilities of their manufacturing enterprises. They will have consistent and interoperable business processes and use software and Web-based services to support those improved internal business processes. Leading manufacturers will answer their customers' demands for improved customer service by providing windows (sometimes called portals) into their operations. These windows will help integrate shared business processes such as improved product planning and collaborative forecasting.

Finally, Internet-based exchanges will streamline pricing and distribution. Commodity products will move more quickly and efficiently through the distribution network while specialized, value-added products command premium prices and become increasingly customized to end-user needs. As in other industries, e-business in the process industries entails a transfer of power from vendors to their customers. Vendors who understand and embrace this shift stand to reap significant benefits.

Business Processes Will Be Streamlined

Manufacturers will only capture the benefits of increased connectivity if they are able to collaborate more effectively with their business partners. To start with, this means that internal business processes must be streamlined and made interoperable with their business partners' processes. If a company rushes to collaborate with business partners before it has optimized its internal business processes, it is courting disaster.

Once a company has streamlined, consistent, and interoperable internal processes, it is "Internet ready." The next step is to create an extended enterprise by integrating those business processes with their business partners. Many companies have experienced the pain of integrating their internal business processes – often in conjunction with the implementation of an ERP system, such as SAP R/3™. Integrating business processes externally with business partners will be equally challenging for process manufacturers. They will need to deploy advanced software systems that facilitate and automate the integration of their business processes with partners so they can collaborate and transact B2B commerce over the Internet.

One basic example of collaboration is the use of supplier-managed inventories, where customers share information about the demand for their products so that their suppliers can ensure that there will be enough raw materials on hand to manufacture the end products. Shell is among the companies that are currently experimenting with this shared business process.

Web-Based Services Will Support Internal Business Processes

Not all business processes involve established relationships, such as those maintained with customers, key suppliers, and distributors. A good portion of them involve infrequent or occasional interactions or one-off requests. Emerging Web-based services will play a key role in supporting many of these non-standard business processes. In particular, such Web-based services will be especially useful in cases where a business process requires obtaining multiple quotes or where information from many different sources must be brought together to solve a problem.

The most obvious example of the first case would be the business processes that a purchasing agent engages in. Here, the purchasing agent must obtain quotes from multiple suppliers and determine if the goods offered meet the company's required specifications. In the past this might have been done manually via phone and fax. Today sites like Chemdex (www.chemdex.com) claim that their services can "reduce costs and streamline enterprise procurement processes" in the life sciences industry.

In the second case, consider the challenge design engineers face today when performing a cost-benefit analysis for expanding the capacity of a particular process.

Here, the engineer needs to first research the problem and determine how other people have solved similar problems. Then the engineer needs to model the new process using process design software. This step entails several sub-steps such as obtaining information about the plant, process, and physical properties of chemicals in different states. Finally, once the engineer has designed the new process, he or she needs to obtain cost information on any new required equipment, and perhaps get quotes for selling old equipment that is no longer needed. A Web-based service that supported the business processes of a design engineer would bring all of these disparate services and information sources together so that they could be searched and utilized in minutes.

BUSINESS PROCESS INTEGRATION WITH TRADING PARTNERS
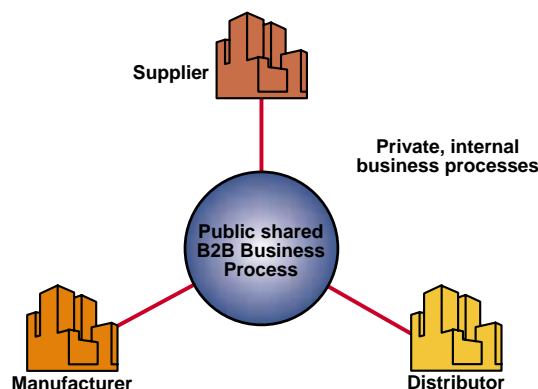PRIVATE PROCESSES vs PUBLIC, SHARED PROCESSES

Figure 2.0 | Business process integration with trading partners

Portals Will Provide "Windows" Into Your Operations

Just as computers have used the Internet to interconnect and form a "super network," companies will use the Internet to connect as well. One of the principal ways companies in the process industries will connect and collaborate is through the use of portals, or windows, into manufacturing enterprises. These portals will help to integrate inter-company business processes and streamline the extended supply chain by allowing customers to automate key business functions such as collaborative forecasting and planning.

This collaboration will increase the likelihood the right product will be made at the right time, cost, and quality and be sent to the right customer. This is especially important in the process industry since transitioning from one product to another is a complex and costly endeavor. BASF is already doing this by allowing suppliers to check current inventory and calculate forecasts based on real-time information from its IT systems. Dow has a similar arrangement with some of its business partners.

Integrated Supply Chain & Plant Systems Will Be Required to Enable E-Business

A trap manufacturers will face is creating Internet windows with nothing for their business partners to view. For collaboration to become a reality, manufacturers will need to ensure they have reliable, up-to-date information to share with their business partners. This will require integrated supply chain and plant systems that are updated in real time and model-centric – based on consistent, accurate physical and financial models of their manufacturing processes. Without this underlying technology, manufacturers will not be able to make real-time, profitable decisions about which products to make, where to make them, and when to make them.

The Internet Will Raise the Bar on Customer Service

The increased communication enabled by the Internet is raising customer expectations ever higher. This is compounded by the fact that popular Web-based retailers, such as Amazon.com, have set a high standard for customer service on the Internet. The Internet will ultimately enable and require a similar level of customer service from companies in the process industries.

There are two principle ways in which manufacturers will use the Web to improve customer service. First, they will service non-strategic customers more cost effectively. For many companies, 80% of the customers account for only 20% of revenues. The opportunity for servicing these customers more efficiently is

enormous. The other way manufacturers will use the Internet is to provide exceptional customer service to their top customers – the other 20%.

Manufacturers are already creating customized Web sites that allow customers to place and track orders via the Internet. Air Products (www.airproducts.com), Condea Vista (www.condeavista.com), Eastman Chemicals (www.eastman.com), and GE Plastics (www.polymerland.com) are examples of companies that are doing this on their public Web sites today. GE goes so far as to allow users to customize polymers to their specific needs. The strategy is paying dividends. Already 15% of GE Plastics' $1 billion sales are now conducted via the Internet and Internet-routed sales are increasing at 20% per month.

Some manufacturers are also rolling out the red carpet for key customers. AlliedSignal, for example, has set up private Web pages built for its key customers so they can access individualized product data, technical and R&D information, as well as place orders, track inventory, and pay bills. Closer relationships through these types of interfaces and the streamlined business processes that support them will increasingly allow manufacturers to use exceptional customer service as a "reward" for their very best customers.

Internet Exchanges Will Streamline Distribution

Internet exchanges will help streamline the sales and distribution of the products that process manufacturers create. Burgeoning online exchanges such as eSteel, Metalsite, e-Chemicals, and Chematch are vying to make the business of trading chemical commodities more liquid and efficient. Companies like DuPont, Elf Atochem, and Huntsman have also experimented with these types of exchanges.

Internet exchanges create opportunities and challenges for manufacturers. On the positive side, they open up new market segments such as customers who want to buy small quantities and, in downstream processes, the direct-to-consumer market. In past years these segments would have been too expensive for large manufacturers to sell and serve profitably.

The online exchanges will also provide an effective outlet for off-spec products. In short, online exchanges will help grease the distribution channel for commodity chemicals and, perhaps, make pricing more transparent.

Manufacturers who use these exchanges strategically could reduce their inventory carrying costs by more efficiently offloading low-priced goods and thus freeing up their time to sell and market their differentiated, value-added products.

In short, the future of e-business in the process industries as described above is shifting power toward the consumer just as it has in other industries. This is a double-edged sword since every manufacturer is both a supplier and a customer. Process manufacturers must find ways to exploit their newly found power over their suppliers while they marshal their own resources to make themselves agile to compete in the hyper-competitive e-business era.

What Process Manufacturers Must Do to Prepare for the E-Business Era

E-business has clearly had a smaller impact on the process industries to date than it has in other industries such as personal computers and online stock trading. However, as the above examples demonstrate, the pace of change is rapidly accelerating. When the dust settles a few years from now the change will be no less dramatic than it has been in other industries.

Now that the future is coming into focus, process manufacturers are beginning to ask themselves how they can make their enterprises "Internet ready." The answer comes down to three issues: (1) people, (2) plants, and (3) business processes. Manufacturers need to understand that the Internet will impact their entire business. Before they can enter the e-business era and reap the rewards, manufacturers must ensure that their people, their plants, and their business processes are "Internet ready."

By its nature, the Internet cuts across a company's entire organization. Therefore, companies must organize their people around their key business processes to facil-

itate the integration of those business processes with their trading partners. Furthermore, manufacturers must prepare their people to make decisions at Internet speed. This means organizing, delegating, and equipping them with accurate, up-to-date information about their plants. Finally, process manufacturers need to know their manufacturing capabilities – especially operating constraints and product profitability – and need to ensure that their plants and extended supply chain are sufficiently agile to respond to change.

Start With an Enterprise-Wide Strategy Driven from the Top

The Internet is a bomb, not a missile. Process manufacturers need to understand that the Internet impacts their entire organization. The Internet affects business processes that cut across every functional group within an organization. From product development, to marketing, to sales, to customer service, to internal processes such as human resources, the Internet will affect how process manufacturers work and interact with their customers, suppliers, and partners.

The only way to ensure a manufacturing enterprise will be Internet ready is for e-business initiatives to be led from the top. Without executive management sponsorship, e-business initiatives will become yet another sales, IT, or marketing initiative – which improve one or two parts of the organization but fail to prepare the organization to move into the e-business era. Ask someone who has tried to lead an e-business initiative, and they will tell you that a lack of top-level management support is tantamount to failure.

Decisioning Bottleneck Information Flow

Some of the largest bottlenecks on the path towards e-business arise when companies restrict the flow of information. The increased pace of change fostered by the Internet requires faster decision-making. Decisions require information. If companies are unwilling or unable to share critical information, both internally and with business partners, they are creating bottle-

necks and restricting their ability to successfully enter the e-business era.

Organize Around Business Processes

The Internet is creating extended enterprises by interconnecting suppliers, manufacturers, distributors, and customers into dynamic trading communities. However, creating extended enterprises implies business processes must be extended as well. To prepare, process manufacturers must organize themselves primarily around business processes, rather than product lines or business units. This is the way their business partners will expect to interact with them.

If manufacturers attempt to knit their disparate business processes together across multiple business units, and then haphazardly integrate those processes with their business partners, they will be setting themselves up for failure. For example, if customer service is a business process and a manufacturer is organized around five product categories, each with its own customer service organization, it will be very difficult for that manufacturer to provide the seamless, unified customer service, which customers expect.

Integrate Business Processes with Trading Partners – Not Just IT Systems

The extended enterprise that Internet and e-business pundits have been forecasting can only become a reality if enterprises integrate their business processes such that they behave like an extended enterprise. It is simply not enough just to integrate your IT system with your trading partners. The prerequisite for integrating business processes between companies is for manufacturers to align and integrate their own internal business processes.

Integrating business processes between companies will not be easy. Stories about the difficulties of ERP implementations aimed at streamlining internal business abound. Breaking down the barriers between organizations, where power and decision-making are more dispersed, may prove to be as difficult as some of the ERP implementations.

To succeed, manufacturers will need to utilize sophisticated business process automation software that facilitates inter-company business process integration. This type of software keeps internal business processes shielded from shared, external processes. An example of an internal business process is transmitting a customer order to manufacturing for execution. An example of a shared process is processing a request for quotation and purchase order for additional raw materials.

Deploy "E-Business Ready" Manufacturing Execution Systems to Ensure Agile, Responsive Plants

Your plants are out of date or incorrect data and information are useless. To make decisions at Internet speed, manufacturers must know the actual capabilities of their plants in real time so they can rapidly and profitably respond to the increasing demands of their customers. Manufacturing data must be made more meaningful and readily accessible throughout the manufacturing enterprise than it is at most process manufacturers today.

This accuracy and accessibility requires integrated, Internet-enabled manufacturing execution systems based on accurate, consistent models of the plant. Why is a model-based architecture critical? Without accurate physical and financial models of the plant it is impossible to predict how the plant will perform when producing a particular product under varying operating conditions, and thus whether or not a product can be pro-

duced profitably, on time, and to the customer's specifications.

For example, if a polymer manufacturer does not know the time to transition from one grade of polymer to another, it cannot accurately schedule the plant. This means when a customer calls to request a custom batch of polymer, the manufacturer cannot confidently determine whether it would be profitable to alter the production schedule to accommodate the customer's request or not. These kinds of decisions will have to be made in minutes or perhaps seconds in the future to remain competitive.

Once process manufacturers know the true capabilities of their plants and what their customers are demanding, they need to be certain their plants will respond. They must be certain they can push the limits of their plants while running them safely, efficiently, and predictably. Deploying truly integrated plant design, operation, and management technologies, based on accurate, consistent models is the only way for process manufacturers to ensure they are prepared for the e-business era.

Integrate Your Extended Supply Chain and Manufacturing Execution Systems

The greatest point of cost, complexity, and uncertainty in the extended supply chain of the make-centric enterprise is the plant. How can you process customer orders over the Internet, promise delivery dates in real-time, provide key manufacturing information, and know if you are making money if your extended supply chain system is not tightly integrated with your manufacturing execution system? This reality is one of the unique characteristics that set the process industries apart from other companies such as those making tennis shoes or personal computers.