

The People-Ready Business

Whitepaper

The Next Wave of Innovation in Manufacturing
Insights from the New World of Work

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Before joining Microsoft in October 2003, Rasmus was an analyst with Forrester Research Inc. His achievements included inventing conceptual frameworks for enabling the future of work, including adaptive workspaces and intelligent content services.

Before working for Forrester, Rasmus was manager of workgroup computing at Hughes Space and Communications Co., where he handled network operations, e-mail, collaboration and an 8,000-client Windows NT® rollout. As a technology writer, Rasmus has worked on staff at PC AI Magazine and Manufacturing Systems Magazine, and has been a columnist for several other publications. He has authored nearly 200 trade journal articles and three books, including "Rethinking Smart Objects," published in 1999.

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The New World of Work:

The Next Generation of Manufacturing Innovation Through Software

EXECUTIVE SUMMARY

Globalization, connectivity, regulation and demographics are the trends shaping the landscape for manufacturers over the next 10 to 15 years. In this “new world of work,” the ability to create, share and act on information can help manufacturers compete more effectively and operate more efficiently amid rapid change and relentless pricing pressure. People are the critical factor. Only people have the agility and resilience to identify and act on new information quickly to meet challenges or capitalize on new opportunities. By surrounding people with powerful tools and a culture of learning, manufacturers can bring innovative new products to market more quickly and mobilize a network of suppliers in deeper, more collaborative relationships. Empowered people can drive operational excellence by constantly improving products, streamlining practices and sharing knowledge. And they can work responsively with customers to build high-value relationships to drive business growth. Microsoft uniquely delivers software and solutions that empower people to take their manufacturing business further.

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INTRODUCTION

Few industries have seen as profound a transformation as a result of globalization and technological innovation as manufacturing. Over the past decade, the practices and assumptions of more than a century have been turned upside down by the opening of borders and markets, global connectivity, and rapid changes in manufacturing, distribution and logistics.

In addition to the issues raised by globalization and new technology, manufacturing companies also face demographic and compliance challenges. Around the world, huge numbers of baby boomers are nearing retirement. A smaller cohort of “millennials,” with dramatically different experiences and expectations of the working world, are poised to take their place. What are the implications for organizations that often rely on experiential knowledge and informal practices to improve processes, discover new efficiencies, and propagate a unique company culture in a future that may see higher employee turnover?

Although regulatory compliance poses a specific challenge for companies operating in highly regulated markets, the issue of transparency presents profound challenges. Not only governments, but customers, suppliers, shareholders and workers increasingly expect greater visibility into, and interaction with, processes that concern them. Is there a way to leverage the investments manufacturers are already making in supply chain and compliance systems to achieve secure levels of transparency that can help organizations deepen trust within the markets they serve?

Manufacturers that have developed expertise in their own line of business are increasingly challenged to embrace a more rapid pace of change, and entirely new skills are required to remain competitive in a much wider world. Some of the key questions facing manufacturing executives include these:

- How do you encourage a culture of innovation to stay ahead of competitors and maintain pricing power?
- How do you maximize work-force productivity in the midst of demographic transition and a more complex global market?
- How do you use the advantages of global “supply webs” and deepen collaborative relationships with partners and customers while maintaining control over core business areas?
- How do you extend the benefits of “mass customization,” using the flexibility of manufacturing systems and real-time customer and market data, while continuing to maximize the advantages of scale?
- How do you adapt to higher demands for transparency and compliance from governments, markets, customers and partners?

Every manufacturer has to assess these issues based on its unique business requirements. At Microsoft Corp., we are taking a strategic perspective on the way that trends and technology will evolve over the next 10 to 12 years, and we are thinking deeply about how software will enable people and organizations to continue to prosper in a fast-changing world. This paper offers a glimpse into how we see people, technology and global trends coming together for manufacturers. This paper is not a product road map, but a vision of software's role in manufacturing that we hope will start conversations about how we can work together to create a competitive and productive manufacturing industry in the years ahead.

Software Can Help Manufacturers Adapt to a Changing World

The increasing sophistication, interoperability, security and usability of software will enable manufacturers to transition from rigid, process-based solutions based on costly, custom-developed proprietary technologies to role-based solutions using familiar, centrally managed platforms and applications that give workers more power to configure the interface and the application to fit the way they work.

Manufacturing has always been an industry with strong desires to integrate data to improve operations and increase innovation. Until recently, advances in manufacturing software were highly dependent on proprietary investments by the manufacturers themselves. Software has now developed to the point that common infrastructure software, from Microsoft® Windows® to the Microsoft Office system to standards-based middleware such as BizTalk®, can be used to drive the development of innovative solutions from the factory floor and the supply chain to the master production schedule. We've seen the rapid maturing of software for manufacturing over the past six to seven years because of the enormous investments in Internet-enabled technologies, the emergence of standards such as XML and SOA, and secure implementations of TCP/IP-based applications.

Over the next 10 years, the pace of change will only increase. The increasing sophistication, interoperability, security and usability of software will enable manufacturers to transition from rigid, process-based solutions based on costly, custom-developed proprietary technologies to role-based solutions using familiar, centrally managed platforms and applications that give workers more power to configure the interface and the application to fit the way they work. Products such as Microsoft SharePoint®, which integrates directly through the Microsoft Office user interface, bring the data and functionality of the enterprise portal into the application environment that people know and use for document creation, data analysis and communication. This kind of simplification, both for end users and for IT, can help organizations move toward the flexible, people-ready posture necessary to respond to market developments and capitalize on emerging trends.

According to a white paper on manufacturing automation published in 2006, the role of next-generation software is central to achieving a number of strategic priorities for manufacturers:

[Manufacturing C-level IT executives who responded to the survey said] software must become better able to model and represent the real world, including the potential risks and rewards associated with specific tactical decisions. Second, IT middleware tools must improve to the point where integration of systems becomes more flexible and much less expensive. And, third, software must better support major business improvement initiatives such as lean manufacturing.¹

Microsoft strongly concurs in this assessment. Modeling and visualization, integration of systems, and the ability to support business improvement are central to our vision for the next generation of applications and platforms. But more than just a set of capabilities and features, our software embodies a philosophy that people, not systems, are the key to long-term success.

In a fast-changing environment, the real key to capitalizing on new opportunities is by empowering people in your organization to add new value, whatever their job role or skill level. Investments in systems that lock people into low-value roles in the hopes of containing costs or promoting standardization risks creating a kind of organizational rigidity that is ill-adapted to a fast-paced, customer-centric world. By contrast, empowered people can make a difference at every level, by doing the following:

- **Innovating more quickly through better collaboration**
- **Maximizing their value and contribution to the work force**

- Managing supply relationships in a complex global market
- Meeting demands for compliance and transparency at lower cost and frictionⁱⁱ

People Lead and Innovate

Manufacturers live and die by their capability to bring new products to market quickly. To succeed in this competitive environment, a company's people must collaborate with suppliers, engineers and product designers using shared platforms to exchange ideas. People who have a talent for leadership can then take these ideas and transform them into innovation.

People Drive Operational Excellence

Manufacturers can excel by focusing on operational excellence — running their business better than the competition and at lower cost. Companies that build their success on operational excellence provide ready and easy-to-use technologies to empower their people to be highly efficient.

Technology can offer increased visibility into business processes — everything from tracking sales to plant-floor operations — visibility that managers can use to make decisions faster and improve productivity.

People Strengthen Value Chain Partnerships

Technology enables people to maintain the critical agility that's required for their companies to adapt to ever-changing market conditions. An important part of that agility involves working closely with suppliers and industry partners to reduce time-to-market, to manage inventory and replenish parts as needed, and to share financial responsibility and risks if markets shift.

With the right hardware and software, people can manage complex relationships with multiple partners to produce quality, error-free products, and higher profitability. Microsoft industry partners

have developed software solutions that are built on a standard Microsoft platform and help people collaborate and manage these relationships both within and across enterprise boundaries.

People Build Customer Relationships

Any manufacturer can benefit from a deeper connection with its customers. But to achieve these connections, the manufacturer's employees must have the tools to meet their commitment to serve customers well. Microsoft software is helping manufacturers by consolidating information across and within enterprises, which leads to improved customer service and lasting customer relationships.

Microsoft's goal is to help manufacturers succeed by giving people the right tools, information, connections and access to expertise that will allow them to implement new efficiencies while enabling them to apply their creativity quickly to process improvement, customer requirements, partner relationships, and product and service innovation. Today, these capabilities are integrated into our next generation of Microsoft Office and Microsoft Windows products and platforms, and the industry solutions our partners build using our technology. Our commitment is to continue to evolve those products and solutions to meet the emerging needs of manufacturers and to stay in front of the larger social, political, demographic and economic trends that are transforming the way we live, work and do business so that our software continues to bring value to this ever-changing market.

The Value of an Empowered Workforce:

- People lead and innovate, collaborating with suppliers, engineers and product designers using shared platforms to exchange ideas.
 - People drive operational excellence. Manufacturers can excel by focusing on operational excellence—running their businesses more efficiently than the competition and at lower cost.
 - People strengthen value chain partnerships. Agility requires working closely with suppliers and industry partners to reduce time-to-market, manage inventory and share financial responsibility if markets shift.
 - People build customer relationships. Manufacturers' employees must have the tools to meet their commitment to serve customers well.
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Manufacturing in 2016 — A Glimpse Ahead

Before we venture into the practices, methods and technology that will enable the evolution of manufacturing, let us step back and take a glimpse at what the future of manufacturing may look like. The following narrative describes how a fictional manufacturing day might go based on technologies we believe will be in widespread use in the next eight to 12 years.

Keenan McTaggart is director of research for Trey Manufacturing, a leading provider of implantable medical monitoring devices. Over the past several years, demand for these devices has grown as technology has improved and medical practice has accepted the devices' various benefits. Obviously, performance, precision and quality are critical to the success of Trey's products in a market that is both highly competitive and subject to intense regulatory scrutiny.

In earlier times, Keenan would have had to travel extensively to meet with suppliers, researchers and customers in the medical field to coordinate their efforts and manage quality control. However, Trey's recent technology investments now allow Keenan to zero in on the most detailed levels of the research and product development cycle from his office in Toronto, or wherever he happens to find himself.

Recently, an analysis of performance data gathered from the earlier generation of Trey products revealed a slight inefficiency in one of the intake valves used to collect cell samples from patients. Keenan is facilitating a three-way networked conference between a medical researcher in Boston, part of Trey's "brain trust" network who helped to identify the problem, and Impulse, the Taiwan-based supplier of the molecular valve component. The three scientists are working together to figure out how to improve the design for the next version.

In a shared virtual workspace, they are able to work collaboratively and interactively on a 3-D model of the device, testing different combinations of materials and assembly techniques. With each new permutation, the software gives Keenan an updated view of costs, resource planning schedules and project timelines from the supplier's systems, and checks the new design against current and pending patents from government networks worldwide. Although this process of open innovation provides open access to the scientific data required to make decisions, certain business information is rights-managed across the different systems so each conference participant only sees the data appropriate to his or her role in the project.

A sample display that might be seen from the manufacturing perspective, showing readings from the manufacturing process as new options are exposed to the software. The software automatically pulls the data into an FDA regulatory compliance form, then checks a box in a list of FDA task requirements.

After a few tries, the team agrees on a design, but there is a question over how well the new valve will integrate into several of Impulse's existing products. A quick search of the organization's expertise repository reveals that the best person to answer the question is Gail Nakamura, a fabrication specialist in the "clean room" in the Toronto facility, who has successfully solved several similar design issues in the past. Gail's presence status shows her as available for a video-conference, so Keenan loops her in to the call.

Sure enough, she identifies a potential problem of interaction between the materials that none of the others had thought of, but figures it can be solved by a slight recalibration of the assembly systems when the valves are integrated into the device. She writes up a quick



A sample display that might be seen from the manufacturing perspective, showing readings from the manufacturing process as new options are exposed to the software. The software automatically pulls the data into an FDA regulatory compliance form, then checks a box in a list of FDA task requirements.

summary of her thoughts and inserts it into Trey's Practice Base, where it automatically propagates to all related material and assembly issues.

Manufacturing receives its updated operational models so it can continue to plan for the impact of the new design on its processes.

Keenan wraps up the call and moves on to the next item on his task list. As he does so, the system automatically generates a summary of the call. Relevant members of the operations, legal and marketing teams who have explicitly subscribed to this process or whose role requires that they be kept in the loop automatically receive the updates on their currently preferred device and channel (e-mail,

shared workspace, wiki, subscribed Web feed or other collaborative environment) so that they can get started on the various activities stemming from the decision to update a critical product feature.

The scenario above represents a glimpse into Microsoft's vision for how a new generation of powerful information worker tools can support and extend the capabilities of people and organizations in the face of new challenges. The following sections explore the business, social and technological assumptions of the scenario to show how a people-centric approach can position manufacturers to maximize the opportunities of the new world of work.



It is now widely recognized that the next great breakthrough in products, services or processes can come from any-where inside or outside an organization: from customers, partners, frontline workers, outside experts, or from "the wisdom of crowds."

Creating a Culture of Innovation

Our story centers on research and development (R&D) because the drive for continuous innovation has emerged as one of the defining features of manufacturing in the 21st century.ⁱⁱⁱ Manufacturers that do not find new ways to add value to their products, product lines and processes risk losing margins and market share through commoditization. It is of course possible to be successful in a commodity business, but only through relentless attention to cost management. Innovation provides a clear alternative to preserving pricing power, brand strength and leadership.

For many manufacturers, innovation has traditionally been a compartmentalized, controlled, top-down process, run by a small team of product designers, engineers and experts. The rapid spread of networks, however, has changed the model of innovation. It is now widely recognized that the next great breakthrough in products, services or processes can come from any-where inside or outside an organization: from customers, partners, frontline workers, outside experts, or from "the wisdom of crowds."^{iv} We refer to the social-ecosystem created by these relations as "networks of open innovation."

Consequently, the managers tasked with R&D responsibilities operate in an increasingly collaborative environment. Product development is the integration point between domain innovation and operational processes such as company knowledge, customer feedback, partner input and line-of-business systems, as innovation often requires changes that ripple through and affect all aspects of the business. The tools used by R&D professionals should reflect this connectivity and integration, both within and beyond the four walls of the company.

Demand-Driven Innovation

In the example above, the team's product development drivers are derived from data and experiences collected from customers using earlier versions of the device. In addition, the story assumes that many products will be able to autonomously report product status and performance back to the manufacturer, within a framework that respects and protects customer privacy. The falling costs of technology such as RFID and the growing ubiquity of wireless networks will soon make it both possible and

Organizational learning through collaboration will benefit by extending the scope of participation to customers, partners and regulators.

practical for companies to gather real-world product data rather than relying on third-party studies, market research and anecdotal customer evidence.

The data collected by such systems will then require back-end analysis to expose meaningful patterns that can be acted on by human experts and product teams. Pattern recognition algorithms already in use in high-end data mining applications (such as those found in national security systems, for example) will be standard in mainstream information work and midmarket database software in five to seven years, and will continue to improve. This technology can help isolate specific, highly detailed issues based on subtle patterns of data, saving enormous amounts of human time and effort. The result is a continuous feedback loop of innovation, refinement and response driven by real data and customer demand.

Collaborative Innovation

In all but the smallest companies, innovation is usually a collaborative activity. Over the past decades, team collaboration has evolved from the in-person meeting and conference call to a variety of methods including discussion forums, team workspaces, real-time online meetings, document sharing and more. Organizational learning through collaboration will benefit by extending the scope of participation to customers, partners and regulators.

In the story above, the corporate R&D manager works collaboratively with an outside researcher and an engineer for one of the company's suppliers. This is necessary to achieve the combination of diverse perspectives — pure academic, practical and strategic — necessary to achieve durable innovation. If this more ad hoc approach to collaboration is to become more prevalent in the next decade, organizations will need to embrace technical innovations that allow this kind of interaction, and adopt policies that encourage its use while protecting proprietary information on networks and devices.

The story also envisions rich, seamless interorganizational collaboration across time and geography, facilitated by the next generation of real-time environments such as Microsoft Office Live Meeting. Not only people, but also relevant applications and data (such as the vendor's ERP systems and the government's patent database) are integrated into the meeting space as needed, without requiring participants to leave the context of the meeting to do a separate search. Machine learning and pattern recognition allow the meeting space itself to interpret the participants' needs and update the information environment accordingly.

We see that each participant's view of the data displayed on the periphery of the meeting space is determined by that person's role and identity. Keenan, the corporate R&D manager, sees the implications of the product enhancement on the company's internal sales and marketing projections; the vendor sees information on profit margins and sublevels of the supply chain proprietary to his own organization; the researcher is connected to academic databases not available to the corporate players. All of them see the scientific and design elements required to make good decisions and reach consensus.

The products of their work are protected by rights management software that restricts the duplication and redistribution of proprietary content even as it moves beyond the firewall. A successor to technology such as Microsoft Information Rights Management Services, this new content-level security can be embedded in any type of data, document or document component (e.g., portion of a drawing or model, word or paragraph in a text file, cell or formula of a spreadsheet). Access is automatically managed through the identity management platform, and authenticated through new technologies that rely on a "preponderance of evidence" which incorporates biometrics such as fingerprints, handwriting and facial recognition, along with tokens and passwords to reduce the burden of authentication, while increasing its effectiveness.

Work-Force Empowerment

Manufacturers are among the leaders in recognizing the potential contribution of frontline employees to innovation and quality. Since the 1980s, many manufacturers have used quality circles, statistical process control methods, and various other strategies to aid in the discovery and dissemination of best practices.

In our story, the hands-on experience of the production worker is critical to the successful implementation of the researchers' solution. This situation is common, according to industry experts. As manufacturers extend their operations around the world to take advantage of differences in the cost and skill of labor, they will need to find new ways to identify the potential contributions of workers so that the efficiencies gained through work-force globalization are not lost to lower productivity, quality management problems, or inability to capitalize on informal knowledge and experience.

For manufacturers to innovate, to adapt to change and to retain knowledge in the global economy, they will need to invest in people, and in the tools that allow people to readily take action on their insights, collaborate about problems and improve business operations, bringing to bear their experience and creating innovative products, processes and services.

Expertise as Capital

The R&D manager in the story identifies the worker with the highest potential to contribute to the product development conversation by using an expertise location system. An evolution of current technology such as Microsoft SharePoint Portal Server, the system keeps track of employee information across a range of different internal sources (HR records, performance appraisals, documents the user has created, entries into the knowledge base, participation in e-mail and IM discussions, etc.) to develop a profile of expertise for each worker across the company and perhaps beyond. Pattern recognition technology simplifies the

creation and management of these expertise portfolios, avoiding the taxonomy problems of a static database.

Armed with this information, manufacturers can track and manage their institutional expertise like any other kind of capital asset. They can invest in work-force development to fill gaps, be extremely strategic in hiring decisions, and gain a qualitative metric that can be used to calculate the value of worker contributions as an offset to the cost of labor when making global sourcing decisions.

Attention Management

As helpful as employee input can be to management processes, it's important that frontline workers remain focused on their primary role in production. Workers hired in traditional information work roles are already seeing some downside to the "always on, always connected" workstyle, and many report diminished ability to complete tasks due to constant interruptions from e-mail, instant messaging and other distractions.^v It's reasonable that manufacturers would seek to avoid having that problem spread to the production environment.

One solution to information fatigue for both managers and production workers is the use of full-spectrum presence. This is an extension of the capability already used in technology such as Microsoft Office Live Communications Server, which allows people to indicate their availability for different modes of communication or to different people. Most people have experienced this with the "paw" or person icon in an instant messaging application.

In the story, the worker whose expertise the team wants to consult indicates she is "available" for that activity. Her status may be controlled by her own setting, by her manager, or by a management system that assesses her current activity, the role of the people who want to speak with her, and the relative importance of her expertise to the project, as well as the urgency of the request. Dynamic presence

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As the world faces the demographic shifts of the retirement of the baby boomers and the arrival of a new generation of millennials in the work force, issues of knowledge management are moving from the domain of theory into the very real world of profits and productivity.

can help organizations manage the flow of person-to-person information around their organizations, gaining the benefits of ad hoc communication and personal experience without the drawbacks of information overload.

Knowledge Retention

Organizations of all kinds benefit from capturing and reusing knowledge discovered in informal situations so that they don't have to repeat complicated consultations over and over again to solve the same problems. Knowledge management was a big IT issue in the mid-1990s, but many initiatives failed because of low rates of worker participation. As the world faces the demographic shifts of the retirement of the baby boomers and the arrival of a new generation of millennials in the work force, issues of knowledge management are moving from the domain of theory into the very real world of profits and productivity.^{vi}

The story above envisions the capture of the employee's contribution to the R&D discussion in a knowledge base. Common storage technology that would be familiar today is augmented by replication features that dynamically propagate the new knowledge across all relevant practices, and make it visible to people who have subscribed to these practices. Along with technology innovation will come innovations in the system of incentives and protections that employers extend to workers who share their knowledge and risk losing their own competitive advantage within the work force. Microsoft has no specific recommendations on how organizations can accomplish this except to note the increasing importance of knowledge management systems and practices, especially to companies that rely heavily on informal knowledge and experience of frontline workers.

Maximizing the Value of Information Workers

The final element of the story illustrates the R&D manager's information work environment, automatically wrapping up

the loose ends of the task he just accomplished so that he can move quickly to other issues. Organizations that pay a premium for formal expertise should maximize the contributions of those experts within their domains, rather than having them perform routine clerical tasks.

One unintended consequence of the first generation of information work productivity software, such as older editions of Microsoft Office or current versions of open-source office applications, is that they push essentially low-value, low-skill work such as document creation, presentation design and calendar management directly onto information professionals whose core skills likely lie in other areas. In earlier times, this sort of activity was the work of an executive assistant — a luxury fewer and fewer organizations can afford, especially for midlevel professionals.

Current and future versions of Microsoft Office embed more and more low-level management activities into the software itself. Manufacturing employees can create higher-quality products in a more timely fashion, not just because of access to better equipment, but because they have better information and visibility into what is required of them and why. They can see who will receive their work, and how it will be used. They can see the analysis of downstream processes and customer returns.

As software continues to evolve and machine learning and pattern recognition technology improve, we can imagine professionals will spend little or no time wondering "what folder did I save that document in?" or "did I actually include the attachment to that e-mail I sent?" and less time issuing routine memos closing the loop with colleagues, as these tasks will be automated reflections on the work mediated within the software. Both organizations and workers stand to gain a great deal in terms of efficiency, productivity, job satisfaction and focus.

Operational Excellence

Customers need real-time information on inventory, availability and manufacturing status and the ability to integrate that data with transaction business ERP systems from vendors such as SAP AG and Oracle Corp. Today, managing data in disparate systems is prone to errors and inaccuracies. Even the smallest plant floor inefficiencies can translate into significant losses for global manufacturers. Gaining visibility into plant floor operations represents a critical step to bring products to market on time and on budget.

Furthermore, competitive pressure to meet customer demands means that manufacturers must see capacity for ATP and ability to meet customer demands. Participating in a networked supply chain means that manufacturers must trigger materials suppliers and alert logistics to shipment timing.

Today, Microsoft and its manufacturing ISV partners have over 80 percent of all manufacturing control systems currently installed. Microsoft and its partners deliver the strongest heterogeneous platform to provide end-to-end solutions for collaboration, analytics and integration; it is unlikely that any other software company has this capability or can present a broader ISV ecosystem.

Better Collaboration for Plant Visibility

Microsoft enables people in operations to take advantage of better collaboration across multiple systems and devices, to deliver information to the people that need it so it can be acted upon accordingly. This improves productivity and return on assets (ROA) with full visibility across processes, lines, departments, plants, and outsourced operations, and throughout the global supply network. In the future, collaboration and workflow will be even more integrated into documents, data, workspaces and processes, making it

easier for managers and workers across the manufacturing enterprise to have real-time visibility into plant floor activities.

Visual Analytics

In addition, manufacturing decision-makers require visual and responsive tools for analytics based on data from SQL Server™ and third-party ERP data sources. Current technologies enable analysts to model plant performance past, present and future to drive production efficiency and provide industry-specific KPIs and benchmarks. Moving forward, business leaders will be able to gain more vivid and sophisticated views of complex data sets and interactively test new models with greater performance, thanks to advances in processing power and distributed computing. This greater ability to visualize activity in abstract representations will make it easier for managers to spot important relationships, zero in on points of failure, and drive operational performance even higher.

Data Tracking and Integration

Today, manufacturers look to leverage technologies inside and outside the plant and integrate real-time plant floor systems with business transaction ERP systems to ensure all appropriate data comes together for a view with context (heterogeneous integration platform that supports open standards such as ISA 95 and OAGIS) and facilitate traceability that identifies every action taken for a specific component for a particular order. This requires the creation and application of complex sets of business rules across multiple systems, and the ability to maintain large stores of metadata based on changing business requirements. The introduction of smart content and self-organizing metadata in next-generation systems will greatly simplify the tracking and integration of data across systems. Smart content uses dynamic metadata to “learn” and then “know” how to translate across different data schema, update its history, and report its status back to processes and systems.

Even the smallest plant floor inefficiencies can translate into significant losses for global manufacturers. Gaining visibility into plant floor operations represents a critical step to bring products to market on time and on budget.

Microsoft's approach to CRM is to build these tools and capabilities into the applications and devices people already use in their work, so that customer data is visible in documents, calendar and communication software, shared workspaces, portals, and business applications.

Customer-Centricity

Managing customer relationships can be a key advantage in differentiating a manufacturing business in the face of intense global competition and the downward pressures of commoditization. Organizations need to maximize the value of their existing relationships, increase the effectiveness of their sales, marketing and distribution channel, and deliver the kind of excellent customer care that ensures positive experiences and loyalty.

Customer Relationship Management

Every year, more and more studies show that retaining customers costs significantly less than attracting new ones. And every year, companies lose or fail to convert huge percentages of sales leads because of limited sales resources, broken processes or broken communication channels. As a result, many manufacturers have invested in comprehensive customer relationship management platforms designed to provide a complete view of the customer relationship for every customer-facing professional in sales or service. Microsoft's approach to CRM is to build these tools and capabilities into the applications and devices people already use in their work, so that customer data is visible in documents, calendar and communication software, shared workspaces, portals, and business applications. Moving forward, CRM systems will offer more visual and intuitive ways to view relationships, processes, and points of contact so that sales and service professionals will be able to anticipate customer needs, respond quickly and accurately to inquiries, and follow up on processes (including sales leads) to ensure they reach a successful conclusion.

Customer Care Experience

Customer care is among the most troublesome and costly areas for many manufacturers. Current processes are time-consuming, prone to error, and

increasingly risky to outsource because of the high value of customer relationships. The nature of the work makes it one of the highest turnover job roles in any organization, requiring continuous investments in training and knowledge transfer. Despite this, manufacturers face constant pressure to convert every call center experience into a positive one for customers.

Microsoft's current solutions for call centers integrate back-end applications to a single desktop tool for the call center operator. This enables dramatic improvements in employee and customer experience by delivering information faster to service representatives, in an easy-to-use interface, and offers outstanding ROI for the business. Going forward, Microsoft remains focused on improving the employee experience as a necessary driver of business and customer value. This means creating environments that put information within easy reach of the call center worker, without having to constantly change screens, launch new applications, or employ complex practices to solve customer issues. It also means integrating capabilities for ad hoc communication, such as instant messaging, application sharing, expertise location, and access to shared documents and workspaces to facilitate escalations and reduce frustration for both the call center worker and the customer.

Channel Management

For manufacturers that depend on a distribution channel such as a dealer network to bring their products to market, maintaining close coordination between corporate and dealer activities is often a challenge. Dealers have tactical knowledge of their markets and customers, while the manufacturer has strategic insights into overall demand, new product development cycles, marketing and advertising, and perhaps a more complete picture of the customer relationship. Both the dealer and the manufacturer would benefit from

sharing this data and integrating systems, calendars, resources and messages to maximize market effectiveness.

Microsoft and its partners currently offer a number of compelling solutions for dealers and distributors that are designed to enable greater operational efficiency and closer coordination with manufacturers. Emerging technologies will enable even tighter integration. Rights-managed content will reduce the risk of sharing sensitive information through the dealer channel by enabling both sides to tightly manage access and distribution policies. Standards for

cross-platform identity management will enable smoother interorganizational collaboration in areas such as marketing and advertising, product support and sharing of technical information. Dealers and the manufacturer will be able to access each other's systems in a secure, centrally managed environment with low-level integration and security managed in the background across heterogeneous applications. Mutual transparency between the company and its partners will help the partners leverage their tactical market knowledge more effectively in combination with strategic support from the manufacturer.

Technology should provide every customer with the inherent flexibility to take advantage of global markets, global supply networks, and a distributed work force should conditions require.

Operating in a Global Environment

With free trade, fluid capital, immigration and global sourcing, nearly every manufacturer today is operating in a global marketplace. Some companies are able to use disparities in wages, skill levels, resource costs and infrastructure that exist between different countries and regions to generate a competitive advantage. Others have had to dramatically rethink their whole operating model in light of new conditions.

The issue of global sourcing is politically sensitive in many developed markets for obvious reasons. Microsoft takes no position on the strategies that individual manufacturers pursue with respect to globalization. Our goal is to ensure that our technology provides every customer with the inherent flexibility to take advantage of global markets, global supply networks, and a distributed work force should conditions require.

The story above assumes that supply chains for manufacturers routinely extend to international partners that, despite geographic distance, must be as tightly integrated with core business processes as a vendor operating right down

the street. As processes become more distributed between partners, suppliers and independent workers, the traditional "supply chain" will evolve into a more complex "supply web" whose interdependencies will require more sophisticated management, both in terms of software and practices. Our story demonstrates how instances of collaboration, systems integration and security technologies have incorporated innovations already being developed in some advanced research settings to support more intensive and less formal supply relationships.

In the example, the company manufactures highly complex medical equipment. Coordination with vendors must be close, not just to satisfy economic requirements but also to meet demanding standards of quality and compatibility.

Compliance, however, is just one facet of the larger issue of transparency. Governments and, to some extent, capital markets have the power to require companies to disclose and validate information about their operations. There are other situations in which companies might choose transparency as an affirmative strategy with respect to customers, partners, workers and the community.

Secure Interorganizational Integration

Maintaining a relationship with global vendors on this level requires a high degree of interorganizational collaboration and integration. As discussed earlier, collaboration technologies that today help connect teams within companies will soon be extended — with appropriate security precautions — to less formal types of teams and partnerships. Through cross-platform identity management and content-level security, clients and vendors will have rich facilities for person-to-person collaboration across time and distance without the impediments of virtual private networks (VPNs) and firewalls or the risks today associated with public networks.

As people experience more fluid connections, so too will the systems that support them: Connections to appropriate data and application resources will achieve tighter integration of processes between partners. In the story, the manufacturer and the vendor have integrated the collaborative design application with relevant enterprise resource planning

(ERP), logistics, project management and compliance data. This allows the meeting participants to immediately recognize the implications of their design and development decisions on other aspects of the business, including crucial areas such as supply costs and time-to-market. Virtual planning allows organizations to become more agile and cost effective as they use information as a substitute for inventory.

Because content security policies are tied to the identity management platform, individuals can control which resources, within the policy framework of an organization, to expose within a collaborative environment. They can also set policies on how shared content is distributed using information rights management capabilities embedded in the content at a granular level. The heightened level of security and control that these next-generation systems provide will dramatically reduce the risks associated with interorganizational collaboration, paving the way for higher-value supply relationships anywhere, over any network.

Compliance as a Tool of Transparency

The final element of the story is that of compliance and transparency. Nearly every manufacturer faces some degree of regulatory scrutiny related to financial operations, labor relations, workplace safety or product quality standards. Some companies have avoided high levels of regulation by relocating to markets with less intrusive requirements, but that involves other tradeoffs and may not solve the problem permanently.

Compliance, however, is just one facet of the larger issue of transparency. Governments and, to some extent, capital markets have the power to require companies to disclose and validate information about their operations. There are other situations in which companies might choose transparency as an affirmative strategy with respect to customers, partners, workers and the community.

Transparent to Government and Markets

For decades, technology systems have been helpful in meeting compliance requirements. Governmental response to the latest round of corporate accounting scandals — such as the Sarbanes-Oxley law in the United States — triggered an enormous round of investment in IT compliance solutions for finance. Specific to manufacturing, many line-of-business systems also help manufacturers validate their compliance with quality and safety standards. Typically, businesses do not expect a high return on these sorts of investments. Mostly, they are viewed as nothing more than requirements for doing business in particular markets.

In the story, the ability of the system to check prospective device designs against an online government registry of patents

to prevent claims of infringement suggests a deep level of integration between corporate systems and those of the government. There is no reason benefits of that integration can't flow in both directions. The government can fulfill its regulatory responsibility to protect consumers by demanding high standards from manufacturers, while manufacturing firms can pre-empt exposure to patent infringement claims.

Transparent to Consumers and Communities

Over the past decade, the Internet has empowered unprecedented levels of consumer activism and scrutiny of corporate business practices.^{vii} Exposure of an intrusive copy-protection scheme on its compact discs, for example, led to consumer action against Sony Corp., resulting in the costly recall of tens of thousands compact discs.^{viii} Reputation systems such as those used by Amazon.com Inc. and eBay Inc. give consumers enormous power to evaluate the quality of products and transactions. Just a few "negative" reactions can drive away scores of potential customers.

As globalization makes transactions increasingly anonymous, consumer feedback technologies will see wider adoption in a range of applications critical to manufacturers. Companies that have good records with respect to issues of concern to communities, such as environmental awareness, energy usage, employment policies, labor relations and corporate citizenship, can use those assets to drive brand value and trust to a far greater extent than the limited avenues of public relations and press releases provided in the past.

Transparent to Partners and Customers

Finally, transparency can provide affirmative benefits for partners and customers while reducing costs for the company. Giving interested parties access to transaction, payment and logistics systems can help ensure that customer and partner expectations are properly calibrated to operational realities, resulting in higher-quality relationships. Self-service sites directly connected to company systems, with appropriate security, can help customers and partners streamline the way they deal with the company, reducing demands on costly customer service resources.

Microsoft believes that people are the key to success in the new world of work. Our approach is to develop technology that strengthens the capabilities and connections of people in their work roles and lives, so that they can apply their unique insight and experience to solve problems effectively.

Microsoft: Committed to the Future of Manufacturing

The next 10 years will pose unique challenges to manufacturers. Promoting a culture of innovation, maximizing work-force productivity, navigating the complexities of globalization, and meeting demands for transparency will all require investment and adaptation.

Microsoft believes that people are the key to success in the new world of work. Our approach is to develop technology that strengthens the capabilities and connections of people in their work roles and lives, so that they can apply their unique insight and experience to solve problems effectively. In an environment

of constant, rapid change, only empowered people can provide the flexibility and innovation that manufacturers need to adapt, compete and win. Software amplifies the ability of people to more rapidly adapt to challenge, and to take advantage of opportunities more quickly, to better understand customers based on insights derived from both data and communications, and to build better partnerships because they have the ability to collaborate more readily.

Microsoft is delivering on this vision through architecture and products that enable manufacturers to deploy flexible

solutions based on familiar, easy-to-use software, and connect to robust business applications and data. Manufacturers benefit because they can roll out new solutions to meet new business needs quickly, simply by extending the investments they've already made. Often, end users themselves can create and modify processes without extensive IT participation, so that they can take a more active role in responding to business needs. Finally, Microsoft platforms and products enable developers and integrators with

specialized knowledge of manufacturing industry requirements to build and maintain custom solutions quickly and cost-effectively, without the kind of open-ended costs and requirements of proprietary systems.

Working together with a global ecosystem of partners, developers and IT professionals, Microsoft delivers the software applications and platforms that can help manufacturers become People-Ready Businesses.

The people ready business.

A people-ready business is one where people can apply their unique skills, insights and experience to create new products and services, work responsively with customers and partners, and drive operational excellence in every aspect of the business. People-Ready businesses support people with knowledge, practices and tools so that they can add the extra value that helps differentiate successful organizations in a competitive, fast-moving global economy.

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