White Paper

The Future of Manufacturing

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IN THIS WHITE PAPER

Manufacturing is back. Governments, media, and manufacturers themselves are changing their minds about the industry, with a renewed awareness of the role it can play in achieving a strong economy. With a better business outlook expected in 2014, the manufacturing industry is undergoing a renaissance. To harness the momentum created by the manufacturing renaissance, manufacturers will need to transform today's challenges into opportunities. It won't be an easy task, and manufacturers will need to completely rethink their business model, organizational structure, and IT landscape.

This IDC White Paper will help manufacturers as they make this transformation by providing an overview of:

- The current challenges and future opportunities that justify the need for manufacturers to undertake a major rethinking of their business models.
- The business capabilities that manufacturers will need to be successful – self-forming teams, skilled resources, speed of business, "globally local" manufacturers, customer experience, and end-to-end supply chain visibility.
- The transformation strategy needed to move the company from a "transactional business" to a "real-time business," including the key business initiatives that manufacturers will need to implement over the coming years.
- The extraordinary advancements and increased adoption in IT – particularly cloud, mobility, social business, and Big Data analytics – that support and speed up every process domain of a manufacturing enterprise.
- The 3rd IT Platform (based on cloud, mobility, social business, Big Data analytics technologies), which will create a real-time, collaborative, decision-making environment.
- The next-generation ERP system based on the 3rd IT Platform which will continue to support the manufacturing industry of the future.

The paper also provides an essential guidance section with advice for manufacturing enterprises setting out on the journey toward the future of manufacturing.

SITUATION OVERVIEW

The financial and economic problems of the past few years have proved to be a turning point for the manufacturing industry. Going back 10 to 15 years, the manufacturing industry was "neglected" compared with other industries such as finance and services. Manufacturing was not considered a good industry to invest in for the most advanced economies around the world.

The industry itself underwent a phase of extreme manufacturing outsourcing in which production facilities were too easily and too quickly moved offshore. As a result, the manufacturing industry's contribution to GDP fell in most of the largest developed economies, with the notable exception of Germany.

Germany — which never "gave up" on manufacturing — has been more resilient to the global financial and economic crisis than countries with economies that were less focused on manufacturing. This has led to a profound rethinking of the role of the manufacturing industry as a source of wealth. Governments around the world now better understand that an economy based on service alone cannot survive in the longer run.

Recent Harvard University research confirms that the manufacturing industry is vital to national prosperity, with over 70% of income variations of 128 nations over the last 60 years explained by differences in manufactured product exports alone (source: WEF, 2012).

A number of countries are investing to develop and attract more manufacturing. One of U.S. President Barack Obama's second-term areas of focus is around reviving American manufacturing. China has become the largest market in the world for robots and production automation, and this will help it better manage rising wages and guarantee higher product quality.

The European Commission has enforced policies to raise manufacturing's share of GDP from today's historical low of 16% to 20%. Germany, with 21% of GDP from manufacturing, is leading the way with its "Industrie 4.0" initiative that defines the "fourth industrial revolution" as highly automated and based on the use of cyber-physical systems — i.e., sensor-enabled systems that can intelligently communicate through the Internet of things.

With greater attention from governments and media, the manufacturing industry is back under the spotlight, and with a better business outlook expected for 2014, it is undergoing a renaissance.

Most Critical Manufacturing Challenges

A number of challenges are making it difficult for manufacturers, however, especially those in advanced economies, to leverage the opportunities of the manufacturing renaissance:

- **Lack of skilled workforce.** In the last two decades manufacturers have failed to attract enough young talent to keep the workforce vibrant and fully engaged with new technology, with graduates increasingly drawn to other sectors such as financial services and media. The result is that the manufacturing sector now has an aging workforce, with many employees retiring over the next 10 to 15 years. At the same time the labor market has a significant talent shortage and manufacturers are striving to find product engineers, skilled technicians, and line workers. As a result, skilled labor costs are increasing. The difficulty in finding skilled workers (with between 300,000 and 600,000 open positions in the U.S. alone, based on different economic reports) combined with the chronic inability of the industry to attract younger people have created one of the most critical challenges in manufacturing today.

- **Consumerization of manufacturing: from B2B to B2B2C.** Consumers are driving the "speed of business" in manufacturing today. Purchasing patterns have been completely redefined by the extensive availability of information through social networks and its rapid transmission via a vast range of new mobile devices. Consumers are well informed about market products, prices, and dynamics. They are brand agnostic and compare, select, or discard multiple products with just a tap on their tablet. They are increasingly impatient too: they don't want to wait and they just want it now. This consumer purchasing style is not only having an impact on brand-oriented industries – it is impacting the whole manufacturing value chain, to a point that B2B (business-to-business) trading is now often defined as B2B2C (business-to-business-to-consumer), indicating how increasingly important it is to take care of the customer of the customer.
- **Shortage of natural resources.** Demand for rare earth elements is accelerating rapidly. These minerals (such as lanthanum, neodymium, and praseodymium) are essential for most high-tech equipment, and their availability impacts many industry sectors, including aerospace, automotive, industrial machinery, and medical devices. China supplies 95% of global demand for rare earth elements, making sourcing of these materials a critical issue. Add to this the continued pressure on renewable resources that are used across industries (e.g., corn for food as well as fuel), and it is clear that the drive for sustainable resource planning is ever expanding. Today, countries and companies are responding to the scarcity and higher prices of natural resources by stocking or hedging. In the long run, however, they will need to invest in the discovery of alternative elements and in latent supply access and more efficient practices to use these resources.
- **Additive manufacturing.** A range of new 3D printers and additive manufacturing machinery is hitting the market using a variety of new "printable" materials such as engineering plastics and powdered metals including stainless steel, nickel, titanium, and silver. Additive manufacturing promises more efficient manufacturing processes for highly customized products, and in the future it will be the only profitable option for the increasing number of high-mix/low-volume manufacturers. The impact of additive manufacturing will go far beyond production and will profoundly change the way manufacturers operate. Customers will be fulfilled through "make-to-individual" techniques, making the industry much faster and much more competitive than today. Supply chains will be significantly shortened and there will be a dramatic increase in the number of trading transactions (with much lower quantity per transaction).

Case Study 1: BAE Systems MAI

With defense marketing budgets shrinking and international competition increasing, quick time to market and excellent customer service are essential capabilities for companies operating in the military and defense sector.

One such company is BAE Systems Military Air & Information (MAI) — as part of the U.K. defense giant BAE Systems, it provides military aircraft and the associated support, training, and defense information.

To win in these complex markets, the company knows it needs to be innovation-oriented and always open to new technology. The company, for example, is keen to adopt cloud technology wherever it is appropriate and doesn't pose security threats, and already has in place a set of mobile-friendly applications to enable its employees to manage day-to-day business activities on the fly.

MAI realized that its current enterprise application had to be changed. The company had a diverse ecosystem of multiple enterprise applications to serve its business units, and over time it had had to stretch these systems to support additional business functions and ensure technology upgrades.

This complex IT architecture had a number of drawbacks. Heavy customization made the applications very complex to maintain and upgrade. This also hampered the company's access to the more modern technology available on the market. Most importantly, however, the system meant it was not able to manage its business needs as efficiently as possible, as it hampered its ability to make quick, effective decisions in an increasingly fast-paced market.

To improve its decision making and to ensure one version of the truth MAI had to move toward new technology standards and implement simpler and more efficient IT systems. The company decided therefore to consolidate the number of enterprise applications under a single, off-the-shelf ERP application for about 4,000 users.

A key benefit of the ERP application it chose is that it comes with an off-the-shelf collaborative social user interface that facilitates change management and system transitioning. Going forward, the company expects these functionalities to gradually become the standard way to generate and disseminate alerts and messages across the organization.

A key takeaway for manufacturers from this case study is the need to overcome the IT system fragmentation currently in place in most companies and to encourage more collaboration and more visibility and intelligence of information along the value chain. Leading manufacturers have the opportunity to simplify IT architectures by leveraging modern technologies such as the "four pillars," and this will be essential to enable them to break organizational silos, streamline business processes, and make better decisions.

FUTURE OUTLOOK

The Capabilities of Future Manufacturers

To make the most of the new opportunities, manufacturers will need to quickly overcome current operational challenges. It will be a daunting task and future manufacturers will be fundamentally different to those of today. Manufacturers will need to completely rethink their business model: the way they source raw materials, the way they design products, the way they manufacture and fulfill customer orders, and the way they engage with employees.

The following section looks at the key capabilities of future manufacturers.

Collaborative Organizations With Self-Forming Teams

People will be at the center of the manufacturing of the future as they provide the flexibility and decision-making capabilities that are required to deal with increasing globalization, complexity, and competition. Manufacturers will have to simplify today's complex organizational structures by breaking organizational silos and encouraging greater collaboration. In the future, manufacturers will better streamline business processes by reinforcing communities of shared dialogues between employees and their trading partners. This will allow future manufacturers to empower individuals to make informed decisions and be fully engaged in proactive strategies. IDC Manufacturing Insights expects that greater customer experience and new product innovation and revenue generation will come from self-forming teams among the community rather than coming top down from management. We expect this take place as much as 75% of the time — a complete inverse of the ratio today.

Attractive for the Best Available Skilled Resources

Manufacturers of the future will be better able to recruit and retain the highly-sought-after skilled resources, particularly younger workers. Younger generations — who have a natural inclination for innovation, quick adoption of new technologies, and collaboration — will be an essential success factor for future manufacturers. To make this happen, manufacturing organizations of the future will set up a collaborative work environment that will be essential to attract, retain, and engage younger skilled resources. This means that future manufacturing organizations will have to be open and information-centric. They will have to integrate decision making (not just processes) from the strategic to the operational, so that the choices that management make are evidence based.

Speed of Business

Speed of business — the ability to be agile and responsive in decision making and process execution — will be a major capability for the leading manufacturing companies of the future. Speed will be essential when trying to take advantage of trends. Speed helps to meet fickle, fast-changing consumer demand and specialized opportunities in niche markets and even anticipate buying preferences before they happen. Speed of business will be enabled by unrelenting change management capabilities, fast pace of innovation and knowledge sharing, better customer insight, and real-time supply chain and manufacturing visibility, enabling companies to react to customer needs and market trends before their competitors. In its 2012 report "The Future of Manufacturing: Opportunities to Drive Economic Growth," the World Economic Forum concluded that speed, and not knowledge, will be at the basis of future manufacturing competition: "*In a world where change is speeding up, knowledge stocks depreciate in value at an accelerating rate. In this new world, companies […] need to become more adept at tapping into a broader range of more diverse knowledge flows so that they can refresh their knowledge stocks at a faster and faster rate.*"

"Globally Local" (or "Glocal") Manufacturers

Future manufacturers will have to meet customer expectations for speed, flexibility, and capability. They will need to be faster in understanding emerging demand trends, introducing new products to the market and meeting very specific customer fulfillment needs, in multiple global markets, each having different expectations for product features, quality, and costs. In the future, fulfilling customers' needs through a "make-to-individual" approach – fulfilling clients with a single, specifically tailored, customized product, made on demand – will be the norm. To do so, future manufacturers will have to rely on a network of locally based small factories – with a blend of supplier, distributor, and retailer production capabilities – that will customize final products according to local demand requirements. The network structure will be based on the tradeoff of operational costs, supply chain risks, and demand opportunities.

Customer Experience

Creating a greater customer experience will be essential for future manufacturers. A recent research study from IDC Manufacturing Insights reveals that customer retention, differentiation from competitors, and sales force effectiveness are the top benefits of delivering a greater customer experience. These capabilities are essential elements of the customer experience and can go a long way toward positively impacting profitability and revenue growth and attracting new clients. However, the same research highlighted that today's manufacturers have been slow to understand the importance of customer experience. Less than 10% of today's manufacturers recognize that nurturing a customer-centric culture among employees is essential to delivering responsiveness and building long-term relationships with their clients, securing revenue growth, and increasing profits. Future manufacturers will have to fully realize the importance of creating a superior customer experience.

End-to-End Supply Chain Visibility

End-to-end supply chain visibility will be at the core of future manufacturers' strategies. Having a full picture of supply, demand, and capacity across all levels of their supply chain will enable future manufacturers to get trading partners working together more effectively, stimulate collaboration, maximize responsiveness, and improve performance. Manufacturers will have to work hard to achieve full end-to-end supply chain visibility as today almost half of manufacturers still say they lack visibility beyond their immediate suppliers, according to a recent study from the Economist Intelligence Unit (source: "Global Manufacturing Outlook Competitive Advantage: Enhancing Supply Chain Networks for Efficiency and Innovation," an Economist Intelligence Unit research program sponsored by KPMG International, 2013). Lack of visibility can hold up the discovery of anomalies or problems in supply chain and manufacturing operations that need attention, resulting in delays or higher costs of fulfilling customer needs. Manufacturing companies of the future will have to gain a greater level of real-time visibility across the network of global manufacturing operations. Today's manufacturers are well aware of these challenges and are investing to improve visibility, as confirmed by a recent survey from IDC Manufacturing Insights which showed that the key business driver leading to higher investments in IT business applications is the need to improve supply chain and shop floor visibility

The Journey Toward Manufacturing of the Future

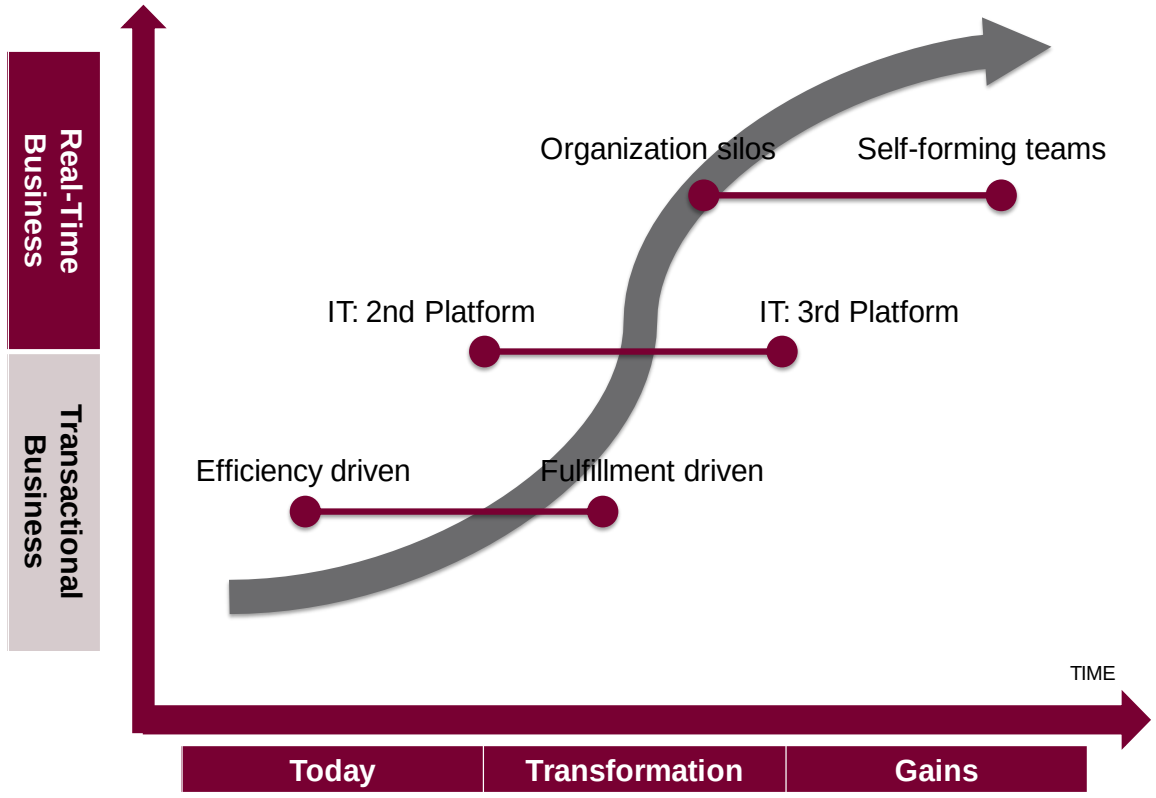
The journey to the manufacturing industry of the future will require today's manufacturers to undertake a profound transformation of their business model. Manufacturers will have to move away from today's "transactional" business approach and will have to become "real-time" businesses. To do so they will have to break organizational silos, create a more collaborative working environment, get closer to customers, and leverage modern IT, which will enable them to operate at the speed of the marketplace.

The transformation won't happen immediately and will require a step-by-step approach. The S-curve in Figure 1 highlights the main initiatives manufacturers will have to go through over time to support their transformation toward the future of manufacturing.

- **Initiative 1: from efficiency-driven to fulfillment-driven.** The first initiative — which is already ongoing in many leading manufacturers — is aimed at moving away from today's extreme focus on efficiency toward closer attention to customer fulfillment. Efficiency will continue to be important for future manufacturers, but they will acknowledge that an excess of efficiency tends to be inward-looking and risks distracting attention from the essential goal of fulfilling customer expectations. To do so, manufacturers will have to nurture a customer-centric culture among their employees; they will have to become more agile and flexible in fulfilling customer requests; they will have to pursue process execution excellence along with planning excellence. Creating a customer-centric culture will help manufacturers think "outside the box" and prepare for a profound rethinking of their current IT landscape.
- **Initiative 2: from the 2nd IT Platform to the 3rd IT Platform.** Underpinning the future of manufacturing is the extraordinary advancement in IT to support and speed up processes throughout the manufacturing enterprise, from R&D to manufacturing operations, from supply chain to business intelligence. The transition from the 2nd IT Platform (client/server applications) to the 3rd IT Platform (based on cloud, mobility, social business, and Big Data analytics technologies) promises to create a real-time, collaborative, decision-making environment that will be pivotal to supporting manufacturers as they make the shift from a transactional to a real-time business. The transformation from the 2nd to the 3rd IT Platform is easy to explain but very difficult to implement. This profound IT transformation initiative will bring the fastest benefits to manufacturers.
- **Initiative 3: from organizational silos to self-forming teams.** With an embedded customer-centric culture and the 3rd IT Platform in place, manufacturers will be well prepared to take the last initiative toward becoming real-time businesses. This will entail breaking organizational and information silos, further simplifying hierarchical organization, and becoming more attractive to younger and skilled resources. Enabled by the 3rd IT Platform, future manufacturers' employees will form communities of interest and focus. They will create dynamic teams to address issues and leverage opportunities through a higher degree of real-time visibility and the collaborative working environment. Self-forming teams will take informed decisions in real time based on evidence and will provide future manufacturers with the level of speed and flexibility required to be successful in the future.

FIGURE 1

Manufacturers' Journey Along the S-Curve



Source: IDC Manufacturing Insights, 2014

The Role of the 3rd IT Platform

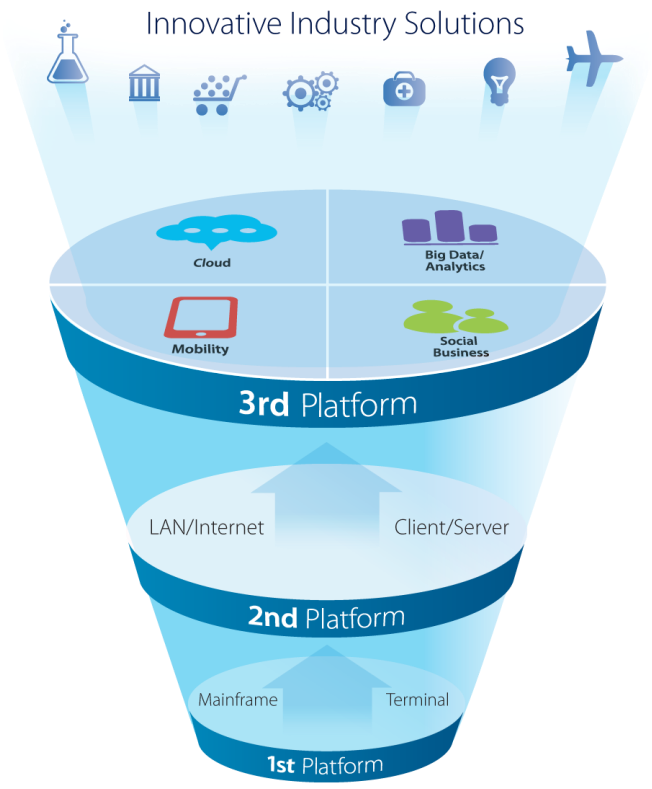
The IT industry is in the midst of a massive structural shift – from the PC and client/server-based 2nd IT Platform to the "3rd Platform" built on Big Data analytics, cloud, mobility, and social technologies:

- **Mobility.** Smartphones outshipped feature phones for the first time ever in 1Q13. This historic turnaround is just the first landmark in the continued proliferation of these devices. By 2016, global mobility spending will reach $800 billion. By 2020, every connected household will have an average of 12.5 devices in use. This same reliance on mobile devices will carry over to the workplace as the next generation of managers brings with them their communication habits and expectations to be connected 24 x 7 to critical resources. Going forward, mobile technologies will be essential to deliver information in real time anywhere, to connect the workforce with operational process, and to engage customers.
- **Social business.** By 2020, 40% of Global 2000 companies will use new social media platforms to redefine their marketing and customer services. By 2016, the global social business software market will reach $10.3 billion. These technologies will be the basis for collaboration platforms, and for inter-enterprise integration and collaboration. Ease of communication between personnel will contribute to the creation of self-forming teams. This will help companies to speed up their decision making, understand issues faster, and take action without delays.

- **Big Data analytics.** The total amount of data created and replicated will double every two years between now and 2020, reaching 40ZB by 2020. Considering most of it will be totally unstructured — such as audio/video records — the capability to manage and analyze it will be crucial in the future. By 2016, global Big Data and services spending will reach $23.8 billion. Big Data analytics will be decisive in manufacturing to support process automation, information, and visibility. Harnessing the power of Big Data analytics will allow manufacturers to not only analyze trends but to predict events such as future buying cycles and equipment lifespan.
- **Cloud.** Cloud technologies have become the standard for infrastructure. By 2016, more than 60% of enterprise grade storage capacity will be provisioned in cloud. By the same year, global cloud spending will reach $179 billion. These technologies will prove essential for manufacturers to speed IT implementations and reduce costs, as well as achieving process standardization and integration along the supply chain. The lower total cost of ownership of cloud solutions will help manufacturers upgrade and replace outdated systems with greater ease, allowing even small to midsize organizations to deploy world-class business applications to stay competitive with larger organizations.

FIGURE 2

IDC's 3rd Platform



Source: IDC Manufacturing Insights, 2014

IDC Manufacturing Insights predicts that the next 20 years of innovation, productivity, and growth – in the IT industry and in virtually every other industry – will be based on the 3rd IT Platform, as hundreds of thousands to millions of high-value industry solutions will be built. The 3rd IT Platform will drive nearly 100% of the IT industry's growth from 2014 through 2020, with an unprecedented share of that growth coming from increasingly strategic classes of customers – in emerging markets, in small businesses and startups, in service provider organizations, and in line-of-business roles.

Future manufacturers will leverage the 3rd IT Platform to deploy a collaborative working environment, which will be technology-enabled to achieve more openness, agility, and decisions made on real-time data. This will provide speed of business, informed people, and open lines of communication across different functions and along the supply chain. The 3rd IT Platform will enable self-forming teams to identify a problem, isolate the root causes, and take corrective action as quickly as possible.

Case Study 2: Preferred Sands

Preferred Sands, a leading manufacturer of frac sand for the oil and gas industry, is a perfect example of a company sprinting through a technology transformation to make processes more nimble and information-based.

As a fast-growing company, Preferred Sands needs to have its entire staff – from operations to the boardroom – making informed decisions very quickly. In this context, even two-hour-old information is useless.

Before starting the transformation, Preferred Sands' major challenge was decision making based on old and inconsistent information, or even just "anecdotal" evidence. Managing information with third-party distribution partners was particularly problematic.

To solve these issues, the company is equipping its workforce with a social platform to enable information to flow directly from enterprise applications to users in a "Twitter-like" fashion. This is in contrast to its previous systems, which required users to spend time and effort trying to retrieve non-real-time data and information on their own.

The transformation ensures that all employees are provided with the right information at the right time, and it impacted all hierarchical levels, from warehouse operator to the boardroom. Going forward, for instance, the company's CFO will receive automatic updates on new orders above $100 million, instead of having an assistant provide him with a specific report.

When implementing such an open, collaborative work environment, problems typically arise from the aging workforce, which is often resistant to change. Preferred Sands, however, employs mostly young professionals, and as a result it has faced little resistance to change – in fact its young workforce is eager for a more dynamic and user-friendly way to access information. In addition, there are few technical challenges in terms of information security when sharing it with external business partners.

Considering the lack of resistance, the implementation can take place in only a few months. The implementation was prefaced by a process of information cataloguing, with the company identifying what information each user regularly looks for in his or her daily activities to ensure that the most appropriate information was delivered.

The next steps for Preferred Sands are further investment in 3rd Platform technologies, as it strongly believes that cloud and mobility will greatly improve the way information is made available and consumed. Investments in Big Data analytics are a more long-term plan for the company. It is particularly interested in the use of unstructured information (e.g., industry analyst reports) to improve demand forecasting.

The key advice for manufacturers from this case study is the importance of a mindset change. In many business contexts, it is better to have information delivered at the speed of business in a flexible and unstructured collaborative environment rather than setting up a bulletproof, hierarchical, step-by-step information workflow with the risk of having people unaware of critical information.

The Role of ERP in Supporting This Transformation

For today's manufacturers, ERP is the essential system of record to run the business. None would be able to operate without an ERP system. However, the journey toward the future of manufacturing is exposing the limitations of traditional ERP systems.

IDC Manufacturing Insights believes that ERP systems will continue to be the IT backbone of future manufacturers, but these IT solutions will have to fundamentally evolve into next-generation ERP systems that incorporate the 3rd IT Platform. The next-generation ERP systems will:

- Go beyond managing mere transactions and will create a decision-making environment. They will bring the information to the user's fingertips through proactive and in-context alerts, triggers, and dashboards delivered through mobile devices. Not only will this ease of use improve productivity, it will also help employees become more fully engaged and leverage the power of the ERP system.
- Provide insight into the users and will not require users to endlessly search transactions for problems. They will embed Big Data analytics technologies that will be able to automatically analyze large amounts of unstructured and variable information, gathered in real time from the business and the supply chain.
- Be deployed as a virtual application over the cloud that will enable manufacturers and their trading partners to seamlessly operate in real time over an intelligent value chain.
- Significantly improve the way information is delivered and shared. Leveraging a social platform, it will be easier for the right information to reach the most appropriate user. Social business capabilities will create a collaborative "social ERP" environment that will foster the creation of self-forming teams. This will speed up processes, help ensure compliance with fast-changing regulations, and improve the ability to collect and store the specialized "tribal knowledge" of employees, from sales representatives to service technicians.

ESSENTIAL GUIDANCE

IDC Manufacturing Insights offers the following advice to manufacturing enterprises setting out on the journey toward the future of manufacturing:

- **No choice but change.** Acknowledge that the manufacturing marketplace is rapidly changing, so your company will have to change fundamentally as well. There is no choice, as "business as usual" will no longer be sufficient. With a better business outlook expected in 2014, this is the perfect time to start your journey toward the future of the manufacturing industry.
- **Revolution, not evolution.** The journey toward the future of manufacturing will be more revolution than evolution. It will require a multiyear transformation strategy. Your top management support and funding will be essential for the success of the strategy. The three-step transformation approach proposed in this paper should be the starting point for your company to define your own transformation journey.
- **Prioritize your own capabilities.** Strive to develop the capabilities of the future manufacturers as outlined in this paper: self-forming teams, skilled resources, speed of business, globally local manufacturers, customer experience, and end-to-end supply chain visibility. Identify those that best characterize your industry and differentiate your company.
- **People at the center.** Understand that your workforce is your most precious resource today and in the future. Invest to retain and attract the best skilled resources by creating a more collaborative working environment with solutions that are easy to use.

- **Adopt the 3rd IT Platform.** The extraordinary advancements in IT represent an opportunity to support and speed up the most critical process domain in a manufacturing enterprise. Adopt IDC's 3rd IT Platform based on cloud, mobility, social business, and Big Data analytics.
- **Be a brave CIO.** The transformation from the 2nd to the 3rd IT Platform is easy to explain but very difficult to implement. CIOs will have to be brave and will have to radically transform the current IT infrastructure, dismantling IT systems that required significant investments in the past. Don't let your IT heritage be a significant barrier to this transformation.
- **Next-generation ERP.** With the 3rd IT Platform in mind, start rethinking your current ERP system. Going beyond managing mere transactions, the next-generation ERP system will create the collaborative working environment that will pave the way to the future of your company.

About IDC

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