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Smart manufacturing employs computer-integrated manufacturing, high levels of adaptability and rapid design changes, digital information technology, and more flexible technical workforce training to compete in a rapidly changing environment.

The Importance of Adaptability in Achieving Manufacturing Digital Transformation

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Questions posed by: PTC

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Q. How are increased competition and evolving consumer demands impacting the manufacturing industry?

A. While cutting costs and increasing efficiency have always been top priorities, there is a new driver causing manufacturers to rethink how they approach production. Competition has never been higher in manufacturing. More companies competing for the same customer base make differentiation a challenge. Today, survival of the fittest is linked not to size or strength but to the ability to change — to move quickly, adapt, seize opportunities, and be agile. With customer needs evolving faster than ever before, customization of products is key to standing out. As a result, factories are being relied upon to handle more complex operations to serve a wider range of products, with faster throughput and smaller lots, at minimized costs. Balancing cost, quality, throughput, and agility is a complex equation with which many manufacturers struggle. Personalization, customizations, and increasing product complexity are driving how factories need to adapt. All these factors are leading to smart manufacturing as a strategic priority.

Q. Why is smart manufacturing such a high priority on the digital transformation (DX) journey?

A. Manufacturing, specifically the processes involved in physically transforming materials into goods for sale, has become a hot topic across the globe. A decade ago, many companies considered their factories dead weight, assets to be arbitraged while new production moved to low-cost regions, particularly Asia, Latin America, and Eastern Europe. That mindset has shifted decidedly. At its core, smart manufacturing is the convergence of data acquisition, analytics, and automated control to improve the flexibility and overall effectiveness of a company's factory network. For engineering-oriented manufacturers (automotive, aerospace and defense, industrial machinery), smart manufacturing is the second-highest DX priority, just behind supply chain optimization. In fact, smart manufacturing represents over $1 trillion of the $4.5 trillion DX opportunity in manufacturing. It is also the most important

Smart manufacturing represents roughly 27% of the annual DX budget for engineering-oriented manufacturers.

reason why companies are seeking the opportunity to drive value by connecting their factories. Smart manufacturing is built around three main programs:

- **Strategic asset management.** Use cases include asset instrumentation, digital work instructions, predictive maintenance, and augmented maintenance.
- **Quality management.** Use cases include remote expert guidance, cognitive root cause analysis, and manufacturing/specification intelligence.
- **Resilient lean.** Use cases include real-time scheduling, digital shift handover, resource/yield management, materials optimization, and energy management.

Many companies are well on their way in their smart manufacturing program and already reaping the benefits. In today's highly competitive industrial environment, companies cannot risk falling behind because of inaction.

Q. How can you succeed with the growing skills gap in manufacturing?

A. Talent is a hot-button issue for most companies, but manufacturers are feeling the pressure more than most. IDC's 2019 *Industrial Talent Management Survey* found that 45% of companies are understaffed in their high-skilled positions. However, even if current staffing is adequate, almost every company is focused on improving its talent levels: 96% of companies stated that talent is a top priority. In part, this reflects the reality that the manufacturing workforce is skewed toward older workers, and these employees are not getting any younger. Baby boomers are retiring every day and leaving knowledge gaps that are difficult to fill.

To achieve smart manufacturing, companies must employ an adaptable and flexible workforce. Attracting new talent is a challenge because manufacturing is not viewed as the most "desirable" industry by younger workers. Manufacturers will need to rethink how they attract, retain, and upskill a generation of employees. While manufacturers are taking many actions to address these issues, one of the most important steps for enabling smart manufacturing is the use of technology to solve the growing skills gap. Augmented reality (AR) is emerging as a new intuitive interface for humans to interact with digital and physical realities on the plant floor. With AR, information and graphics are superimposed within the user's line of sight, enabling them to be consumed in context. AR offers "the right information at the right time" by consolidating content from multiple systems of record into a single role-based or task-based view. This technology will allow a manufacturer to improve the ramp-up time and flexibility of worker skills, reduce the amount of low-value work, and streamline how information is displayed, improving overall productivity.

Q. How can you scale smart manufacturing across the enterprise?

A. The reality within manufacturing is that most factories are full of aging assets and infrastructure. Modernizing these plants is one of the top drivers for investment. However, it is not realistic for a company to rip and replace the technology that is already in place. To be successful, manufacturers need to take advantage of their existing systems and add technology that makes them better with minimal disruption. They require experiences that merge digital information with their physical environment,

delivering knowledge and assistance to frontline workers, where and when needed, for maximum success. Technology, such as wearable assisted and mixed reality headsets, can easily scale the delivery of information in the most effective way possible, leaving operators to work hands free while they receive the information they need. Properly managing and utilizing plant floor data and receiving relevant assistance to complete operator or technician tasks should be a key focus. It is already a major challenge among most manufacturers to make use of the data available currently, and as more assets are connected, this problem will only get worse. The task of identifying and incorporating the plant, product, and Internet of Things (IoT) data that is critical to performance is daunting but necessary to drive transformation at scale. The ability to properly manage plant floor data and make knowledge more accessible allows a company to drive standardization across facilities/locations when it comes to smart manufacturing. Organizations also need the right analytical capability in place from both a technology standpoint and a workforce standpoint. They shouldn't deploy technology for the sake of technology; they should focus instead on the outcomes (such as productivity, cost reduction, and quality management) that will bring the highest value to their company.

Q. What is technology's role in achieving smart manufacturing goals such as equipment efficiency or workforce productivity?

A. Manufacturers recognize that the IoT will be among the technologies with the greatest impact on their businesses in the next five years, with 49% of the industry in the United States already utilizing some form of it. Using IoT to provide real-time data on the status of assets, processes, and people is where most manufacturers start when it comes to smart manufacturing. Combining IoT with augmented reality (AR) improves manufacturing experiences by merging digital information, feedback, and enhancements with the physical environment to deliver positive outcomes. While there are many benefits to be realized just from better visibility into performance, connecting assets also serves as the building block to predictive asset management, and "connecting people" helps create labor efficiencies as workers interact with operations. IDC has observed that manufacturers taking this approach can see an improvement of up to 20% in asset availability and an 8- to 10-point increase in mechanical efficiencies.

There are also many tools and innovation accelerators that can augment a company's current workforce and make workers more productive. Possessing the ability to make effective decisions in a shorter time frame is becoming essential to success. For example, mobile and wearable devices and applications are powerful tools that arm employees with the data they need to make the most informed decisions.

About the Analyst

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Reid Paquin is Research Director for IDC Manufacturing Insights responsible for the IT Priorities and Strategies (ITP&S) practice. Mr. Paquin's core research coverage includes IT investments made across the manufacturing industry and manufacturers' progress with digital transformation. Based on his background covering the manufacturing space, Mr. Paquin's research also includes an emphasis on the technology enablers that help manufacturing executives make better-informed operational decisions.

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- Advance operational performance with real-time visibility into people, processes, and machines
- Maximize workforce productivity while improving safety, quality, and labor costs
- Reach new levels of efficiency by delivering the right data to the right worker at the right time

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