

White Paper

Digital Innovation in Manufacturing: Building the Foundation for Transformation

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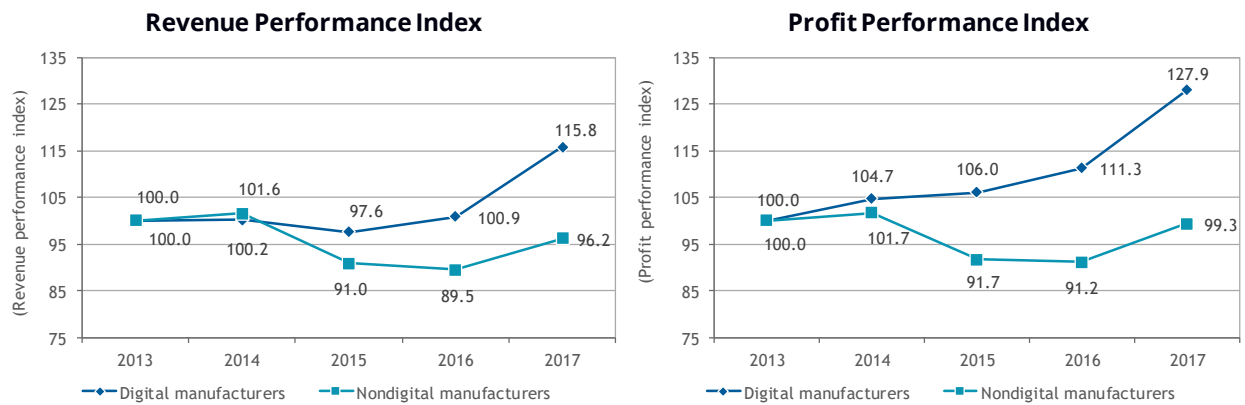
SITUATION OVERVIEW

Manufacturing has been focused on its fourth revolution over the past decade. The incorporation of technology such as cyberphysical systems, the Internet of Things, and cloud/edge computing allows for new possibilities on the shop floor. While this initiative represents massive opportunity across the globe, manufacturers must ensure their existing processes, operations, and IT systems are optimized to truly take advantage of what these new technologies can bring. Unfortunately, many organizations have overlooked the foundational elements of manufacturing and still possess manual or paper-based processes across the enterprise. These processes often result in errors, delays, and inefficiencies and are present across manufacturing organizations – maintenance, quality, engineering, or service departments. Manufacturers turned to these manual systems for reasons such as perceived capital savings, flexibility in process changes, and knowledge of existing solutions. However, as a manufacturer grows and innovates, these systems cannot scale with the business. Digitizing these processes results in many immediate business benefits, but more importantly, they serve as the building blocks for digital transformation (DX). Innovation accelerators such as Big Data and analytics, artificial intelligence (AI), and machine learning will change how manufacturers operate, but these technologies cannot be applied without digitization.

Ensuring the foundation is in place within manufacturing is crucial; digitization provides that foundation. The financial impact of digitizing manufacturing processes cannot be overstated. IDC recently conducted an analysis of manufacturing organizations, comparing organizations with digital initiatives in place and organizations without. The analysis looked at revenue and profit performance over a five-year period and the changes that occur within each group. IDC normalized the performance through a revenue performance index (RPI) and profit performance index (PPI), with every organization starting at 100 in 2013. The delta was tracked, with increases in the index meaning improved revenue and profit performance and decreases meaning poorer performance (see Figure 1).

FIGURE 1

Digital Initiatives Impact the Top Line and the Bottom Line



Source: IDC's *Digital Manufacturing Study*, 2019

A clear advantage occurs over time for manufacturers that embrace digital technology: For both revenue performance and profit performance, digital manufacturers come out ahead. Eliminating paper and reducing manual tasks are potential quick win areas that serve as building blocks for overall DX efforts, and the savings can be reinvested into the business. Another important benefit from eliminating manual processes is the impact on continuous improvement; digitization allows for closed-loop processes that can be optimized over time. Digitization is an essential part of a manufacturer's DX efforts, and the benefits to the business can't be ignored.

However, the biggest takeaway from the performance of digital versus nondigital manufacturers is how the gap increases over time. Many companies have already acted, digitizing as many processes as possible, and they are reaping the benefits. The data proves it: Those that embark on digital initiatives thrive; those that don't stagnate. The question to ask the nondigital manufacturers is, how much longer can you wait? The more time that passes without taking any actions, the more of an advantage their peers experience. In today's highly competitive manufacturing environment, manufacturers cannot risk inaction.

FUTURE OUTLOOK

When exploring why DX is so important for manufacturing, one need look at only the opportunity that is present. IDC estimates that the overall DX opportunity is around \$18.5 trillion in annual economic value globally, with manufacturing representing \$4.5 trillion. This analysis includes upstream (supply chain), production (factory), and downstream (customer experience and product development). The DX opportunity can be broken down further across the source, make, and deliver manufacturing functions. No matter the organization or process, the economic opportunity for DX is immense. In fact, over the past year, global organizations have spent more than \$1 trillion on digital transformation, with discrete and process manufacturers contributing almost 30% of this spending. Although investment in DX is high, most manufacturers still approach it in a siloed manner, sticking to pilots or proof of concepts (POCs).

Organizations have spent more than \$1 trillion on digital transformation globally, yet less than 15% of manufacturers have enterprisewide initiatives.

Currently, less than 15% of all industrial organizations have DX initiatives in production enterprisewide, which is the only way to truly transform. The failure of these pilots can be attributed largely to the fact that there are steps that cannot be skipped within manufacturing; digitization is an important action to take early in the transformation process. Eliminating manual processes has been an initiative for years, but most of the work has occurred in the back office. Manufacturers also need to turn their attention to the many paper-based processes that are bogging down performance within operations.

Another important point to consider is that the DX mission and needs vary among manufacturing segments. IDC focuses on product-centric organizations across four distinct value chains:

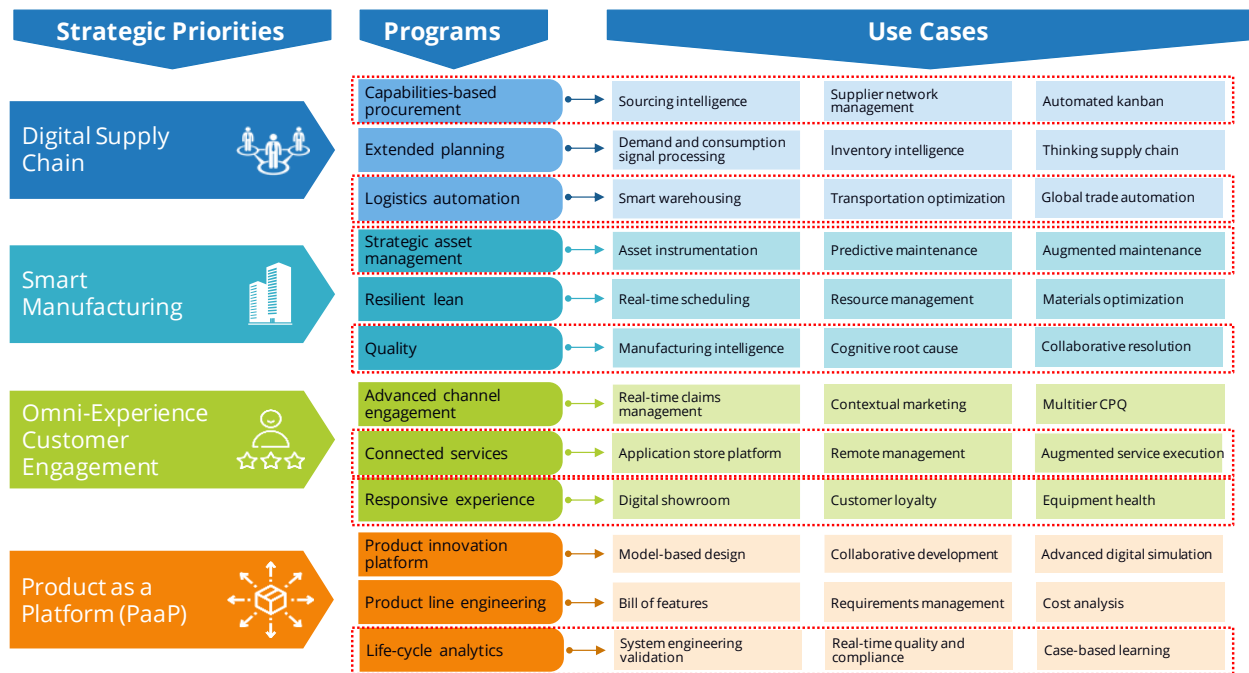
- **Asset-oriented value chain (AOVC).** Industries include chemicals, metals, and pulp and paper.
- **Brand-oriented value chain (BOVC).** Industries include consumer packaged goods (CPG), food and beverage (F&B), fashion, and life sciences.
- **Engineering-oriented value chain (EOVC).** Industries include automotive, aerospace and defense (A&D), and industrial machinery.
- **Technology-oriented value chain (TOVC).** Industries include electronics and semiconductor (high tech).

For AOVC companies, maximizing asset performance and ensuring the health and safety of the workforce are the highest priorities. For BOVC and EOVC organizations, quality management is top of mind because of the potential impact on consumers. For TOVC companies, managing an increasingly complex supply chain and changes through the new product introduction process are top concerns. The main point is that manual processes are prevalent across the entire manufacturing value chain.

IDC's DX taxonomy outlines the strategic priorities, programs, and use cases for a typical manufacturer. The programs most likely to still rely on manual or paper-based processes are highlighted in red in Figure 2. No matter which strategic priority is the top focus for your company, you will be able to identify manufacturing use cases that require digitization for successful implementation. Identifying the paper-based processes still being utilized is essential as you build out your DX road map.

FIGURE 2

Manual Processes Remain in Place Across Manufacturing



Note: For more details, see IDC's *Worldwide Digital Transformation Use Case Taxonomy, 2019: Engineering-Oriented Value Chains in the Manufacturing Industry* (IDC #US45119818, June 2019).

Source: IDC, 2019

CANDIDATES FOR DIGITIZATION

Determining and prioritizing the processes to start with can be daunting tasks, and there are many variables to consider (segment, company size, geography, etc.). The most common processes across manufacturing that are prime candidates for digitization include:

- Quality management.** Product rework, high amounts of scrap, noncompliance, costly recalls, and customer loyalty are all at stake when it comes to the quality of products. These pressures are driving many manufacturers to question the efficacy and approach of their current quality system. However, the reality is that most manufacturers rely upon inefficient manual or paper-based systems to manage their quality information. Within F&B manufacturing, quality assurance is of top concern. Managing and tracking certificates of analysis (COAs), for example, can be cumbersome if a manufacturer relies on a manual approach. Automotive manufacturers and F&B manufacturers feel similar quality pressures: The impact that poor quality can have on the business is immense, and the need for reliable quality control procedures is vital. Automotive quality control activities require the coordination of skills and expertise across numerous specialties, including mechanical engineering, electronics, upholstery, and tooling. Quality control checklists and inspection processes are areas ripe for digitization, providing inspectors with the tools needed to be more effective at their job. Digitized process control checklists can also be used by managers for improved visibility into

quality performance, allowing for data-driven decision making. Evolving regulatory requirements also benefit from digitization efforts because it is easier to demonstrate compliance, and time is not wasted going through binders full of paper. Any manufacturer that has adopted international standards for quality, such as ISO 9000 or ISO/TS 16949, knows that the certification process can be the most daunting task. Digitizing quality documents is a critical step in the verification process. Beyond the costs and regulatory concerns of poor quality, ensuring customer satisfaction is the number 1 driver behind a manufacturer's quality efforts. As a result, successful companies have embraced digitization to ensure that their customers are happy while keeping costs to a minimum.

- **Environmental health and safety (EH&S).** The need to reduce costs and stay productive is constant for any company, but compliance and the risk of an adverse event are still top of mind. Investments in safety are more than just cost avoidance measures. Today, safety must be considered vital not only to the health of employees but also to the health of the business. Companies that are not working to eliminate incidents and comply with safety mandates are introducing large amounts of risk into their organizations. This is especially true in asset-intensive segments such as chemicals, metals, and petroleum refining. Leaders in the industry are looking at new ways to have the best of both worlds – a safer work environment for employees and optimized productivity. Areas of particular importance are safety audits and inspections. Common practice for these processes entails review of a lengthy list of compliance-slanted elements by a small number of personnel. These tasks have a tendency to be viewed as a chore by many manufacturers, not a critical function for safety and compliance. A large driver behind this mindset can be traced back to the safety culture in place at a manufacturer and a lack of knowledge among employees about functional safety standards. Many newer employees are limited in their knowledge of company policies and best practices for safety. A manual or paper-based system simply cannot keep up with the demands and requirements of an effective audit/inspection program. Safety cannot be managed through manual processes in a siloed manner; automating processes is essential. Required reporting and notices can be digitized to create a normalized set of data that can be used for analytics and reporting. Similarly, audits and inspections can be accessed on a mobile application to streamline the process and improve data accuracy. By realizing that audits and inspections are not just chores but critical processes that enable compliance and safety, manufacturers will begin to see improvements in performance. Successful manufacturers have digitized their audit and inspection processes, making them easier to conduct and properly manage.
- **Change management (engineering change orders).** The very nature of new product introduction makes it susceptible to change. There is almost no way to avoid it. New regulations could force a change in material, process, or function. A cheaper, more effective process or machine could be introduced, and change in the product is needed to take advantage of the benefits. Successful manufacturers know how important change management is to not only a new product but also the business. While most manufacturers have a system in place to manage and communicate changes from engineering to the plant floor, two-way communication is lacking. Often, changes that occur on the plant floor are recorded on paper and not communicated to other groups. The use of paper to record and manage change comes with many drawbacks. Because these changes cannot be easily searched, modified, accessed, or remotely approved, paper-based change management systems require additional time and effort to search for pertinent information. In addition, there is the added risk to the business: Paper is more susceptible to

"The most successful action our company has taken is to automate the EH&S auditing program. This ensures all sites use the same format and audit against applicable regulations." – EH&S manager, medium-sized chemical manufacturer

damage caused by wear and tear, fire, water, or theft. Digitizing changes that occur on the plant floor remains a major area for improvement among manufacturers. Automating change management enables manufacturers to standardize change requests; utilize a formal process to review, approve, communicate, and manage changes; and close the loop for all change-related tasks. For high-tech manufacturers, the DX mission is to accelerate time to volume, capitalizing on the shrinking profitability windows for new products. Streamlining the change management process is essential for an electronics manufacturer to get new products into the hands of consumers with minimal delays. Change is inevitable within manufacturing; digitizing the process allows changes to occur without causing issues down the line.

- **Maintenance/field service.** Making the rounds with a clipboard is still part of the job description for many maintenance and field service technicians across the manufacturing industry. Whether out on the plant floor or in the field, many technicians still rely on paper-based checklists and forms to complete their work. Depending on the number of assets observed, this could result in hours of additional time needed to manually reenter this information electronically into the system of record (enterprise resource planning, enterprise asset management, manufacturing execution system, etc.). Digitizing this information and the actions required (work orders/issues, maintenance records, contracts, etc.) to keep assets running is critical. Digitization also allows for mobile solutions to be utilized, providing relevant information to workers no matter their location and allowing them to record information directly into the appropriate systems – once. These solutions become very important during operator rounds when workers need to store inspection data. Storing this information on paper often creates the risk of data not being entered in the system in a timely manner and reduced quality of the data. Providing mobile devices will enable field workers to store inspection data in the system automatically, access pending work orders, track repairs, and perform other critical tasks that traditionally required employees to go back and forth from workstations. Some advanced manufacturers have implemented Strategic Asset Management programs that can start to predict downtime before it ever occurs, but they all had to move away from manual processes first. Capturing asset information digitally is an easy way to improve current performance while building out a more in-depth program.
- **Supply chain.** After years of being relegated to support status, the supply chain is now perceived by manufacturers as a strategic tool for business performance and growth – an "opportunity center" rather than a "cost center." Digital technology is now the top driver of change in the supply chain, reflecting both the potential for driving transformation and the lack of full clarity into true potential. Global trade management and freight accounting processes are a natural fit for digitization. Manufacturers often utilize disparate systems to manage logistics and trade compliance. Storing all supporting documents, logistics data, compliance submissions, and related correspondence for each shipment in one digital folder can provide secure and timely access to essential shipment information for every level of an organization's trade compliance and supply chains, both internal and external. Digitizing trade documents and data can accelerate the transfer of information to customs agencies, ports, shippers, and logistics service providers, preventing delays. Likewise, the bill of lading (B/L) that accompanies each shipment needs to be digitized, and shippers need to manage the flow of electronic data from their offices and docks to motor carriers. There are still many handwritten bills of lading, which contributes to data inaccuracies in the supply chain. If the data can be shared electronically (eB/L), it is available earlier, and a company can build a road map for where drivers are needed at a given time based on freight flows. This reduces waste in the line-haul operation, cutting out costs and improving delivery times. Automating the process can streamline the entire life cycle of global trade across orders, logistics, and settlement activities to significantly improve operating efficiencies and cash flow. Eliminating manual or paper-based systems will cut costs while supporting compliance with ever-changing regulations.

- **Talent management.** Talent is a hot-button issue for most companies, but manufacturers are feeling the pressure more than most. A recent IDC study found that 45% of manufacturers are understaffed in their high-skills positions, but only 4% of manufacturers don't consider talent a top priority. One of the main reasons is because the manufacturing workforce is skewed toward older workers and aging. Baby boomers are retiring every day and leaving gaps that need to be filled. In addition, attracting younger talent is a challenge because manufacturing is not viewed as an "exciting" industry. Companies need to rethink how they approach talent management to succeed going forward. The role of technology will be one of the most important questions to answer to solve the problem. In fact, 53% of manufacturers stated that automating low-value work (manual tasks/data collection) is the top action they are taking in response. Eliminating this type of work frees up workers, allowing them to focus on higher-value activities to further drive improvements. Manufacturers will also turn to knowledge management systems and collaboration tools, but for these systems and tools to be implemented successfully, the digitization of operational information is necessary.

The speed and complexity of manufacturing operations are increasing faster than ever before, and manual processes are no longer acceptable for manufacturers. The ability to simplify and optimize processes through digitization can become invaluable over time to DX initiatives. The key takeaway here is that successful companies not only are digitizing at higher rates but also are utilizing digitization across a wider variety of operational processes. Successful manufacturers have realized this fact and, as a result, are reaping the benefits.

CHALLENGES/SOLUTIONS

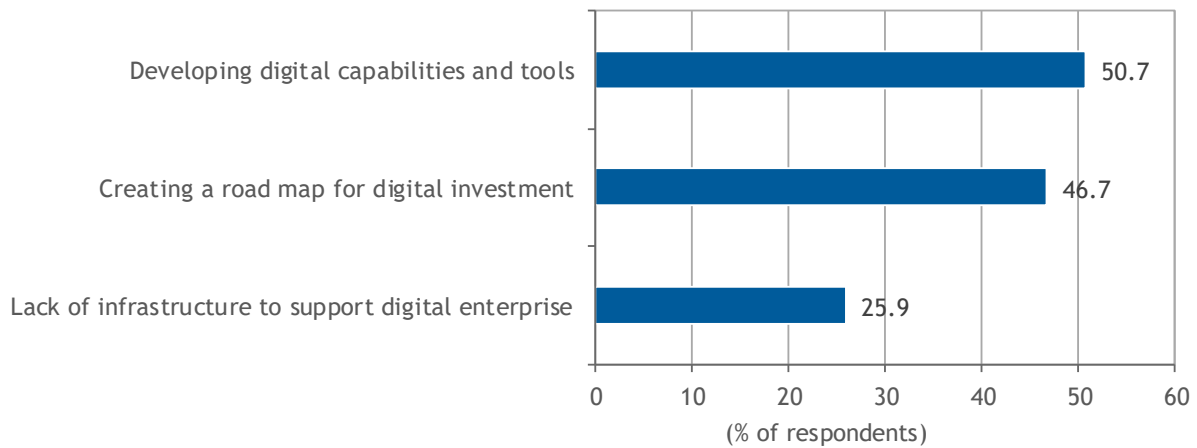
Considering the role that real-time visibility plays in improved performance, it is alarming to see a large number of manufacturers still utilizing manual/paper-based systems across their operations. Manual systems are far too inefficient and outdated to meet the demands of a modern manufacturer. The drawbacks include:

- Increased costs
- Wasted time
- Data inaccuracies and latency
- Limited traceability
- Poor communication
- Lack of process standardization

All employees, no matter where they are located around the world, need access to standard information to improve communication and collaboration across the enterprise. As a result, successful manufacturers continue their digitization efforts, eliminating paper-based/manual systems across operations. However, digitization comes with its own challenges. In IDC's recent *Global Digital Transformation Executive Sentiment Survey*, manufacturers indicated that the development of digital tools and creating a road map for digital investment are their top concerns (see Figure 3).

FIGURE 3

Top DX Challenges – Manufacturing



Source: IDC's *Global Digital Transformation Executive Sentiment Survey*, May 2018

While developing digital tools and creating a road map for digital investment are top challenges, there are more ways than ever before to address these concerns. Technology solutions have continued to mature, and there is no need for a manufacturer to continue to rely on legacy systems. System modernization brings a company's existing application portfolio to a point where those applications can maintain the pace of digital operations. This focus on modernizing the IT landscape has led many companies to turn to a digital platform approach for operational improvements. For example, content services platforms provide manufacturers with a suite of capabilities such as document management and workflow automation that can be leveraged across all the scenarios discussed previously. With the ability to integrate with core business systems such as an enterprise resource planning system, these platforms can provide manufacturers with a single source of the truth for information. A platform approach not only allows a manufacturer to become more agile and better manage/act upon information across the enterprise but also allows for the incorporation of innovation accelerators such as artificial intelligence and machine learning. As the manufacturing industry continues to evolve faster than ever, companies that break down silos and embrace modern technology will thrive in this environment.

CONCLUSION

While manufacturers across the globe are imagining new ways to innovate through the use of advanced technologies such as AI and machine learning, many are still inhibited by manual and paper-based processes. The presence of these inefficient processes spans the entire manufacturing value chain – from the supply chain to production and customer service. With digital transformation becoming a top priority in the industry, sometimes the fundamentals can be overlooked. Digitizing these processes is a tried-and-true method to reduce costs, improve accuracy, and increase visibility across the organization. Manufacturers looking to improve their performance should look internally at the everyday actions they take and identify whether digitization can be of benefit.

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