



Manufacturing 2023: Digital Transformation and Energy Transition

Manufacturers are deep into digital transformation, but approaches vary by company type, industry and region. Digital transformation is an ongoing process often accelerated by one deployment building upon another — for example, implementing an industrial internet of things (IIoT) solution in one area of a plant opens that infrastructure for additional use cases. Companies already in the process of digital transformation get incremental competitive gains compared to those still in the consideration and planning stages.

Manufacturing companies have a constant drive to improve, to hit the “golden batch” or optimized process and stay in that zone; this wave of digital transformation is helping companies achieve that goal. For cost and supply reasons, manufacturing companies are also focusing on efficient energy usage, which has the side benefit of helping them achieve environmental, social and governance (ESG) targets. Finally, companies are caught in a perfect storm with a demographic shift causing the skills gap known as the “great crew change.” The need to combine IT and OT skills in the rapidly evolving digital space adds to the skills pressure.

Of note are the unique requirements and paths of two distinct types of industrial firms: continuous process and discrete manufacturers. Those in each group have much to gain from digitalizing their operations and modernizing their energy consumption, yet they also have distinct operational challenges that are reflected in their respective digital priorities.

This report is based on a survey commissioned by Eaton and conducted by 451 Research of 250 industrial respondents involved in their organization's digital transformation efforts in eight countries across North America and Europe, the Middle East and Africa. Of the 250 industrial respondent organizations, 41% are continuous process manufacturers, primarily producing or extracting products via ongoing processes (e.g., food, pharmaceuticals, chemicals, mining, oil and gas, paper and pulp). Discrete manufacturing (e.g., automobiles, furniture, electronics) accounts for 53%. The remaining 6% identify as hybrid. (See the Methodology section for more information.)



Powering Business Worldwide

Digital focus: continuous process manufacturing

KPI issues – continuous process manufacturing

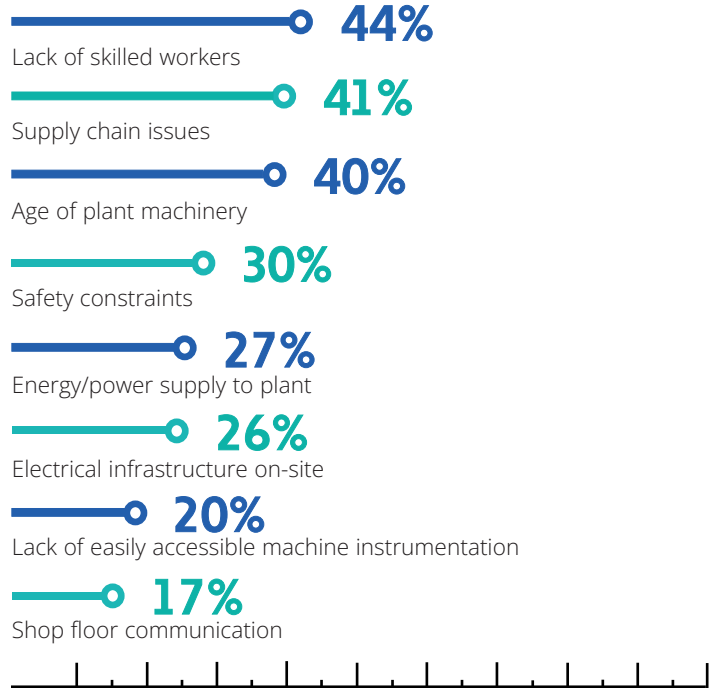
Digital transformation in the batch and continuous process manufacturing sector is quite mature. Just 2% of respondents say they have no transformation strategy at all. Almost half (48%) say they are actively executing digital transformation, with the remainder in the consideration or evaluation stage.

KPI concerns in continuous process manufacturing

Whether they are engaged in digital transformation or considering it, all respondents in continuous process industries cite a range of issues negatively impacting their operations (see Figure 1).

- Long-term “great crew change” concerns are shown in the lack of skilled workers, which pre-dates digital initiatives.
- A blend of OT and IT skills are required for digital transformation, further exacerbating the skills shortage.
- Brownfield IIoT instrumentation of an existing plant requires detailed understanding of each business and operational process.
- Replacing or upgrading continuous process plant equipment is expensive and causes downtime, but it can reduce the upskilling need by mainly requiring operator training on enhancements.

Figure 1: Skills, supply chain and plant age are top continuous process manufacturing concerns¹

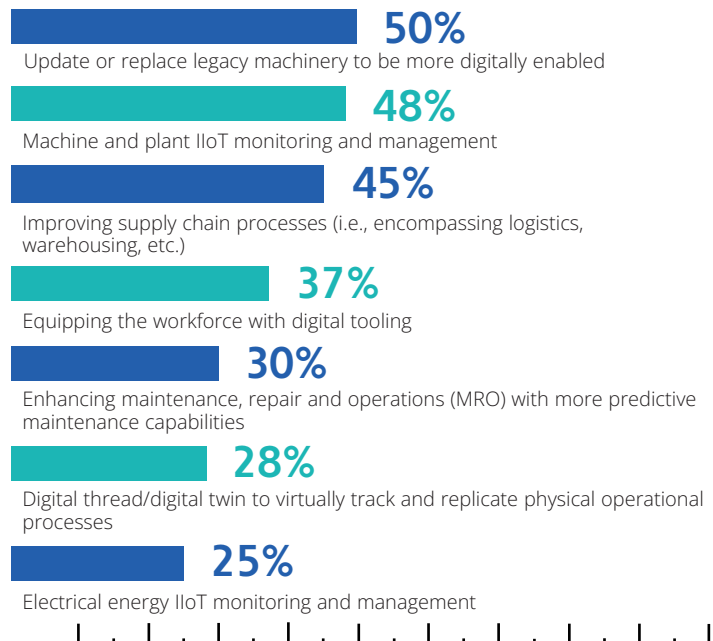


Deployed and planned technology in continuous process manufacturing

The digitally enabled use cases that respondents have deployed or plan to deploy are a good indicator of the maturity of digital transformation (see Figure 2).

- Half of continuous process respondents are looking to replace or upgrade equipment, and nearly half are engaging in IIoT plant monitoring. This shows that gaining a more detailed level of instrumentation and control to improve efficiency is a key driver.
- Improving supply chain processes will be an ongoing task, but this is initially enhanced by these first digital transformation steps because each part of the system requires more detailed instrumentation and information flow.
- Companies initially focus on updating the plant, which in turn leads to process changes and then workforce tool improvement.
- New digitally enabled tools and procedures for the workforce impact the skills profile needed on the shop floor.

Figure 2: Updating plant, enabling monitoring and improving supply chain processes are leading use cases for continuous process industries²

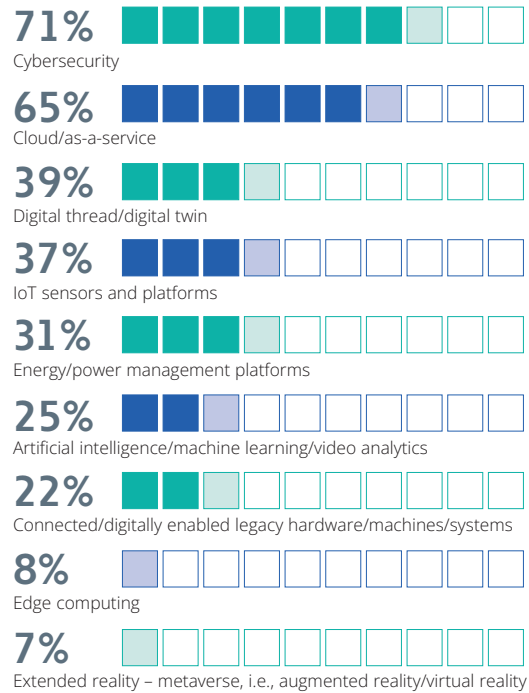


New technology adoption in continuous process manufacturing

Digital transformation in continuous process industries allows manufacturers to adopt new technology to help improve business outcomes. Rates of deployment or planned deployment of these new technologies are shown in Figure 3.

- Cybersecurity adoption sits alongside a move to cloud and as-a-service offerings across continuous process industries.
- Because connected systems offer significant benefits for operations, industry attitudes have shifted from initially avoiding data in the cloud to focusing on cybersecurity protection.
- Digital twin/digital thread approaches are an evolution of IIoT sensors and platforms as operational data becomes more contextualized and integrated into operations. They support more use cases such as workforce training and simulation, thereby supporting the pattern of progression from machinery to processes to workforce enablement.

Figure 3: Cybersecurity adoption is top priority as data from continuous process industries moves to cloud and as-a-service platforms³

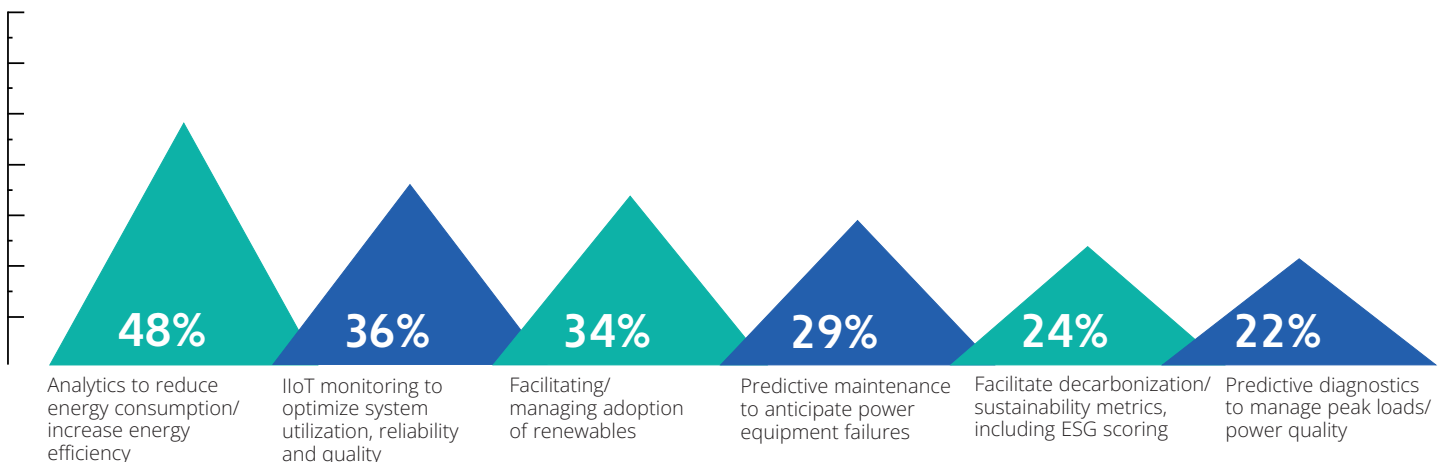


Energy and power technology in continuous process manufacturing

Manufacturing of all types is power-intensive, but continuous processes include some of the most intense uses. We asked respondents about specific use cases of digital transformation in energy and power (see Figure 4).

- Almost half of continuous process respondents have deployed or will soon deploy analytics to reduce energy consumption/increase energy efficiency. Analytics can be paired with IIoT monitoring for optimizations and quality, with the primary driver being energy cost reduction rather than ESG scores.
- Over a third of continuous process respondents are using or will soon use digital technologies to facilitate/manage adoption of renewables. This shows how energy-intensive continuous process facilities are looking for cost savings and reduced supply volatility in their energy mix (as seen in supply chain concerns).
- Digital transformation efforts to improve efficiency and reduce cost will also improve ESG benefits and scores, a use case cited by nearly a quarter of continuous process respondents.

Figure 4: Continuous process manufacturing respondents are focused on analytics to reduce energy consumption⁴



Digital focus: discrete manufacturing

KPI issues - discrete manufacturing

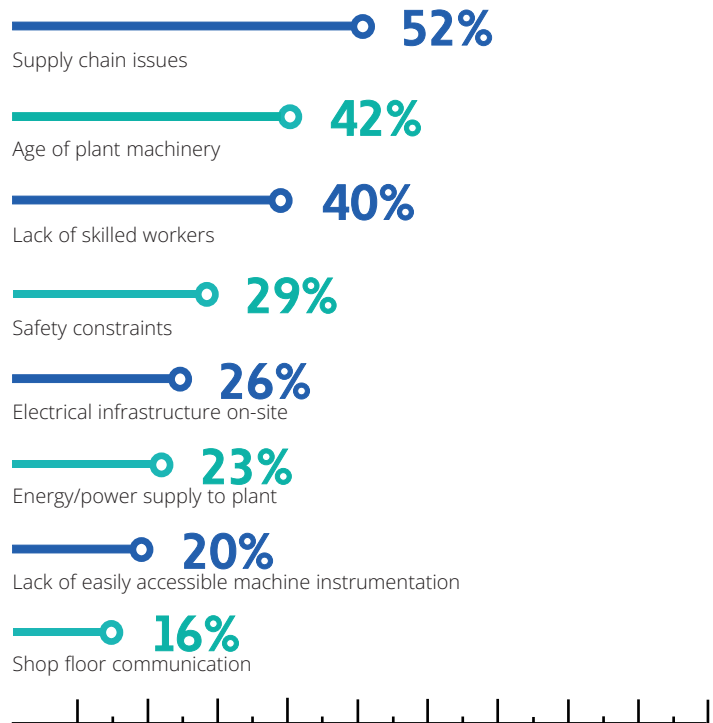
Discrete manufacturing i.e., the assembly of finished goods, is well along the digital transformation path with only 1% of the 133 respondents stating they have no digital transformation strategy. A further 44% are considering or evaluating plans to develop a strategy. The majority (55%) are executing a formal strategy and actively digitalizing business processes and/or assets.

KPI concerns

Whether they are engaged in digital transformation or considering it, all respondents in discrete manufacturing industries report a range of concerns negatively impacting their operations (see Figure 5).

- Supply chain issues impact discrete manufacturing significantly due to the large number of varied components, often globally sourced, in a typical product.
- Innovations in robotics and manufacturing machine capabilities have dated even relatively new plants. For example, an early computer numerical control (CNC) industrial robot now competes with more flexible models that have computer vision, AI processing and IIoT connectivity, performing a wider range of tasks.
- More advanced digital equipment requires a mix of IT and OT skills to maintain, repair and program devices. This impacts skills shortages on top of the demographic impact of the great crew change.
- Electrical infrastructure on-site is a concern in an increasingly high-tech sector in which many different types of plant machinery, edge computing, networking and robotics (including AGV battery charging) present a more complex set of electrical requirements than for a traditional plant.

Figure 5: Supply chain issues are biggest concern for discrete manufacturing⁵

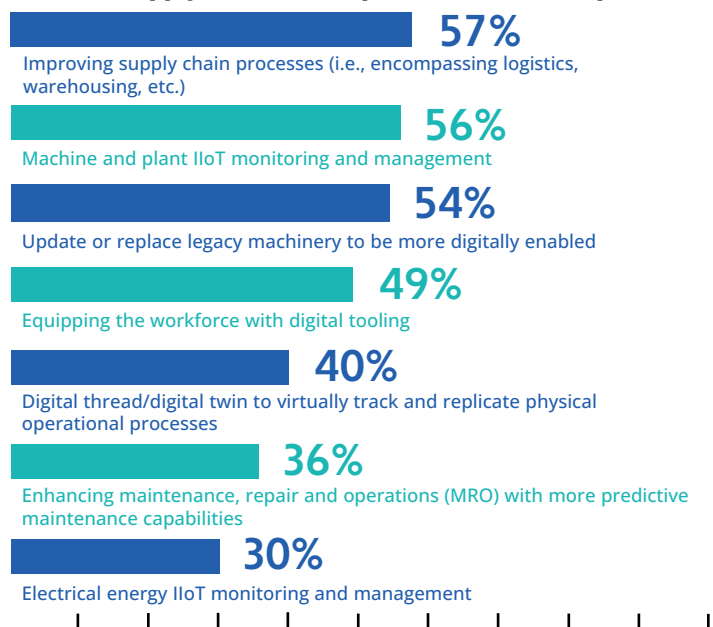


Deployed and planned technology in discrete manufacturing

Major digitally enabled use cases in discrete manufacturing can be seen in Figure 6.

- Upgrading or replacing legacy plant equipment and implementing machine and plant IIoT monitoring has the added effect of providing quicker insight into quality issues related to incoming raw materials and components, providing an opportunity to address supply chain issues.
- Digital transformation needs to happen throughout the supply chain ecosystem to be fully effective. Discrete manufacturers need to position themselves to take advantage of those developments, and they will also be in a position to drive suppliers to transform.
- New machines require new resources for the workforce; some of these tools, such as low-code/no-code and AI assistance, may help reduce skill requirements and challenges.

Figure 6: Discrete manufacturing looks to improve supply chains and update and monitor plant

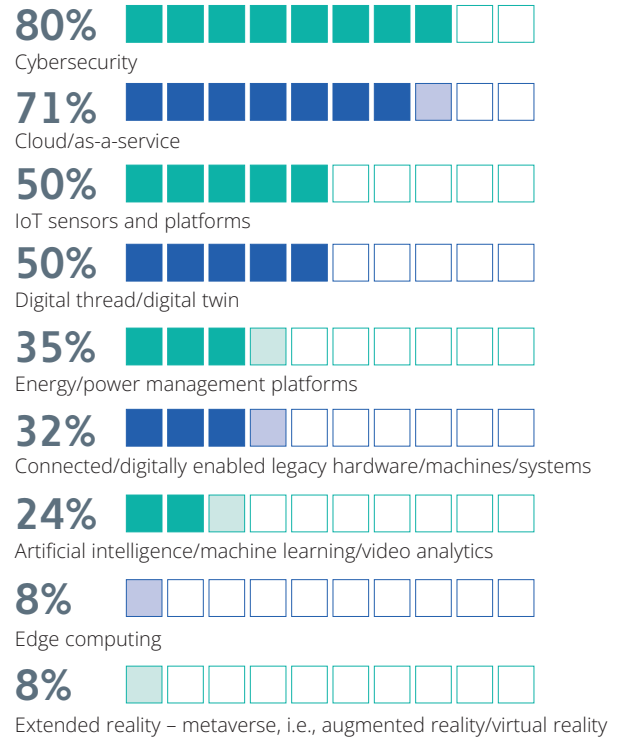


New technology adoption in discrete manufacturing

Digital transformation in discrete manufacturing facilitates the adoption of new technology to help improve business outcomes. Rates of deployment or planned deployment of these new technologies are shown in Figure 7.

- Cybersecurity adoption goes hand in hand with a move to cloud and as-a-service offerings across discrete-focused industries.
- With discrete manufacturing increasingly moving to a more flexible high-mix, low-volume approach, manufacturers need to adjust plant operations in a more software-defined way, which typically relies on as-a-service offerings.
- Digital twin/digital thread approaches are an evolution of IIoT sensors and platforms and provide a richer set of tools not only to operate discrete manufacturing facilities but also to simulate what-if situations such as plant reconfiguration for new products and the impact of supply chain changes.
- Understanding and controlling energy costs and improving energy efficiency is directly related to operations and is widely cited by respondents. AI/ML/video analytics scores lower, despite its effectiveness; one probable explanation is that these functions are more likely to already be embedded in an updated plant, and thus not subject to a separate deployment.

Figure 7: Cybersecurity and cloud/as-a-service top discrete manufacturing new technology adoption⁷

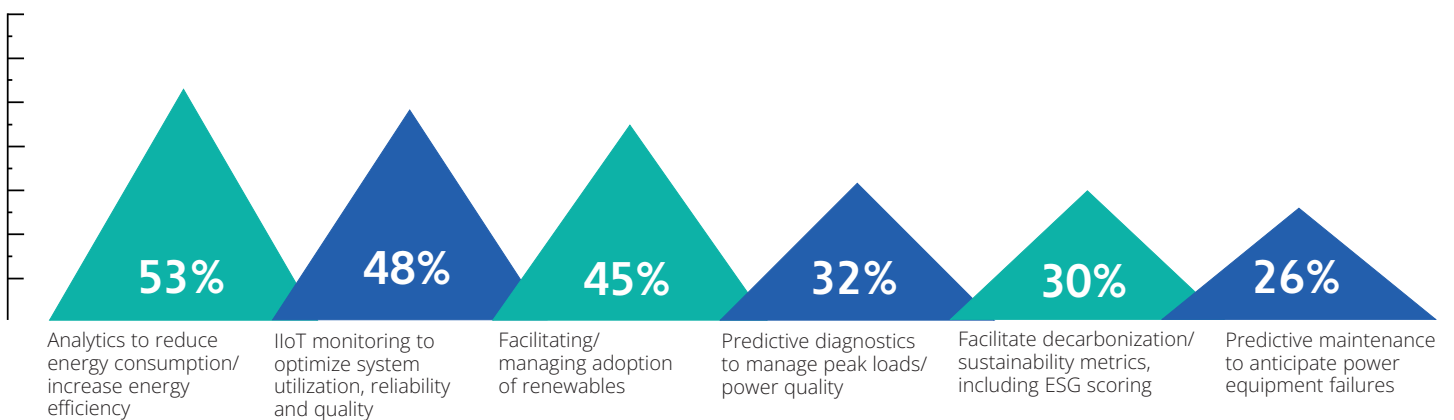


Energy and power technology in discrete manufacturing

Discrete manufacturing is often energy-intensive, and facilities may rely on multiple energy sources. We asked respondents about specific use cases of digital transformation in energy and power (see Figure 8).

- Almost half of discrete process respondents have deployed or will soon deploy analytics to reduce energy consumption or increase energy efficiency. Analytics can be paired with IIoT monitoring for optimizations and quality; the driver is typically energy cost reduction rather than ESG scores.
- The result regarding facilitation/management of renewables adoption suggests that discrete manufacturing respondents' flexibility in adding to their energy mix is primarily a means to reduce cost rather than being driven by ESG compliance.
- Achieving ESG benefits and scores tends to be the result of digital transformation to improve efficiency and reduce cost.

Figure 8: Analytics for energy efficiency, IIoT monitoring and adoption of renewables are of great importance in discrete manufacturing⁸



Footnotes

Chart data correlates to these questions from the survey conducted by 451 Research/S&P Global Market Intelligence.

1. Which of the following issues negatively impact the efficiency or capabilities of your operations today?
2. Which of the following digitally enabled use cases have you deployed or plan to deploy to improve the efficiency or capabilities of your operations?
3. Which of the following technologies, tools or applications have you deployed or plan to deploy in the next 12 months to support your organization's digital transformation?
4. Thinking specifically about your organization's energy and power systems, which of the following digitally enabled use cases have you deployed or plan to deploy in the next 12 months?
5. Which of the following issues negatively impact the efficiency or capabilities of your operations today?
6. Which of the following digitally enabled use cases have you deployed or plan to deploy to improve the efficiency or capabilities of your operations?
7. Which of the following technologies, tools or applications have you deployed or plan to deploy in the next 12 months to support your organization's digital transformation?
8. Thinking specifically about your organization's energy and power systems, which of the following digitally enabled use cases have you deployed or plan to deploy in the next 12 months?

Methodology

This report is based on a commissioned web survey conducted in April and May 2022. The respondents were qualified based on their expertise in their organization's adoption of digital transformation. Respondent companies were from diverse industries and had 100+ full-time employees. Surveyed countries were France, Germany, Italy, Nordic countries, Spain, UAE/Dubai, the United Kingdom and the United States. (Note that the base size for both the Nordics and UAE is less than n=30 so should be interpreted anecdotally.) Total sample size for the study is 1,001.

Respondent roles fit into one of four eligible industry sectors: building services/facilities; datacenter owner/provider (including colocation and edge); manufacturing/industrial; and utilities. Survey invitations reached executives at the director level and above in IT, technology, facility operations, power management and environmental management roles. Respondents were screened to be purchase decision-makers for embedded operations technology, having responsibility or connection in their role to operations technology for the site/facility. Their connection to operations technology could be either for IT or other mechanical operations. The survey was executed blindly — i.e., the survey sponsor name was not revealed to the participants at any stage of the project.

About S&P Global Market Intelligence

S&P Global Market Intelligence's Technology, Media and Telecommunications (TMT) Research provides essential insight into the pace and extent of digital transformation across the global TMT landscape. Through the 451 Research and Kagan products, TMT Research offers differentiated insight and data on adoption, innovation and disruption across the telecom, media and technology markets, backed by a global team of industry experts, and delivered via a range of syndicated research, consulting and go-to-market services, and live events.

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