

# 2024 manufacturing industry outlook

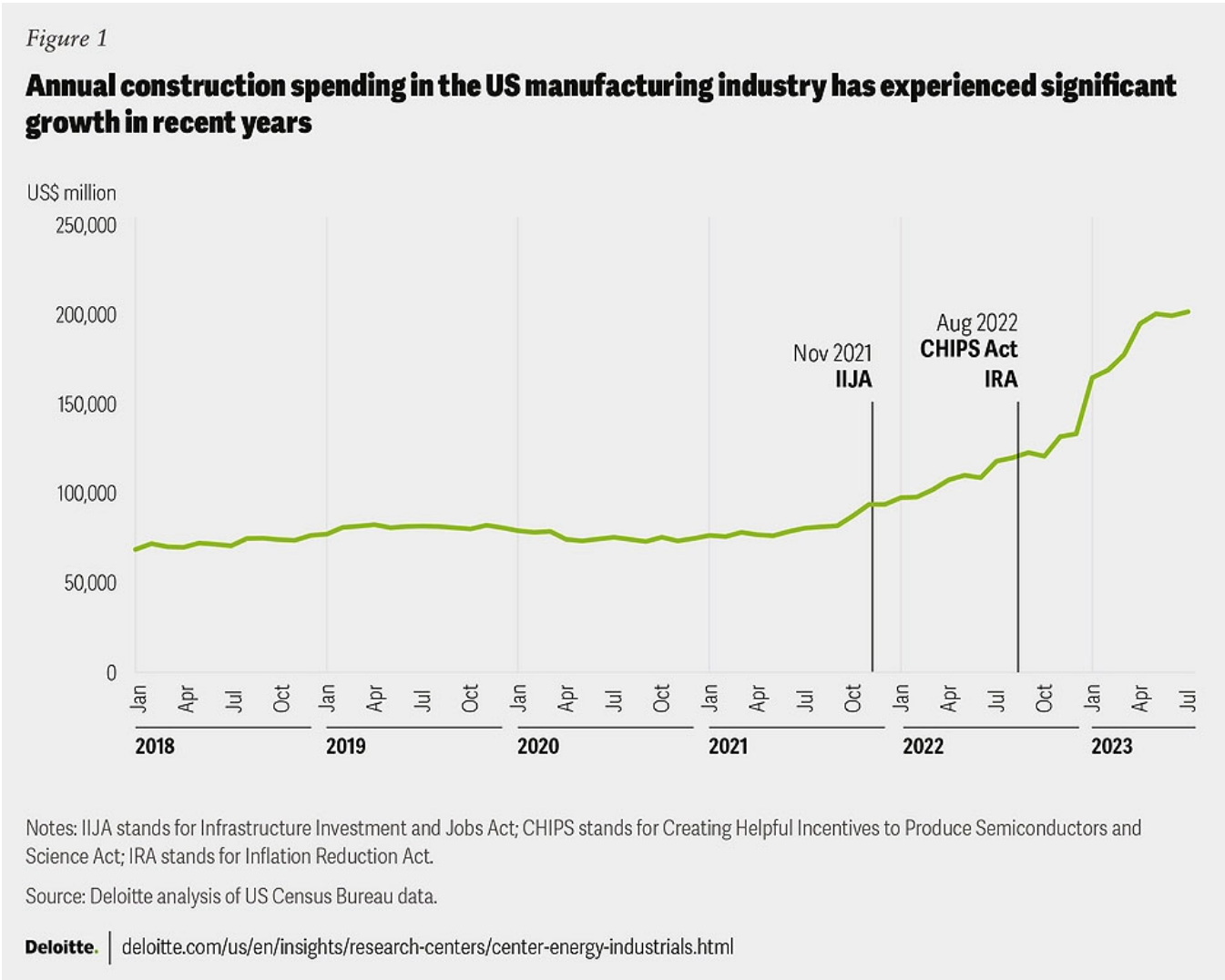
*Manufacturers should continue embracing digital transformation to contribute to a competitive and resilient future and to help tackle ongoing manufacturing challenges.*

ARTICLE • 19-MIN • Deloitte Research Center  
READ for Energy & Industrials

In 2023, the US manufacturing industry capitalized on the momentum generated by three significant pieces of legislation that were signed into law in 2021 and 2022—the Infrastructure Investment and Jobs Act (IIJA), the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act, and the Inflation Reduction Act (IRA). Together, these laws prioritize rebuilding infrastructure, advancing clean energy initiatives, and building out the domestic semiconductor industry, while also aiming to foster job growth, workforce development, and equity. By introducing an infusion of funds and tax incentives into US manufacturing across various sectors—including semiconductors, clean energy components, electric vehicles, batteries, and the constituent parts and raw materials of these products—the IIJA, CHIPS, and IRA have already spurred record private sector investment in the manufacturing industry.<sup>1</sup>

For example, the investments in semiconductor and clean technology manufacturing are nearly double the commitments made for these sectors throughout 2021, and nearly 20 times the amount allocated in 2019.<sup>2</sup> Since passage of the IRA, close to 200 new clean technology manufacturing facilities have been announced—representing US\$88B in investment—which are expected to create over 75,000 new jobs.<sup>3</sup> There

has been a significant increase in construction spending in manufacturing industry after the passage of the IIJA, CHIPS Act, and IRA (figure 1). As of July 2023, annual construction spending in manufacturing stands at US\$201 billion, representing a 70% year-over-year increase and setting the stage for further industry growth in 2024.<sup>4</sup>



The manufacturing industry continues to face headwinds, however. In 2024, manufacturers are expected to face economic uncertainty, the ongoing shortage of skilled labor, lingering and targeted supply chain disruptions, and new challenges spurred by the need for product innovation to meet company-set net-zero emissions goals. Deloitte’s analysis of Purchasing Managers’ Index (PMI) data reveals that the manufacturing sector was in contraction for most of 2023.<sup>5</sup> So, what strategies should

manufacturers consider in order to tackle these ongoing challenges, help scale up production, improve competitiveness, and capture the full potential of the record influx of capital into the industry? To help companies begin to answer this question, the 2024 manufacturing industry outlook explores the following trends:

- [Navigating persistent talent obstacles](#)
- [Smart factory and the journey toward the industrial metaverse](#)
- [Supply chain digitalization for enhancing performance and resilience](#)
- [Aftermarket services as a potential differentiator](#)
- [Product electrification and decarbonization](#)

Technology is poised to play a significant role in supporting manufacturers in taking on the challenges they may face in 2024. With a persistent search for efficiency and focus on building resilience across the organization, many manufacturers look to continue to pursue their digital transformation objectives—even as some may be considering pausing investments because of the challenging business environment. Companies seem to be embracing a smart factory approach, exploring the industrial metaverse, and investigating the possibilities of generative AI, one of the latest additions to the arsenal, as tools they can use to add value to their operations.

A recent Deloitte study indicated that a striking 86% of surveyed manufacturing executives believe that smart factory solutions will be the primary drivers of competitiveness in the next five years.<sup>6</sup> According to another recent survey, manufacturers anticipate that the industrial metaverse could lead to a 12% gain in labor productivity, which might help address the ongoing labor shortages. Generative AI is expected to hold immense potential in areas such as product design, aftermarket services, and supply chain management. It could lead to reduced costs across manufacturing organizations and could serve as another tool for navigating a challenging labor market. Considering the immense scope of this technology, we have presented generative AI use cases for each trend.



## Key trends

**01**

To **improve talent attraction and retention**, manufacturers can consider **employing new digital tools**, **tapping into the knowledge of retirees**, and establishing external partnerships to **build and upskill the talent pipeline**.

**02**

Manufacturers are increasingly **leveraging digital technologies**, embracing a **smart factory approach**, and exploring the **industrial metaverse** to **improve agility, resilience, and efficiency** in the face of economic uncertainty.

**03**

**Supply chain challenges persist**, and manufacturers are pivoting toward **digital solutions**, including the **industrial metaverse**, to **drive supply chain efficiency, resilience, and innovation**.

**04**

Manufacturers are **investing in digital technologies** that can create **new and enhanced aftermarket offerings** that could lead to **revenue-generating opportunities**, enhanced **customer loyalty**, **upselling and cross-selling opportunities**, and a **competitive advantage in general**.

**05**

**Federal funds and incentives** and a general drive toward a **net-zero future** have led to **increased investments in product electrification and decarbonization**. Manufacturers are implementing a **variety of strategies** to **overcome** some of the challenges associated with the **transition**.

Source: Deloitte analysis.

**Deloitte** | [deloitte.com/us/en/insights/research-centers/center-energy-industrials.html](https://deloitte.com/us/en/insights/research-centers/center-energy-industrials.html)

# 1. Navigating persistent talent obstacles

Labor market tightness has continued into 2023 (figure 2), and the same trend is expected for 2024. In a recent survey conducted by the National Association of Manufacturers (NAM), almost three-quarters of surveyed manufacturing executives feel that attracting and retaining a quality workforce is their primary business challenge.<sup>7</sup> Manufacturers have been proactive about adjusting their workforce policies to improve employee attraction and retention. Some recent changes include:

- **Keeping flexibility at the forefront:** In a recent survey conducted by NAM, 46.8% of surveyed manufacturing executives pointed out that their company offers flexible scheduling to production workers. Other forms of flexibility offered to production

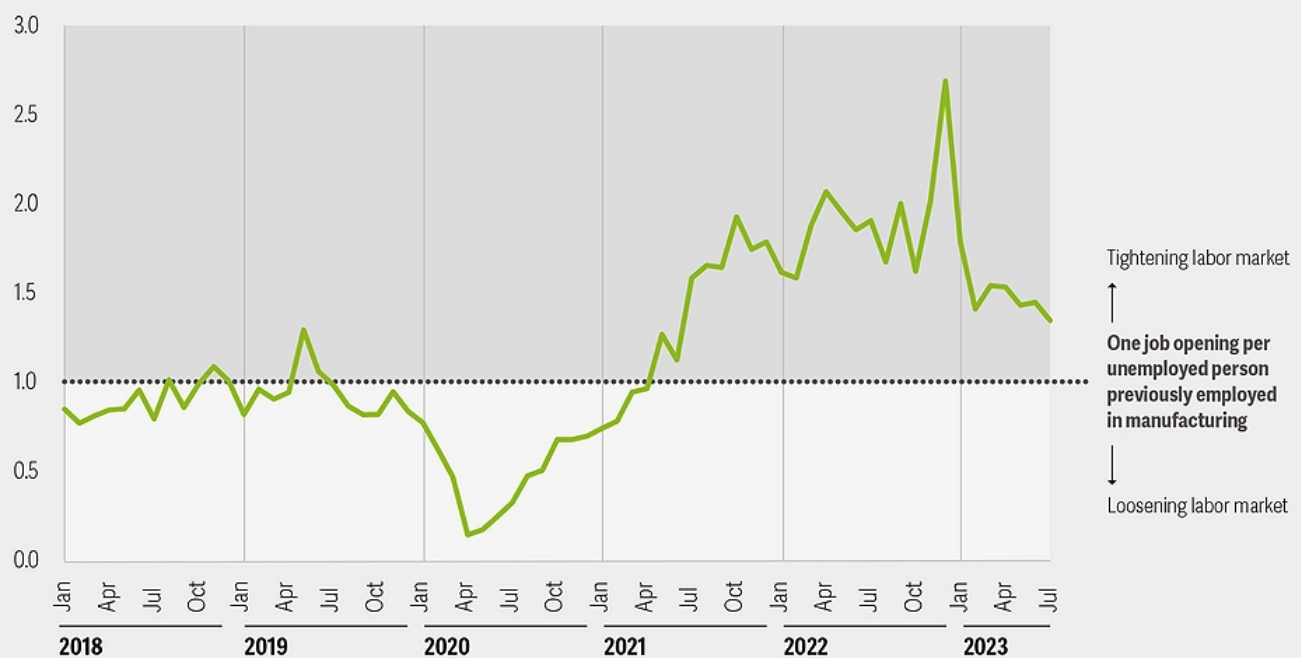
workers include remote work, compressed workweeks, and the opportunity to swap or split shifts.<sup>8</sup>

- **Rewarding the workforce:** Per Deloitte analysis, between Q1 FY2022 and Q1 FY2023, there has been a 4% rise in the average hourly earnings of employees. Notably, there has also been a 19% reduction in the average number of voluntary separations over the same period.<sup>9</sup>

Figure 2

### The US manufacturing industry continued to experience labor market tightness in 2023

Job openings/unemployment in the US manufacturing industry



Source: Deloitte analysis of Bureau of Labor Statistics data.

Deloitte. | [deloitte.com/us/en/insights/research-centers/center-energy-industrials.html](https://deloitte.com/us/en/insights/research-centers/center-energy-industrials.html)

## Enhancing workforce strategies for a better future

While manufacturers have made progress in adapting their workforce policies to improve talent attraction and retention, additional strategies can be considered in 2024 to continue to build on this momentum. Potential approaches to hiring amid a tight labor market include:

- **Employing digital tools to enhance talent acquisition:** Many manufacturers face challenges in acquiring the right talent to meet current and future demand. Companies often no longer view location decisions solely as real estate choices, but as strategies for optimizing talent and efficiency and minimizing risk. Enhanced “locational awareness” when selecting a new manufacturing location can help businesses balance market access, talent pools, and overall costs.<sup>10</sup> Companies are investigating the use of digital tools, such as artificial intelligence, to quantify the need for employees in both new and established manufacturing facilities. These tools can help to sense the local labor market and generate approaches for marketing to potential employees. Digital solutions have also been employed to help improve access to temporary labor. By working with organizations that use innovative tools like mobile applications that leverage AI to engage and perform basic screening of potential employees, some manufacturers have been able to increase their pool of difficult-to-find, higher-skilled workers.<sup>11</sup> This includes engineers, maintenance technicians, and machinists who seem to favor the flexibility and higher pay that on-demand positions can offer.<sup>12</sup>

- **Tapping into the knowledge of retirees:** Developing alumni programs for retired employees might serve as an effective strategy to maintain engagement.<sup>13</sup> In 2022, nearly one-third of the manufacturing workforce was over 55 years of age.<sup>14</sup> When they retire, this pool of experienced employees could be enrolled in an alumni program. These networks could help keep retirees connected to the company’s activities for potential job opportunities as well as transfer of important knowledge to younger workers.

- **Building and upskilling the talent pipeline:** Engaging in collaborations with educational programs that start preparing students for STEM careers as early as kindergarten can allow manufacturers to nurture local talent, mentor students, and establish future STEM-ready workforce pipelines, making it a strategic approach for both community involvement and long-term talent attraction and retention.<sup>15</sup> Another such relationship can be established with community and technical colleges



to unite industry knowledge with educational innovation to help provide students with specific skills.<sup>16</sup> Manufacturers should also think about ways to create new opportunities for upskilling existing employees. For example, companies could free up three additional hours a day per person by adapting digitization and automation and offer more training sessions to workers during those freed-up hours.<sup>17</sup> This could enable manufacturers to better prepare employees for current and future job roles, including those that require advanced digital skills, and help build career pathways. In addition, the industrial metaverse can be employed to offer new, efficient, enhanced, and flexible training methods that can be accessed even from remote locations.<sup>18</sup>

## **Generative AI spotlight: Use case in talent**

Generative AI can be used to customize training materials based on specific job roles, site conditions, or regulatory requirements. This technology can analyze large volumes of data, such as incident reports, occupational health and safety (OHS) guidelines, or compliance standards and generate tailored content, including videos, interactive modules, or quizzes. Combined with VR, generative AI can be used to develop virtual training environments that replicate operational conditions. With realistic scenarios that simulate OHS incidents, trainees can navigate hazardous situations, identify risks, and improve their OHS awareness and response capabilities in a safe setting.

Source: Deloitte, [The generative AI dossier](#), September 12, 2023.

## **2. Smart factory and the journey toward the industrial metaverse**

As economic uncertainty, tight labor markets, and rising costs continue to challenge manufacturers, the importance of leveraging digital technologies—both within and

beyond the factory walls—grows. The journey of the manufacturing industry toward industry 4.0 and the concept of a “smart factory” seems to be in full swing. According to a recent study, 83% of manufacturers believe that smart factory solutions will transform the way products are made in five years.<sup>19</sup>

## **Why going smart might be the smartest choice**

The smart factory integrates advanced technologies such as AI, 5G, Internet of Things (IoT), data analytics, and cloud computing in the production environment to help provide real-time insights, end-to-end visibility, and scalable solutions. Economic upheaval, a tight labor market, rising costs, and continued supply chain stresses underline the importance of agility, resilience, and efficiency in manufacturing operations. The potential benefits of smart factories are vast—ranging from gains in asset efficiency, labor productivity, and product quality to substantial cost reduction, along with the advancement of the cause of safety and sustainability (figure 3).<sup>20</sup>

## **Laying the foundation for the industrial metaverse**

Manufacturers don’t seem to be stopping at the smart factory transition. A recent Deloitte study reveals that, through their smart factory efforts, over 70% of surveyed manufacturers have woven technologies such as data analytics and cloud computing into their processes, and nearly half are already harnessing the power of IoT sensors, devices, and systems.<sup>21</sup> These technologies are also foundational to the industrial metaverse. In addition, the majority of surveyed manufacturers have made significant investments in digital twins, 3D modeling, and 3D scanning, which can serve as key building blocks of the immersive 3D environments that make up the industrial metaverse.<sup>22</sup> With connectivity to data-rich 3D immersive environments from virtually any location with a broadband internet connection, the industrial metaverse provides manufacturers with the opportunity to enhance their business both within and beyond the production environment of the smart factory.

Building a model-based enterprise and leveraging the industrial metaverse can enable manufacturers to connect and collaborate with internal and external stakeholders across the globe. This can help companies unlock efficiencies by synchronizing



communication between functions, for instance, communication between engineering and production. It can also create the potential to accelerate new product design, gain access to difficult-to-find talent at remote locations, enhance supply chain collaboration and visibility, and provide new customer experiences. According to the 2023 *Deloitte and MLC industrial metaverse study*,<sup>23</sup> 92% of surveyed manufacturers are already experimenting with or implementing at least one metaverse-related use case, and on average, they are currently running more than six use cases. Executives surveyed anticipate an increase of 12% or more in several key performance indicators, including sales, quality, throughput, and labor productivity because of industrial metaverse initiatives.

## Unlocking digital transformation while keeping cybersecurity in focus

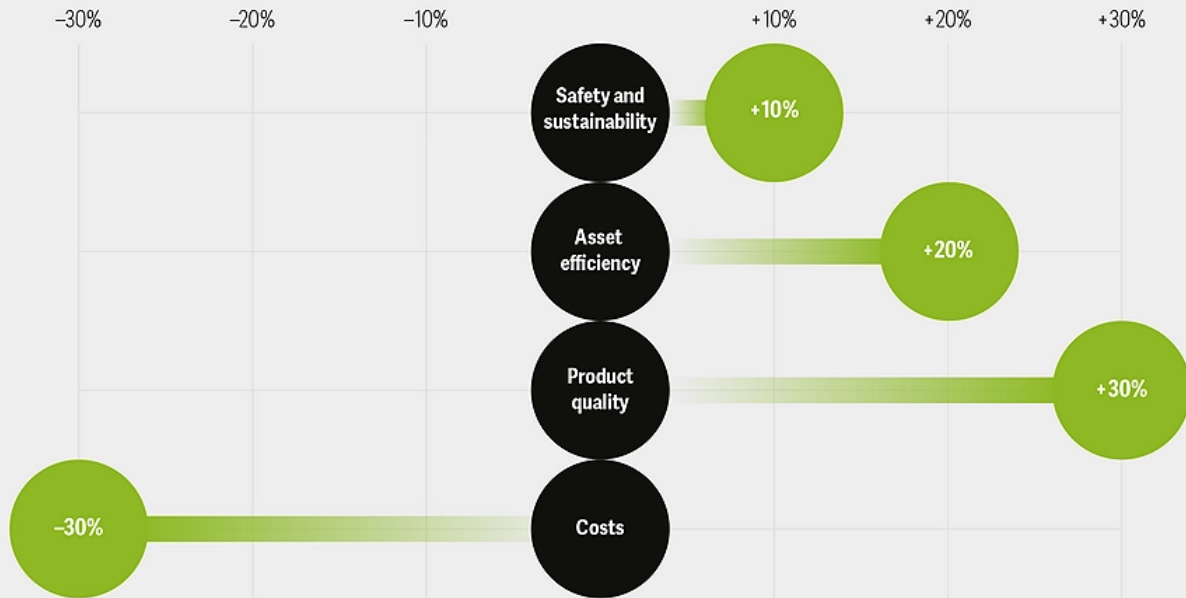
While digital transformation offers many benefits for the manufacturing sector, it also carries the potential to add to cybersecurity risks. In a recent study, more than half of surveyed manufacturing companies said they were targeted by ransomware, with nearly seven out of 10 of these attacks resulting in malicious data encryption.<sup>24</sup>

Manufacturing was also the most targeted sector for ransomware attacks in 2022 for the second consecutive year.<sup>25</sup> To mitigate the risk of cyberthreats, as manufacturers implement digital transformation projects, they should consider giving cybersecurity as much priority as these projects themselves. It is often common to focus primarily on the potential benefits and ROI when implementing new digital technologies; however, directing equal focus to how systems and data will be protected as the technologies are implemented can help build and enhance cybersecurity from day one. Manufacturers should also consider the cybersecurity preparedness of their suppliers against cyberthreats, including the risk of a supply chain disruption caused by a cyberattack as well as the potential exposure of proprietary and sensitive data.

According to Deloitte's article [\*Meeting the challenge of supply chain disruption\*](#), many companies are employing a range of strategies and digital tools to sense, monitor, take action, and engage in scenario planning to enhance the effectiveness of their suppliers in managing third-party risks.<sup>26</sup>

Figure 3

### Surveyed manufacturers have benefitted from undertaking smart factory initiatives



Source: Data taken from Deloitte, "Smart factory for smart manufacturing."

**Deloitte** | [deloitte.com/us/en/insights/research-centers/center-energy-industrials.html](https://deloitte.com/us/en/insights/research-centers/center-energy-industrials.html)

## Generative AI spotlight: Use case for smart factory

Generative design can enable product development teams to generate and visualize multiple alternatives of a new 3D product design based on input constraints such as weight, performance requirements, strength, material, cost, etc. The benefits can include optimized products, cost savings, and accelerated product innovation.

Source: Deloitte, [The generative AI dossier](#), September 12, 2023.

## 3. Supply chain digitalization for enhancing performance and resilience

Navigating evolving and challenging supply chains has been a key focus for manufacturers since the start of the COVID-19 pandemic. Nonetheless, there are indications of recent stabilization. According to Deloitte's analysis of PMI data over the past year, manufacturers have generally observed a gradual improvement in delivery times. The average delivery times for production materials peaked at an all-time high of 100 days in July 2022 but have since steadily improved, reaching 87 days in August 2023.<sup>27</sup> However, the journey is still challenging. While there has been a notable improvement in the average lead time for production materials, it has not returned to prepandemic levels (figure 4).

Figure 4

### Average lead time for production materials is yet to reach prepandemic level

Average lead time (in days)



Note: The prepandemic average was calculated from lead time values taken from January 2015 to December 2019.

Source: Deloitte analysis of the Purchasing Managers' Index reports published by the Institute for Supply Management.

Deloitte | [deloitte.com/us/en/insights/research-centers/center-energy-industrials.html](https://deloitte.com/us/en/insights/research-centers/center-energy-industrials.html)

One factor contributing to continued supply chain delays is ongoing shortages in components such as electrical, electronic, and semiconductor parts. These shortages, which have persisted for more than 30 months now, can complicate production and delivery for a variety of manufacturing subsectors.<sup>28</sup> The enactment of the CHIPS Act has triggered investments in semiconductor manufacturing in the United States, with

the first plant expected to begin production in 2024, followed by additional plants coming online in 2025.<sup>29</sup> While this is expected to increase the domestic supply of chips, it may be a few years before these production facilities can make a significant dent in the ongoing semiconductor shortages, often affecting the manufacturing industry. In addition, the record growth in clean technology manufacturing spurred by the IIJA and the IRA is likely to cause increased demand for not only semiconductors but also electronic components in general.

## **The continued push to digitize supply chains**

As the industry faces ongoing supply chain challenges, manufacturers have pivoted toward digital supply chain solutions to help achieve better visibility across the value chain and bolster resilience. According to a recent Deloitte survey, 76% of manufacturers are adopting digital tools to gain enhanced transparency into their supply chain.<sup>30</sup> Some manufacturers have also started experimenting with and implementing industrial metaverse use cases to fortify supply chain resilience. In fact, 21% of respondents in the 2023 *Deloitte and MLC industrial metaverse study* are already integrating metaverse technologies to elevate their supply chain ecosystem.<sup>31</sup>

As one example, an aerospace and defense manufacturer has created a digital twin of its supply chain for its key products, a virtual model that can be used to simulate a variety of potential real-world scenarios. Using the digital twin, the manufacturer can produce a heat map highlighting the components that exert the most influence on its value chain. This can help the company identify alternative suppliers for key components and, thus, reduce dependencies, increasing supply chain robustness and agility.<sup>32</sup>

Novel technologies—for example, distributed ledgers such as blockchains, or smart contracts, which automate contract execution within blockchains—are gaining interest from some manufacturers. While distributed ledgers can help make transactions among multiple parties tamperproof and verifiable, smart contracts can help automatically assess the transaction status and perform actions such as automatic shipment verification and payments.<sup>33</sup> About one-quarter of manufacturers surveyed

plan to implement these technologies within the next year, hinting at a potential new wave of adoption and innovation.<sup>34</sup>

As the manufacturing industry continues to navigate the postpandemic recovery, persistent shortages, economic uncertainty, and record investment, technology will likely remain a pivotal force in driving efficiency, resilience, and innovation in the supply chain.

## **Generative AI spotlight: Use case for supply chain**

Generative AI could help identify and simulate potential disruptions or risks in the supply chain from both publicly available data and supplier data. By assessing port congestions, shipment routes, and tier supplier mapping, generative AI could predict potential risks and their corresponding impact on operations, and recommend actions such as rerouting shipments, adjusting maintenance plans, or triggering stock transfer. It could allow supply chain managers to proactively implement mitigation strategies, develop contingency plans, and help improve overall resilience.

Source: Deloitte, [The generative AI dossier](#), September 12, 2023.

## **4. Aftermarket services as a potential differentiator**

In recent years, manufacturers have accelerated their use of advanced technologies to enhance their products, such as IoT sensors, onboard computers, machine learning capabilities, embedded radio frequency identification tracking, augmented reality (AR) interfaces, energy-efficient components, and countless other innovations, pushing the boundaries of what's possible. These improvements have underscored not only the importance of comprehensive aftermarket support but also the opportunity it offers. A strong aftermarket presence can serve as a significant source of revenue, signal a

commitment to long-term product reliability, and increase customer satisfaction.<sup>35</sup> And manufacturers seem to have noticed. As per Deloitte's analysis of publicly available reports from industrial companies, there is a surge in interest in aftermarket services—2022 ended with 71% of industrials talking positively about aftermarket services.<sup>36</sup>

The lockdowns following the pandemic highlighted some of the challenges, costs, and inefficiencies of dispatching field service technicians to address customers' critical repair and maintenance needs to maintain product uptime and optimal operation. Digital technologies that enable remote assistance can become important in ensuring business continuity.<sup>37</sup> In the 2023 *Deloitte and MLC industrial metaverse study*, nearly one-third of respondents are already implementing or experimenting with virtual aftermarket services.<sup>38</sup> Technologies such as AR and virtual reality can create new and enhanced offerings, such as AR-based remote troubleshooting assistance and virtual operation manuals. For example, an automation and robotics company has developed an AR-based app for smartphones that can simplify installation of its robots for clients. AR capabilities allow the installer to overlay a visualization of the installation steps in the real-world environment.<sup>39</sup>

Enhanced aftermarket services can provide several additional benefits for manufacturers, which include:

- **Revenue-generating opportunities, at better margins:** Aftermarket services have increasingly become a valuable tool for manufacturers, as offering these services may help them offset the impact of economic downturns or disruptions. These services can create consistent revenue flows and offer 2.5 times greater operating margins than new equipment sales.<sup>40</sup>
- **Enhanced customer loyalty:** Manufacturers are starting to move beyond annual maintenance contracts. In fact, some companies have started entering into performance- and outcome-based contracts that guarantee operational performance and reduced downtime.<sup>41</sup> This could bolster customer confidence, loyalty, and brand perception.



- **Upselling and cross-selling opportunities:** A greater presence in the aftermarket allows manufacturers to work more closely with their customers, understand customer needs, and provide tailored service offerings. Services can be bundled, helping manufacturers scale their XaaS (anything as service) or servitization strategies.<sup>42</sup>
- **Competitive advantage:** Having a robust aftermarket presence is likely to provide a competitive advantage for manufacturers, especially over a competitor that is still behind in the race. Introducing digital remote assistance can help companies further set themselves apart by offering faster problem resolution and service.

## **Generative AI spotlight: Use case in aftermarket**

A generative-AI-enabled virtual field assistant can serve as a reference tool and provide quick access to a vast amount of technical information. When encountering issues or challenges in the field, for example, with an in-service product, engineers or technicians can describe the problem to a virtual field assistant, and it will return appropriate questions to identify the cause or provide step-by-step guidance for resolution.

Source: Deloitte, [The generative AI dossier](#), September 12, 2023.

## **5. Product electrification and decarbonization**

An influx of federal funds and incentives, combined with a general drive toward a net-zero emissions future, have created an increase in investments in electrification and decarbonization of the product portfolios of industrial products manufacturers. The IIJA's investments in electric vehicle (EV) charging infrastructure is complemented by the IRA, which aims to accelerate the adoption of EVs and boost battery

manufacturing. Overall, the IRA provides more than US\$270 billion in climate- and clean energy-related incentives, including more than US\$40 billion in tax credits to expand manufacturing of EVs, batteries, and numerous other types of clean energy technologies.<sup>43</sup> Over 125 new manufacturing facilities for clean vehicle and battery technology production have been announced in the United States since the IRA was signed into law in August 2022.<sup>44</sup>

## **The transition brings new challenges**

As companies move forward on their journey to electrifying and decarbonizing their product portfolios, new challenges emerge. These challenges include the need to address technical readiness, high initial costs of transitioning production processes, as well as new and complex supply chains for batteries and their crucial rare earth metals. There is also risk associated with customer willingness to make the shift—at least in the short term—from more affordable alternatives. Another challenge is the intricate management of the battery life cycle, from cradle to grave. While these challenges may seem daunting, some manufacturers have already taken the lead in the transition.

## **How are some manufacturers achieving success in making the transition?**

Companies have implemented a variety of strategies, ranging from making organizational changes to forming important partnerships, to overcoming some of the challenges associated with product electrification and decarbonization. Some of their approaches include:

- **Collaborating for decarbonization:** Some manufacturers are forming external partnerships and joint ventures to meet ambitious emissions goals for their products. By identifying key needs and seeking external collaborators with the knowledge to meet those needs, they're often making significant strides in product decarbonization.<sup>45</sup> For instance, a leading industrial automation provider has partnered with a clean energy solutions company to electrify mining haulage trucks

with energy storage systems, underscoring the power of strategic collaboration in advancing sustainability.<sup>46</sup>

- **Embracing net-zero emissions:** Some manufacturers are targeting net-zero emissions by investing in electrification as well as other low-carbon or renewable fuel technologies for their products.<sup>47</sup> For example, a leading engine manufacturer is investing over US\$1 billion in its US facilities to support engines that run on low-carbon fuels such as hydrogen, in alignment with its broader clean energy goals.<sup>48</sup>

- **Creating a specialized vertical:** As manufacturers electrify their product portfolios, some are forming specialized divisions dedicated to the effort.<sup>49</sup> For instance, a leading global manufacturer of construction and mining equipment has formed a specialized vertical that is committed to creating zero-emissions products and technologies, including modular and scalable advanced power sources and electrified drivetrain product lines, to help customers achieve their climate-related goals.<sup>50</sup>

- **Undertaking strategic expansion into adjacent markets:** Some manufacturers are targeting adjacent markets to align with electrification trends. Strategic investments in these areas can help enable growth and readiness for emerging opportunities.<sup>51</sup> For example, a leading US fabrication company is prioritizing capital investment in lightweight materials to support customer growth in EVs, energy infrastructure, and renewables.<sup>52</sup>

# **Generative AI spotlight: Use case for product electrification and decarbonization**

As companies build new facilities to support manufacturing of electrified and decarbonized products, generative AI can automate certain aspects of the site design process, provide designers with a multitude of design options, and help reduce time and cost of manufacturing.

Source: Deloitte, [The generative AI dossier](#), September 12, 2023.

## **Navigating the path ahead: An opportunity for continued industry growth amid persistent challenges**

Significant investment and growth in the US manufacturing industry is expected to continue in 2024. Continuing to embrace new technology and digital transformation will likely be important for manufacturers as they look for ways to capture the opportunity at hand and tackle the challenges they face. In the coming year, manufacturers may deploy strategies that could help navigate economic uncertainty, skilled labor shortages, lingering supply chain challenges, and the hurdles of transitioning to zero-emission products:

- Improve employee attraction and retention by leveraging digital tools, engaging retirees, and fostering partnerships within the local community.
- Improve operational efficiency, reduce costs, and increase revenue by leveraging a smart factory approach and the industrial metaverse.
- Improve supply chain visibility, resilience, and performance by leveraging digital tools, including the industrial metaverse, and considering new technologies such as

distributed ledgers.

- Create new stable revenue streams and build customer loyalty by expanding aftermarket services.
- Improve business outcomes by experimenting with generative AI use cases throughout the organization. Accelerate the transition to a zero-emission product portfolio by benchmarking leading practices, such as forming external partnerships and creating specialized verticals dedicated to the effort.

**BY**

**John Coykendall**  
United States

**Kate Hardin**  
United States

**John Morehouse**  
United States

---

## Endnotes

1. John Keilman, “[America is back in the factory business](#),” *Wall Street Journal*, April 8, 2023.

[View in Article](#)

2. Amanda Chu and Oliver Roeder, “[US manufacturing commitments double after Biden subsidies launched](#),” *Financial Times*, April 16, 2023.

[View in Article](#)

3. Environmental Entrepreneurs, “[Clean economy works: Tracking new clean energy projects across United States](#),” accessed October 16, 2023.

[View in Article](#)

4. Deloitte analysis of US Census Bureau data.

[View in Article](#)

5. Deloitte analysis of the Institute for Supply Management Purchasing Managers’ Index (PMI) reports.

[View in Article](#)

6. Deloitte’s Research Center for Energy & Industrials group, “[2019 Deloitte and MAPI smart factory study](#),” accessed October 16, 2023.

[View in Article](#)

7. National Association of Manufacturers (NAM), “[NAMs’ outlook survey second quarter 2023](#),” June 7, 2023.

[View in Article](#)

8. NAM, “[NAMs’ outlook survey first quarter 2023](#),” March 27, 2023.

[View in Article](#)

9. Deloitte analysis of Bureau of Labor Statistics (BLS) data.



[View in Article](#)

10. Deloitte, “[Location Strategy services](#),” accessed October 16, 2023.

[View in Article](#)

11. Craig Guillot, “[How manufacturers can tap into the gig economy](#),” *Chief Executive*, accessed October 16, 2023.

[View in Article](#)

12. Ibid.

[View in Article](#)

13. Lin Grensing-Pophal, “[Retirees: A rich talent pool that many overlook](#),” HR Daily Advisor, February 2, 2023.

[View in Article](#)

14. Deloitte analysis of BLS data.

[View in Article](#)

15. LBMC staffing solutions, “[Creative ways for manufacturers to attract fresh, young talent](#),” LBMC, October 5, 2022.

[View in Article](#)

16. Business Wire, “[SME announces new initiative in partnership with community and technical colleges to address the manufacturing industry’s workforce shortage and skills gap crisis](#),” press release, August 30, 2023.

[View in Article](#)

17. Jeff Wald, “[How automation could save your business US\\$4 million annually](#),” *Forbes*, August 3, 2017.

[View in Article](#)

18. Paul Wellener, John Coykendall, Kate Hardin, John Morehouse, and David R. Brousell, [Exploring the industrial metaverse](#), Deloitte Research Center for

Energy & Industrials, accessed October 16, 2023.

[View in Article](#)

19. Deloitte's Research Center for Energy & Industrials group, "[2019 Deloitte and MAPI smart factory study](#)."

[View in Article](#)

20. Deloitte, "[Smart factory for smart manufacturing](#)," accessed October 16, 2023; Paul Wellener, Steve Shepley, Ben Dollar, Stephen Laaper, Heather Ashton, and David Beckoff, *Manufacturing goes digital: Smart factories have the potential to spark labor productivity*, Deloitte Insights, September 16, 2019.

[View in Article](#)

21. Wellener, Coykendall, Hardin, Morehouse, and Brousell, *Exploring the industrial metaverse*.

[View in Article](#)

22. Ibid.

[View in Article](#)

23. Ibid.

[View in Article](#)

24. Puja Mahendru, "[Insights from 'The state of ransomware in manufacturing and production 2023'](#)," Sophos, June 21, 2023.

[View in Article](#)

25. IBM Newsroom, "[IBM report: Ransomware persisted despite improved detection in 2022](#)," press release, February 22, 2023.

[View in Article](#)

26. Paul Wellener, Kate Hardin, Stephen Gold, Stephen Laaper, and Aaron Parrott, *Meeting the challenge of supply chain disruption*, Deloitte Insights, September 21, 2022.

[View in Article](#)

27. Deloitte analysis of PMI reports.

[View in Article](#)

28. July 2023 PMI report.

[View in Article](#)

29. Anton Shilov, “[US semiconductor renaissance: All the upcoming fabs](#)” *Tom’s Hardware*, August 29, 2022.

[View in Article](#)

30. Wellener, Hardin, Gold, Laaper, and Parrott, *[Meeting the challenge of supply chain disruption](#)*.

[View in Article](#)

31. Wellener, Coykendall, Hardin, Morehouse, and Brousell, *[Exploring the industrial metaverse](#)*.

[View in Article](#)

32. Analysis of company filings using AlphaSense.

[View in Article](#)

33. Vishal Gaur and Abhinav Gaiha, “[Building a transparent supply chain: Blockchain can enhance trust, efficiency, and speed](#),” *Harvard Business Review*, May–June 2020.

[View in Article](#)

34. Wellener, Coykendall, Hardin, Morehouse, and Brousell, *[Exploring the industrial metaverse](#)*.

[View in Article](#)

35. Paul Wellener, Kerry Millar, Oliver Bendig, and Aijaz Hussain, *[Aftermarket services: Transforming manufacturing in the wake of the COVID-19 pandemic](#)*,

Deloitte Insights, May 14, 2020.

[View in Article](#)

36. Deloitte analysis of publicly available company documents.

[View in Article](#)

37. Wellener, Millar, Bendig, and Hussain, *Aftermarket services*.

[View in Article](#)

38. Wellener, Coykendall, Hardin, Morehouse, and Brousell, *Exploring the industrial metaverse*.

[View in Article](#)

39. Editorial, “Free AR smartphone app visualizes robotic installations,” *Drives & Controls*, September 10, 2020.

[View in Article](#)

40. Wellener, Millar, Bendig, and Hussain, *Aftermarket services*.

[View in Article](#)

41. Radiana Pit, “Innovative business models for manufacturers: Outcome-based and performance-based contracting,” Copperberg, accessed October 17, 2023.

[View in Article](#)

42. SAP, “XaaS and subscription business models: How business model innovation is driving growth strategies,” accessed October 17, 2023.

[View in Article](#)

43. BlueGreen Alliance, “Clean manufacturing investments in the Inflation Reduction Act,” accessed October 17, 2023.

[View in Article](#)

44. Environmental Entrepreneurs, “Clean economy works.”

[View in Article](#)

45. Deloitte analysis of publicly available company documents.

[View in Article](#)

46. Partners, “[The future of sustainable mining in Australia: ABB technology driving change](#),” *Australia’s Mining Monthly*, August 29, 2023.

[View in Article](#)

47. Deloitte analysis of publicly available company documents.

[View in Article](#)

48. Hydrogen Forward, “[Engine maker touts US\\$1 billion investment ahead of Biden visit](#),” accessed October 17, 2023.

[View in Article](#)

49. Deloitte analysis of publicly available company documents.

[View in Article](#)

50. Caterpillar, [2022 annual report](#), accessed October 17, 2023.

[View in Article](#)

51. Deloitte analysis of publicly available company documents.

[View in Article](#)

52. Business Wire, “[Mayville engineering company announces definitive agreement to acquire Mid-States Aluminum Corp.](#),” Yahoo! Finance, June 20, 2023.

[View in Article](#)

---

## Acknowledgments

The authors would like to thank **Visharad Bhatia** for his role as a key contributor to this report, including research, analysis, and writing.

Additionally, the authors extend their gratitude to the following members from the Deloitte 2024 manufacturing industry outlook advisory board:

**Heather Ashton Manolian, Ben Dollar, Luke Monck, Brian Wolfe, Lindsey Berckman,**  
and **Michael Schlotterbeck.**

The authors would also like to acknowledge the following people for their respective contributions:

- **Julia Tavlas, Patricia Buckley, and Lisa Iliff** for their subject matter inputs;
- Business leaders **Ann Scheuerman, Steven C Shepley, and Doug Alkema** for their valuable insights;
- **Clayton Wilkerson** for orchestrating resources related to the report;
- **Tara Meyer, Kimberly Prauda, and Neelu Rajput** who drove the marketing strategy and related assets to bring the story to life;
- **Alyssa Weir** for her leadership in public relations; and
- **Rithu Thomas and Pubali Dey** from the Deloitte Insights team who supported the report's publication.

Cover image by: **Rahul B**

---