

Harness the power of industrial augmented reality to optimize manufacturing and warehouse operations

Immersive industrial augmented reality technologies offer tangible benefits in productivity, safety, and efficiency for organizations seeking to thrive in a competitive landscape.



Introduction

The manufacturing industry is well on its way to digitalization, with many companies having completed the early stages of their planned transformation or poised to execute in the near term. Yet manufacturing industry leaders are now recognizing several internal and external challenges that were not on their radar when they made their initial plans.

To explore those challenges, Foundry recently surveyed more than 300 directors, managers, vice presidents, and other senior-level executives involved with operations technology investment decision-making. The research, conducted on behalf of TeamViewer, identified some of their current top concerns. Many were encountering unanticipated complexities in integrating new and existing systems, unacceptable error rates, and mushrooming costs. Some were struggling with how to substantially improve sustainability. For most, the shrinking talent pool of frontline job applicants, which has become a pervasive problem in the manufacturing industry, has compounded the difficulty of addressing these challenges effectively.

Manufacturing enterprises are increasingly embracing new approaches to surmount persistent problems and achieve their strategic goals. For example, there is growing interest in immersive industrial augmented reality (IAR) products, such as augmented reality (AR), virtual reality (VR) headsets, and vision picking solutions. Early adopters of some of these innovative technologies have already reported tangible benefits.



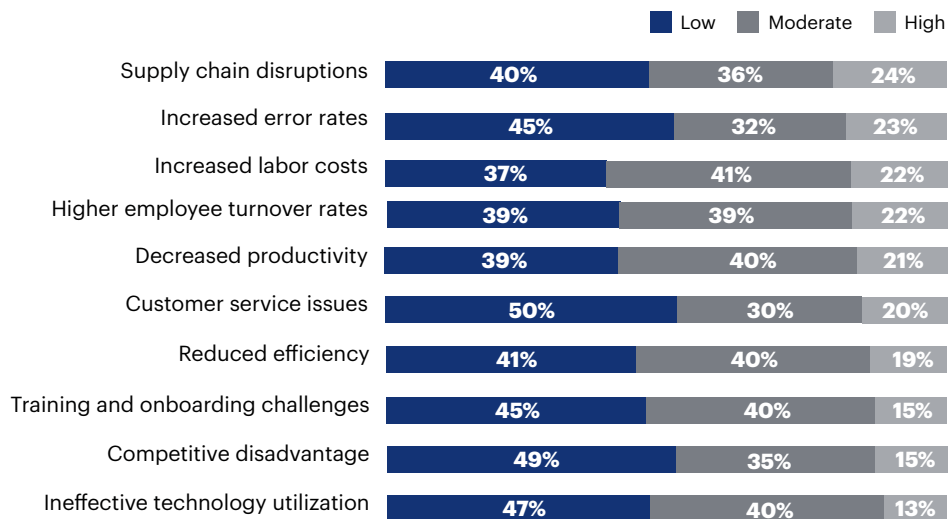
Workforce and operational landscape

Manufacturers that operate globally need efficient, scalable solutions to navigate complex logistics and supply chain networks. Disruptions in one part of a supply chain can negatively impact production schedules, inventories, and customer experiences. Further, manufacturers need scalable solutions to adjust to demand fluctuations in evolving market conditions. Efficient logistics and supply chain management minimize lead times, reduce operating costs, and enable faster responses to customers, ultimately driving profitability and ensuring competitiveness.

On average, the survey participants operated 11 warehouses globally. More than 60% of the large manufacturing enterprises surveyed were operating warehouses in six to 50 locations around the world. To navigate complex logistics and supply chain networks, these global concerns require efficient, scalable solutions. Among their most pressing needs for warehouse and supply chain improvements, survey respondents cited reductions in error rates and waste, real-time data capabilities, and better interconnectivity. They also pointed to ongoing difficulty in acquiring enough skilled frontline workers.

Among all survey participants, frontline workers accounted for 11% of their workforce, which underscores the strategic importance of those in day-to-day operational roles. Respondents viewed frontline labor shortages as particularly problematic, due to their impact on error rates, labor costs, and human turnover.

Impact of labor shortages on business for each of the following factors



Survey participants representing manufacturers with more than US\$1 billion annual revenue reported that approximately 1 in 9 of their full-time employees were frontline workers. That percentage might have been higher if organizations were able to fill all of their open positions.

There are widespread concerns about impacts of the frontline worker deficit that are directly linked to operational challenges in large manufacturing enterprises. When asked to assess the severity of the challenge in specific areas, using a scale of 1 to 10 (with 1 being “not challenging at all” and 10 being “critical”):

Challenges resulting from frontline worker deficit	% of respondents	Importance (scale 1–10)
Competitive disadvantage	86%	5–10
Decreased productivity	90%	5–10
Error rates due to frontline deficit	76%	5–10
Increased labor costs	79%	5–10
Supply chain disruptions due to deficit	20%	9–10
Training challenges	14%	9–10
Reduced efficiency	10%	9–10



Nearly two-thirds of the enterprise manufacturers were stymied in hiring frontline workers because of a lack of applicants with specific required skill sets. Other factors contributing to the hiring conundrum include demographic shifts, lack of interest in frontline manufacturing jobs among younger people, and heavy competition for skilled workers from hyperscale e-commerce and logistics companies as well as from outside the manufacturing industry.

Some of the approaches large organizations have been taking to the labor shortage are obvious: offering more attractive wage and benefit packages, upskilling existing employees, and enlisting temporary or gig workers. Some have turned to technological solutions, such as automation, remote monitoring, and workforce management software.

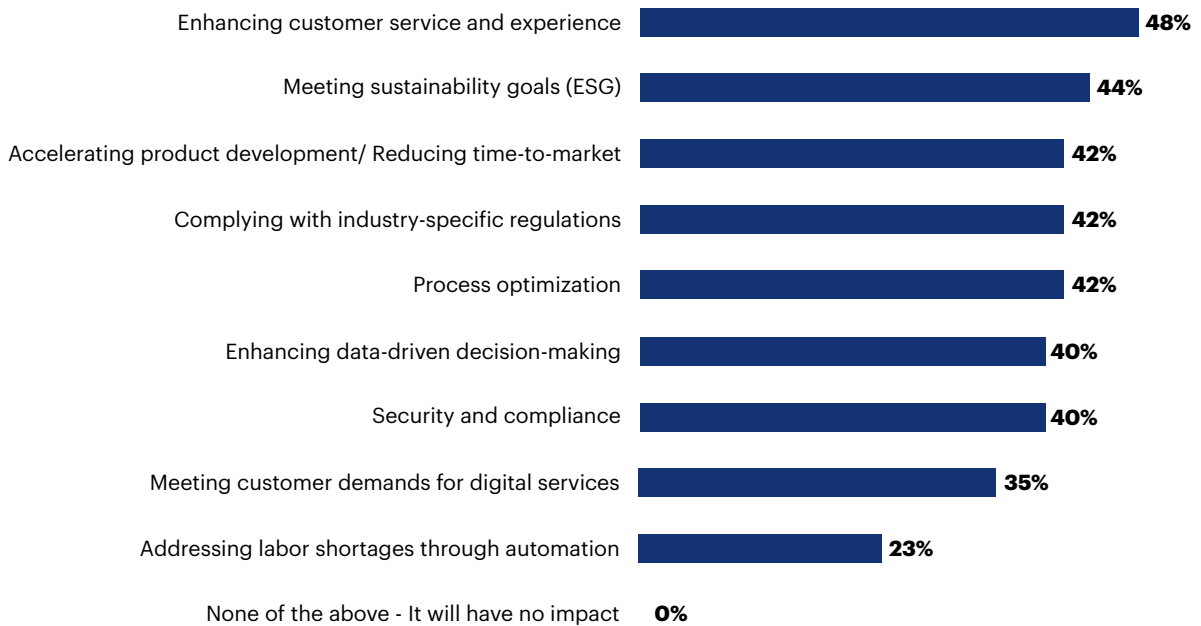
Digitalization is a very high priority for organizations that want to enhance efficiency, visibility, and responsiveness. More than three-fourths of all organizations participating in the survey prioritized digitalizing operations and supply chain management.

Among the respondents, 35% had a digitalization program under way and 18% planned to undertake digitalization within one year. Also, 41% indicated that they had already completed a digitalization program, but that almost certainly reflects the conclusion of specific projects rather than the unlikely view that digitalization has a distinct endpoint. Organizations at all stages of digital transformation are always on the lookout for solutions that align with their value propositions, and as newer technologies become more widespread, previously unforeseen opportunities often present themselves. That can be the case with frontline worker technology, for example, when organizations that have digitalized their warehouse processes discover new ways to interact with valuable data.



Among the goals for digitalizing operations and supply chain management, those most widely shared are enhancing customer service and experience, meeting sustainability goals, accelerating product development/reducing time-to-market, complying with industry-specific regulations, and doing process optimization. Addressing labor shortages through automation was the least common goal. It could be that organizations didn't have enough humans with the right skill sets to effectively implement this goal.

Goals for digitalizing operations and supply chain management processes in the next 12 months



Survey respondents placed labor shortages high on the list of issues that complicate implementation of new solutions for digitalizing processes and operations, right behind budget constraints, system compatibility, and legacy infrastructures. All four of these top issues clearly relate to financial considerations. The survey results also reflect the connection between frontline labor shortages and increased error rates, which are highly disruptive to supply chain operations.

As previously stated, Organizations have been reacting to labor shortages by offering higher wages and other perks. However, there may be more cost-effective tactics – boosting the productivity of frontline workers, for example. The use of automation for certain demanding, repetitive processes can improve satisfaction among existing workers while reducing error rates.

The use of advanced technologies also increases the likelihood that job seekers with the desired skill sets will view an enterprise as a more attractive workplace.

Interestingly, more than one-fifth of the large enterprise manufacturing respondents said their enterprises were leveraging augmented reality or wearable technology to assist their workers. Although immersive technologies are not yet mainstream, many organizations view their digital transformation programs as constantly evolving, with many new opportunities to improve operational efficiency yet to come. What this suggests is that digital transformation is never really over. Enterprises that executed 1.0 plans developed several years ago may find that now it's time for 2.0.

In fact, ABI Research has forecasted sharp increases in IAR adoption in multiple use cases for the Manufacturing and Logistics sectors.¹ Its research detailed impressive 2015–2030 global growth trends in AR, with the top use cases being training, remote assistance, inspection, and assembly (for manufacturing), and vision picking (for logistics).

Eric Abbruzzese, Research Director at ABI Research, articulates the growing significance of AR in enterprise digitalization: “As enterprise digitalization continues to expand, augmented reality plays a similarly growing role. Enabling hands-free access to data and expertise maintains and expands operational efficiency. A combination of universally valuable use cases, like training and remote assistance, along with more specific applications like vision picking in Logistics, bolsters the capabilities of frontline workers thereby influencing overall operations. Those that are most susceptible to downtime costs, operational complexity, and the need for expert on-site presence are rapidly embracing the transformative benefits.”

Among the more striking trends, the use of smart glasses was predicted to overtake the use of mobile devices for remote assistance, assembly, and training. By 2030, ABI forecast, smart glasses would account for 71% of use cases in remote assistance, compared to 29% for mobile devices. For assembly use cases, ABI predicted that smart glasses would reach an impressive 78%, compared to mobile's 22%, by 2030. And by that year, adoption of smart glasses was predicted to reach 52%, versus 48% for mobile, in training use cases. The number of active pick-and-pack users was predicted to grow from 884,000 in 2023 to more than 18.7 million in 2030, according to ABI's research.

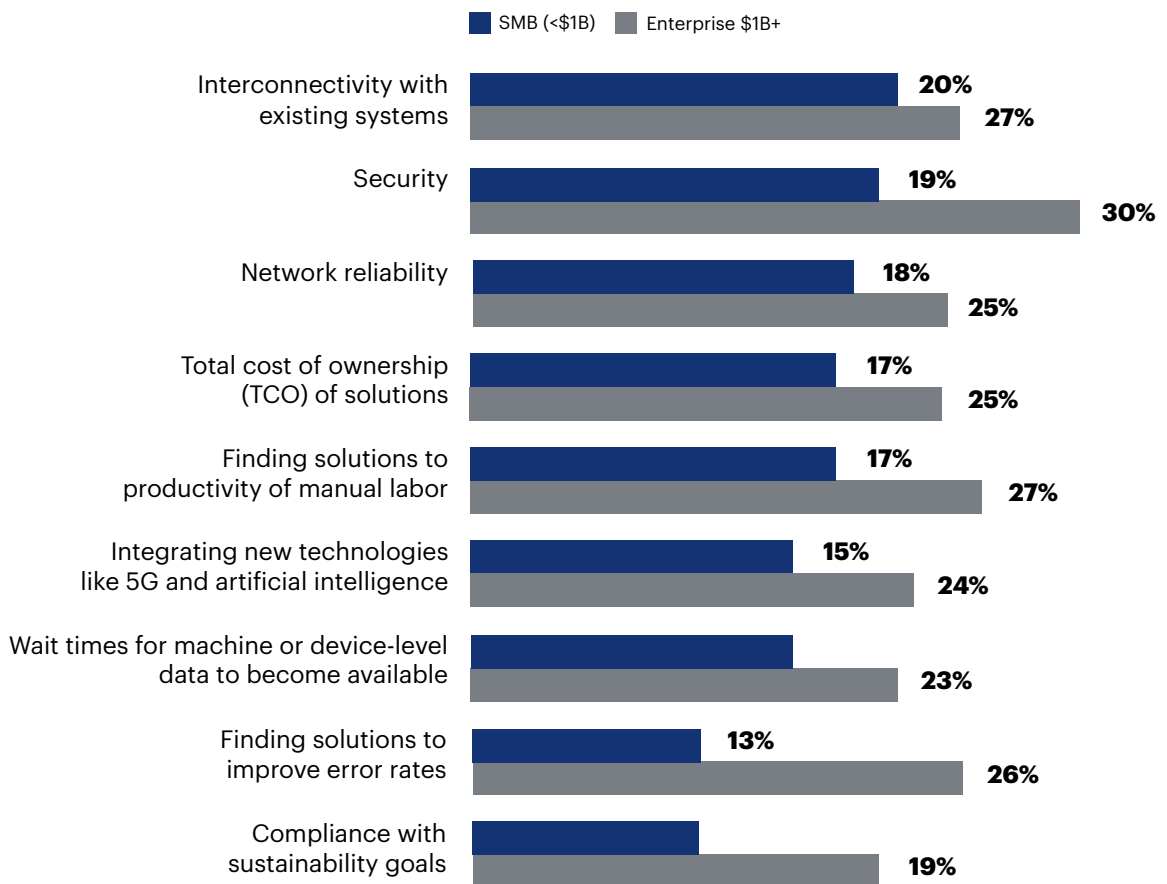
1 ABI Research, “[Industrial Augmented and Mixed Reality: Devices, Use Cases, Verticals, and Value Chain](#),” August 24, 2023.

Challenges in digitalization

In carrying out their warehouse and supply chain digitalization plans, respondents to the Foundry survey reported, they were encountering challenges across a diverse set of factors, including error rates, manual labor productivity, integrating new tech, total cost of ownership (TCO), and interconnectivity with existing systems.

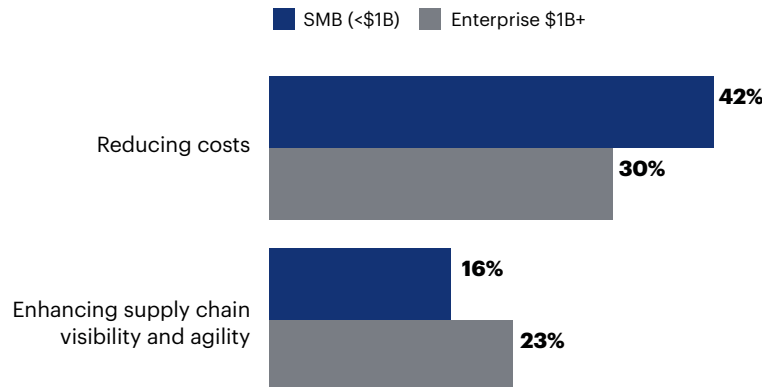
One of the chief takeaways of the survey is that organizations require nuanced digital solutions that are specifically geared toward executing their strategies and achieving their goals. For example, manufacturers reported more challenges in digitalizing warehouses than did consumer packaged goods (CPG) or supply chain and logistics companies. On the other hand, digitalization of supply chains poses more difficulties than digitalization of operations. This suggests that digitalizing operations offers greater potential for short- and medium-term gains, thanks to increased efficiency and productivity.

Challenging factors when digitalizing warehouse or supply chains



Small and midsize businesses face more cost-related challenges related to digitalization. Large enterprises are especially focused on supply chain visibility and agility, likely due to the heightened impact that disruptions among suppliers and distributors can have on their bottom line and their consequent need for fast, proactive decision-making to mitigate risks.

Top challenges in warehouse/supply chain operations.



Among the large enterprise manufacturers that responded to the survey, 76% identified IT security as a top critical challenge – that is, a 9 or 10 on a scale of 1 to 10. Other top critical challenges for these respondents include improving error rates (73%), total cost of ownership (69%), interconnectivity with existing systems (65%), integrating new technologies such as artificial intelligence (AI) and 5G (64%), finding productivity solutions for manual labor (64%), data wait times (62%), network reliability (59%), and compliance with sustainability goals (53%).

In searching for the right digital warehouse solutions to meet their needs, enterprise leaders are motivated to choose implementations that will minimize disruption while offering proof of effectiveness. They are concerned with how the new technology will integrate with their existing systems, what cost/benefit to reasonably expect, how well the solutions will meet their specific criteria, and ease of scalability and sustainability.

Industrial augmented reality

Industries including manufacturing, automotive, and aerospace have begun integrating IAR solutions to improve productivity and reduce costs. Immersive technologies as well as wearable tech are already in use for supply chain and operations management at 13% of the large enterprises surveyed.

Although current adoption is limited, IAR has been steadily gaining traction, thanks to widespread awareness of its potential to significantly enhance operational efficiency, training, and maintenance processes.

Some large manufacturing enterprises have already initiated phased implementations of IAR programs. The areas those pioneers are most likely to be exploring are quality control and inspection (80%), product design and development (67%), assembly and manufacturing (67%), and production planning and control (47%).

The conviction among early adopters is that IAR has the potential to supercharge productivity; bridge skills gaps; and transform quality assurance, safety, and training. Vision picking, a technology that leverages IAR, is drawing interest in logistics and supply chain management, for its promise to enable more agile, efficient, and responsive warehouse and order fulfillment processes.

Although automation and robotics have gained a strong presence at many warehouses and e-commerce centers, these technologies are not always well suited for order fulfillment tasks. Human workers remain essential for selecting and collecting – that is, picking – items detailed on customer orders. Products may undergo changes, for example, or they may simply be placed in different package sizes. Humans can often adapt more quickly and easily to such circumstances than machines.

Yet human efficiency can be enhanced by technology. Vision picking, also known as pick-by-vision, employs AR tech in a wearable device. For example, workers can use smart glasses to get information displays that will help them identify and locate items by following the most efficient route through the warehouse. The smart glasses can give them inventory status, special handling instructions, and even safety alerts about hazardous conditions.

With vision picking tools, workers can interact with other digitalized systems in their environment to carry out their activities hands-free, enjoying better ergonomics. Organizations that deploy vision picking realize faster training times and greater employee satisfaction results.

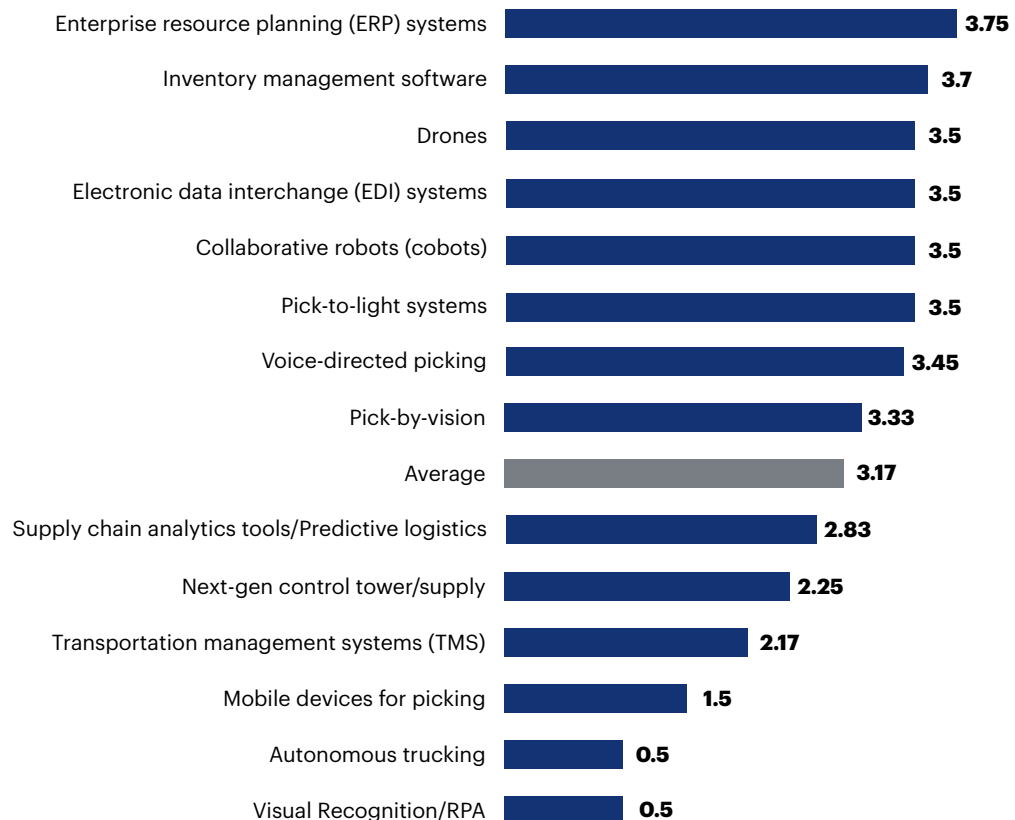
The primary advantages of vision picking include:

- **Increased picking accuracy**
- **Improved productivity**
- **Enhanced training**
- **Reduced operational costs**
- **Faster exception handling**

Further, vision picking software enables a direct connection between order fulfillment, inventory management, and product-level data.

In the settings where vision picking tools are in use, they appear to have proven their value. Based on survey responses, they are among the most mature digital tools in supply chain and warehousing operations in terms of years implemented.

Maturity of digital tools in supply chain and/or warehousing operations (in years)



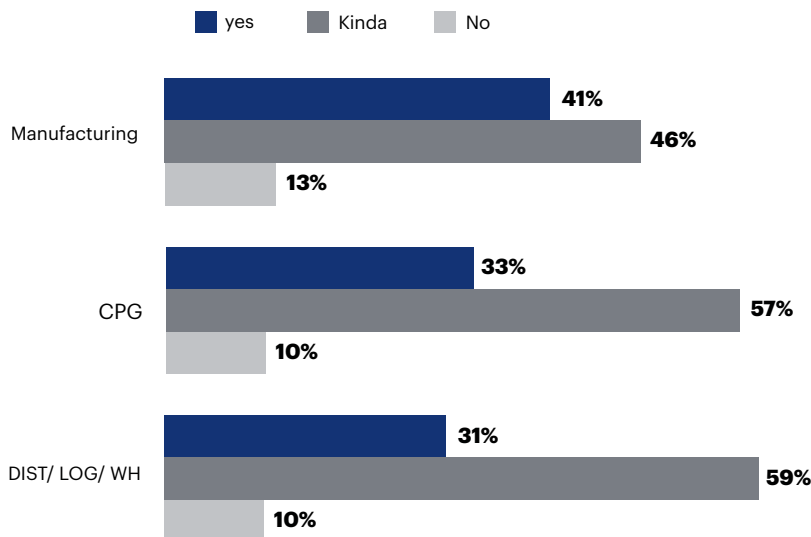
Among the large enterprises surveyed, one-fourth had been using pick-by-vision tech in their supply chain or warehousing operations within the immediately last 12 months. One-fifth reported using such tech in the preceding two years, and 7% had two to five years' experience with using vision picking tools. Among the large enterprise respondents, 16% said their organizations planned to use pick-by-vision tools within the next six months, indicating a constant pattern of growth.

ABI Research forecasts that the number of AR smart glasses and head-mounted devices will grow from 1.89 million worldwide in 2023 to more than 44.3 million in 2030.² It is expected that the number of IAR active users employing mobile devices and smart glasses will increase from 11.5 million in 2023 to more than 267.3 million in 2030.

Sustainability

There is a widespread expectation that IAR can be an invaluable tool for achieving sustainability goals. Among the large manufacturing enterprise survey respondents, 41% identified sustainability as a key corporate goal. An additional 45% said that it was a consideration, although it was not at the very top of their priority list. Only 1 in 10 respondents said it was not a concern whatsoever.

Is sustainability considered a key corporate goal for your organization?



2 [Ibid](#)

IAR offers significant advantages to enterprises committed to achieving their sustainability goals. For example:

- **Facilitates just-in-time and just-in-sequence feeding of production lines with high accuracy, reducing resource-intensive downtime and scrap production**
- **Increases the accuracy of product assembly and delivery, resulting in fewer returns**
- **Increases energy efficiency by optimizing the operation of machinery and processes, helping reduce greenhouse gas emissions and lower energy costs**

Sustainability could play an important role in IAR adoption, due to the growing emphasis on environmental, social, and governance (ESG) practices, especially at large enterprises.

Conclusion

The manufacturing industry has encountered unforeseen challenges in its path to digitalization, prompting enterprise leaders to reassess their strategic goals. Foundry's recent survey sheds light on a multitude of concerns, including systems integration, rising costs, and workforce shortages, particularly in frontline roles. Large manufacturing enterprises operating across multiple global locations face additional complexities in their supply chain and warehouse management, necessitating efficient, scalable solutions to mitigate risks and maintain competitiveness.

Yet just as challenges have evolved, there has been a continuous evolution in digital transformation strategies within the industry. There's a growing interest in leveraging immersive technologies such as IAR, which offers a plethora of use cases that enhance productivity, safety, and efficiency. In manufacturing, IAR empowers workers by connecting them with critical actionable, contextual, real-time data. Vision picking, a solution focused specifically on warehousing and logistics operations, increases accuracy, improves productivity, and reduces operational costs for manual warehousing processes. Field service technicians benefit from IAR-enabled remote assistance via live video feeds and digital annotations. In training and workforce development, IAR simulations offer immersive learning experiences in a risk-free environment. Health and safety are paramount in industrial environments, and IAR plays a crucial role in enhancing worker protection.

Furthermore, IAR-powered data visualization tools enable real-time monitoring of operational metrics, supply chain logistics, and asset performance. To accelerate IAR adoption, companies should foster a culture of innovation and partner with a provider that can offer tailored solutions, comprehensive training, and ongoing support.



TeamViewer enables companies of all sizes and industries to digitalize their business-critical processes through seamless remote connectivity and industrial augmented reality platforms and solutions. To help customers tackle business challenges, TeamViewer proactively shapes digital transformation and continuously innovates in the fields of augmented reality, the internet of things, and artificial intelligence. TeamViewer's connectivity platform enables secure remote access to and control and support of any device, in any location. TeamViewer's software has been installed on more than 2.5 billion devices globally. Its leading enterprise AR platform for deskless workplace digitalization helps streamline onboarding, training, and operational work processes across the entire value chain, increasing productivity, reducing errors and inspection times, and simplifying daily tasks for frontline workers. Learn more about TeamViewer's [Frontline AR solutions](#).