

IDC FutureScape: Worldwide Manufacturing 2024 Predictions

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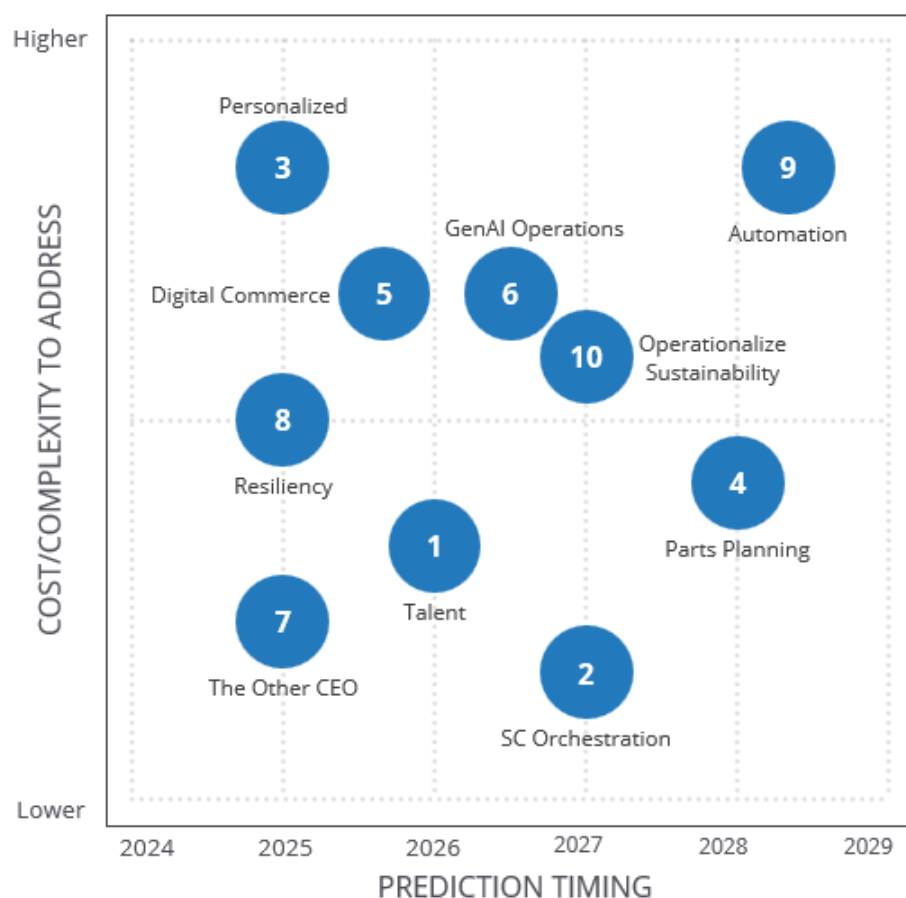
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IDC FUTURESCAPE FIGURE

FIGURE 1

IDC FutureScape: Worldwide Manufacturing 2024 Top 10 Predictions



Note: Marker number refers only to the order the prediction appears in the document and does not indicate rank or importance, unless otherwise noted in the Executive Summary.

Source: IDC, 2023

EXECUTIVE SUMMARY

The manufacturing industry continues to deal with high levels of change and both challenges and opportunities abound. In no particular order, IDC sees three main challenges: How and when to best transition to the cloud and leave behind highly customized, legacy on-premises applications? How to best meet emerging sustainability regulation and more from reporting to embedding sustainable practices into the way "we run the business"? and How best to both adopt and adapt to decision and process automation technologies while preserving the critical roles for people and accelerating "time to expertise"?

Key themes woven into our worldwide manufacturing top 10 predictions for 2024 include the focus on balancing resiliency and efficiency, supply chain management, product and service innovation, digital commerce, talent gaps, sustainability, and the emerging role of generative AI (GenAI). These predictions span the manufacturing value chain, as digital transformation (DX) continues to be embraced by all parts of the business. This IDC study provides manufacturers with the top 10 predictions and underlying drivers that we expect to impact manufacturers' IT investments in 2024 and beyond. Technology leaders and their counterparts in the line-of-business (LOB) operations can use this document to guide their IT strategic planning efforts.

IDC provides its top 10 predictions for the manufacturing industry with analysis that covers a five-year period. The predictions are designed to provide organizational decision makers with a call-to-action investment plan with respect to these technologies. Over the next few years, we believe some of the most notable changes in the manufacturing industry will be the following:

- **Prediction 1:** By 2026, 90% of G2000 organizations will augment operational roles with automation technology, elevating employee engagement and unlocking a 30% increase in worker efficiency.
- **Prediction 2:** By 2027, 35% of G2000 companies will use supply chain orchestration tools integrating key suppliers/customers that include digital twin capabilities, improving supply chain responsiveness by 15%.
- **Prediction 3:** By 2025, to promote personalized products as added value, 30% of G2000 manufacturers will fully utilize AI/ML for high-mix, low-volume production.
- **Prediction 4:** By 2028, 65% of the G2000 will look to autonomous service parts planning for improved mean time to repair, driving 25% better service delivery through optimized customer or operator asset productivity.
- **Prediction 5:** By 2026, 75% of G2000 organizations will have a digital commerce platform in place for ecosystem operation, driving a 10% higher data capitalization rate and improving customer retention by 20%.
- **Prediction 6:** By 2026, half of G2000 companies will integrate operational systems with GenAI to better ingest data, identify issues, and provide real-time context to operators, improving efficiency by 5%.
- **Prediction 7:** By 2025, 25% of CIOs will also have the role of chief ecosystem officer, orchestrating IT and business across their ecosystem to meet customer needs and lower cost of ecosystem participation by 25%.
- **Prediction 8:** By 2025, 75% of G2000 companies will have strategies in place to better balance operational resiliency with cost efficiency, thus improving margins by 5%.

- **Prediction 9:** By 2028, the integration of AI/ML into robotic and automation routines within industrial operations will increase by 30%, driving higher efficiencies and a 10% reduction in downtime.
- **Prediction 10:** By 2027, 40% of G2000 companies will be using comprehensive ecosystem sustainability data to make decisions across the full range of operations, reducing carbon footprint by 30%.

This IDC study provides manufacturers with the top 10 predictions and underlying drivers that we expect to impact manufacturers' IT investments in 2024 and beyond.

According to Simon Ellis, group vice president, U.S. Manufacturing Insights, U.S. Energy Insights, and Global Supply Chain Strategies at IDC, "The manufacturing industry has maintained its rapid pace of change and disruption, making the ability to adapt a premium. Manufacturers have encountered many challenges in their efforts to become more resilient while maintaining efficiency, but one of the most cited issues are outdated/legacy systems. While the predictions highlighted touch upon many areas of the business, the main theme can be tied back to having the proper digital infrastructure in place to serve as the foundation for meeting challenges and taking advantage of opportunities."

IDC FUTUREScape PREDICTIONS

Summary of External Drivers

- **AI everywhere** – Generative AI takes the spotlight
- **The drive to automate** – Maximizing efficiency and new opportunities
- **Economic uncertainty** – IT malaise and market volatility
- **Global supply chain resiliency** – Push for diversification
- **The digital business imperative** – Competitiveness and outcomes
- **Dynamic work and skills requirements** – New work mode era
- **Operationalization of ESG** – Measuring and implementing sustainability

Predictions: Impact on Technology Buyers

Prediction 1: By 2026, 90% of G2000 Organizations Will Augment Operational Roles with Automation Technology, Elevating Employee Engagement and Unlocking a 30% Increase in Worker Efficiency

Operational workers have historically relied on paper manuals or peer guidance to drive expertise and experience, which has generally worked well. But, when that peer guidance and expertise is increasingly walking out the door for better opportunities or retirement, that historical approach becomes less viable. Operations are increasingly experiencing the hidden cost of physical labor (turnover rate, training, and employee qualification), and the total cost of that labor and its impact on operational performance often get undercounted by as much as 30%. This directly impacts key performance indicators, such as operational efficiency and line productivity. With attrition being so high across the industry, especially among newly hired workers (those hired within the previous 90 days), preventing these employees from leaving will be impactful.

The role of technology will be one of the most important questions to answer to solve labor issues. In fact, according to IDC's 2022 *Talent Management Study*, 53% of organizations stated that automating low-value work (manual tasks/data collection) is the top action they are taking over the next 12

months. Eliminating this type of work frees up the workers you do have to focus on higher-value activities to further drive improvements. Leading organizations will also turn to knowledge management systems and collaboration tools to further improve employee engagement and training, but for these to be implemented successfully, the digitization of operational information is a necessary first step. The use of technology, either to automate rote tasks, offers a way to both improve the productivity of existing workers and improve the "time to expertise" for new workers.

While operations are more automated today than they were five years ago, significant opportunities to better leverage technology remain. Resilient decision making through automation not only speeds conclusions through decision support but also potentially limits dependency on human involvement in more repetitive decision-making tasks. An advanced level of automation in decision making provides more rapid and effective actions in times of disruption and addresses an overall need to draw insights from the rapidly growing amounts of data being generated and ingested by the organization. Yet resilient decision making is not solely about predicting or responding to larger and potentially longer-term disruptions but is about deftly navigating the multitude of small "divergences" that occur almost continuously within global operations.

Associated Drivers

- **Dynamic work and skills requirements** – New work mode era
- **The drive to automate** – Maximizing efficiency and new opportunities
- **AI everywhere** – Generative AI takes the spotlight

IT Impact

- IT departments will need to work with the line of business to build the road map for operational automation, focusing on eliminating repetitive tasks and low-value activities.
- To increase employee experience, investments in solutions that support talent and skill development will be key, this would include tools that enhance productivity as well as systems to better capture and disseminate knowledge.
- Investments in solutions and tools that support onboarding of geographically distributed skills globally will be needed to ensure the long-term effectiveness of new talent acquisition.

Guidance

- Assess new technologies and approach automation investments as strategic, both within the four walls of operations and out in the field.
- Integrate the different data sources throughout the operation, ensuring the insights and data streams are shared across the organization while maintaining a single source of truth for people to draw from for both operational processes and optimization practices.
- Start experimenting with artificial intelligence (AI) on tangible use cases for your company that are measurable and scalable – operational employees able to utilize AI to improve decision making will be far more productive.

Prediction 2: By 2027, 35% of G2000 Companies Will Use Supply Chain Orchestration Tools Integrating Key Suppliers/Customers That Include Digital Twin Capabilities, Improving Supply Chain Responsiveness by 15%

Most supply chain organizations have been progressing along a maturity continuum in their digital transformation journey for some years now. One of the hallmarks of this digital transformation has been the concept of the control tower.

Control tower concepts and tools originally carried the promise of fully integrating end-to-end operations. To date, many such tools and capabilities have not gone much further than promoting data visibility and, in a cynical view, perhaps are "reading the news" as opposed to delivering the promise of improved speed, integration, and responsiveness.

The next evolution of end-to-end integration and supply chain responsiveness will be a shift from "reading the news" to acting on it and in some cases creating it. This will be accomplished through supply chain orchestration tools that can both read and react to real-time or near-real-time data and incorporate artificial intelligence/machine learning (ML) capabilities to suggest action or even take action in automated processing (related to this concept, see prediction number 6). IDC views the role of the digital twin within supply chain orchestration as the "sandbox" in which manufacturers can explore what-if scenarios and model potential outcomes.

By integrating data, layering insights, and proposing action or even taking action, supply chain orchestration tools will increase responsiveness and further optimize supply chains.

Associated Drivers

- **AI everywhere** – Generative AI takes the spotlight
- **The drive to automate** – Maximizing efficiency and new opportunities
- **Global supply chain resiliency** – Push for diversification

IT Impact

- Evolving from control towers to orchestration will require process mapping, developments in AI, decision trees, and front-end UI to enable integration and rapid response.
- Developing algorithms, "pretraining" them on supply chains, and supporting businesses to implement, and then continuously train will all be tracks of work.
- Either AI will need to be trained to clean data or data accuracy will become even more highly prioritized than it already is. Either way, solutions need to consider the cleanliness and availability of data.

Guidance

- For supply chains, prepare for having a workforce with the skills to train their own copilots. Training algorithms will become a valuable skill.
- Develop disciplined processes end to end to enable automation.
- Ensure data is robust and "clean." As with most initiatives, data will continue to matter.

Prediction 3: By 2025, to Promote Personalized Products as Added Value, 30% of G2000 Manufacturers Will Fully Utilize AI/ML for High-Mix, Low-Volume Production

The daily life of individuals viewing/obtaining different information and content optimized for each has become the norm for consumers. This personalization effort extends from content/information providers to financial, retail, and other service providers to manufacturers. Smart devices have become the center of consumer contact media, and manufacturers have been able to connect with individual consumers via apps and have a one-to-one relationship without consumers being conscious of logging in. In an environment where many manufacturers are aiming to shift from the product selling business to the recurring business, how to create customer loyalty of capricious consumers and increase lifetime value (LTV) with personalization/customization as added value is a high priority for manufacturers to pursue the sustainability of their business.

Many brands are emerging that promote personalization/customization of the product itself and the purchase experience as added value and differentiated value, as well as the product-related information and contents. By introducing digital tools such as a dedicated app, Maserati has allowed customers to test drive and set product specifications online, and then complete their purchase at the retailer of their choice, making it possible to personalize the customer's buying experience. It is also offering a personalized experience for customers to complete their own styled car with the introduction of the Euroseries Program. Among certain retailers, which carry out their entire process from product planning/development to manufacturing and sales, operators such as SHEIN have emerged to respond to customers' desire for personalization, using their system to produce an extremely large variety of products in ultrasmall quantities as a strength.

PLM adoption aimed at integrating product planning/design and manufacturing operations will be particularly important in realizing high-mix, low-volume production. According to IDC's June 2023 *Product Innovation and Aftermarket Services Survey*, as the near-term priority initiative for transforming the organization's PLM success, 33.2% of respondents selected "increase product lifetime value" and 32.2% cited "improve product customization/personalization/configuration" as their priorities. Digital technologies such as AI, IoT, and robotics can also contribute to high-mix, low-volume production in various processes. For example, even if product appearance quality inspections become more complex due to the increasing variety and small quantity of products, AI-based quality inspections can reduce the time and effort required for visual inspections and stabilize quality. Lenskart, which is a retail chain that handles products from eyewear product planning/development to manufacturing based in Gurugram, India, has raised funds from investment companies around the world and operates a technology-oriented business. At its factory, the inevitable high-mix, low-volume production of assembling eyeglass frames and left and right lenses with different levels of optical power corresponding to various people's eyesight is thoroughly automated by AI and robotics. The deployment of AI and other digital technologies across the value chain to personalize products and the buying experience will be a high priority for manufacturers seeking to acquire customers who wish to reflect their own personality in the products they purchase.

Associated Drivers

- **AI everywhere** – Generative AI takes the spotlight
- **The drive to automate** – Maximizing efficiency and new opportunities
- **The digital business imperative** – Competitiveness and outcomes

IT Impact

- IT needs to understand the company's shift in strategy of its business model, such as the shift to a recurring business, and proactively align its workforce with the appropriate skills and capacities to handle the technology required to realize that strategy.
- To differentiate itself from the competitors on the strength of high-mix, low-volume production, IT needs to build the system based on the premise that it will require many initiatives that it has not experienced in the past.
- It is necessary to be able to flexibly utilize and operate customer information for personalization in preparation for further changes and evolution of its business model.

Guidance

- Secure IT architects who have high-level listening and communication skills in addition to technical skills to design a system that takes into account the needs of not only the

manufacturing division but also top management, managers of related business units, and those in charge of related operational practices.

- Collaborate with technology partners that are flexible and willing to try implementing technologies including robotics, as well as incorporating AIOps/MLOps capabilities in unprecedented development.
- Consider the data security operation that can enable utilization of customer data not only in divisions close to customers but also across a wide range of value chains from product planning to manufacturing division.

Prediction 4: By 2028, 65% of the G2000 Will Look to Autonomous Service Parts Planning for Improved Mean Time to Repair, Driving 25% Better Service Delivery Through Optimized Customer or Operator Asset Productivity

The ability to predict all potential outcomes or failures within the service supply chain can be an effort in futility. Equipment will fail, assets will perform below standards, and products will break. But in a more connected world where, as noted by IDC's Product Innovation and Aftermarket Service Survey, nearly half (49.6%) of all products and equipment are connected providing real-time or near-real-time data on performance, the ability to be smarter regarding service execution is a real possibility. Organizations in this more connected world need to better position service parts to, if not predict the failure, at least better understand what issues are most common on which assets and what part will resolve the issue. Issue resolution demands the right spare parts are in the right locations to solve specific service needs. But spares are a finite resource and thus need to be allocated around the world based on when and where they are needed.

Knowing where the next part will be needed can be a challenge. Full autonomy of service needs is a way off, as only 18.7% of service organizations state the ability to be prescriptive whereby products have autonomic capabilities to report problems or issues and request repair. However, more than half of organizations sampled in IDC's Product Innovation and Aftermarket Service Survey are either operating in a proactive service model (19.3%) or a preventative service model (36.9%). This ability to plan for what will fail in the future and coordinate service resources accordingly is transformative with regard to resolution and customer outcomes. Service organizations may never be able to completely avoid equipment failures or downtime all together, but the future is bright regarding planning for the right spare parts to be in the right places to minimize downtime.

Associated Drivers

- **The drive to automate** – Maximizing efficiency and new opportunities
- **Global supply chain resiliency** – Push for diversification
- **The digital business imperative** – Competitiveness and outcomes

IT Impact

- CIOs need to address the real-time data needs of the service team to enable more insights regarding future failures or product defects.
- IT must enable data to be integrated across partner systems to ensure the service team can proactively plan for service needs.
- IT must establish processes that can autonomously trigger service action-based resource shortfalls or surpluses across the service supply chain.

Guidance

- Encourage the service team to rely on data and not gut feeling with regard to planning for service needs.
- Incentivize suppliers, dealers, and third parties to adopt technology that can provide a full view of products and assets across the service supply chain.
- Automate service decision-making to allow for a shift away from reactive service to more proactive, predictive, and prescriptive support.

Prediction 5: By 2026, 75% of G2000 Organizations Will Have a Digital Commerce Platform in Place for Ecosystem Operation, Driving a 10% Higher Data Capitalization Rate and Improving Customer Retention by 20%

The COVID-19 pandemic has undoubtedly accelerated the adoption of digital commerce in manufacturing. As we have moved beyond the era of lockdowns, manufacturers will continue to invest in digital commerce to access new markets, automate and streamline processes, and enhance the customer experience (CX). B2B buyers increasingly use digital channels to research, compare, and procure products and services. Fueled by their experiences with B2C companies, they demand personalized interactions, seamless buying experiences, intuitive self-service platforms, and on-demand support for their B2B purchases. Consequently, CX can be a significant competitive differentiator, leading to increased loyalty, positive referrals, and repeat purchases. According to IDC's 2023 *Global Manufacturing Survey*, over half of manufacturers globally are already using digital commerce applications, with a further 35% considering investing in the next 18 months. Although there are some regional differences, this is broadly a priority for all. In addition, building B2B digital commerce capabilities to enhance the customer experience is considered a top initiative for 47% of manufacturers worldwide.

Beyond the efficiency gains and access to a wider market, digital commerce can increase data capitalization by leveraging various types of data such as customers' purchase history, feedback, reviews, and product searches to make more informed decisions. This extensive access to data enables manufacturers to deliver a more personalized engagement and tailor their marketing activities toward customers. Manufacturers setting up their own marketplaces can tap into a wider ecosystem of potential buyers and partners, resulting in increased market opportunities. These will allow them to establish a more direct connection with the customer and give them better visibility and control over the experience across the buyer journey. In the same way, customers can have the convenience of buying from a trusted manufacturer's website and have access to complementary products or adjacent/value-added services that can be fulfilled by the partner ecosystem.

Providing a seamless buying experience and proactively engaging customers will be key to retaining them in the long term. This is even more relevant in the B2B space, which is more complex and where building and nurturing long-term relationships are essential elements to succeed. In this context, digital commerce is no longer a nice to have but will be a necessity for manufacturers to thrive.

Associated Drivers

- **The digital business imperative** – Competitiveness and outcomes
- **The drive to automate** – Maximizing efficiency and new opportunities
- **AI everywhere** – Generative AI takes the spotlight

IT Impact

- Digital commerce platforms should be easy to scale to leverage growth opportunities and accommodate increasing business requirements such as geographical expansion and growth in the number of products, transactions, and users.
- Relevant business applications such as ERP, CRM, PIM, WMS, CPQ, and SCM need to be integrated with the digital commerce platform. In the context of a marketplace, this includes partners' or dealers' ERP systems to enable real-time updates on product availability, order status, and pricing information.
- Scalable data storage, robust data management practices, and data analytics tools will be key to extracting value and generating insights from the vast amount and types of data available.

Guidance

- Build robust data analytics capabilities, leveraging AI and machine learning, including GenAI, to analyze and leverage customer data to provide highly personalized experiences and targeted recommendations.
- Focus on user experience design to develop user-friendly and intuitive interfaces that interact with your customers to provide a frictionless buying experience.
- Ensure robust privacy and security measures are in place and provide clear transparency on data usage to foster trust with customers.

Prediction 6: By 2026, Half of G2000 Companies Will Integrate Operational Systems with GenAI to Better Ingest Data, Identify Issues, and Provide Real-Time Context to Operators, Improving Efficiency by 5%

Perhaps the most significant challenge to operations and operational productivity in the modern era is in getting data/information to the right employee/worker at the right time. Latency and/or incorrect information results in both incorrect decisions and delayed decisions. In a world where operational disruptions (many of them not predictable) are far more prevalent than ever before and where quick, accurate decisions may be the difference between success and failure, finding the right tools to identify issues as they occur and provide quick, real-time context to factory operators is hugely beneficial. The data exists, and is often collected, though in disparate systems, but it is not shared in a way that can optimize decisions and eliminate latency. Even if data is shared, it is often buried within "inscrutable" systems and not useful on the dynamic, fast-paced factory floor.

Although early days, GenAI offers powerful tools to ingest data and disseminate insights in plain language that factory or warehouse floor operators can easily and quickly process in real time to support quick decision requirements. These tools also offer the potential to accelerate "time to expertise" for new employees who may not yet have an operational understanding or comfort with operational systems. Clearly, GenAI tools will evolve over time, and as they do, IDC expects that they will help improve operator efficiency by as much as 5%.

Associated Drivers

- **AI everywhere** – Generative AI takes the spotlight
- **Dynamic work and skills requirements** – New work mode era
- **The digital business imperative** – Competitiveness and outcomes

IT Impact

- IT must ensure technology integrates with current systems and software, scales with the business, and provides flexibility.

- IT must ensure adequate collaboration with operational employees to ensure GenAI automation tools are both practical and effective.
- Companies will need to analyze the effect of different stakeholders, such as factory floor workers, warehouse workers, IT teams, supervisors, and inventory controllers.

Guidance

- Automate data to insight wherever possible to both make jobs more interesting and as a way to speed decision making and improve operator efficiency.
- Note that companies must first fully understand their processes and then decide the right level and balance of GenAI automation.
- Communicate, communicate, communicate as GenAI is not a threat, it is a tool that operators can use to be more efficient and effective.

Prediction 7: By 2025, 25% of CIOs Will Also Have the Role of Chief Ecosystem Officer, Orchestrating IT and Business Across Their Ecosystem to Meet Customer Needs and Lower Cost of Ecosystem Participation by 25%

As end-user organizations become more focused on building their ecosystem partnerships and increase systems and process complexity, CIOs will become more involved in how their organization interacts with partners. CIOs, with their unique mix of business, systems, and IT knowledge, are well poised to architect and lead ecosystem initiatives – in essence, become the other chief ecosystem officer (CEO). One CIO from a large office furniture company plans and architects the systems and processes that support their supply chain and broader ecosystem initiatives, as well as helps support relationships as well. This does not mean displacing the heads of partnership, strategic initiatives, and channels, rather, the CIO and their team will work in close concert with these functions to optimize ecosystem approach. Digital businesses require digital ecosystems, and the CIO must be at the front of all digital initiatives.

Another important role the CIO will play with ecosystems is working with consultants and integrators needed to stitch together data models and processes with very complex privacy and regulatory compliance. Consultants are considered one of the top 2 most important participants in ecosystems, and they must work closely with the CIO and their team to ensure that systems and business processes are aligned. While consultants will help plan and orchestrate, the CIO will be ultimately the decision maker in how IT systems, processes, and business use cases with ecosystem partners are facilitated.

Finally, to build ecosystem trust and adoption, the CIO will also need to play a significant role in both evangelizing and demonstrating the benefits of ecosystem participation and orchestration both inside and outside the organization. Many business leaders have significant concerns about data protection, which requires technical solutions and strong data governance processes and tools. The CIO will need to take a central role in assuring business leaders that data sharing complexity can be safely managed while still enjoying the desired benefits of ecosystem participation.

Associated Drivers

- **AI everywhere** – Generative AI takes the spotlight
- **The digital business imperative** – Competitiveness and outcomes
- **Dynamic work and skills requirements** – New work mode era

IT Impact

- Investment in a cloud-based digital platform provides visibility for the CIO and their IT team to ecosystem initiatives, along with their business-line counterparts.
- CIOs and their IT teams should take the lead on designing ecosystem platforms, data models, and integrations – complement this with external services help to execute and orchestrate.
- CIOs and their IT teams must consider AI and GenAI impacts and use cases for ecosystems and implement this in a consumable way for partners.

Guidance

- Empower the CIO and their team to design and operate ecosystem initiatives, in concert with business-line owners such as from marketing and sales, R&D and engineering, supply chain, business and facility operations, as well as field services and customer support.
- Note that IT needs to own the ecosystem design and operation relationship with consultants and systems integrators to ensure trusted, uninterrupted data sharing, collaboration, and innovation among partners.
- Given the large skills gaps in organizations today within IT, supply chain, production, and operations, consider AI and GenAI as an augmentation of decision making for ecosystem initiatives.

Prediction 8: By 2025, 75% of G2000 Companies Will Have Strategies in Place to Better Balance Operational Resiliency with Cost Efficiency, Thus Improving Margins by 5%

Over the past decade, IDC has talked at length about the need for operations to be more resilient. Indeed, we have included it occasionally in annual predictions' documents. In 2013, in a published IDC document, we wrote that disruption and outsourcing are clearly moving operational risk and resiliency up the investment priority list. In a recent conversation with IDC Manufacturing Insights, a supply chain leader from a global steel manufacturer observed that "investments in risk awareness and mitigation have been difficult to justify in the past, but growing concerns for the impact of extreme weather on our facilities and regulations for conflict minerals are definitely raising concern and awareness." Until global operations were beset by a global COVID-19 pandemic, it was our view that many, perhaps even most, struggled to find the business case for resiliency. Yet now, with 2021, 2022, and soon 2023, in the rearview mirror, resiliency is on the tip of everybody's tongue.

At the same time, in 2022 and into 2023, we have had to deal with unprecedented levels of inflation and the grim prospect of a global recession. Resiliency does not come for free, and efforts, for example, to diversify supply will likely mean less economies of scale for procurement. Sourcing something from one supplier in one country may not be a particularly resilient practice, but it is likely cheaper than sourcing from four suppliers in four countries. At IDC, we are not suggesting that companies will, or should, abandon their efforts to improve operational resiliency, but we are suggesting that 2024 will be a year where they must reconcile resiliency with efficiency. Many of the companies we speak to are struggling with margins and profit performance and efforts to rebalance resiliency and efficiency/waste reduction should allow for some recovery of margin or at least help prevent further erosion. Examples of this include looking to balance single shoring (cheaper) with multishoring (more resilient) or balancing factory bandwidth and spare capacity.

Associated Drivers

- **Economic uncertainty** – IT malaise and market volatility
- **Global supply chain resiliency** – Push for diversification

- **The digital business imperative** – Competitiveness and outcomes

IT Impact

- Resiliency will require substantial investment with respect to IT infrastructure, manpower, and support services for operational sustenance – this must be balanced with efforts to improve efficiency.
- Real-time data capture and analytics and remote connectivity options will be critical to provide necessary visibility.
- Rethinking IT KPIs will better inform technology trade-offs.

Guidance

- Ensure visibility and data-driven insights inform the inherent trade-offs between resiliency and efficiency efforts.
- Integrate both existing and new supply chain systems so that all relevant data and insights can be combined for optimal operational balance.
- Redefine the underlying business processes to ensure that the data and insights generated are seamlessly integrated into the operating systems.

Prediction 9: By 2028, the Integration of AI/ML into Robotic and Automation Routines Within Industrial Operations Will Increase by 30%, Driving Higher Efficiencies and a 10% Reduction in Downtime

The use of advanced algorithms in industrial operations is already an established practice. Industry 4.0 is defined by the collection of data and its analysis to achieve process improvements and efficiencies. The result has been companies using predictive maintenance, life-cycle management, digital twins, and generative computer-aided design to reach a higher level of productivity.

Today, artificial intelligence and machine learning have gained the spotlight. ChatGPT and other public AI tools have attracted other industry players and the consumer market to explore what AI/ML may bring to the table. Industrial operations are also exploring how to further expand upon the advanced algorithms already in place and how these new advances can aid in programming and inspection.

According to IDC's August 2023 *Worldwide Future of Operations Survey*, 43.9% of respondents claim AI/ML as an important tool to reach operational excellence and resilience, while 31.6% said it was critical and 24.4% said it was somewhat important to not all important.

The future use cases of AI/ML center around programming assistance and advanced inspection methods. The democratization of robotics has made it feasible for anyone to use one. Lower price points, ease of installation and programming, and universal end effector tools have made robots a flexible multipurpose industrial tool. Robots today can be found tending CNC machines, welding sheet metal, and roaming the plant floor autonomously. AI/ML has aided these advances. For example, many autonomous mobile robots (AMRs) use AI/ML to adjust programming in real time. When a robot encounters an obstacle, the unit can take corrective action and avoid it, creating a new program routine. Robots interacting with human workers, typically collaborative robots (cobots) designed with built-in safety features, use AI/ML to make programming easier. For example, Universal Robots, a leader in the cobot space, has partnered with MathWorks to introduce MATLAB and Simulink into its cobot-based applications. The partnership uses AI algorithms to allow engineers to create advanced industrial automation systems. AMRs and cobots are examples of how automation is expanding the use of AI/ML within industrial operations.

Visual inspection will also benefit from AI/ML advances. Machine vision for inspection has already been established in industrial operations, especially for consumer goods and packaging. With machine learning at the edge, companies can train machine vision systems faster. Cognex, for example, uses edge learning models to train visual inspection systems for product inspection and quality control. Edge learning can be done in a few minutes and requires 5-10 images to train. The speed at which companies can deploy AI powered for visual inspection will enable more companies to use the tool.

Associated Drivers

- **AI everywhere** – Generative AI takes the spotlight
- **The digital business imperative** – Competitiveness and outcomes
- **Dynamic work and skills requirements** – New work mode era

IT Impact

- IT and engineering will need to establish efficient data networks for the transfer of information. AI/ML needs data to operate. The use of cloud networking and computing will be essential for the success of AI deployment.
- The security of data will also need to increase. More operational data in the cloud will be required to operate AI tools. Securing the data to deny access to bad actors will be a pressing issue for industrial operators.
- The upskilling and training of the workforce will be vital to ensure they can interact and operate with AI/ML technologies.

Guidance

- Develop an enterprisewide strategy for data access. The strategy should enable collaboration among departments to ensure accuracy in the data and that the AI algorithms are being trained correctly.
- Evaluate cloud platforms and their security. The use of AI will drive companies to invest in the cloud. Be sure that accessibility and security meet your company's needs.
- Identify use cases that will benefit most from AI/ML deployment. Like any new technology, the rollout of AI/ML algorithms should be on a case-by-case basis, ensuring the return on investment for future projects.

Prediction 10: By 2027, 40% of G2000 Companies Will Be Using Comprehensive Ecosystem Sustainability Data to Make Decisions Across the Full Range of Operations, Reducing Carbon Footprint by 30%

If today's operations are to balance resilience with efficiency, they must also be sustainable; that seems increasingly clear. It's not just about an organization's carbon footprint. True sustainability must encompass all scarce resources as well as issues of waste, emissions, and inequality extended through the life cycle of products. IDC recently interviewed a manufacturing executive whose company runs a large factory in the western United States. The factory consumes a lot of water in a region that is in a 20-year drought and facing the prospect of unprecedented water restrictions. He noted, "We must find a way to reduce net water consumption at this site; otherwise, we may be forced to close. If that isn't sustainability, I don't know what is!" It appears the more advanced a company's operations and digital operational capabilities, the more focused that company is on sustainable operations. Which one follows the other could be debated, but a clear correlation is evident.

We also see linkages between sustainability and workers/skills. Ten years ago, most consumers didn't care much about the sustainability practices of the companies whose products they bought and used;

even if they did, there was probably no easy or effective way of finding out which were, and which were not, operating sustainably. As consumers skew younger and more environmentally savvy, sustainability becomes a much more important element of their product selection criteria. They can research the companies and the products they buy and make informed choices.

Investing in sustainability, and the circular economy, must become a part of the way that we run operations rather than as separate ESG initiatives; in other words, moving sustainability from "posters to practice." Net zero goals will never be achieved unless manufacturers operationalize sustainability into the ways that they run their factories and the ways that they operate their supply chains. The ability and willingness to operationalize (from "posters" to "practice") sustainability will be essential to both business continuity and cost efficiency over the next decade, and IDC expects that will significantly reduce the company's carbon footprint.

Associated Drivers

- **Economic uncertainty** – IT malaise and market volatility
- **The digital business imperative** – Competitiveness and outcomes
- **Operationalization of ESG** – Measuring and implementing sustainability

IT Impact

- Operationalizing sustainability will require substantial investment with respect to IT infrastructure, manpower, and support services – this must be balanced with cost.
- Real-time sustainability data capture and analytics and remote connectivity options will be critical to provide necessary visibility for decisions.
- It requires making the right tools available to move from "posters to practice."

Guidance

- Take a broader view of the cost/benefit and how longer-term customer demographic shifts will impact buying priorities.
- Expect that regulatory pressure will increase – even if you don't act proactively, be prepared to respond.
- Build sustainability metrics into service-level agreements with suppliers, contract manufacturers, and third-party logistics providers.

ADVICE FOR TECHNOLOGY BUYERS

Throughout this document, we have detailed guidance specific to each of the 10 predictions; in addition, we recommend that manufacturers take the following approaches to ensure they are maximizing the value they derive from both current and future technology investments:

- **Assess your digital maturity.** Evaluate your relative maturity in adopting new technologies and, more importantly, your ability to translate those technologies into digital transformation, not just simple digitization while retaining paper-based thinking. You will probably move more quickly with some technologies, such as IoT and machine learning, but make sure you're experimenting with all the technologies we identify as innovation accelerators.
- **Invest in the short and long terms.** Look for technologies that provide efficiency/effectiveness today yet enable future capabilities that support your company's digital transformation road map. Investing in an IoT platform, for example, can drive immediate process improvements but also set you up to capitalize on new products/services in the future.

- **No "technology for technology's" sake.** While most of the predictions listed talk about the opportunity for innovation accelerators to take transformation efforts to the next level, make sure that you are applying it to achievable outcomes. Work with technology partners and focus your efforts on how technology helps solve existing business problems or in anticipation of future ones.
- **Pay attention to GenAI.** Yes, we have gone down the technology rabbit hole before, but GenAI seems different. It is poised to make a massive impact on manufacturing and operational performance. You don't have to be a GenAI expert, but make sure to pay attention and identify technical partners that can help.
- **Create a single source of the truth.** Data within your enterprise and from connected products, supply chains, and assets will increasingly be the starting point for new initiatives.
- **Talent, talent, talent.** There is a major skills gap within manufacturing that will not get better anytime soon without action. Make sure you have a process in place to capture the knowledge of your more senior employees and provide your employees with ways to collaborate and learn together. Talent can be your most valuable resource; make sure that you are constantly cultivating it across the organization.
- **Take the mindset that it is technology and people, not technology replacing people.** Be clear organizationally that modern, digital technologies are not about replacing people but replacing tasks and freeing up people to focus on more impactful things. Technology will allow for workers to maximize their time on high-value activities.
- **Look to the partner ecosystem to close gaps.** Work with small and large partners to accelerate your IT capabilities and serve the line of business. External resources and expertise can help you move quickly and effectively, which is essential in today's global marketplace. Expand your horizons to include smaller, app-driven capabilities as extensions to broader systems.

EXTERNAL DRIVERS: DETAIL

AI Everywhere – Generative AI Takes the Spotlight

- **Description:** With intelligence becoming the primary source of value creation, we are on the verge of the "Intelligence Revolution," in which artificial intelligence (AI) and automation-oriented technology will be the main accelerators of business change. In the realm of "AI everywhere," generative AI (GenAI) emerges as a transformative force, potentially revolutionizing the future. This branch of artificial intelligence enables a machine-driven autonomous creation of new content, from images to music to even written text, with remarkable accuracy. Early applications of GenAI have showcased its potential in fields such as creative arts, content and code generation, and personalized recommendations. However, it also raises concerns regarding bias and privacy: AI algorithms can inadvertently perpetuate biases and pose threats to personal data. As a result, regulation becomes crucial to ensure responsible and ethical use of GenAI. Despite these challenges, the possibilities are vast, ranging from improved customer experiences (CXs) to innovative problem-solving. Harnessing the power of GenAI and navigating its associated complexities have the potential to shape the future of industries and drive advancements in the AI-driven world.
- **Context:** Businesses are already jumping to get a piece of the AI pie, afraid to miss out on the opportunities it presents. Although we are in the early days, monetization and scale of AI solutions are expected to evolve rapidly. However, this comes during a time of relative economic uncertainty and increasingly constrained IT budgets. Furthermore, AI is not without

risks, especially when it comes to ethical AI and data privacy, and companies need to carefully consider the best use cases in order to implement AI effectively.

The Drive to Automate – Maximizing Efficiency and New Opportunities

- **Description:** Broader automation use cases – beyond just generative AI – are now ubiquitous. Now that data is embedded in the core of strategic capability for every organization, automation is critical to scaling a digital business and is evident in three domains – IT automation, process automation, and value stream automation – leading to autonomous operations, digital value engineering, and innovation velocity. Industrial organizations have spent the past few years evolving toward the Fourth Industrial Revolution (Industry 4.0) through the use of industrial automation and intelligence. Thoughtful implementation is more important than ever as data becomes embedded in the strategic core of every organization. Automation technologies such as robots and drones are being used increasingly in the military and healthcare sectors. Given this boost in automation, data is increasingly precious, and privacy must be prioritized and security enhanced. In some cases, automation has also led to concerns over the future of work – whether it will enhance or take away.
- **Context:** Businesses are rethinking how to employ automation to maximize operational efficiency – from automating assembly in manufacturing to identifying opportunities for food waste reduction in hospitality to improving customer experience in digital banking. IT will need to continue to assess new technologies and approach automation investments strategically, both within the walls of the organization and in the field. Among industrial organizations, IT/OT convergence will necessitate shared responsibility across teams for automation priorities and implementations.

Economic Uncertainty – IT Malaise and Market Volatility

- **Description:** The global markets have been thrown into a state of prolonged uncertainty. The era of low interest rates and easily accessible corporate debt has abruptly transitioned into an economic slowdown, accompanied by a surge in interest rates. Despite monetary policy interventions, inflation persists due to the compounding effects of global conflicts and supply chain constraints. As a result, economic growth is stifled, hindered by soaring commodity prices and mounting sovereign debt. In certain cases, this instability has even escalated into recessions. These conditions have created a situation of IT malaise, especially in the United States and Europe in early 2023, as uncertainty makes budget planning and forecasting challenging for executives. Many IT leaders are now bracing for an onslaught of AI-driven technology while battling uncertainty about which current expenditures and assets they should keep or discard. While technological innovation may be a rejuvenator, it further contributes to disruption and uncertainty in today's already-volatile economic environment.
- **Context:** Given uncertainty around inflation and interest rates, C-suite executives need to strategically plan IT spend. Most executives view IT as a deflationary measure but striking this balance between digital investments and cost management becomes increasingly challenging given volatile conditions. With generative AI, IT executives further find themselves caught up in questions of strategic spending. While many IT organizations initially focused on constraining new expenditures and optimizing the use of existing assets, they now find themselves grappling with how to invest in AI and other drivers of innovation while reining in costs.

Global Supply Chain Resiliency – Push for Diversification

- **Description:** Despite gradual easing of supply, supply chain disruptions overall continue to impact most markets and resiliency remains a top priority. Whether due to geopolitical issues

(Russia-Ukraine War-driven energy supply scenario, semiconductor chains shifting due to China-Taiwan dynamics, etc.), broader economic concerns, or the impact of demand volatility on raw material costs (e.g., access to key components for tech products), the global supply chain remains at a critical inflection point. Furthermore, national economic security, inflation and interest rates, data sovereignty, cybersecurity, and climate change are critical factors in determining how to approach the future of supply chains. Many of the old methods have proven ineffective, so companies are looking for new approaches to improve resilience. These include multisource orchestration and multi-scenario adaptation, better visibility and agility, and business process automation. The global supply chain will persist, and it always does, but policymakers and business leaders are looking to better balance global, regional, and local solutions, shortening supply chains where possible and diversifying to reduce risk.

- **Context:** The IT supply chain is especially affected by global supply chain policy and volatility. Given the excitement around generative AI especially, GPUs, semiconductors, and other silicon-based technologies are more crucial than ever. As key components for technology products are limited in supply and subject to volatility, businesses will need to continue to strategize to build resilience and diversification.

The Digital Business Imperative – Competitiveness and Outcomes

- **Description:** A digital business sees value creation based on the use of digital technologies for both internal and external processes, including customer engagement, employee experience, and product and services development. Building and leading a digital business is imperative for organizations to be competitive. While certain operational aspects may always have a nondigital component, digital businesses prioritize a digital-first strategy that aligns all parts of the business and IT landscape with digital workflows to drive value and growth. The development strategies for both digital and nondigital assets now require leveraging multiple channels for the digital business to obtain support or funding. This places a strong emphasis on providing digital experiences for customers and citizens, employees, and partners and necessitates a shift toward fully digital operating models and resilient supply structures enabled by digital technology. The focus of a digital business is increasingly on delivering measurable outcomes. Businesses that have recognized the value of digital anticipate maintaining or even increasing their investment in technology, even in times of economic uncertainty.
- **Context:** As more and more enterprises embrace digital strategies and technology, they prioritize technology investments that drive innovation or allow for competitive differentiation. Technology is no longer viewed as a tool to keep the business running, but it is the foundation for building new revenue-generating experiences and products. Laggards will need to adapt quickly and develop their digital road maps and embrace a digital business platform. Identifying top digital revenue opportunities that deliver value will be crucial for overall business success and implementation of organizational digital-first strategies.

Dynamic Work and Skills Requirements – New Work Mode Era

- **Description:** In the wake of COVID-19 pandemic-driven accelerated work transformation, enterprises continue to face dynamic work conditions. These range from lack of skilled employees to codifying more flexible ways of working that rely on a broad range of technologies and services. In some regions, most notably in Asia/Pacific, organizations are focused on building more secure and technically sophisticated office environments. In North America, remote and more flexible work models are driving investments in technologies that support collaboration across and within disparate work environments. Across this spectrum of work models, organizations are investing in infrastructure, hardware, software, and services to

enable and manage increasingly automated ways of working. These include automated remote onboarding, learning in the flow of work, and use of AI and generative AI to facilitate basic tasks and workflows. While the pandemic drew much needed attention to the employee experience, enterprises have shifted to aligning employee requirements more plainly to strategic business goals. The key challenge around the globe has been to find or upskill/cross-skill employees to scale and meet the demands of complex, automated work processes. Flexible work models continue to change to become even more agile, with digital workspaces highlighting skills, workforce management, automation, changing demographics, and as-a-service talent resourcing.

- **Context:** New modes of working are now intrinsic to leadership and organizational resilience and go well beyond traditional staff planning methods. They are also having an impact on frontline workers who have historically been neglected in favor of higher-paid front- and back-office peers. New work models require agile cross-functional teams – including HR, IT, LOB, finance, facilities management, and operations – to engage top talent and meet client brand expectations. While headlines debate the fate of environmental, social, and corporate governance (ESG) initiatives, it's clear that environmental concerns will be an embedded element of workplace design and implementation of flexible work models. C-suite leaders and their teams must collaborate to recalibrate work culture, augmentation, and space/place planning to enable more secure, dynamic, and refined work models of the future.

Operationalization of ESG – Measuring and Implementing Sustainability

- **Description:** Environmental, social, and governance, a globally adopted framework supporting actions to achieve sustainability and a better future for all, is gaining more traction than ever. ESG laws are increasing: the EU launched the Corporate Sustainability Reporting Directive (CSRD) requiring companies to disclose and assure ESG metrics, the SEC's climate disclosure requirement is forthcoming, and Japan's GX Basic Policy implements an emissions trading scheme and carbon tax. There are also new International Financial Reporting Standards. Given this, many companies are actively operationalizing ESG with AI-informed carbon accounting software, carbon budgets, and sustainability requirements into requests for proposals (RFPs) they send to tech suppliers. Many companies now have positions such as chief sustainability officer or are integrating sustainability into the responsibilities of the C-suite. And many enterprises are replacing redundant faulty and energy-heavy tech with newer, more efficient energy-saving counterparts. Businesses recognize that diversity, equity, and inclusion are positively affecting profits and are therefore implementing DEI initiatives to include more women and minorities. In addition, ESG compliance is a form of long-term strategic business risk reduction. Given climate change and instable energy prices, among other risks, ESG helps curb costs and hedge against risks caused by natural disasters and other shocks.
- **Context:** ESG is more than just a measure; it is foundational to business purpose and value. Businesses are increasingly beholden to ESG. More and more customers care about whether the companies they deal with behave sustainably and deliver sustainable products and services. ESG can also be a cost-saving measure and hedge against risks. Yet, despite much progress, there is still work to be done, especially in complying with carbon footprint measuring and achieving high-quality data. As laws and regulations – as well as investment opportunities – amp up around ESG, the IT industry will increasingly require green talent and skills and better data modeling of ESG metrics to achieve maximum benefit.

LEARN MORE

Related Research

- *IDC's Worldwide Digital Transformation Use Case Taxonomy, 2023: Brand-Oriented Value Chains in the Manufacturing Industry* (IDC #US51204523, September 2023)
- *Critical External Drivers Shaping Global IT and Business Planning, 2024* (IDC #US51057623, September 2023)
- *IDC's Worldwide Digital Transformation Use Case Taxonomy, 2023: Engineering-Oriented Value Chains in the Manufacturing Industry* (IDC #US51040623, August 2023)
- *IDC's Worldwide Digital Transformation Use Case Taxonomy, 2023: Technology-Oriented Value Chains in the Manufacturing Industry* (IDC #US51058423, August 2023)
- *IDC's Worldwide Digital Transformation Use Case Taxonomy, 2023: Asset-Oriented Value Chains in the Manufacturing Industry* (IDC #US51062023, August 2023)
- *IDC FutureScape: Worldwide Manufacturing 2023 Predictions* (IDC #US48630122, October 2022)

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