

IDC FutureScape

IDC FutureScape: Worldwide Manufacturing 2021 Predictions

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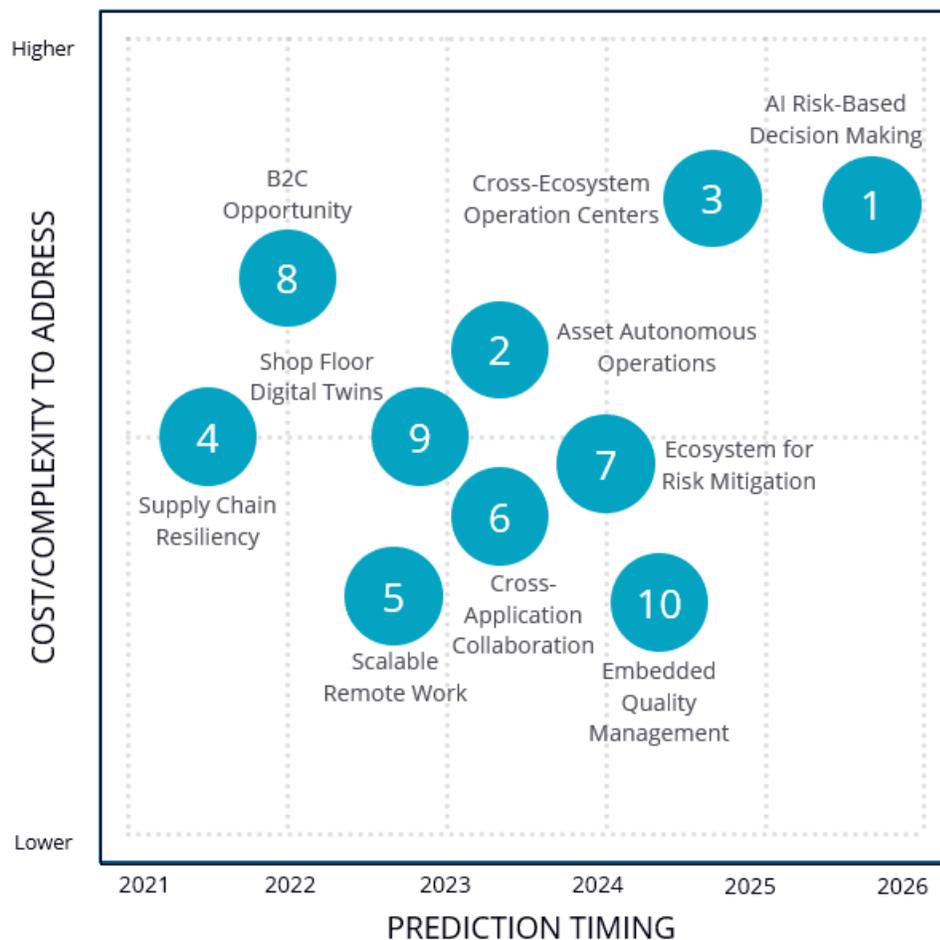
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IDC FUTURESCAPE FIGURE

FIGURE 1

IDC FutureScape: Worldwide Manufacturing 2021 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, 2020

EXECUTIVE SUMMARY

Key themes woven into our worldwide manufacturing top 10 predictions for 2021 include the focus on the ecosystems, supply chain management, product and service innovation, quality, technology consolidation, and AI. These predictions span the manufacturing value chain, as 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 2021 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:

- **Prediction 1:** By 2026, 70% of G2000 companies will use AI to develop guidance and insights for risk-based operational decision making, compared with less than 5% of the G2000 today.
- **Prediction 2:** By 2022, to support autonomous operations, organizations will increase their investments in data governance, digital engineering organizations, and digital operations technologies by 40%.
- **Prediction 3:** By 2024, 50% of G2000 organizations will develop industry ecosystem digital operation centers to monitor capacity, expertise, market, and environmental conditions, for 50% faster time to market.
- **Prediction 4:** By the end of 2021, 90% of all manufacturing supply chains will have invested in the technology and business processes necessary for true resiliency, resulting in productivity improvements of 5%.
- **Prediction 5:** By 2023, manufacturers will reduce onsite personnel by 30%, utilizing machine vision and AR/VR to scale offsite expertise to onsite, delivering engineering and maintenance support from anywhere.
- **Prediction 6:** By 2023, 25% of manufacturers will consolidate their enterprise applications through solutions that can enable multivendor capabilities and streamline the Industry 4.0 technology stacks requirements.
- **Prediction 7:** By 2024, 60% of manufacturers will participate in distributed supply chain network to reduce the risk of an unplanned disruption in their value chain.
- **Prediction 8:** By 2022, due to COVID-19, 70% of consumer-facing manufacturers will leverage new direct-to-consumer channels, producing up to 15% more profits, improved customer satisfaction, and business resiliency.
- **Prediction 9:** By 2023, 30% of manufacturers will enhance their shop floor digital twin with real-time signal transponder data, leading to an 80% reduction in logistic bottlenecks in shop floor and storage areas.
- **Prediction 10:** By 2024, 75% of manufacturers will embed quality management across the value chain, including the supply chain and field service, reducing overall cost of quality by 25%.

This IDC study provides manufacturers with the top 10 predictions and underlying drivers that we expect to impact manufacturers' IT investments in 2021 and beyond.

"Although the specter of disruption has been front and center in 2020, we do not believe that invalidates the manufacturing transformation journey that so many companies are pursuing – in fact, we think it justifies and accelerates it. Manufacturing companies have a renewed focus on transforming from efficiency-oriented operations to resilient organizations driven by a tighter connection to their markets and customers. The key component to this shift will be maximizing the value of ever-increasing data, which is reflected in many of the predictions we have made," according to Reid Paquin, research director for IDC Manufacturing Insights' IT Priorities and Strategies Practice.

IDC FUTUREScape PREDICTIONS

Summary of External Drivers

IDC's Manufacturing Insights team has identified a list of key drivers that are expected to have substantive influence on the market's near-term direction. The following drivers should be taken into consideration when organizational decision makers think about these acquisitions:

- **Accelerated disruption** – Crisis, resilience, and opportunity
- **The next normal** – Resilient business and operating models
- **Intelligence everywhere** – Data drives action
- **Rethinking globalization** – Disruptions challenge resilience
- **Digital platform** – Ecosystems at scale
- **Customer engagement redefined** – Safe, secure, and sustainable digital experience
- **Work transformation** – Redefining teams, skills, and leadership

Predictions: Impact on Technology Buyers

Prediction 1: By 2026, 70% of G2000 Companies Will Use AI to Develop Guidance and Insights for Risk-Based Operational Decision Making, Compared with Less Than 5% of the G2000 Today

One of the primary reasons for the large layer of middle management in companies is to provide the conduit for data and information to senior decision makers. Another responsibility is taking the decisions from senior management and turning them into direct action in operations. But as data volumes have accelerated and volatility in markets has increased, either middle management has grown, data has gone unused, or the decision-making process has become less effective. Even with larger, newer transaction-based business systems and large organizations, the decision-making process has struggled to provide effective risk-based operational actions.

IDC's research has shown that data generation in typical operations is more than tripling in the next five years. But there is little appetite or business justification for adding middle management to sort through the data and deliver insights for decision makers. And volatility in the markets is only going to increase in the next few years.

The only real solution is for companies to use AI-based systems to ingest, manage, and analyze all the data. The large volumes of data and the inability of even large middle management organizations to provide timely insights means that an AI decision-making framework is essential. This framework will

turn data into actionable recommendations and then disseminate the decisions back down to the point of activity to execute the decisions. This AI framework will provide rapid, effective, and consistent actions to minimize risk in the operation.

Associated Drivers

- **The next normal** – Resilient business and operating models
- **Intelligence everywhere** – Data drives action
- **Accelerated disruption** – Crisis, resilience, and opportunity

IT Impact

- IT will provide a flexible data architecture that allows data to be quickly transformed into insights.
- IT works more closely with operations to capture the real-time data at the point of activity.
- IT evaluates all systems for their contribution to decision-making framework.
- The resilient decision-making process will require a complete reevaluation of all middle management roles and functions for their value contribution and use of data tools.

Guidance

- Develop a data governance model to align operational data with broader enterprise data.
- Evaluate all new systems for how they fit into the decision-making framework.
- Assess any role whose main function is data manipulation or reporting for shifting the value of the role to developing insights and enhancing decision making.

Prediction 2: By 2022, to Support Autonomous Operations, Organizations Will Increase Their Investments in Data Governance, Digital Engineering Organizations, and Digital Operations Technologies by 40%

According to IDC's 2020 *Worldwide IT/OT Convergence Survey*, integration of OT systems with IT systems or other OT systems has become the top investment priority among industrial enterprises. Catalyzed by the ongoing value driven by digital initiatives and accelerated by the pandemic, enterprises continue to recognize that operational data is the fuel that drives resilient decision making. This data-driven autonomous working model will enable greater levels of remote work and provide the agility necessary to adapt when unexpected market conditions arise. But as industrial organizations embark on this journey to the autonomous operation, they have thus far uncovered more challenges with data accessibility and normalization, organizational inertia, and holistic technology solutions than expected.

To support this imperative digital transformation, we predict that organizations will rapidly accelerate and increase investments in three key foundational areas:

- **Data governance** – To stand up the business processes necessary to create a data-driven and empowered decision culture, past behaviors must be modified. Historically, operations professionals have had little reason to develop standard practices in the way they tag, retrieve, and analyze operational data. This has resulted in many digital initiatives failing to scale up, as tedious data cleansing efforts related to pilot programs for a particular operations environment or asset category are unable to be transferred to the broader transformation effort.
- **Digital engineering organizations** – Centralizing the remote monitoring and optimization of assets and processes is a key value driver of digital technologies. But this value can only be achieved if those data streams are contextualized prior to driving an action. This is where IDC

has observed "digital engineering" organizations coming in. While IDC has not witnessed a standard naming convention being adopted, we have observed leading organizations staffing up these central functions with a mix of IT skills and experienced operations professionals. These organizations will provide the business context and continuity necessary to realize value from digitalization and will accelerate the implementation and scalable management of technologies deployed in operations including industrial networking, data management and semantics, low-code application development, advanced analytics and machine learning (ML), and operations cybersecurity.

- **Digital operations technologies** – To manage these five critical disciplines in a unified and scalable way, digital engineering organizations will require an integrated mix of technology solutions and platforms. Today, networking and security tools and device management and low-code solution development in IIoT platforms, analytics workbenches, and other essential digital engineering technologies remain somewhat isolated both in terms of technical capabilities and site-by-site adoption and architectures. Industrial enterprises are now moving quickly to integrate these tools and consolidate their technology portfolios around solutions and providers that make this integration practical. Digital operations technologies must be holistic where they align to a particular operational business process and complementary where there is a technical requirement from IT.

Associated Drivers

- **Intelligence everywhere** – Data drives action
- **Work transformation** – Redefining teams, skills, and leadership
- **The next normal** – Resilient business and operating models

IT Impact

- Enterprise data governance models will include a host of new operations technologies including industrial control systems, asset management systems, distribution management, SCADA, process data historians, laboratory and quality systems, and others.
- IT will have resources embedded within the line of business and will require specialization to operational business processes.
- IT will need to develop a digital operations technology architecture that includes a road map for legacy technologies as well as new digital requirements.

Guidance

- Adapt and bridge existing data governance models and best practices to operations settings and workers. It is essential that the value of adopting new data governance practices is apparent to operations, and that support channels and ongoing governance be tightly integrated to ensure adoption. New and existing tools and technologies must be stringently evaluated for their ability to align with and support overall data governance goals.
- Build and rebuild relationships of trust with operations as a work transformation for both IT and operations. With digital capabilities delivering strategic value and being embedded in every process, gone are the days of siloed behavior between IT and operations. Focus on reducing redundancy of process and aligning around common goals to begin this relationship building.
- Foster collaboration between IT and operations to take inventory of the physical and digital asset portfolio. This includes taking stock of legacy OT and its capabilities, new IT solutions that offer comparable capabilities, and physical processes and assets that may not be digitized yet. From this foundation, the overall operations technology architecture can be reimaged for the digital future.

Prediction 3: By 2024, 50% of G2000 Organizations Will Develop Industry Ecosystem Digital Operation Centers to Monitor Capacity, Expertise, Market, and Environmental Conditions for 50% Faster Time to Market

Organizations that have digitally transformed in recent years are focused on leveraging data for a more evidenced-based culture and improving cross-enterprise and cross-value chain collaboration and operation. Those organizations that had instituted a unified data structure combined with digital technology were able to pivot more easily to a fully virtual way of working, with their internal colleagues as well as their partners and broader industry ecosystem. In short, they were more resilient. According to IDC's 2020 *COVID-19 Impact on IT Spending Survey*, over 50% of organizations are planning to maintain this approach post-pandemic, while also focused on rethinking how they work with ecosystem partners to develop products and services. IDC expects these internally focused data and operations initiatives to expand externally to become digital operations centers for industry ecosystems, resulting in improved ability to respond to change, opportunity, and disruption.

There are multiple sources of data collated, analyzed, and federated for these digital operations centers to function optimally: supply chain, R&D/innovation, operation, asset management, service, customer knowledge, as well as market and environmental condition data. Having a near-real-time view into this information enables companies to monitor capacity, expertise, market, and environmental conditions; improve time to innovation and time to market; and expedite the ability to respond to disruption and new opportunity. This single, digital "war room" for industry ecosystem data, insights, applications, operations, and expertise also enables organizations to optimize the capabilities and capacities that exist within their industry ecosystem, taking a flexible, shared, on-demand approach that evolves and shifts as required to survive and thrive, much as a biological ecosystem does.

The operations center will serve to monitor and manage ongoing operations, in addition to running strategic projects such as the introduction of new products and services, geographic expansion, and entry into new markets. Digital twins can be used to model and view ecosystem elements within the industry ecosystem digital operations center – these elements include products, assets, resources, processes, participants, and overall ecosystem function. Early examples of digital operations centers include a large CPG manufacturer that developed a digital engineering center to unify cross-domain data internally and will be extending this externally to suppliers and partners. In automotive, Oxbotica's universal autonomy platform in concert with Cisco's OpenRoaming platform will enable faster, more secure vehicle-to-everything (V2X) communication, such as vehicle to Smart City infrastructure.

Associated Drivers

- **Intelligence everywhere** – Data drives action
- **Digital platform** – Ecosystems at scale
- **Work transformation** – Redefining teams, skills, and leadership

IT Impact

- Huge amounts of data from across the ecosystems will need to be cleansed and unified from multiple sources – including supply chain, R&D/engineering and innovation, operation, asset management, service, and customer knowledge – analyzed to support decision making.
- Data access, security, and trust must be established through multifactor authentication protocols and policies, as well as blockchain for participant validation and data access – not everybody in the ecosystem will have access to all data.

- Existing vendor marketplaces and collaboration environments can serve as the foundation to expand to a digital operation center for your industry ecosystem.

Guidance

- Build your industry ecosystem data model encompassing all aspects, and ensure it can be flexibly consumed by all participants on any device, from any location, text based, graphical, or via digital twin.
- Establish a secure, immutable approach for ecosystem participants, as trust is the lifeblood for industry ecosystems and corresponding technology platforms such as a digital operation center.
- Leverage existing technology and process investments that may have established an environment for a small number of suppliers or partners to collaborate.

Prediction 4: By the End of 2021, 90% of All Manufacturing Supply Chains Will Have Invested in the Technology and Business Processes Necessary for True Resiliency, Resulting in Productivity Improvements of 5%

In the age of COVID-19, supply chains are experiencing a bumpy ride. Some industry supply chains have seen significant supply disruptions but only minor demand changes, other industries have seen minimal supply disruptions but major demand changes, and still others have seen both. Regardless of the industry, supply chains are experiencing pressures unlike any we have seen in a generation.

Those who have both studied and operated supply chains for decades have always talked about the importance of visibility, agility and resiliency, but these terms are now on the tip of everybody's tongue and are taking on a profoundly more important role in an increasingly disruptive world. Although resiliency is not something that can be achieved overnight, there are things that can be done in the shorter term to better understand the drivers of demand volatility and allow companies to better match supply with demand. When both supply and demand are highly volatile, supply chain resiliency is critical.

Although it is "easy" to see now the importance of resiliency, even five years ago, IDC was suggesting that supply chain resiliency may well be the most important characteristic of the modern supply chain. Although COVID-19 is having a global impact in 2020, there have been a multitude of other disruptions in recent years that have also impacted the supply chain. Just in the past decade, we have seen earthquakes, floods, extreme weather, and trade disputes have a major impact – and there is every reason to think that these kinds of disruptions will continue to occur.

Supply chain resiliency will allow companies to react more quickly to both internal and external events and speed "time to recovery" for larger disruptions. IDC expects that supply chain resiliency will have a material impact on overall productivity.

Associated Drivers

- **Accelerated disruption** – Crisis, resilience, and opportunity
- **The next normal** – Resilient business and operating models
- **Digital platform** – Ecosystems at scale

IT Impact

- Resiliency will require substantial investment with respect to IT infrastructure, manpower, and support services for operational sustenance.
- Real-time data capture and analytics and remote connectivity options will be critical.

- IT security will be a major aspect that ultimately determines the confidence with which organizations would be ready to share and exchange data.

Guidance

- Ensure that the necessary visibility and agility is enabled for true resiliency.
- Sell the idea of technology as an augmentation of people to ensure that the workforce understands the implications.
- Integrate both existing and new supply chain systems so that all relevant data and insights can be combined for optimal resiliency.
- Redefine the underlying business processes to ensure that the data and insights generated are seamlessly integrated into the supply chain systems.

Prediction 5: By 2023, Manufacturers Will Reduce Onsite Personnel by 30%, Utilizing Machine Vision and AR/VR to Scale Offsite Expertise to Onsite, Delivering Engineering and Maintenance Support from Anywhere

Adjustments to personnel onsite access and shift management have become necessary because of recent circumstances to keep workers safe, while at the same time maintain productivity and effectiveness. Manufacturers are turning to technology to find solutions to address the need for personnel to virtually access production sites and assets from a distance, in addition to the data and systems to drive decisions.

In IDC's recent *Supply Chain Survey*, 61% of manufacturers indicated that AR/VR will be critical over the next three years. This technology can bring expertise to the shop floor for operators to receive guidance, training, and support from remote colleagues. Troubleshooting or maintenance activities can be guided from a distance through the use of augmented reality, allowing not only for worker safety but the scaling of expertise across the organization.

Similarly, quality inspections and process monitoring can occur using machine vision capabilities. Markings, dimensions, flaws, and blemishes can be detected with more precision than the human eye. Platforms enable machine learning, which allows for better pattern recognition, decision support capabilities, and faster time to resolution. The automation capabilities enabled by platforms connected to computer vision technology will allow for quick detection. Any assistance required can take place through offsite access via AR or mobile devices.

Associated Drivers

- **The next normal** – Resilient business and operating models
- **Intelligence everywhere** – Data drives action
- **Work transformation** – Redefining teams, skills, and leadership

IT Impact

- Vision computing adoption streamlines data movement to further IT/operational technology (OT) integration but may not necessarily require extensive hardware investment. Interim solutions are possible using high-resolution security footage to speed up adoption to accelerate a return to previous facility productivity levels.
- With increased reliance on digital technologies for quality and process monitoring on the shop floor, service levels for repair and system disruptions are necessary to support critical taskings.

- There will be a need to either consider edge capabilities or increase data connectivity support to manage the increased lead of data from AR/VR support and vision solutions to offsite personnel. Security and control requirements will also need to be addressed as there will be an increase in the multiple parties and devices involved.

Guidance

- Develop a platform that securely supports the access of remote personnel to onsite assets and workers to ensure business continuity. There is an imperative for technology to support the continuity and productivity of manufacturing like never before.
- Set the expectations of workers that assistance is available through a reliable means to ensure adoption occurs and productivity increases. Training and guidance will be required to address any teething problems that occur and ensure that offsite resources are access and utilized.
- Focus on integration and interoperability during the vendor selection process. Remote work requires the convergence of multiple technologies – IT systems, IoT, AR/VR, and so forth – organizations will see a significant impact on productivity and the ability to scale if this is done well.

Prediction 6: By 2023, 25% of Manufacturers Will Consolidate Their Enterprise Applications Through Solutions That Can Enable Multivendor Capabilities and Streamline the Industry 4.0 Technology Stacks Requirements

Organizations have always been chasing optimal configurations to operationalize Industry 4.0 for increased productivity, visibility, efficiency, and quality. The presence of multiple platforms and applications with siloed data streams has been an area of concern for LoB and IT heads. With increasing license renewal and maintenance costs, there has been a conscious effort to reassess the installed application landscape and identify consolidation opportunities while reducing redundant spend.

Leveraging existing partner ecosystems and consolidating multiple software modules can reduce and manage these transactional costs while creating the necessary links for seamless data flow between various functional applications. Through these partnerships, organizations can determine the most viable software products that can be compatible with their organizational requirements without the need to solicit further information from potential vendors. Examples such as ABB with Dassault Systèmes and HPE, SAP with Siemens, and PTC with Ansys substantiates the traction for integrated application platforms, which can help reduce the need for multiple touch points across various functional requirements.

Apart from consolidation, the other critical aspect is the process maturity that allows organizations to manage the data streams from disparate applications. These data sets can help generate comprehensive insights that can address the existing functional gaps and subsequently develop a single point of view. Middleware and ETL tools can help connect the enterprise applications but would introduce an additional layer of complexity. The long-term aspiration would be to have a smart and connected manufacturing environment with embedded application capabilities that negate the need for third-party solutions. In essence, enabling the idea of having intelligence at the "asset edge" for ensuring a continuous stream of high-quality and relevant insights are getting fed to the subsequent assembly nodes for faster decision making and exception handling.

Associated Drivers

- **The next normal** – Resilient business and operating models
- **Intelligence everywhere** – Data drives action

- **Digital platform** – Ecosystems at scale

IT Impact

- Streamlining existing technology stacks will require additional rationalization drives that can impact planned project budgets.
- Replacing existing vendor solutions with new partnerships can be cumbersome and will involve renegotiation and unexpected downtimes in terms of core data accessibility.
- Consolidation will result in the creation of new use cases that transcend the traditional boundaries of standalone enterprise applications and would involve enhancing the IT infrastructure spend.

Guidance

- Identify an intelligent asset-driven road map for your manufacturing setup, and ensure that the underlying communication links are aligned to provide relevant data inputs and insights in real time.
- Create an application and vendor map across the organization while plotting them against their annual maintenance spend to prioritize the consolidation and integration efforts.
- Invest in stakeholder management for creating collaboration and data-sharing guidelines while ensuring an overall focus that aligns with Industry 4.0.

Prediction 7: By 2024, 60% of Manufacturers Will Participate in Distributed Supply Chain Network to Reduce the Risk of an Unplanned Disruption in Their Value Chain

While 2020 has bitten hard most manufacturers, it's also true that a few companies have still been able to experience revenue gains. For sure, this has probably a lot to do with their business sector not being hit as hard and of course also with the ability some companies had to transition toward digitally enabled business models. But there is an important element to remark, which is that operational performance really mattered. IDC's most recent *Supply Chain Survey* highlights that supply chain best-in-class companies declared on average to have coped better with COVID-19 disruptions and also experienced less uncertainty overall.

On top of that, the same survey highlights that many companies are looking at the benefits of collaboration not just inside their organization – for example, between supply chain and production departments – but also externally, with upstream suppliers and customers and with their business partners and logistic providers.

This extended collaboration enables companies to try and reach a much higher level of resiliency in their operational processes. In some way, we are witnessing the transformation of many supply chain models from linear, efficient, and "just in time" to networked, agile, and "just in case."

And when dealing with such complex and dynamic ecosystems, trust will be center place. In these uncertain times, suppliers need to make sure they are reliable and that they can provide business continuity. In fact, even in case of proven financial stability of suppliers, a thorough assessment is often made by their customers to reconsider their long-term market position as global supply chains evolve and change. Technology enabling transportation and logistics agility, as well as collaborative B2B networks, all powered by cybersecurity and blockchain, are certainly relevant to ensure supply chain resilience, coordination, information exchange and, ultimately, trust. If any company thought that it can just wait and see and postpone its DX investments, it is very wrong. In fact, DX enables the very capabilities that allow a company to survive or maybe even thrive in this new context.

Associated Drivers

- **The next normal** – Resilient business and operating models
- **Intelligence everywhere** – Data drives action
- **Customer engagement redefined** – Safe, secure, and sustainable digital experience

IT Impact

- Achieving trust in the ecosystem will mean sharing strategic goals among business partners, realizing the mutual interdependence and being open about that, while maintaining the strategic independence.
- IT will have to seek a way to enable – and maintain – effective information integration, in particular to manage who can access the data and for which purpose, and under which conditions, without excessive bureaucratic control.
- Security has a key role. Companies have to make sure they can trust the business partner to manage data well and to be compliant with the agreed policies with global regulations.

Guidance

- Ensure line-of-business cooperation to assess the needs and challenges ahead. Integration of supply chain and operational data with the business partners is not an initiative that can be carried by a single business unit.
- Consider the evolution of underlying cloud-based IoT platform's capabilities road map to guarantee the long-term viability of the ecosystem-led collaboration models.
- Establish a long-term collaboration strategy with key partners to guarantee the long-term creation of "security by design" measures, to make sure collaboration speed and momentum is not hampered by tight cybersecurity measures.

Prediction 8: By 2022, Due to COVID-19, 70% of Consumer-Facing Manufacturers Will Leverage New Direct-to-Consumer Channels, Producing Up to 15% More Profits, Improved Customer Satisfaction, and Business Resiliency

The concept of selling direct to consumer (DTC)/end customer has been a nascent one for manufacturing as a whole, with CPG companies forming the exception so far. DTC presents the opportunity to establish direct consumer/end-customer relationships and a deeper understanding of their behaviors, which leads to greater brand stewardship but, more importantly, informs strategic digital investments in operations, business model transformation, and distribution channel management. Consumers, meanwhile, receive personalized messages, offers, and customer service. And yet, pursuing this route has represented challenges, in part because of a well-established channel infrastructure and the reliance thereof, as well as the lack of DTC technology-enabled strategy.

According to IDC's 2020 *Supply Chain Survey*, 48% of manufacturers worldwide, as they think of the future of their supply chain, consider the lack of deep insight into our customers and consumers as a problematic issue if they don't manage to address it. As such, the DTC opportunity couldn't be more relevant today.

This has also become imminently obvious with the outbreak of COVID-19, which has shaken up the manufacturing industry from a supply and demand angle, and forced, overnight, the need to innovate and operate in unprecedented ways, including new ways of forecasting and fulfilling demand. IDC research shows that at the same time, the DTC business model has grown in popularity during these testing months, with both SMBs as well as long-established manufacturers looking into the global digital market to protect revenue and improve margins where possible, or even seizing the opportunity

to gain more market share over their competitors. IDC research undertaken in June 2020 shows cloud taking the digital commerce software market by storm over the past few years, with applications deployed in the public cloud now accounting for 56% of the entire market.

Again, CPG manufacturers stood out as seizing the DTC opportunity during the crisis. Most companies, with the exception of restaurants and food-service companies, had to suddenly ramp up production to meet unprecedented spikes in consumer demand. The situation was further complicated by the fact that channels were shaken up and by consumers' limitations to physically purchase products. Moving toward a DTC model, however, enabled manufacturers in this space to deliver unique and personalized commerce experiences and focus on removing friction from customer engagements, thus enabling them to effectively respond to market changes faster and operating in more agile ways.

To a certain extent DTC cannibalizes the channel, but more importantly, it removes a costly intermediation step and helps manufacturers retain more of their profits, while building more meaningful customer experiences and ensuring customer loyalty in the long term. This is particularly important during a time of agnostic consumers.

Associated Drivers

- **The next normal** – Resilient business and operating models
- **Intelligence everywhere** – Data drives action
- **Customer engagement redefined** – Safe, secure, and sustainable digital experience

IT Impact

- As part of building your DTC capabilities, you will need to consider the investment in software which opens up the channel to customers and allows your company to conduct sales online. Involve IT early in the selection of a cloud commerce platform.
- Digital commerce applications must focus on making the buying experience as seamless as possible, including the discovery, research, selection, checkout, fulfillment, and post-fulfillment stages.
- Data and analytics tools have become more critical than ever to accurately predict consumer behavior. Automation can ensure that the right data is processed immediately and reacted to appropriately.

Guidance

- Define a compelling D2C strategy and proposition that will compel consumers to purchase directly from you rather than from retailers or channel partners. This strategy needs to be complementary to your overall channel strategy, be sure not to cause channel conflict.
- Pilot DTC in one geography initially and with a streamlined offering. Find the right technology partners that can support you in rolling out your DTC strategy in various geographies and, as such, have the expertise of dealing with multiple languages, currencies, regulations, and other cultural nuances.
- Ensure you develop a data management strategy to maximize the use of your data and be able to leverage data to identify, map, and meet "next normal" consumer trends. Data is only useful to the extent that it can be harnessed to generate insights.

Prediction 9: By 2023, 30% of Manufacturers Will Enhance Their Shop Floor Digital Twin with Real-Time Signal Transponder Data, Leading to an 80% Reduction in Logistic Bottlenecks in Shop Floor and Storage Areas

The digital twin of a product or production line becomes a widely used tool in the manufacturing environment. It provides engineers and line builders with exact information about parameters, dimensions, possible interactions, and collisions with other counterparts. Then there is a digital twin of the process, which provides real-time information about the production process and technical and technology parameters. However, the missing element in such a digital twin is live information of the product/asset location. Many tracking technologies are being applied in shop floor and warehouse areas; however, most of them are single standalone solutions. Indoor tracking, in particular, has always been challenging due to the need to locate items precisely. To overcome the preciseness challenge, IDC recognizes the rise of importance of ultrawideband (UWB)-based real-time locating system (RTLS) in recent years.

The preciseness of object location in real time is considered a key enabler in work safety, production planning and management, and material handling automation. A significant role plays the digital integration platform providing scalability and a holistic picture of production and warehouse areas. Such a platform can be considered a "control tower," as it will interface various technologies and data resources, including the UWB RTLS and other factory tracking systems, such as GPS, radio frequency identification (RFID) readers, barcodes, and CCTVs. Most of the applications are addressing the internal logistics bottleneck management. However, IDC recognizes several of other use cases beyond a digital twin, such as electronic kanban, e-Ink tags, or RTLS signal-driven line feeding.

Having an asset construction data (3D model), process and product IoT, and RTLS data in place, the complete digital representative, a digital twin, of shop floor and warehouse environment can be created. Using 3rd Platform technology like IoT software, cloud and edge computing, and AI-driven simulations, the importance of RTLS data-enhanced digital twins is going to grow significantly over the coming three to five years. Needless to say, IDC observes the emerging trend of connecting RTLS data with the process digital twin across the industries, such as automotive (OEMs and tier suppliers), high tech, and machine building.

Associated Drivers

- **The next normal** – Resilient business and operating models
- **Intelligence everywhere** – Data drives action
- **Accelerated disruption** – Crisis, resilience, and opportunity

IT Impact

- A digital twin based on data provided through a cloud-based platform, that includes data from localization technology (e.g., UWB RTLS).
- Machine learning-based algorithm addressing in particular material route planning and bottleneck management.
- A convergence of OT represented by digital transponders (asset tags) and enterprise IT systems such as MES and ERP.

Guidance

- Enhance the digital twin of production environments with real-time location data of assets, transport devices, and material/products provided by RTLS technology.

- Look beyond bottleneck reduction use cases. There are numerous applications that can be adopted, such as in-production line feeding and material handling automation.
- Apply RTLS that provides data to real-time IoT platforms and subsequently to enterprise IT systems, such as the MES and ERP, to get a holistic picture of the shop floor situation.
- Utilize real-time predictive analytics to identify and manage logistics bottlenecks in production and storage areas.

Prediction 10: By 2024, 75% of Manufacturers Will Embed Quality Management Across the Value Chain, Including the Supply Chain and Field Service, Reducing Overall Cost of Quality by 25%

The requirements of quality management systems have evolved significantly over the past several years. Increased complexity within today's products and operating in a global business environment are driving companies to rethink the way they approach quality. The pressure to keep customers satisfied while reducing the overall cost of quality is a daunting task among discrete manufacturers today. Moreover, growing compliance and regulatory requirements add in concerns around safety, traceability, and auditing/reporting. On top of these ever-present challenges, the disruption caused by COVID-19 and the actions taken to ensure business continuity has led to potential quality issues to arise in the near and long term. Poor quality can have a far-reaching impact on the business if not properly prepared. As a result, manufacturers are looking to ingrain quality into the DNA of the business, embedding it across the value chain.

Most manufacturers today depend on a global network of suppliers to produce their offerings. However, this worldwide sourcing brings its own challenges that must be managed effectively, especially in regard to quality. Managing supplier quality must be more than just tracking KPIs such as on-time delivery or defect rates; it is about being alert and able to respond in real time to any issues that may arise. The critical capability successful manufacturers possess for superior supplier management is real-time visibility into supplier quality performance. As has become evident, disruption can occur at any moment, it will be resilient organizations that are best able to adapt and thrive in this type of environment. Another area that has a lot of room for improvement is field service and the impact on quality. If a technician replaces a part with a poor-quality component, it will just lead to more issues down the line. Extending quality out into the field is an often-overlooked aspect of enterprise quality management, but one that more manufacturers will embrace over the next few years.

Quantifying the cost to the business to ensure quality products is usually referred to as cost of quality (COQ). A general rule of thumb is that costs of quality in a successful company will be about 10-15% of revenue. Many organizations will have true quality-related costs as high as 15-20% of sales revenue, in extreme cases some going as high as 40%. The cost of quality is often underestimated across many different manufacturing subvertical industries. Unaccounted for costs are often derived from rework and nonconforming products released to the market, which in turn can be due to a lack of communication between corporate engineering and other important areas of the value chain such as operations, supply chain, and customer service. Ensuring compliant products while minimizing COQ expenditures should be the ultimate goal of any quality management program – embedding quality across the value chain is the best way to deliver true value to the business.

Associated Drivers

- **Intelligence everywhere** – Data drives action
- **Rethinking globalization** – Disruptions challenge resilience
- **Digital platform** – Ecosystems at scale

IT Impact

- IT will lead system standardization to eliminate and harmonize disparate point solutions for quality – reducing errors in quality information, while collecting it in real time, making quality an integral part of the manufacturing value chain.
- IT organizations will be charged with collecting, storing, and managing quality data across the enterprise.
- IT needs to focus on establishing updated security protocols, authentication, and threat detection technologies to secure the quality data as it becomes shared more internally and externally.

Guidance

- Build a digital platform to effectively manage the ever-increasing amount of quality data that is available to manufacturers today.
- Think beyond the shop floor. Suppliers need to be viewed as strategic partners to quality management, especially as disruption causes adjustments in the supply chain.
- Utilize analytics to perform trending analysis on quality data for further continuous improvement and improved decision making.

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 the adoption of new technologies and, more importantly, your ability to translate those technologies into digital transformation. You will probably move more quickly with some technologies, such as IoT and machine learning, but make sure you're experimenting with all of the technologies we identify as innovation accelerators.
- **Don't just have technology for technology's sake.** While most of the prediction 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.
- **Cultivate 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.
- **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.
- **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.

- **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

Accelerated Disruption – Crisis, Resilience, and Opportunity

Description

The pandemic has redefined disruption. Survival of the fittest is linked not to size or strength but to resilience and the ability to change – to move quickly, adapt, seize opportunities, and be ready for the next disruption. Uncertainty in economic norms, political stability, climate effects, and disruptive innovations can't be ignored, but these challenges have been overshadowed by the immediate impacts of the global pandemic. A sense of urgency pervades companies. Distressed businesses are having to make rapid pivots toward new models and viable markets or quickly adjust their supply chains. The immediate imperative is to manage costs, balanced with strategic investment. Now is not the time to sit back and wait but rather to make bold strategic bets that increase the organization's resilience, to keep pace with business change by increasing the speed of business operations and innovation. Past economic crises have proven to be inflection points for organizations that later thrive during the next positive cycle.

Context

In IDC's worldwide *COVID-19 Impact Survey*, 73% of organizations reported that current transformation projects will be reevaluated to deliver more efficiency and ROI and 60% reported that they will focus their organizations on new business and operating models. Worldwide IT spending is now expected to decline 5.1% in constant currency terms this year to \$2.25 trillion. Organizations are expecting the slowdown and recession phases to last into 2021. At the same time, "Seize advantage in a downturn" was a winning strategy after the last economic crisis. Intel's profits soared in 2010 because it continued to invest and release its next-generation chips in 2009. Amazon experienced 28% sales growth, and Lego increased profits by 63%.

The Next Normal – Resilient Business and Operating Models

Description

In the post-COVID-19 economy, expected changes in behavior, consumption, and supply will force companies to adopt digital-led business and operating models that can survive lockdowns, movement restrictions, social distancing, supply disruptions, and more. New realities and customer expectations will redefine product and service expectations. Economies of scale will be challenged by the need for mass customization and social distancing. Products, services, and relationships shift from face-to-face to digital. Work from home, scalability, security, throughput, and redefining internal processes for remote access and communications require immediate attention but will have lasting effects. Resiliency in supply will be balanced against efficiencies as automations are applied to operations. Adaptability will take greater importance in business and operating strategies. Leading organizations will not only adapt to shifting customer needs and market conditions but also proactively shape the needs and the market to match their strengths, innovations, and business models.

Context

COVID-19 has acted as an accelerant to shifting consumer preferences and business models. Global retail 2020 growth estimates will be halved from pre-COVID-19 forecasts. Retailers are responding with alternative delivery methods and more digital touch points across the shopping experience. Work from home is the new normal for knowledge workers, while worker safety takes on new importance. In education, there is a shift in "when" and "where" learning happens, bringing into question some of the fundamental assumptions that underpin the traditional four-year college degree model.

Intelligence Everywhere – Data Drives Action

Description

The real-time continuum of applications and data that stretches from edge to network and core from IoT, mobile devices, and more – combined with historical data, enterprise systems, and global information – continually "sense" an environment and put it into new contexts. AI and machine learning "compute" and spread intelligence to turn data into "action" and action into value. Automation literally extends beyond autonomous operations, resilient decision making, and optimization into life-and-death dependencies. Generating actionable insight is increasingly dynamic and complex. But as automation and augmentation increase, so do the ethical issues and opportunities for misuse, surveillance, invasions of privacy, and more. Competitiveness is determined by the ethical governance of data and AI; how data is transformed into insight to create high-value differentiators for products, customers, and markets; and how effectively organizations deliver meaningful, value-added learning, predictions, and actions that improve engagement, processes, enterprise decision making, resilience, and much more.

Context

In this world where data drives action, ensuring the veracity of the data and transforming data into insights become a strategic imperative. But it is not just having more data that matters. Based on IDC's Global DataSphere study, less than 3% of the data currently created is analyzed to affect enterprise intelligence. What becomes essential is: first, to put data into context to provide meaning; next, to understand it in relationship to other data and events to gain knowledge; and finally, to add judgement and action to achieve insight and the full potential of value realization.

Rethinking Globalization – Disruptions Challenge Resilience

Description

Globalization, already suffering from trade wars and the aftereffects of the financial crisis, has been dealt another blow from COVID-19. The world economy is at a critical inflection point in which fears about dependence on others are creating a move toward self-reliance. Countries argue, threaten punitive actions, and talk about strategic autonomy. The flow of people, trade, and capital has slowed from interruptions in both supply and demand. Supply chains are disrupted and misused. Policymakers and business leaders are now questioning whether globalization of trade and labor has been stretched too far. With both the costs and risks of global operations shifting, companies need to decide where to compete along the value chain, consider new service offerings, evaluate hybrid supply chains, and reassess their geographic footprint. Reactions to globalization – both pro and con – will continue to present businesses with uncertainty, challenge, and opportunity.

Context

For the past four decades, globalization of both supply and demand has been one of the world's most powerful drivers. Global trade increased from less than 40% of the world's GDP in 1980 to over 60% in 2019. The impact of COVID-19 on global supply chains has been profound. In the past, disruptions have tended to be regional, and while the initial reaction to those disruptions has been replete with urgency to change existing practices, all too often that urgency passes with time and the resumption of normalcy. Based on IDC's 2020 Supply Chain Survey, 85% of the companies surveyed said that COVID-19 was either already having or was expected to have a major impact on their supply chain in 2020. Agility and speed to market are becoming critical elements of competitive performance, and many companies are exploring a better balance between globalization and localization for improved supply chain resilience and coordination.

Digital Platform – Ecosystems at Scale

Description

Understanding and provisioning the platforms that will sustain, advance, and scale business and operations and exert strategic control are essential for every business. A digital platform is the assembly of technologies, capabilities, and data upon which digitally enabled businesses run. The data exchanges, intelligence, and network effect within digital ecosystems generate new value beyond the platform itself. Leading organizations today are harnessing the pervasive internet connectivity in the hands of billions of users, combined with massive data and unlimited processing, to power their digital platforms. For users and competitors, the value of digital platforms introduces high switching costs and barriers to entry that cannot be easily replicated through the introduction of new products and services alone.

Context

The digital economy has spread rapidly throughout the world. Leading organizations are shifting to digital platform thinking to evolve their business models and manage their technology architecture. Platform thinking is a fundamental shift in business strategy – moving beyond product differentiation and pricing toward ecosystem-based value creation. It is also a long-term, sustainable response to new realities in the digital economy, one in which organizations transform themselves into digital-native enterprises.

Customer Engagement Redefined – Safe, Secure, and Sustainable Digital Experience

Description

The COVID-19 pandemic has focused what customers care about and shifted how consumers and brands engage and interact. Companies with the best price, coolest product, or most memorable marketing campaign will not necessarily have an advantage compared with companies that provide a safe, secured, and seamless experience. Customers also care about the safety and security of employees, how customer data is collected and used, and a company's environmental and social justice efforts. As a result, companies need to understand the different contextual expectations of their customers – whether they are students, patients, consumers, or businesses – and shift how they engage and support their customers in this emerging reality to create experiences that are empathetic, personal, compelling, and relevant today.

Context

Customers have made the contextual experiences they receive from a brand a crucial aspect of any engagement across the customer journey. Complicating that are the shifting nature of customer expectations, the proliferation of interaction channels, and the adoption of more capable and ever more robust consumer technologies. New business, operational, and organizational models built on a foundation of technology are required to meet the evolving and dynamic nature of customer expectations. It's critical for organizations to create a contextual and empathetic relationship with their customers, focusing on understanding the customer, what they want, and how they want to be treated.

Work Transformation – Redefining Teams, Skills, and Leadership

Description

Technologies are rapidly changing who or what – and where or how – work is being done. The 21st century economy requires workers to operate as agile, dynamic, and reconfigurable teams that can quickly adapt to business demands and new market requirements. The fallout of the pandemic will accelerate digital transformation and automation across a range of industries and sectors. Beside the shift to work from home, new models will emerge in fabrication/assembly, patient/citizen care, and warehousing/transport, changing the work experience, environments, and definition of digital work. Organizations need to rethink their relationship with workers and the creation and retention of skills to meet this demand. The key to turning talent limitations into talent as a competitive advantage lies in recognizing the fundamental shifts toward employee experience, new collaborative leadership styles, and employees as lifelong learners.

Context

In IDC's recent *Future of Work Survey*, over 50% of respondents indicated that they found it very or extremely hard to recruit top talent with needed technical and critical skills. These "digital skills" include both short half-life technical skills and difficult-to-master human skills including critical thinking, collaboration, creative thinking, and communication. According to the World Economic Forum, the challenge to find top talent is only going to become more pressing. The COVID-19 pandemic will undoubtedly have a dampening effect; however, it will also serve as a forcing function to accelerate the adoption of digital skills and the need for new leadership capabilities.

LEARN MORE

Related Research

- *Critical External Drivers Shaping Global IT and Business Planning, 2021* (IDC #US46859220, October 2020)
- *IDC MarketScape: Worldwide Manufacturing Intelligence Transformation 2020 Vendor Assessment* (IDC #US46844820, September 2020)
- *IDC MarketScape: Worldwide Manufacturing Intelligence Transformation Strategic Consulting 2020 Vendor Assessment* (IDC #US46844920, September 2020)
- *IDC Perspective: Shifting Away from Degrees to Skills to Close the Industrial Talent Gap* (IDC #US46728621, September 2020)
- *Ensuring Safe and Efficient Operational Restarts in Manufacturing* (IDC #US46646920, July 2020)
- *Making the Case for Machine Learning in Manufacturing* (IDC #US46179220, April 2020)

- *Asset-Oriented Manufacturing Value Chain 2019 Investment Guide* (IDC #US45794920, January 2020)
- *Brand-Oriented Manufacturing Value Chain 2019 Investment Guide* (IDC #US45795020, January 2020)
- *Engineering-Oriented Manufacturing Value Chain 2019 Investment Guide* (IDC #US45795120, January 2020)
- *Technology-Oriented Manufacturing Value Chain 2019 Investment Guide* (IDC #US45795220, January 2020)

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