

EVOLUTION: REVOLUTION

*BUILDING THE SUPPLY
CHAINS OF TOMORROW*

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“Supply chain leaders have never been in a better position to drive impactful and lasting change for the industry. With the white-hot media spotlight chronicling the after-effects of the pandemic, the importance of supply chain is finally coming into focus in boardrooms across the world ”

- John Paxton, CEO of MHI

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INTRODUCTION

The frailties of today’s supply chains have become a burning issue for everyone from CSCOs and boards to everyday consumers. Thanks to a perfect storm of global supply-related issues, supply chain disruptions are now a topic of daily conversation. Meanwhile, news stories are throwing fuel on the fire by repeatedly calling attention to widespread supply shortages in everything from computer chips to groceries.

Long misunderstood and taken for granted, supply chains are now being dissected, analyzed and explained in ways that make them both more understandable and more intensely scrutinized.

Last year’s report focused on the supply chain vulnerabilities that were exposed by the global pandemic and the resilience that innovation adoption can provide. This year, we challenge business and supply chain leaders to benefit from those insights by embracing groundbreaking innovations that can revolutionize how supply chains operate – enabling future supply chains to thrive in the face of inevitable disruptions. “Supply chain has now become a conversation around the dinner table of the average household” observes Terry L. Esper, Ph.D., from the Fisher College of Business at The Ohio State University. As leaders, it’s time to take advantage of the new awareness and create a bold path for the future.

SPURRED INTO ACTION

According to a Wall Street Journal report¹, there were 2.2 million mentions of the term “supply chain” on Twitter in the fourth quarter of 2021, five times more than in any quarter of 2019 (before the pandemic turned supply shortages and port congestion into



say that the pandemic has altered the strategic importance of supply chain operations

headline news). Also, this year’s survey shows that nearly every major company in every major industry is predicting supply chain bottlenecks or constraints for at least the next two years.

These global supply chain challenges are being cited as significant contributors to inflation and other supply-demand imbalances. With businesses reporting record lead times² and consumers complaining about missed orders, clearly, improvement in supply chain performance will be key to economic recovery.

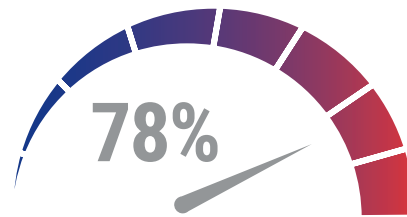
In fact, virtually all industries now view supply chain as strategically important – with more than 87% of this year’s survey respondents stating that the pandemic has elevated the strategic importance of their supply chains.

Over the past eight years, MHI has been tracking the adoption of eleven innovations and digital

technologies that have been expected to change the supply chain industry. And every year, the observed pace of adoption has generally been lower than expected. Until now.

What’s different this year is that business and supply chain leaders are hearing the public outcry for revolutionary change. In fact, 78% of this year’s respondents acknowledge that ongoing global disruptions have accelerated the pace of digital transformation in supply chain.

In response to the rising visibility and strategic importance of supply chains, the large majority of respondents (64%) say their organizations’ investments in supply chain innovation are increasing (Figure 1).



say supply chain transformation has accelerated due to the pandemic

The innovations and leading technologies MHI has been tracking for the past eight years are now being recognized as the answers to help supply chains address their biggest challenges. And now that all the forces are aligned, it’s time for companies to make smart investments in the revolutionary changes necessary to create the supply chains of tomorrow.

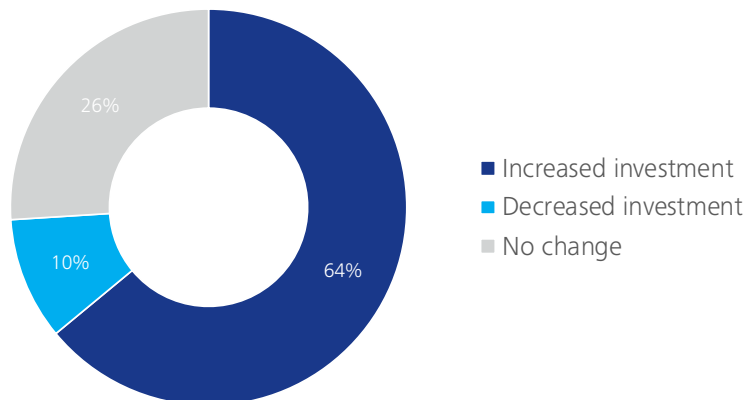


Figure 1: Survey result - Investments in supply chain innovations due to global disruptions

5G ENABLED SMART WAREHOUSE

SITUATION

The US Department of Defense (DoD) launched its "5G-to-Next G" program to accelerate implementation of advanced wireless communications applications across its operations. The program includes the 5G Smart Warehouse project, which aims to improve warehouse operations using advanced 5G-enabled technologies. These smart warehouse technologies will increase the efficiency, accuracy, security, and safety of material and supply handling, management, storage, and distribution.

Deloitte Consulting was selected to manage the first phase of the initiative, working with key technology partners to successfully demonstrate a comprehensive suite of smart warehouse applications operating on a 5G network (and to highlight the numerous resulting benefits). Key focus areas included predictive analytics and visualization, and warehouse space optimization.

ACTIONS

The vision was to enable digitization, automation, and optimization of warehouse functions. The team used a systems engineering approach to design the prototypes. It also relied on recognized open-industry standards and interfaces for all integrations.

Although some leading technologies work on Wi-Fi today, 5G extends next-level communications capabilities across the entire supply chain – from inside the four walls of a warehouse to far beyond those four walls.

RESULT

The initiative built a groundbreaking 5G network in a live functional warehouse, using it to demonstrate technologies that benefit from the power of 5G connectivity, including:

- Warehouse automation featuring robots that collaborate on tasks using machine-to machine communication enabled by 5G's sub 15 msec latency
- Perpetual autonomous audits using high-precision indoor location mapping and battery-



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less cellular Bluetooth technology to enable digital tracking tags on high value assets and every item in inventory

- Augmented reality to improve the experience of warehouse workers and streamline shop floor operations
- High throughput data transfer (e.g., high quality streaming video to perform biometric identification of people for access control purposes)
- Computer vision and artificial intelligence to train robots to interpret visual cues, identify and classify objects, and collaborate with human workers and other computers

ECOSYSTEM OF AUTOMATION WITHIN THE WAREHOUSE

SITUATION

DHL Supply Chain is well known as a leader in innovation and operates more than 450 warehouse facilities in North America, ranging in size from fifty thousand square feet to over a million square feet – and serving an equally broad variety of client types. To effectively serve this diverse client portfolio, DHL must be able to adapt and customize its operations to fit a customer's unique needs and products. Also, as a large third-party logistics provider, DHL is highly susceptible to the workforce shortage that has plagued the supply chain industry for years and needed to get ahead of the looming workforce issues.

ACTIONS

As part of DHL's Accelerated Digitalization agenda, the company has invested over \$300 million in developing and scaling innovative solutions for new technologies. The most recent being a \$15 million investment to further automate warehousing in North America via collaboration with the global leader in mobile robotics, Boston Dynamics.

DHL and Boston Dynamics signed a multi-year agreement that begins with equipping DHL facilities with Stretch, Boston Dynamics' newest robot to automate the unloading process in distribution centers. Boston Dynamics will deliver a fleet of Stretch robots to multiple DHL warehouses throughout North America over the next three years.

Stretch will tackle several box-moving tasks in the warehouse, beginning with truck unloading at select DHL facilities. Stretch is equipped with a compact, omni-directional mobile base, custom-designed lightweight arm as well as a smart gripper with advanced sensing and controls that can handle a large variety of box types and sizes. It also includes Boston Dynamics' computer vision technology, which enables it to identify boxes easily and without any pre-programming. "What we like about these technologies, is that they work within the existing infrastructure," says Adrian Kumar, Global Head of Operations Science & Analytics at DHL Supply Chain. Stretch is capable of working autonomously



courtesy of Boston Dynamics

through complex situations like disordered stacking configurations and recovering fallen boxes.

RESULT

Following the first deployment, the multi-purpose mobile robot will handle additional tasks to support other parts of the warehouse workflow, which will effectively automate warehouse operations. This latest investment in technology follows DHL's commitment to Accelerated Digitalization, which has already seen numerous successful deployments of technology across the supply chain. Other recent examples include autonomous forklifts, autonomous trailer offloading, autonomous robot replenishment and putaway, autonomous robot pickcarts and more.

DHL's Accelerated Digitization agenda has delivered a wide range of significant operational improvements. However, the single biggest improvement has been enhancing the company's workforce by automating dangerous and repetitive tasks that prospective employees find unappealing. DHL's digitization deployments have produced near-perfect employee satisfaction surveys with the technologies, a 50 - 100% increase in warehouse labor productivity, and a 30% increase in facility throughput.



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SURVEY HIGHLIGHTS

MHI and Deloitte Consulting LLP surveyed more than 1,000 supply chain and manufacturing leaders to learn how they are responding to the global pandemic – and how they are transforming their supply chains to become more resilient through adoption of the following digital technologies:

- Internet of Things
- Cloud Computing & Storage
- Sensors & Automatic Identification
- Blockchain
- Robotics & Automation
- Wearable & Mobile Technology
- Driverless Vehicles & Drones
- 3D Printing
- Predictive Analytics
- Inventory & Network Optimization
- Artificial Intelligence

Survey respondents represent a broad cross-section of manufacturing, distribution and supply chain operations both large and small. Five percent of companies in the survey have annual revenues in excess of \$10 billion, and thirteen percent have annual revenues of at least \$1 billion. Fifty-six percent of respondents hold the title of C-suite, Vice President, Director, or General Manager of their supply chain.

KEY SURVEY FINDINGS

Expected investment levels in supply chain innovation over the next two years are rising sharply. Of the 64% of respondents increasing investments, 66% say they will spend more than \$1 million over the next two years. Investments are particularly growing in the middle ranges from \$5 million up to \$100 million - 18% say they will spend more than \$10 million, where 41% say they spend more than \$5 million and 18% say they will spend more than \$10 million. (Figure 2).

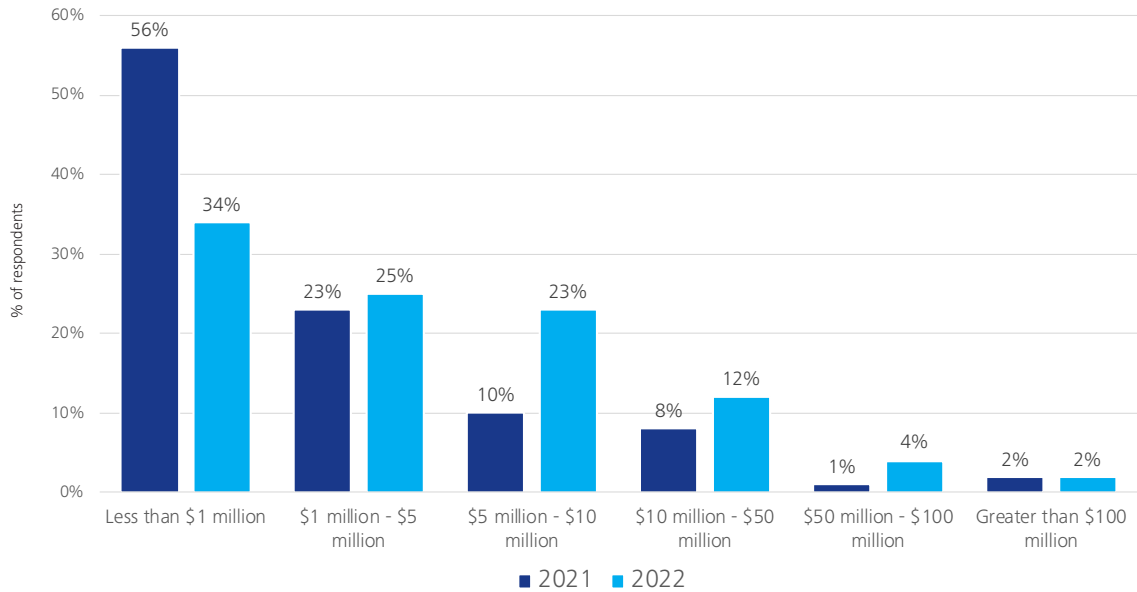


Figure 2: Survey result – Comparison of investment estimates in supply chain innovations over the next two years

As noted earlier, 78% of respondents attribute at least some of their increased spending on supply chain innovations to COVID-19 disruptions.

ADOPTION RATES

All technologies covered by the survey are expected to achieve an adoption rate of 66% or higher over the next five years (Figure 3). Cloud computing, which is now the standard platform for most supply chain software, continues to have the highest current adoption rate at 40%. Inventory and network

optimization is expected to rise to the top over the next five years, with an expected adoption rate of 87% (in a statistical tie with cloud computing at 86%). However, artificial intelligence is expected to see the most accelerated growth – rising from 15% to 73% over the next five years, a nearly five-fold increase.

TOP CHALLENGES

For the past nine years of the survey, hiring and retaining qualified workers was consistently the

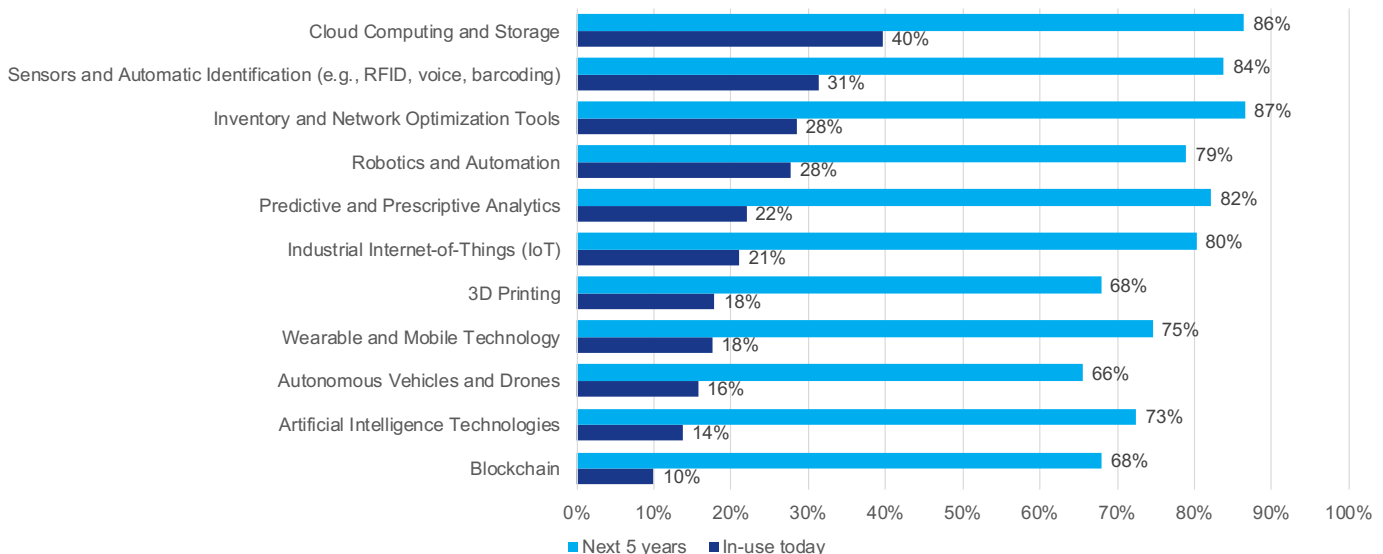


Figure 3: Survey result – 2022 Adoption rates of supply chain innovations and technologies

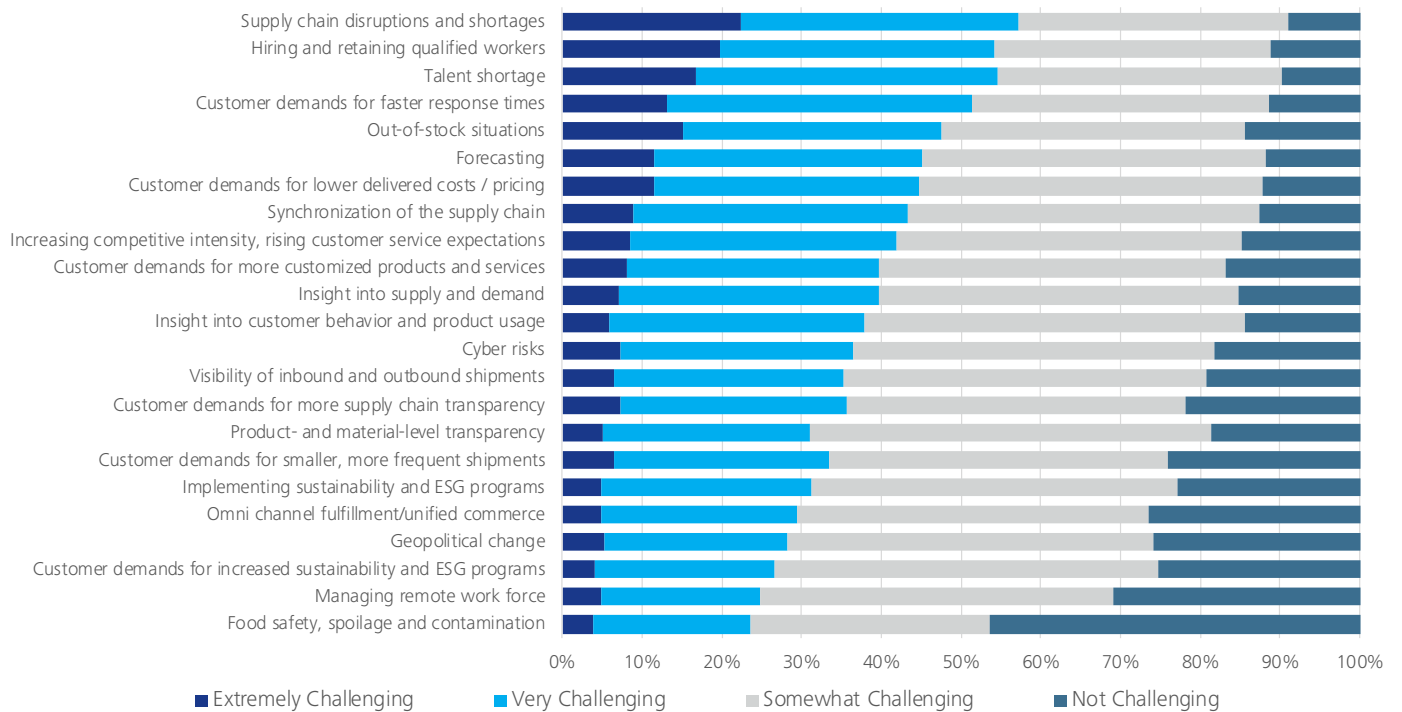


Figure 4: Survey result – Company challenges in the supply chain

top supply chain challenge. However, in this year’s survey supply chain disruptions and shortages rose to the top – presumably due to the ongoing effects of the global pandemic (Figure 4). Talent issues and customer demands remain top challenges, but must now be addressed in the context of avoiding future supply chain disruptions.

POTENTIAL ADVANTAGES

Robotics and automation continue to top the list of innovations that survey respondents believe have

either the potential to disrupt the industry (17%) or to create competitive advantage (39%). However, a handful of other technologies are very close behind, including: predictive and prescriptive analytics; sensors and automatic identification; autonomous vehicles and drones; and AI technologies. 3D printing is at the bottom of the list; however, even that technology is seen as having significant potential for disruption (6%) or competitive advantage (23%) (Figure 5).

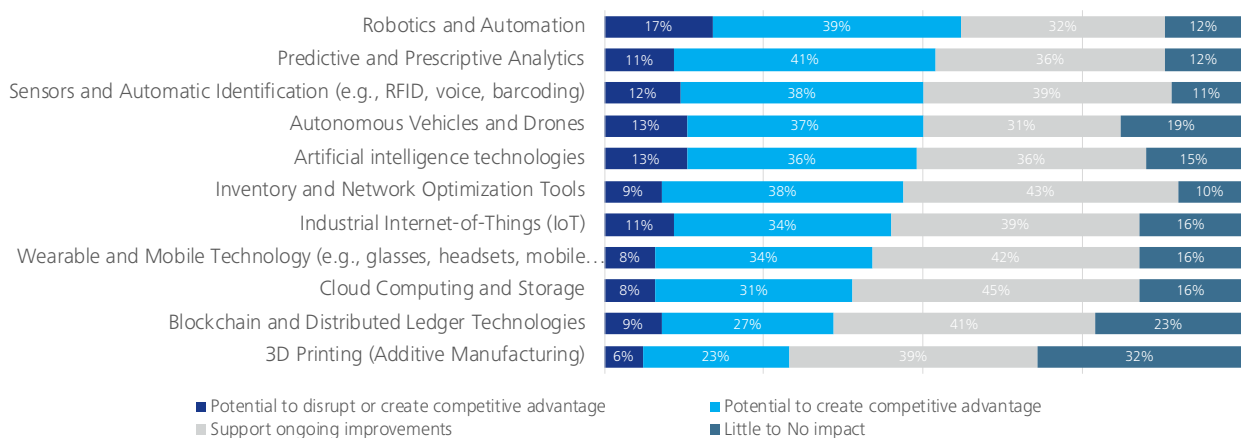


Figure 5: Survey result – Impact of technologies on supply chain



“Leading companies are applying the concept of ‘Digital Twins,’ long used to simulate finite manufacturing operations, to build digital models of entire supply chain networks and ecosystems. These digital supply chain twins can be used like gaming platforms to simulate and evaluate short- and long-term structural and strategic moves – helping companies increase resiliency and navigate future uncertainty.”

- Thomas Boykin, Deloitte Consulting LLP

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DIGITAL SUPPLY CHAIN SIMULATION AND INSIGHTS

Supply chains have experienced unprecedented challenges and disruptions over the past two years, including supply shortages and blockages, erratic consumer demand, port congestion, and political posturing – just to name a few. Before the pandemic, most supply chain issues could be adequately addressed through solid leadership and experience-based judgment. However, the complex and sweeping challenges unearthed by COVID have supply chain leaders searching for new and innovative solutions – creating the need for faster and deeper operational analysis through simulation.

WHAT IS SUPPLY CHAIN SIMULATION?

A digital twin is a virtual model of a physical product,

process, or ecosystem. Digital twins enable the simulation of individual supply chain elements such as factories and warehouses – as well as entire supply chains and ecosystems – making it possible to analyze and optimize operations and test potential solutions in the virtual world at digital speed. The advantages? Pro-active identification of problems before they occur. Faster and cheaper development and testing of new solutions – with less risk and disruption to existing operations. And, ultimately, dramatically improved supply chain performance and efficiency with less failure and downtime.

WHY IS IT IMPORTANT?

In a supply chain environment characterized by

mounting complexity and volatility in all phases – including ever-increasing expectations from customers and constantly shifting demand – even relatively simple optimization problems involve so many combinations and variables that traditional approaches such as Excel spreadsheets, brute force, and gut feel are no longer adequate.

Supply chain simulation using digital twins is the next major advance in how companies can make the most of their existing analytics tools and data. Key capabilities include:

- Creating experiments to test potential software changes prior to implementation
- Running through multiple experiments in just minutes, and then automatically ranking the results – enabling rapid and well-informed decisions
- Identifying optimal scenarios that might have otherwise been overlooked or undervalued
- Comparing labor plans using real data sets to accurately predict productivity impacts

A common problem that organizations face when making any major system or process upgrade is resistance to change. No organization wants to feel like a guinea pig with its critical business operations on the line. Digital twins produce hard data with visual process representations that are compelling and easy to understand. This enables decision-makers to analyze operations and test potential solutions in the virtual world before committing to real-world action. They can see what is likely to work best for their organization's needs, and then make fully informed, forward-looking decisions – with a data trail to back up their decision-making process.

The digital model is fast becoming the predominant model for supply chain management, with more than 75% of our survey respondents predicting it will dominate the market by 2027. Digital twin simulations give supply chain leaders a data-driven way to evaluate different solutions and rapidly prototype multiple designs to identify the best choice for their organization, helping them maximize supply chain performance and optimize direct capital expenditures.

As noted earlier, 2020 and 2021 saw significant and unpredictable disruptions to many organizations' supply chains, revealing friction points that need to be addressed. Many of the most serious concerns can be resolved through the use of digital twin solutions. Running a range of simulations provides actionable data that can be used to harden organizations against the effects of high-, medium- and low-probability disruptions. For challenges such as forecasting, inbound and outbound shipment visibility, and supply chain disruptions and shortages, digital twins can give business leaders a playbook for decision-making that enables more informed and data-driven choices in a much shorter time frame.

Digital twins can also help supply chain organizations address the talent shortage (which has been an ongoing pain point) by simulating human workers in a way that generates actionable ideas for individualized training, enhanced workflows, and an improved understanding of what drives employee job satisfaction³. In addition, digital twin simulations can provide a more precise understanding of demand variability, enabling rapid changes to staffing levels in order to prevent situations where a particular shift of employees is overwhelmed or underutilized. Key indicators in a digital twin can also identify workers who are likely to be receptive to competing job offers and suggest cost-effective ways to retain them⁴.

TAKING THE GUESSWORK OUT OF DIGITAL TRANSFORMATION

Digital twin simulations can provide insight and data-driven suggestions that take the guesswork out of digital warehouse transformation. For example, more than 60% of our survey respondents expect improved space utilization and automation to be critical to supply chain success over the next five years. Twinning a distribution center allows multiple configurations and systems to be rapidly prototyped and tested, helping to identify the type and level of automation that is optimal for an organization's needs and that uses space most efficiently. It can also simulate unexpected and seasonal peaks in demand and then provide insight on how to handle them.

PREDICTING OPERATIONS THROUGH DIGITAL TWIN ANALYTICS

SITUATION

Euro Car Parts (ECP), a UK subsidiary of LKQ Company, had just built a national distribution center with more than a million square feet of space (including a mezzanine floor and dedicated office area). However, before investing in a full design and layout for the highly automated warehouse, company leaders wanted to see a full-scale business case analyzing resource requirements, probable performance, and any potential issues that might affect efficiency. They also wanted to test different layout options against a variety of scenarios without disrupting existing customer fulfillment activities or incurring the considerable cost and risk of unexpected post-build errors and rework.



courtesy of ECP

ACTIONS

ECP purchased a license for CLASS, a warehouse simulation and modelling tool. A CLASS consulting team was then hired to simulate a baseline operating model capable of running at the forecasted demand volumes. The model was used to identify the optimal design for meeting ECP's business goals, including critical performance issues and pain points such as the required number of decant stations and the number of dock doors necessary to effectively process returns. Later, the model was turned over to ECP's experienced logistics management team, enabling them to continue using CLASS to identify best practices.

RESULT

ECP's management team used the completed model to identify and address potential issues that might arise as demand increases. Specific improvements included: removing potential congestion points between very narrow-aisle and wide-aisle picking, and optimizing the design to meet material handling equipment requirements. Also, using visual twins to create direct scale models of pallet and container packing procedures, ECP was able to generate high-

quality instruction sheets that helped warehouse staff see exactly how particular types and sizes of pallets should be packed.

A key additional benefit of the initiative was reducing people's reluctance to embrace new technology. Having a visual representation of how a new process functions – combined with a clear explanation of the associated efficiency improvements – made it much easier to get stakeholders on board.

In addition, ownership of a CLASS license allowed ECP to create its own simulation of a second distribution center and make improvements to the center's operational efficiency. Following the success of the initial simulation program, LKQ Europe implemented a significant digital twin project for its German subsidiary, PV Automotive. And in the US, Keystone Automation, which is part of the company's Specialty Business Segment, is now using CLASS to optimize its operations.

VALUE OF DATA

“Data is the first step in the evolution of insight - first comes data, then with proper context comes information, further, through analytics comes knowledge, insight and finally action. The full value of data is only realized when it results in enlightened action.”

- Thomas Boykin, Deloitte Consulting LLP

In an increasingly digital world, data is a priceless asset – particularly when it comes to avoiding and addressing supply chain disruptions. However, a supply chain organization’s ability to harness the power of data is only as good as its visibility into the data being generated and used across its ecosystem.

Achieving the desired level of visibility starts with identifying all stakeholders in the ecosystem and what information they are generating – and what information they need in order to operate effectively

and address internal and external vulnerabilities. Identifying the critical pieces of information for each stakeholder will help increase the transparency and resiliency of an organization’s supply chain.

According to this year’s survey, customer and internal corporate data continue to be the predominant information sources for supply chains. Internal corporate data includes data such as inventory levels and distribution costs (Figure 6).

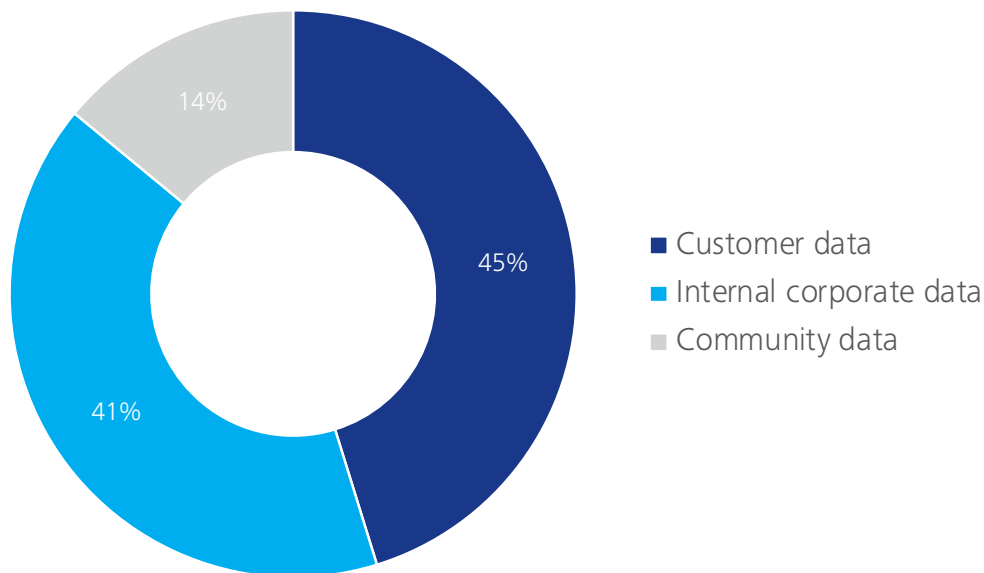


Figure 6: Survey result – Data sources for improving supply chain visibility



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Customer data includes data such as demand patterns and service level requirements. Both types of data are commonly used for supply chain processes such as sales and operations planning, and are a good starting point for advanced analytics. However, those traditional data sources are no longer sufficient for optimizing supply chain operations and avoiding disruptions.

The complexities and uncertainties associated with the global pandemic and other recent global crises have underscored the critical need for supply chains to harness a broader array of external data types, including data about weather, public health, political trends, tariffs, consumer behavior, traffic, and geopolitical conflict. Based on the results of this year's survey, it appears that nearly a quarter of companies (22%) are already incorporating new and

SUPPLY CHAIN SUSTAINABILITY AND ESG

Throughout the pandemic, a seemingly endless series of natural disasters and extreme weather events have affected supply chains and shined a spotlight on Environmental, Social and Governance (ESG) reporting. The interplay between ESG metrics and an organization's performance can be considerable, with factors such as environmental pollution, geopolitics, and corruption or bribery seriously affecting operations and potentially triggering disruptions. For example, given the rising importance of public perceptions related to ESG, if a company breaches public trust, the resulting media coverage can undermine sales and make it hard to attract talent. A responsible and purposeful approach to ESG that embraces the needs of all stakeholders can make a supply chain more robust and less vulnerable to ESG risk.

Even a relatively small and focused effort to improve an organization's contribution to society, such as investing in a more environmentally friendly water treatment process, can have significant and lasting impacts on local communities and economies. Also, increasing supply chain transparency, tracking ESG-related data more accurately, and taking a proactive and responsible approach to business can significantly improve a supply chain's sustainability. Similarly, adapting a collaborative and partner-oriented approach with suppliers can have many ESG benefits, including elevating visibility into supply chain emissions and fostering innovative practices that can reduce Greenhouse Gas (GHG) emissions. Improved GHG tracking can reduce emissions by leveraging the supply chain to link unrelated movements to optimize transportation and minimize disruptions.

Improving the links between supply chains requires expanding the traditional view of what constitutes a supply chain, which in turn requires communication, compromise, and flexibility. Creativity and innovation are key talent attributes that enable this new way of thinking, which is essential to creating optimized supply chains.

diverse external data sets (i.e., "community data") like these into their supply chain processes and systems.

This broader data view can help with production and capacity planning, demand forecasting, predictive analytics, and rerouting or repositioning of goods to avoid potential disruptions. It can also boost overall supply chain performance, reducing inventory levels, stockouts, and product obsolescence.

TRACKING INFORMATION ACROSS THE SUPPLY CHAIN USING BLOCKCHAIN

SITUATION

Pearls are nature's perfect gem: natural, renewable and sustainable. In fact, growing pearls actually enhances the ocean environment. These ESG benefits are helping to spur tremendous demand for pearl jewelry – particularly in light of the controversial mining and business practices surrounding diamonds and other gemstones that have traditionally had more cachet with jewelers and consumers.

Everledger is a digital transparency company that uses blockchain to track complex supply chains, including the supply chains for diamonds and other gemstones. Recently, however, the company began partnering with Pearls of Australia to track the pearl supply chain, using blockchain technology to provide the reliable origin and tracking data behind pearls' powerful sustainability story – a story that is particularly appealing to today's younger consumers.

Pearls are a uniquely sustainable gemstone that can help jewelers grow a sustainable business. But until now, pearl jewelry has been an underserved market. Pearls of Australia wanted to change consumer perceptions about pearls by providing detailed information about their authenticity and sustainability across the supply chain – helping jewelers learn more about pearls' sustainability story and then communicate it more effectively to consumers.

ACTIONS

Everledger harnessed the power of blockchain to record information for each individual pearl in a secure and immutable digital record. Similar to how nutrition facts are used today with food, the unique record follows each pearl from farm to consumer, providing an easily accessible view about important attributes such as the pearl's quality and associated ethically compliant practices.



courtesy of Everledger

RESULT

Using the Everledger platform, Pearls of Australia is successfully using blockchain technology to provide consumers with a holistic and trustworthy view of their pearls. The fashion world is fully embracing pearl jewelry this season, and pearls' data-supported sustainability story is only adding to their desirability. ESG attributes such as working conditions of the individuals supporting the pearl's value chain and carbon emissions associated with its production and transportation are embedded in each pearl's digital record. Tracking occurs at the product component level, enabling individual pearl tracking throughout the entire jewelry lifecycle, including disassembly and refabrication into new products.



"The supply chain has gone from an era of invisibility to being watched and scrutinized by the average consumer in the marketplace which changes the way supply chain has to work their processes."

*- Terry L. Esper, Ph.D., Fisher College of Business,
The Ohio State University*

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DIGITAL INVESTMENTS AND THE TALENT SHORTAGE

The talent shortage continues to be a huge problem for manufacturers and supply chains. However, it could ironically be a blessing in disguise – spurring companies to invest in innovations and technologies that not only reduce the need for manual labor, but also create the kind of advanced technology environment that today’s top talent finds appealing. This could provide a new path to upskilling current employees and attracting new talent – creating a more modern, capable workforce that can quickly adapt and adjust to changes in the technology and market landscape.

From a big picture perspective, investing in workforce development and modernization could help revive

and revolutionize the supply chain industry. It could also help the overall economy, restoring the US manufacturing base and driving factories and jobs back to parts of the country left out of the booming tech and financial industries. For every dollar spent in manufacturing, another \$2.74 is added to the economy⁵. And with warehouse jobs accounting for 20% of employment⁶, restoring growth and competitiveness in the industry could boost annual US GDP by more than 15%⁷.

The CBRE report cited industry studies that predict productivity gains of up to 46% in distribution centers that introduce automated or robotic technology⁶. These technologies enable informed decision-making

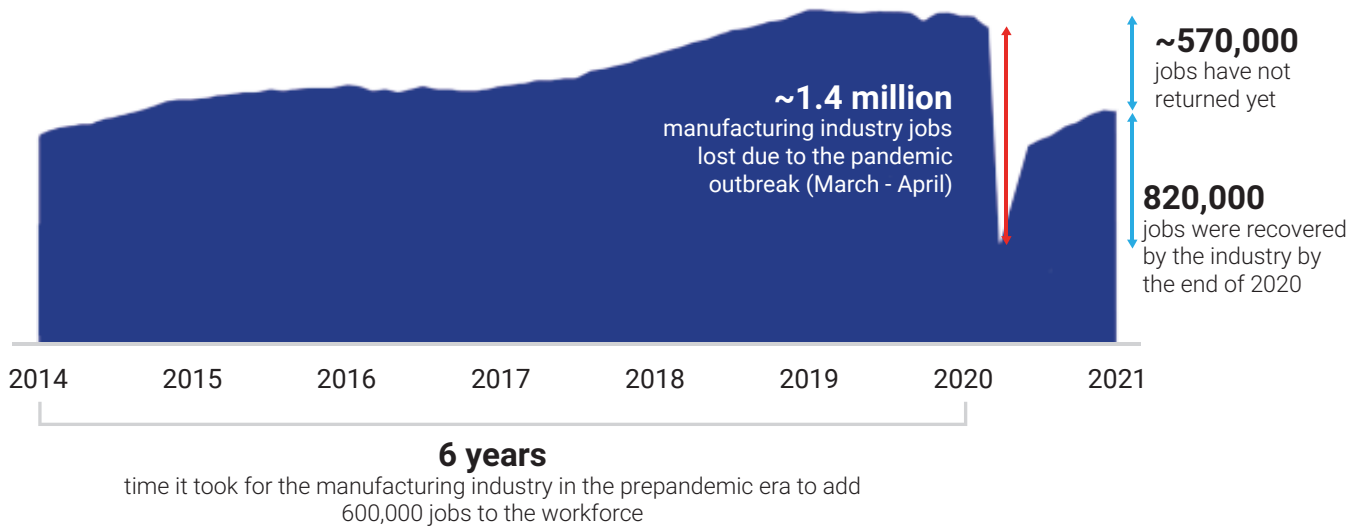


Figure 7: Manufacturing employment trends

in real time. However, the lack of skilled labor poses a challenge for Industry 4.0 transformations, forcing manufacturers to do more work with fewer people.

With more than half a million job openings currently available, manufacturers say it is 36% harder to find talent today than in 2018⁸. Similarly, this year’s survey results show that attracting and retaining a quality workforce remains one of the top business challenges for 2022. (Figure 5)

“We have a perception problem. People don’t know the jobs are here or that these are jobs they want⁸,” says Carolyn Lee, President of the Manufacturing Institute. The inability to fill these open positions could end up preventing the supply chain industry from evolving and growing into a long-term sustainable solution, ultimately costing the US economy \$1 trillion by 2030⁸.

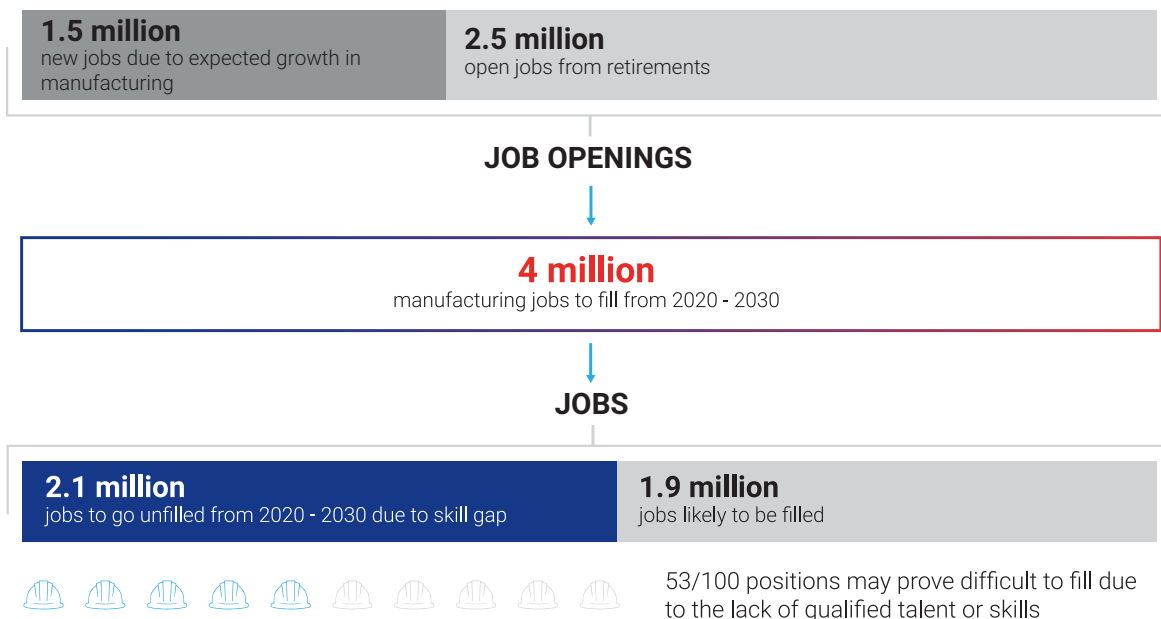


Figure 8: Manufacturing jobs in the US

According to Paul Wellener, Vice Chairman and US Industrial Products and Construction Leader at Deloitte Consulting LLP, “it is deeply concerning that at a time when jobs are in such high demand nationwide, the number of vacant entry-level manufacturing positions continues to grow⁸.” That statement is consistent with recent job figures, which shows that manufacturing job levels – which were already declining before COVID hit – are nowhere near recovering to their pre-pandemic levels (Figure 7).

In this challenging workforce environment, how can manufacturing and supply chain leaders change how talent perceives a career in their fields? “Research shows the next generation is looking for careers that matter,” says the Manufacturing Institute’s Carolyn Lee. “They want to have an impact, and they want the potential for family-supporting jobs with upward mobility, all of which are characteristics of modern manufacturing⁹.”

Leaders should create pathways to tomorrow’s jobs today by engaging with schools and communities through university partnerships and trade school funding, such as The Creators Wanted Tour established by the National Association of Manufacturers (NAM) and the Material Handling Institute.

Today’s students are graduating at an ideal time, with US manufacturers expected to need 4 million jobs filled by 2030⁸. Choosing a career in supply chain gives people an opportunity to discover themselves, and to experience a variety of job roles where they can grow and learn while developing a long-term, fulfilling career.

According to the Congressional Budget Office and Axios, the future workforce will continue to favor workers over employers, with the labor pool set to grow just 0.2% annually from 2024 to 2031⁹. Also, an analysis of the fastest-growing supply chain occupations over the next decade reveals that five of six require a skill set that spans human and technology aspects, but often does not require formal post-secondary education⁵.

As digital transformation in the supply chain industry continues to expand, the skills necessary for jobs in smart factories will likely be different than the skills needed today. However, today’s manufacturing workforce doesn’t possess many of those skills. And unless they can change the workforce’s skills composition, manufacturers could find up to 2.1 million jobs going unfilled between 2020 and 2030, impacting everything from production to innovation and competitiveness to GDP⁵ (Figure 8).

TAKING ACTION ON WORKFORCE

Supply chain organizations need a combined vision for technology and talent. The first step is to rethink how they manage their workforce.

- Take inventory of the skills and capabilities within the current workforce.
- Use the labor shortage as a catalyst to drive supply chain innovations that will attract young, diverse talent.
- Build a workforce management strategy that expands diversity in the talent pipeline, fosters an inclusive culture that will retain talent, and upskills the current workforce for tomorrow¹⁰.
- Design roles that include learning paths to continuously evolve skills and develop talent.
- Invest in advanced technologies that align with the desired talent criteria, along with related learning paths to effectively upskill and reskill workers.
- Use digital technologies – such as robotics and automation – to plug unfilled workforce gaps, not to replace employees’ jobs, with leaders primarily focusing on upskilling the workforce and understanding how to best use workers’ time⁵.

USING TECHNOLOGY TO ENABLE REMOTE FORKLIFT OPERATIONS

SITUATION

A leading logistics company was struggling to hire and retain forklift operators in their facilities. Their labor pool was restricted to local labor markets within commuting distance to their facilities. The company found that even as they continually increased wages and added pressure to their bottom line, they still were not able to attract and retain enough labor.

ACTIONS

The logistics company implemented Phantom Auto remotely-operated forklifts enabling employees to remotely operate forklifts from thousands of miles away. The company started by deploying remotely-operated forklifts in a 500,000 square foot facility located in a region with a relatively low population and a low labor participation rate. Remote operation helped to combat their labor shortage by expanding the potential labor pool to virtually anyone located anywhere with a solid internet connection. With Phantom's technology, these remote "digital drivers" can seamlessly teleport from one forklift to another with the click of a button, creating unprecedented opportunities for workforce allocation efficiencies across their nationwide facility network.

RESULT

By adopting a remote operation strategy, the company is projecting a 30% reduction in the total operating cost per forklift. At the same time, the company is reducing safety and health risks for their forklift operators and enhancing employee satisfaction by creating unprecedented opportunities to work remotely. Phantom-powered forklifts eliminated geographical restrictions to hiring, vastly expanding the labor pool and making jobs more accessible to a diverse group of individuals, including the geographically-isolated, digital natives, women (80%+ of forklift operators across the country are men), and people with physical impairments. Finally,



courtesy of Phantom Auto

remote operation increases operational efficiency and productivity by reducing operator and vehicle downtime. The company can use digital drivers to cover new shifts, and the digital drivers can eliminate walking time between forklifts by teleporting between vehicles in the facility. The same digital drivers can teleport between multiple facilities as the company deploys more Phantom-powered forklifts across their nationwide network, further reducing the company's reliance on costly overtime and unlocking enterprise-wide operational resilience and growth.

ACTIONS FOR SUPPLY CHAIN LEADERS

“A business case is a roadmap to supply chain investment, but it’s so much more. It tells the entire story of why change is imperative to delivering on-going value. It really all comes back to using this technology to better serve the customer,”

- John Paxton, CEO of MHI

Companies today are cautiously optimistic about 2022 and are developing plans to support renewed business growth. According to a recent Deloitte/Fortune survey of 175 CEOs, those growth plans include a variety of supply chain actions over the next 12 months¹¹ (Figure 9).

Rising prices for fuel, electricity and logistics are increasing the cost of doing business and the majority of CEOs surveyed (52%) plan to change their company’s pricing and profit models accordingly. However, customer expectations will likely remain high and some customers might be willing to

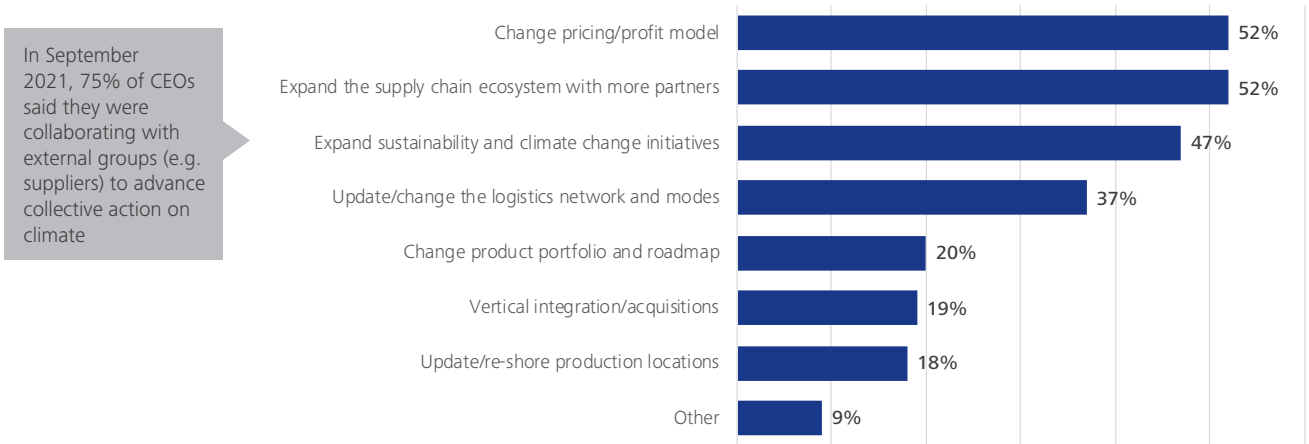


Figure 9: Results from Fortune/Deloitte Consulting LLP CEO survey

abandon their brand loyalty for better value if prices for their preferred products increase. Continuing to deliver high quality products and customer experiences while keeping prices competitive will require innovative solutions.

In addition, working with suppliers to improve supply network transparency and visibility will help companies make real-time adjustments to the flow of critical components – enabling them to minimize disruptions and reliably meet customer demand.

Global supply shortages – such as the semiconductor shortage, which has cost automakers and other manufacturers billions of dollars in revenue — are forcing 52% of companies to expand their supplier networks in order to improve operational resiliency and minimize disruptions. Today’s CEOs are accustomed to uncertainty and are thinking two steps ahead of the next global event, which in this case means building supplier networks across diverse regions while continuing to invest in technology.

Younger generations of workers and consumers are very concerned about climate change and other ESG issues. They want to know if a company is behaving responsibly and doing its part to protect the environment. CEOs are taking notice and 47% plan to expand their company’s sustainability and climate change initiatives. Digital innovations such as blockchain can help support this growing trend by providing the foundation for building trusted and transparent supply chain networks.

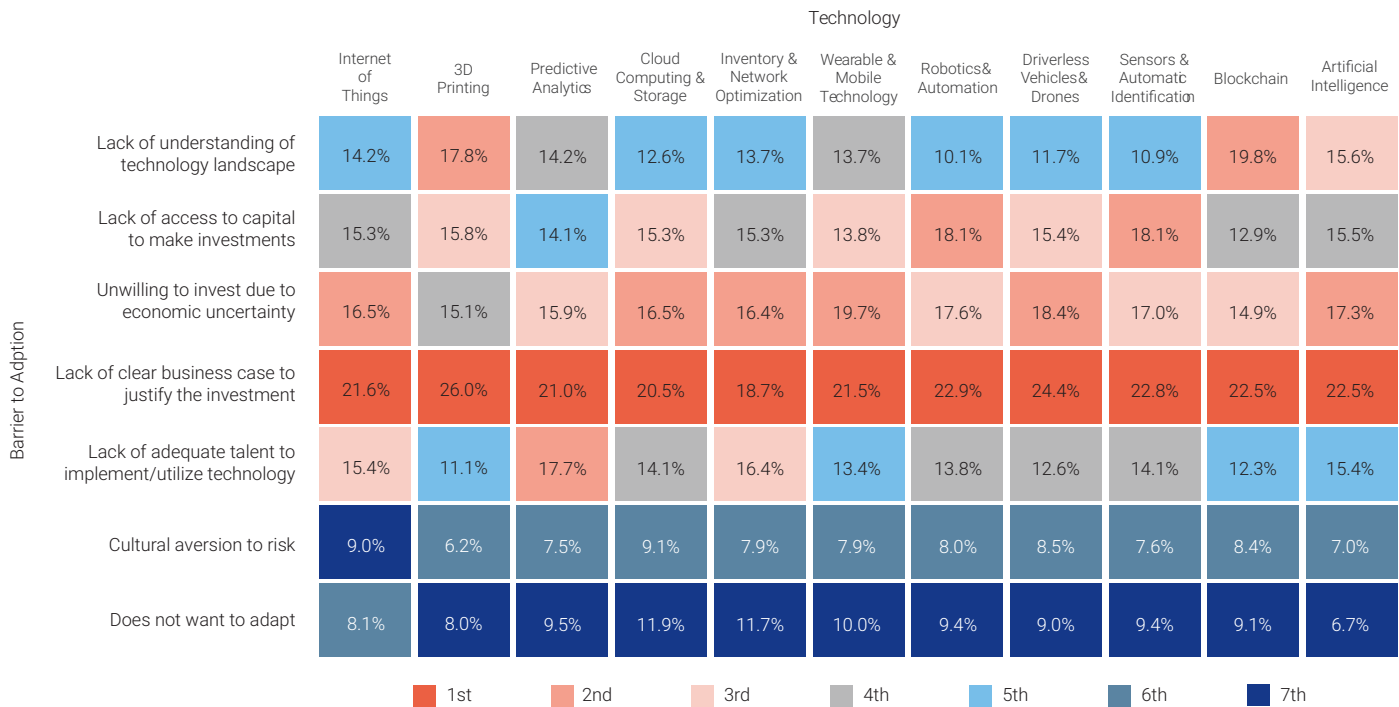


Figure 10: Survey result – Ranking of barriers to adoption of supply chain innovations and technology

The past two years have presented CEOs with unique challenges and forced companies to continuously adapt. However, they have also presented new opportunities and a sense of urgency for companies to reinvent their supply chains. Companies need to continue capitalizing on the latest digital innovations to improve their operational agility and build a more predictive supply chain.

BUSINESS CASE DEVELOPMENT

Company leaders understand at a theoretical level that their supply chains could greatly benefit from investment in innovation. However, given the endless pressure for profitable growth, they are often reluctant to invest in new technologies due to the associated costs and potential for disruption to day-to-day operations. According to this year’s survey results, and unanimous across the technologies for the first time since the inception of the MHI annual survey, the biggest barrier to adoption for all technologies featured in the survey is ‘lack of a clear

business case to justify the investment’ (Figure 10).

Many companies are now using the MHI Digital Consciousness Index (DCI) toolkit we highlighted in our 2020 and 2021 reports to understand their organizations’ digital mindset and evaluate their progress on the journey to becoming more digital (to learn more about the MHI DCI Toolkit, visit mhi.org/dci). However, for every key investment decision on that journey, a robust business case is needed to provide the foundation for informed decision-making.

Of course, before getting started on business cases, it’s important for a company to have a strategic vision that defines its overall objectives. What are the company’s strategic growth initiatives over the next 2-3 years? What opportunities and challenges are top priorities? What needs to happen to make the vision a reality? And what information does the leadership team require to make smart decisions?

A business case provides structure and support for the decision process, helping to create discipline, establish a case for change, provide control, and minimize risk (Figure 11).

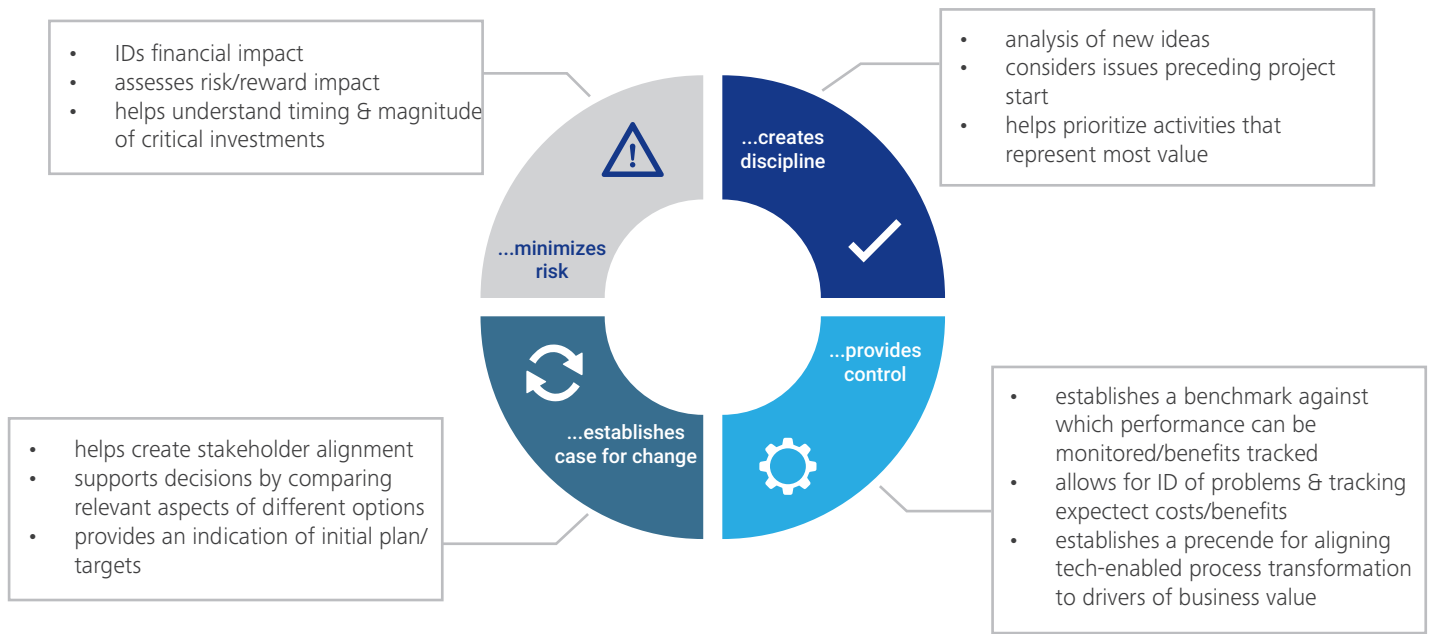


Figure 11: Business case framework

Creating a robust business case is simple in concept but not always easy to do. When building the business case, it is important take into account all of the considerations and activities needed to effectively execute every step of the process (Figure 12).

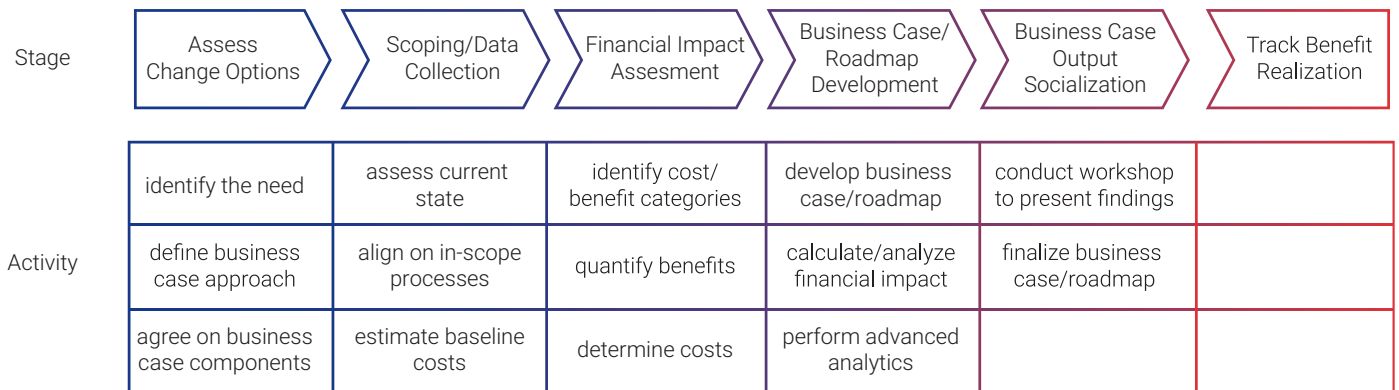


Figure 12: Business case stages

WEARABLE SCANNERS

SITUATION

A large life sciences and healthcare distribution company needed to scale up quickly to meet unprecedented demand for its COVID-19 testing equipment. PCR tests and biomedical testing equipment had to be moved from the manufacturing plant to distribution centers around the world before being shipped to hospitals and testing sites. However, the current workforce had reached a limit on the number of orders it could process with its current handheld devices and desperately needed a platform and equipment upgrade.

ACTIONS

To improve order fulfillment rates, the company implemented Rufus Lab's WorkHero: a wearable scanning solution featuring lightweight scanners that can be ergonomically attached to a worker's hand or fingers, enabling the use of both hands to place products into shipping boxes. The high-speed precision scanning device sends data to a bluetooth-connected wrist-mounted display as the worker performs picking and packing functions throughout the warehouse, with built-in tracking sensors to ensure worker are executing the most critical tasks.

The cloud native platform enables rapid implementation and real-time visibility through dashboards. Warehouse and operations managers can see a user's location, steps, labor tasks (scanning and non-scanning), and scanning metrics. This data is used to track labor efficiency and allows engineers to continuously optimize processes. Also, the platform supports social distancing by allowing users to set proximity alerts from their dashboards.

RESULT

Rufus WorkHero modernized the life science company's operations and improved its global distribution performance by addressing critical operational issues. The company was able to save \$2,000 annually per worker by shifting people's time and effort from low-value tasks to higher value tasks. With better scanning efficiency, workers were able to increase their pick and pack rate by 42%



courtesy of Rufus Labs

-- improving overall labor productivity by 5%. Also, the automated features of WorkHero's dashboard enabled managers to eliminate 520 hours per year of managerial time related to manual data tasks.

With the worker productivity metrics in WorkHero, managers can drive increased employee satisfaction and motivation by setting goal thresholds and providing incentives to top performers. Managers can also identify workers who might need additional training, or shift workers into different roles if they are not suited for their current tasks. In addition, the WorkHero dashboard allows users to manage their own devices by providing data on battery life, location, and device health – encouraging proactive maintenance and minimizing downtime.

With its subscription-based cloud platform and out-of-the-box integration and compatibility with existing WMS and ERP platforms, companies can launch a pilot of the Rufus platform in minutes. Users can then determine their ROI and performance improvements, using the platform's dashboard to compare labor metrics from the current and previous solution and then feeding that information into the business case.



"Supply chain automation and technology provide tools to mitigate disruptions, but the real solution goes much deeper. It's having the right culture and the right people in place to implement this technology and to bring it all together to exceed your customer demands and expectations – whether it's fast delivery, personalization, low cost, delivery transparency or ESG goals."

- John Paxton, CEO of MHI

CONCLUSION

The pandemic has resulted in unprecedented supply chain disruption and shortages and many lessons learned. It also brought this industry into the headlines of every news organization in the world as the strategic importance of supply chains gained clarity. Now is the time to take these learnings and use them to invest in the right technology to mitigate future disruption and respond to future speed and transparency demands - in short, to revolutionize your supply chain.

This revolution is necessary to create a supply chain advantage in a world where disruptions and shortages are expected to continue. Current average lead times for production materials have climbed to 97 days, a 45% increase over the past year alone. Capital equipment lead times now average 173 days. This increase in lead times is having a ripple effect across the entire value chain, leading to supply disruptions and rising costs for manufacturers and end-consumers alike – and triggering continued shortages and inflation.

This report outlines actions leaders can take to address those challenges, and how companies can use investments in key digital technologies and innovation to boost supply chain efficiency, transparency and resiliency.

Digital twinning is a strong tool for the analysis not only of individual machines, but entire facilities and supply chain ecosystems. A digital twin allows companies to proactively identify problems and test new solutions before investing in the physical installation, giving decision makers the data they need to effectively optimize operations.

Data has become more important than ever, and not only big data, but good data. Companies are taking a closer look at internal corporate data and

customer data and shifting what they collect and analyze and why. However, these traditional data sources are no longer enough for optimizing supply chain operations. The complexities highlighted by the pandemic have shown that supply chains need to harness a broader array of external data and marry them into their analytics to boost performance and mitigate disruption, especially as consumer patterns and the workforce continue to evolve rapidly.

Workforce continues to be a linch pin for supply chains and the perception of working in this industry is a barrier for solving the talent shortage. US manufacturers are expected to need 4 million jobs filled by 2030, so leaders can create pathways to those jobs by reskilling the existing workforce and engaging with schools and communities to make the case for working in supply chain.

Making a business case for adoption of technologies to optimize supply chains is also becoming a crucial turning point between operational success and failure. A business case, tied with a strong strategic vision, creates structure and support for the decision process and ensures that decisions are made from benchmark data as opposed to the latest trend.

With supply chain metrics continuing to trend in the wrong direction – and continued disruptions, shortages, and price inflation looming for the foreseeable future – it is more critical than ever for companies to expand investment in digital technologies that can revolutionize their supply chain operations. Now that global supply issues are top-of-mind for businesses and consumers alike, it's time for supply chains to take action – embracing digital technologies and turning their long-expected potential benefits into reality.



"Supply chains are becoming more and more a technology-driven industry. While firms have not adopted some technologies as quickly as they thought they would back in 2014 or 2015, what we are seeing now is a big jump in these investments. Where we used to say evolve or die, what we now say is transform or die."

- Thomas Boykin, Deloitte Consulting LLP

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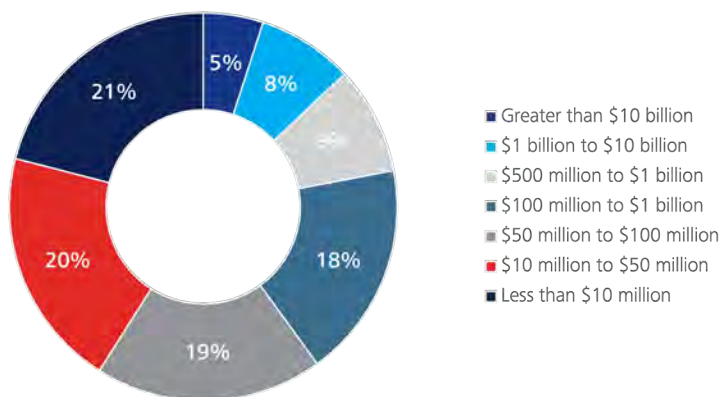
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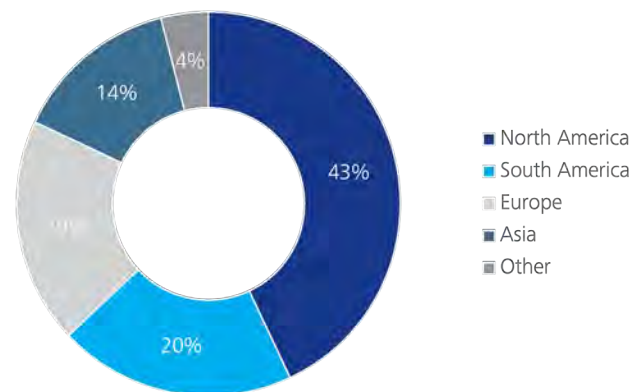
The 2022 MHI Annual Industry Report is our ninth annual study of emerging disruptive technologies and innovations that are transforming supply chains around the world. The findings are primarily based on an in-depth global survey conducted in late 2021, which involved 1,074 supply chain professionals from a wide range of company types and industries.

Half of the participants are executives with the role of CEO, Vice President, General Manager, or Department Head. Participating companies range in size from small to large, with 38% reporting annual sales in excess of \$100 million, and 7% reporting annual sales of \$10 billion or more.

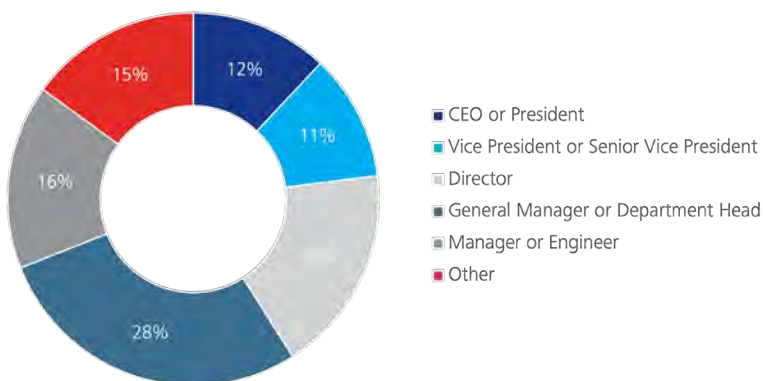
COMPANY SIZE BY REVENUE (USD)



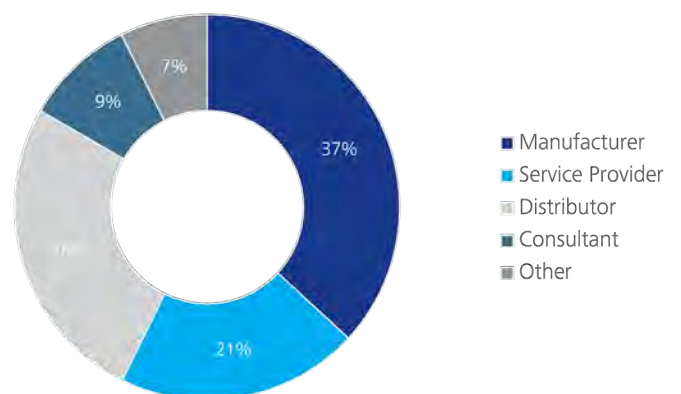
RESPONDER PROFILE BY GEOGRAPHY



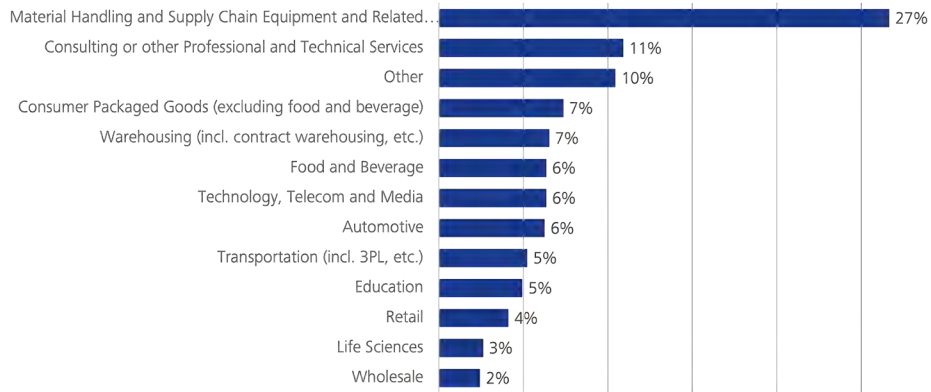
RESPONDER'S ROLE



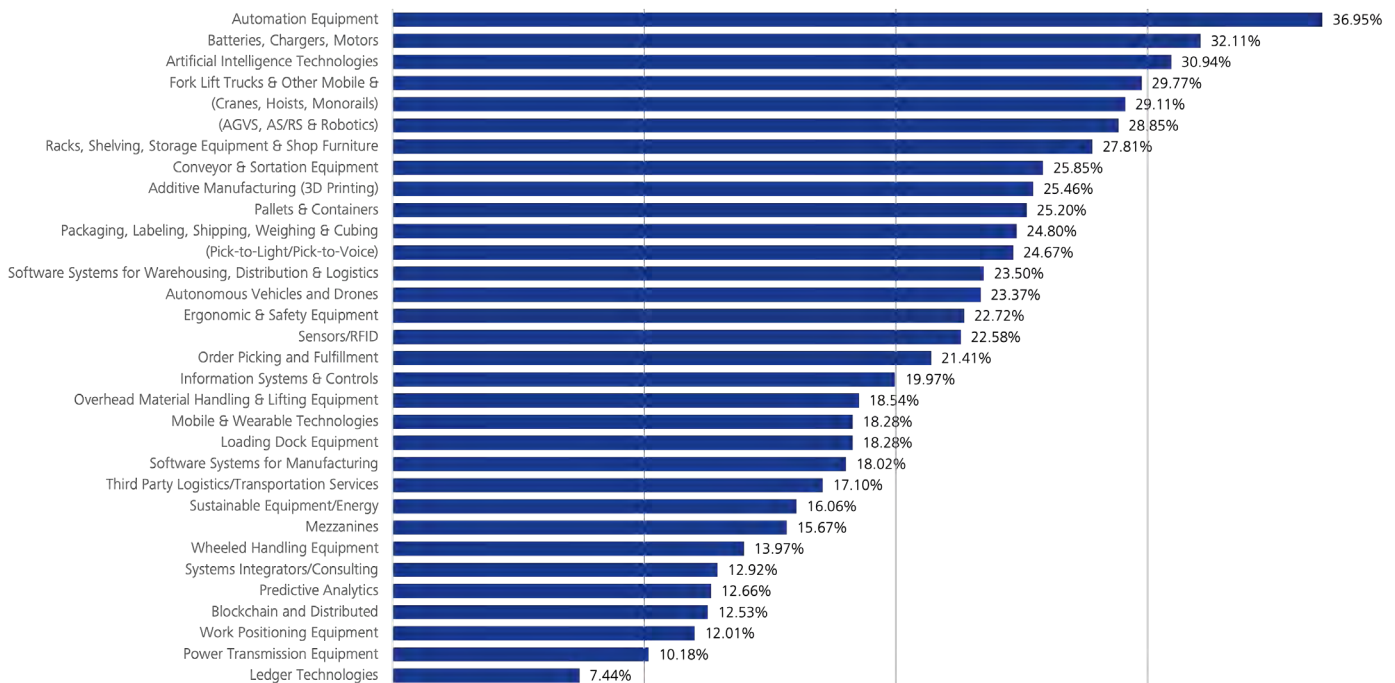
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The Warehousing Education and Research Council (WERC) is a division of MHI and is the only professional organization focused on logistics management and its role in the supply chain. Through membership in WERC, seasoned practitioners and those new to the industry master best practices and establish valuable professional relationships. Since being founded in 1977, WERC has maintained a strategic vision to continuously offer resources that help distribution practitioners and suppliers stay on top in our dynamic, variable field. These include national, regional, local and online educational events; performance metrics for benchmarking; practical research; expert insights; and multiple opportunities for peer-to-peer knowledge exchange.

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