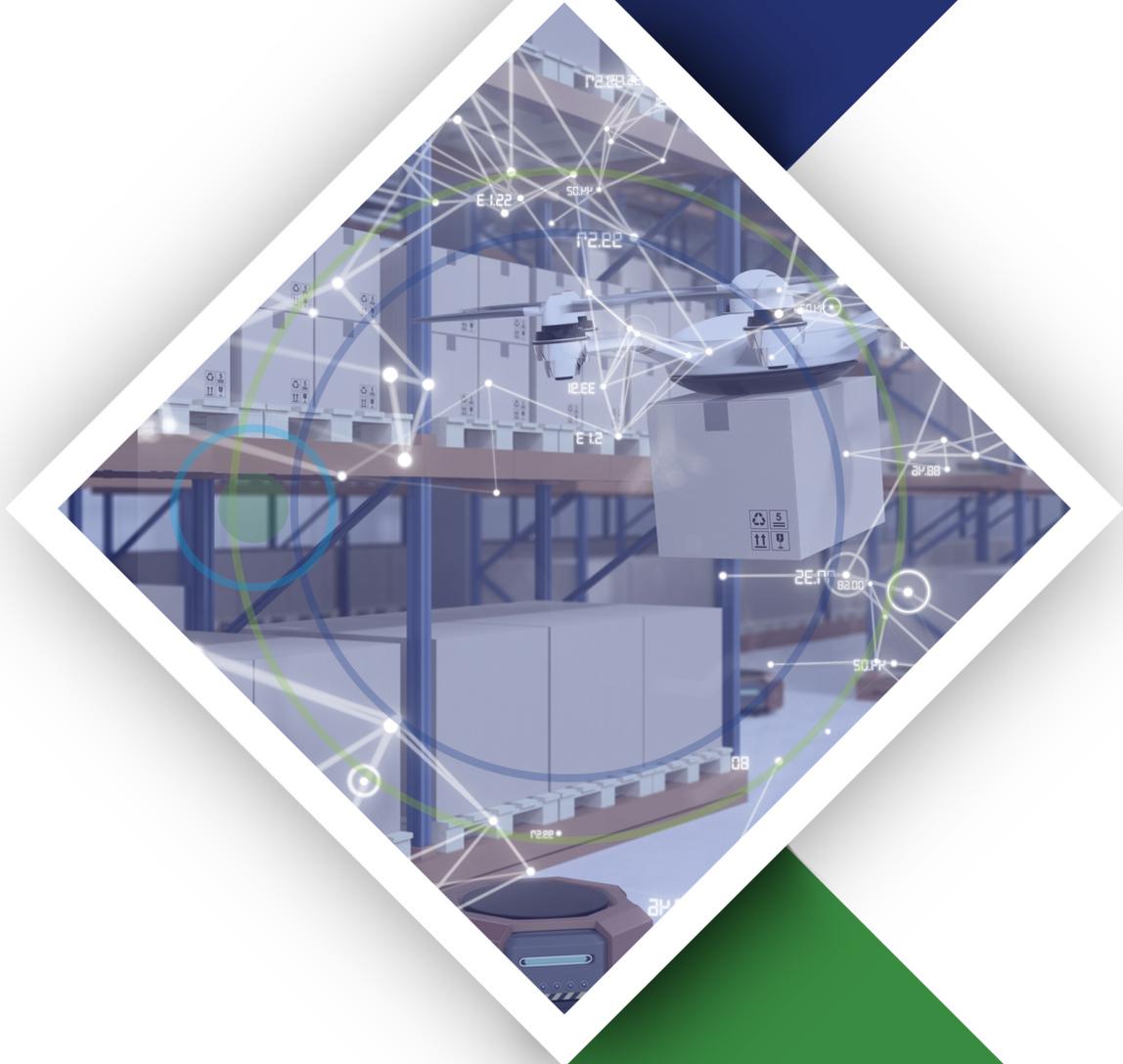




**Deloitte.**



**The 2018 MHI**  
**Annual Industry Report**  
Overcoming Barriers to  
NextGen Supply Chain  
Innovation

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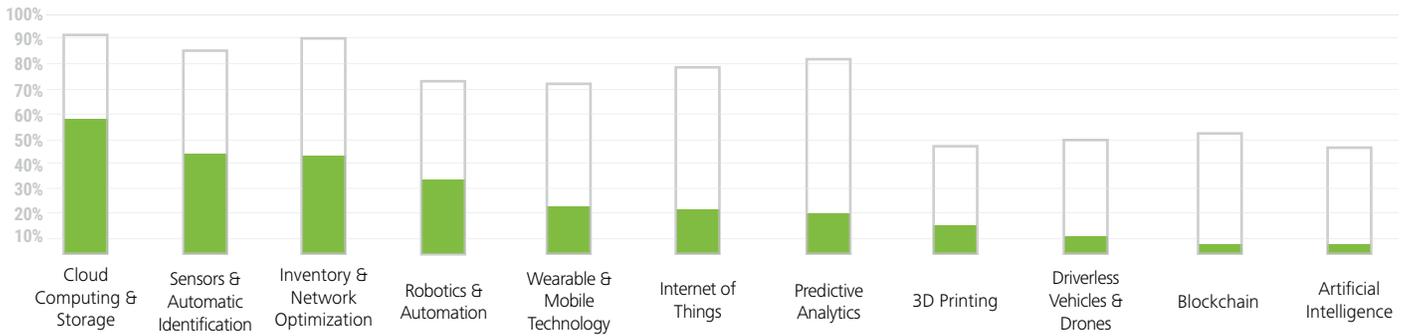
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### ADOPTION RATE

In-use Today

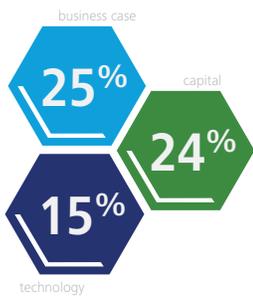
■ 2018 Adoption Rate

□ Projected 5-Year Adoption Rate



### BARRIERS TO ADOPTION

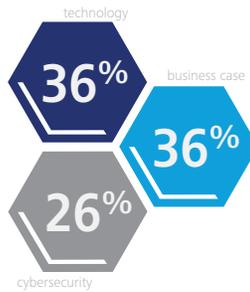
#### Robotics and Automation



#### Predictive Analytics



#### Internet of Things



#### Driverless Vehicles and Drones



#### Artificial Intelligence



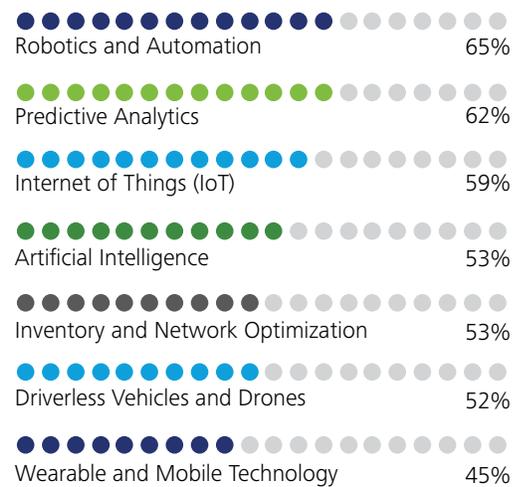
#### Key

- Lack of clear business case
- Lack of adequate talent
- Lack of understanding of technology landscape
- Lack of access to capital to make investments
- Cybersecurity

(Top 3 of 8 Barriers for Each Technology)

### TOP SUPPLY CHAIN INNOVATIONS

Potential to disrupt or create competitive advantage.



Top 7 of 11

### SUPPLY CHAIN CYBERSECURITY RISKS

Top 3



### TOP CHALLENGES

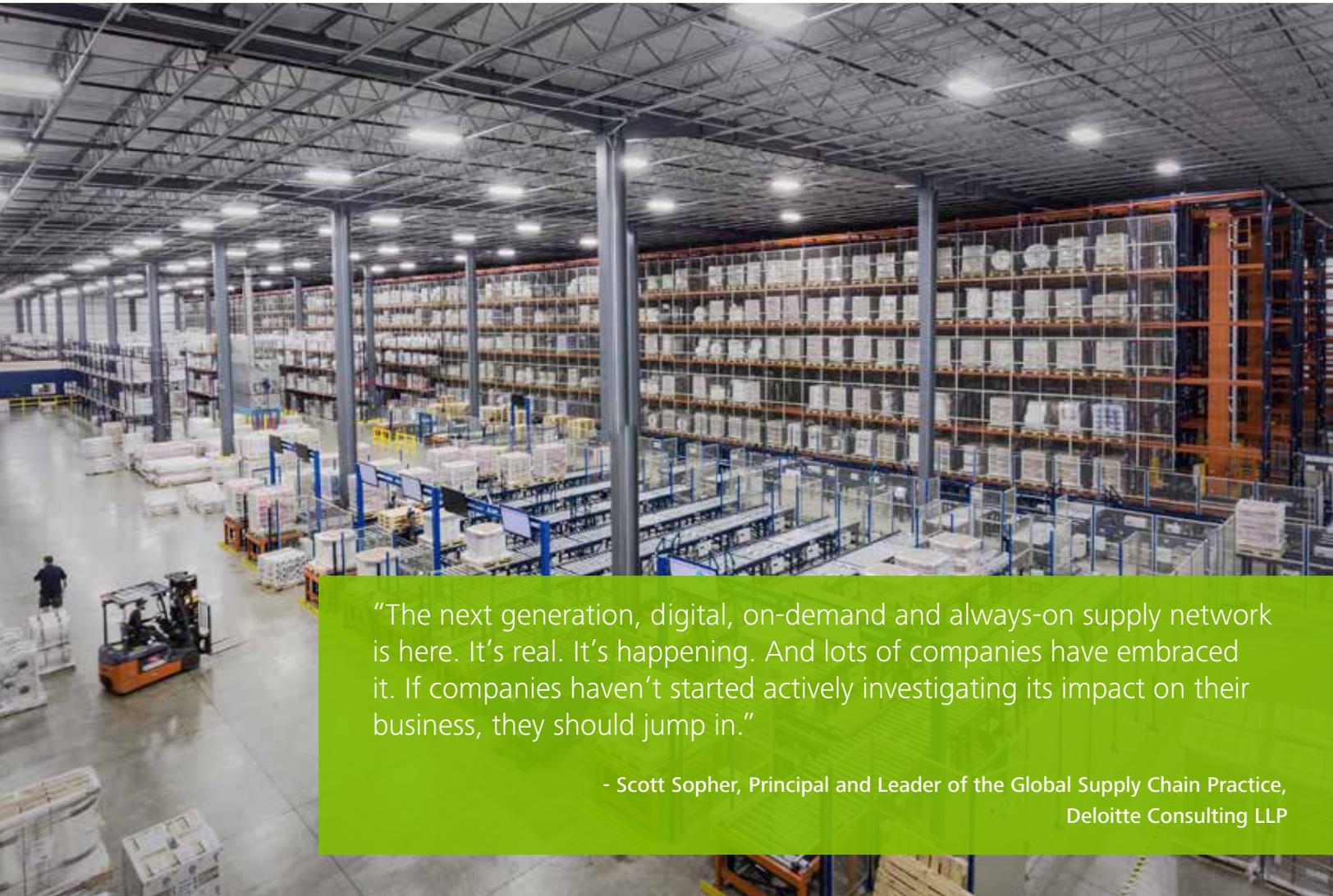


### PREPARATIONS

Actions being taken to prepare for next generation supply chain.



# Introduction



“The next generation, digital, on-demand and always-on supply network is here. It’s real. It’s happening. And lots of companies have embraced it. If companies haven’t started actively investigating its impact on their business, they should jump in.”

- Scott Sopher, Principal and Leader of the Global Supply Chain Practice,  
Deloitte Consulting LLP

COURTESY OF INTERLAKE MECALUX INC.

Digital technologies and innovations are driving massive changes and improvements in supply chain. Meanwhile, digital disruption and continued globalization are sending customer service expectations through the roof and stretching supply chains to the farthest reaches of the planet – putting supply chains under more stress than ever before.

Today’s supply chains do much more than just physically move materials and product from place to place. In an increasingly digital world, supply chains are the backbone of an information ecosystem in which a connected and carefully coordinated set of movements and actions must be tracked at every level in order to maximize efficiency and meet customer demands for increased flexibility, visibility, and transparency.

In this fifth annual survey report on supply chain innovation, MHI and Deloitte Consulting LLP have once again teamed

up to better understand the critical shift toward next-generation (NextGen) digital supply chains – and the real-world impact of 11 key innovations on supply chain operations and strategies. The eleven technologies covered in the report are:

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

The findings in this report are based on survey responses from more than 1,100 manufacturing and supply chain industry leaders across a wide range of industries. Half of respondents hold executive-level positions such as CEO, Vice President, General Manager, or Department Head. Participating companies range in size from small to large, with 47% reporting annual sales in excess of \$100 million, and 10% reporting annual sales of \$10 billion or more.

This year's report features in-depth profiles of the five NextGen innovations having the greatest impact on supply chains:



### Robotics and Automation

The design and use of computer-controlled machines to automatically perform a series of actions or tasks traditionally performed by humans.



### Predictive Analytics

The practice of extracting information from existing data sets in order to determine patterns and trends that can help predict future events and outcomes.



### Internet of Things (IoT)/Sensors

Use of the internet to connect sensors and computers embedded in a growing range of objects, enabling them to send and receive data in real time.



### Artificial Intelligence

Technology that enables machines to learn problem-solving patterns and perform tasks that typically require human intelligence, such as decision-making, speech recognition, visual perception, and language translation.



### Driverless Vehicles and Drones

Computer-guided devices that can operate without human control, either on the ground or in the air.

Each in-depth profile includes a case study illustrating how

the innovation is currently being used in real-world applications.

The report also offers practical advice on how to overcome the three biggest barriers the adoption of supply chain innovations:

- Making the business case for NextGen supply chain investments
- Tackling the supply chain skills gap and workforce shortage
- Building trust and security in digital, always-on supply chains

Although expectations and interest in supply chain innovations remain high, adopting those innovations can be complex and challenging. Learning how to overcome the three main barriers is essential to achieving the full vision and benefits of a NextGen, always-on supply chain.

COURTESY OF SWISSLOG LOGISTICS

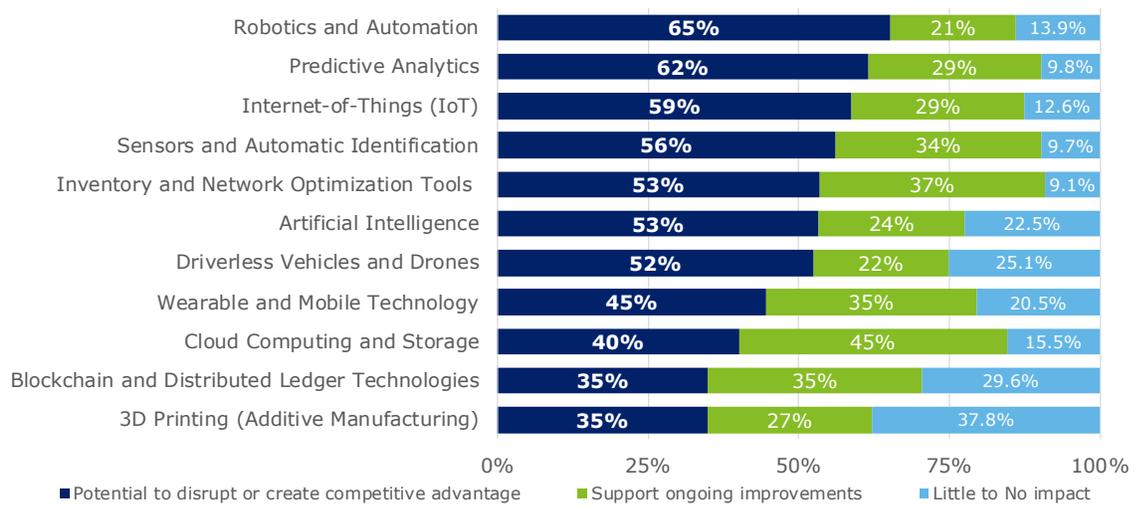


# Survey Highlights

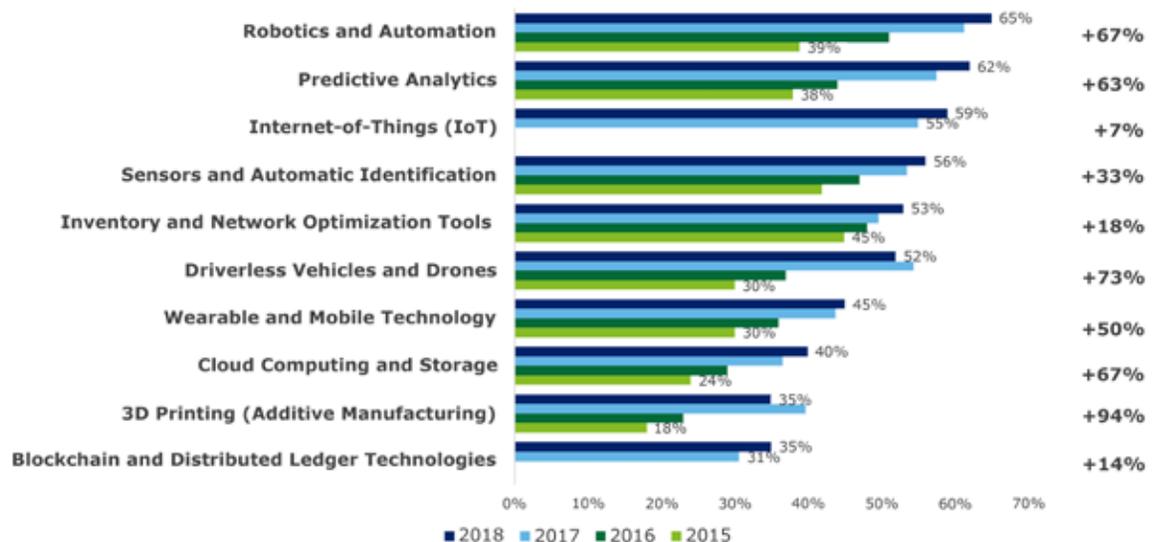
The expected impact of these digital innovations on the future of supply chain is very high, with 8 of 10 survey respondents believing digital supply chain will become the predominant model within the next five years. In addition, respondents believe many of these supply chain innovations have the potential to disrupt the status quo and create a

lasting competitive advantage for companies that embrace them (Figure 1) — a belief that for most of the innovations has been steadily increasing for at least three years (Figure 2).

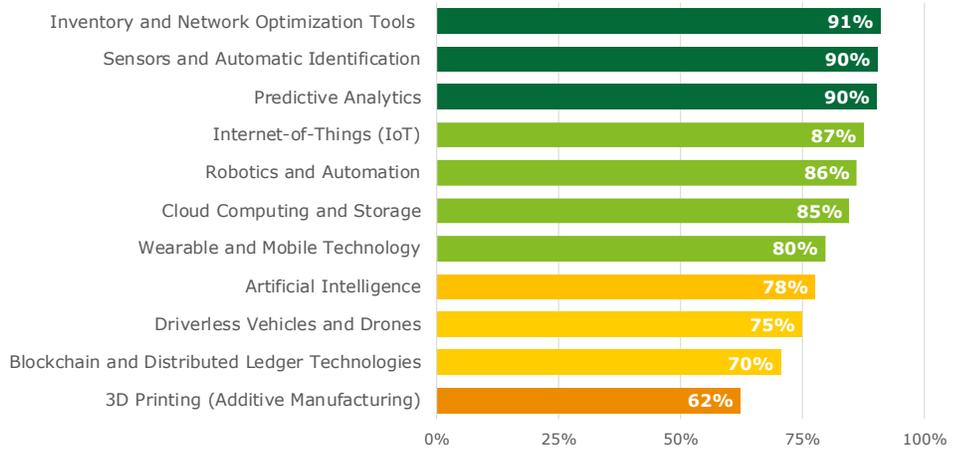
**Figure 1: 2018 Survey Results - Technology with Potential to Disrupt or Create Competitive Advantage**



**Figure 2: 2018 Survey Results - Potential to Disrupt or Create Competitive Advantage - 4-Year Trends**



**Figure 3: 2018 Survey Results - Technologies Expected to Impact Supply Chains Over 10 Year Period**



The top technologies expected to be a source of either disruption or competitive advantage are:

- Robotics and Automation (65%, up from 61% in 2017)
- Predictive Analytics (62%, up from 57% in 2017)
- Internet-of-Things (IoT) (59%, up from 55% in 2017)
- Artificial Intelligence (53%, new category in 2018)
- Driverless Vehicles and Drones (52%, up from 30% in 2015)

In addition, the vast majority of respondents expect most of these innovations to have a significant impact on their supply chains over the next 10 years (Figure 3).

**Adoption Rates**

Cloud computing and storage has the highest current adoption rate (57%). Adoption of this technology is expected to grow to 78% over the next two years, and to 91% over the next five years. Inventory and network optimization is forecast to reach a 75% adoption rate in two years, and 90% over the next five years.

Over the next five years, predictive analytics is expected to reach an adoption rate of 82%, followed by IoT at 79%, and robotics and automation at 73%. Artificial intelligence, which only has a 6% adoption rate today, is expected to reach 47% within five years (Figure 4).

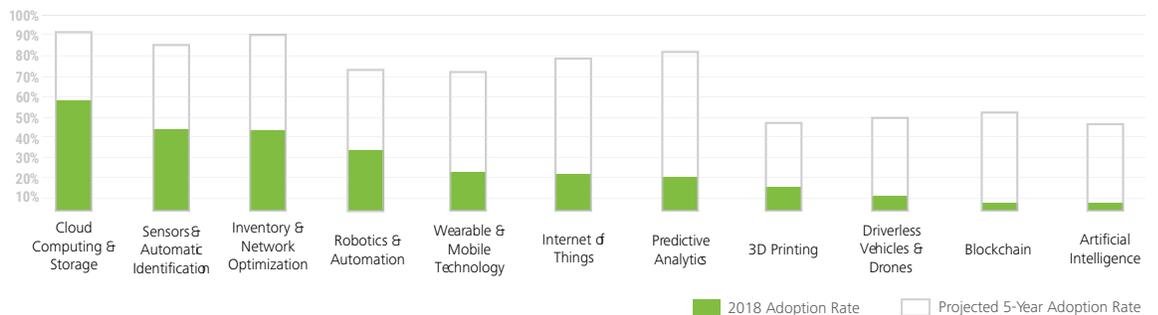
**Customer Demands and the Supply Chain Talent Gap**

Customer demands on the supply chain is seen as the biggest challenge, with 73% of survey respondents rating it as extremely or very challenging. Hiring qualified workers also remains one of the top challenges, with 64% of respondents rating it as extremely or very challenging.

**Investments**

Manufacturing and supply chain operations continue to invest heavily in innovation. According to the survey, 47% of respondents are planning new technology investments totaling more than \$1 million over the next two years, while 20% plan to spend more than \$5 million, and 10% plan to spend more than \$10 million.

**Figure 4: 2018 Survey Results - NextGen Supply Chain Technology Adoption Rates**



# NextGen Supply Chains



“Early adopters are successfully combining NextGen supply chain technologies to improve speed and agility and increase efficiency and visibility.”

- George Prest, CEO of MHI

ZAPP2PHOTO/SHUTTERSTOCK.COM

With each passing year, the vision of NextGen supply chains is coming more sharply into focus. The driving force behind that vision is the flood of digital information being generated by many of the innovations highlighted in this report. It is helpful to understand the key attributes of NextGen supply chains to provide an overall context for the innovations:

## Digital

Supply chains are rapidly being digitized and disrupted, and information and insights are becoming the currency of NextGen supply chains. Sensors and smart devices are connecting companies with every link of their supply chains, creating a massive wave of potentially insight-rich digital information. Artificial intelligence (also known as “machine learning” and/or “cognitive computing”) can take this digital information

and make it immediately actionable by analyzing it in real time and passing it on to supply chain workers through technologies such as cognitive tools and wearables.

## Connected

The physical and digital worlds continue to converge. In the future, all supply chain links will be connected and information will be shared seamlessly across parties. Retailers will share point-of-sale data with their distribution centers, as well as further upstream with manufacturers and vendors, creating real-time demand signals. Manufacturers will use this real-time signal to develop tighter production plans that are shared with suppliers to better manage lead times. Safety stock throughout the chain will be minimized as the links become more synchronized. Thanks to this interconnected-

ness, supply chains will evolve to the point where they can learn and self-correct, or even proactively avoid missteps altogether.

**Collaborative**

In addition to collaborating across all links in pursuit of shared benefits, supply chains will begin to hyper-collaborate, removing traditional competitive barriers. For example, some competitors who in the past might have used two different third-party-logistics (3PL) providers might decide that using the same 3PL and tearing down some of the competitive fences might create benefits for all parties (the competitors and the 3PL).

**Always-on**

To satisfy rising customer expectations for faster, better, and cheaper service, supply chains of the future will never sleep. Today’s consumers are connected around the clock and can fire off an order anytime, from anywhere, and then expect the order to be quickly delivered to wherever they happen to be — for free. This requires a supply chain that operates around the clock.

As noted last year, this trend will affect not only consumer-facing industries such as retail and e-commerce, but will trickle back up the entire supply chain to vendors, manufac-

turers, raw material suppliers, and the industries that support them. In this year’s survey, over 73% of survey respondents cite customer demands (for faster response times) and rising customer service expectations as two of the issues they find most challenging (Figure 5).

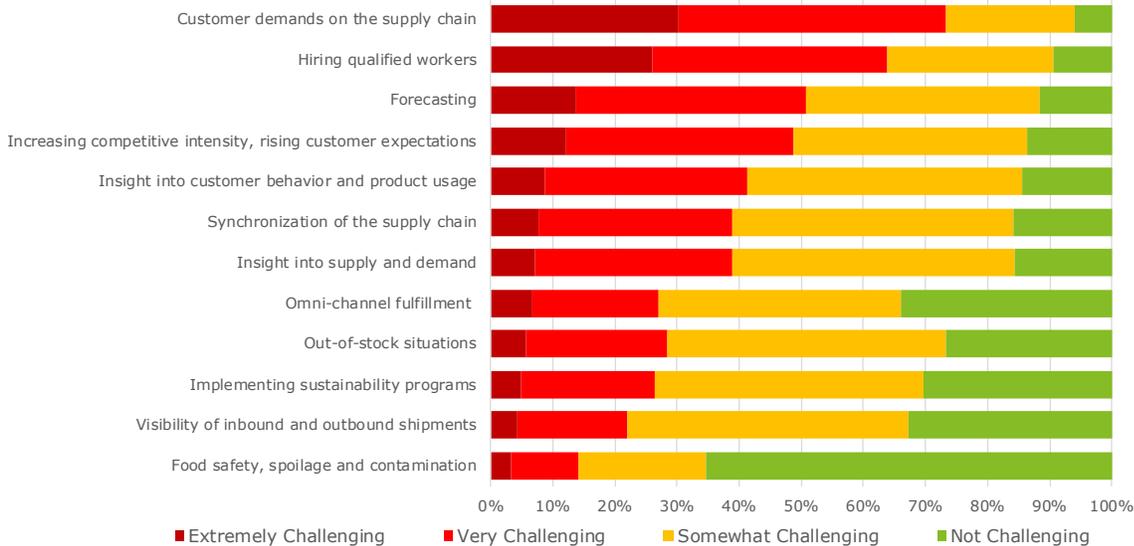
**Driven by Forward-looking Analytics**

Using data to drive better insights is not new; in fact, backward-looking analytics are now table stakes. NextGen supply chains will leverage forward-looking analytics to explore new possibilities, produce data-driven insights and bold decision-making, harness the power of disrupters, and generate breakthrough outcomes.

**Transparent**

Companies that have the deepest two-way relationships with customers will thrive in tomorrow’s economy. Transparency is a necessary element for such intimacy, and it involves more than simply gaining visibility into the extended supply chain. Broadly speaking, transparency is the process by which a company acts on the insights gained through visibility in order to manage risks more effectively. NextGen supply chains will integrate real-time, macroeconomic risk indicators, supply chain visualization tools, and predictive analytics capabilities to create transparency for all stakeholders.

**Figure 5: 2018 Survey Results - Top Supply Chain Challenges**





Information about companies, suppliers, and sourcing locations will be readily available and accessible to all stakeholders across the entire supply chain. Every transaction, from order to cash, will be visible. Customers will be kept informed throughout the delivery process, and, in some cases, given the ability to change their orders (including preferred delivery windows up to the point of delivery). Also, customers will be able to get real-time exception updates about deliveries, as well as milestone updates when deliveries have been completed.

#### **Secure and Trusted**

As global commerce continues to grow, many supply chains are becoming more stretched and dispersed, raising the risks of potential failure or disruption. Also, as supply chains become more digitized, cybersecurity threats increase. To minimize potential problems, NextGen supply chains must implement robust processes to illuminate, monitor, and mitigate such risks on an ongoing basis. This heightened level of security will be essential to achieving the level of trust necessary to thrive in tomorrow's digital, global economy.

#### **Agile, Adaptive and Responsive**

NextGen supply chains will evolve from warehouse-based stockpiles of inventory to high-velocity operations, pushing more product through a smaller pipeline of physical assets while bringing down overall costs. They will be flexible and able to perform flawlessly in response to volatile customer requirements — without breaking stride. Also, they will be intimate with their customers and will have information on real-time demand from the market. And thanks to increased connectedness, companies will be able to sense market changes earlier than ever before.

As real-time demand information is gathered and shared with trading partners, a collaborative planning process will make it possible to better synchronize the links of the supply chain. Whole portions of the supply chain will be able to quickly adjust and adapt to market changes. Also, improved synchronization will extend all the way to collaborative product design, enabling the supply chain to proactively shape consumer needs and desires.

#### **Effective and Efficient**

NextGen supply chains will be both efficient and effective, instead of being forced to trade off one for the other. Efficiency has traditionally focused on internal operations and processes, particularly how well a supply chain manages its resources (human, technology, and financial). Effectiveness is a more externally focused concept that speaks to how well a supply chain fulfills its mission — particularly how well it serves its customers.

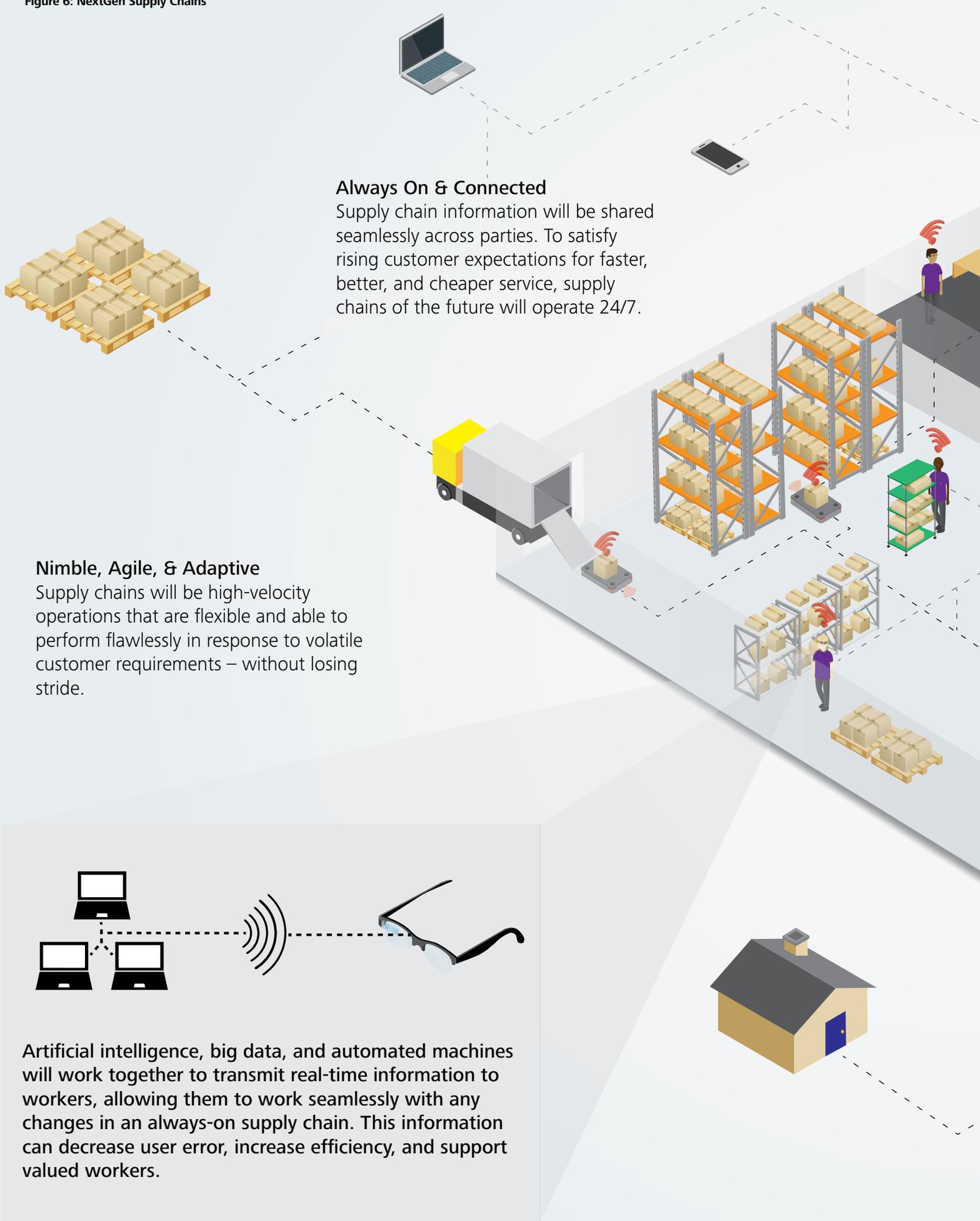
In the past, it was usually necessary to make trade-offs between efficiency and effectiveness when making strategic decisions. For example, a company might be able to produce a high-quality product at a low cost and consider itself efficient, but that same company might have a poor track record of delivering to its customers and be viewed as less than effective by those customers.

The supply chain of the future will view both efficiency and effectiveness from the customer's point of view. As such, it will not be possible for a company to be considered exceptional at one without being exceptional at the other. Improvements enabled by advancements in innovation will make it possible for NextGen supply chains to reduce cost-to-serve and improve margins while at the same time improving customer service.

#### **Safe and Sustainable**

NextGen supply chains will provide a safe workplace, free from health and safety hazards. The work and risk associated with dangerous, repetitive tasks will be shifted to automation and robots working side-by-side with humans. Also, supply chains will be sustainable, minimizing external environmental impacts through programs that minimize energy and water consumption, reduce discretionary travel, and make greater use of recycled and repurposed supplies. Business decisions will be made not only considering the health and safety of the internal workplace, but also considering the impact to the external physical and social environment.

Figure 6: NextGen Supply Chains



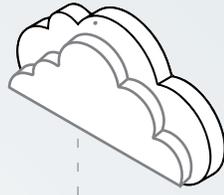
### Always On & Connected

Supply chain information will be shared seamlessly across parties. To satisfy rising customer expectations for faster, better, and cheaper service, supply chains of the future will operate 24/7.

### Nimble, Agile, & Adaptive

Supply chains will be high-velocity operations that are flexible and able to perform flawlessly in response to volatile customer requirements – without losing stride.

Artificial intelligence, big data, and automated machines will work together to transmit real-time information to workers, allowing them to work seamlessly with any changes in an always-on supply chain. This information can decrease user error, increase efficiency, and support valued workers.



### Digital/Big Data

Information and insight are becoming the currency of NextGen supply chains. Supply chains will leverage forward-looking analytics to generate breakthrough outcomes.

### Sensing & Transmitting

Real-time information will come from transmitting, sensing machines to all parts of the supply chain to better manage lead times and synchronize links to avoid missteps.

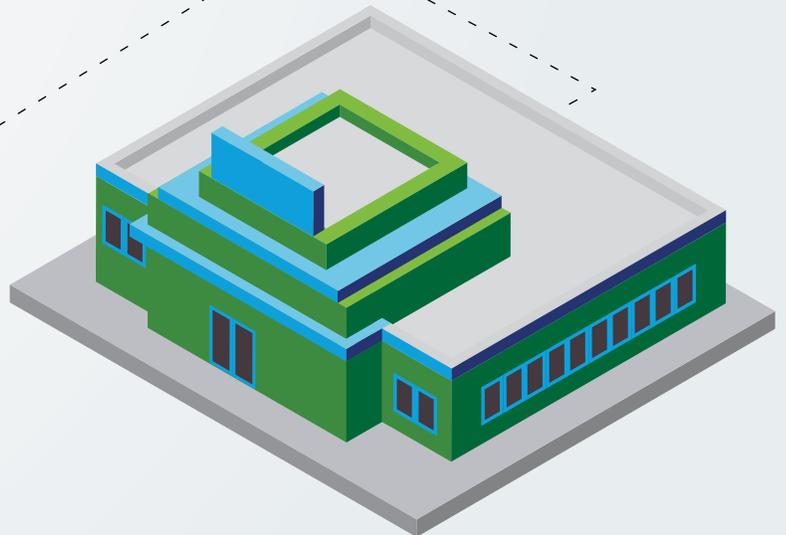


### Collaborative

Supply chains will begin to hyper-collaborate, removing old competitive barriers to collaborate across all links in pursuit of shared benefits.

### Safe & Efficient

Supply chains will provide a workplace free from health and safety hazards while being both efficient and effective, instead of having to trade off one for the other.



# Key Innovations Driving NextGen Supply Chains



“There is no one solution that is likely going to create a major competitive advantage. It’s going to be the combination, the amalgamation of these things and the complementary effects they have on one another, that will create a competitive advantage that’s sustainable.”

- Randy V. Bradley, PhD, Assistant Professor of Information Systems and Supply Chain Management, University of Tennessee

COURTESY OF THE RAYMOND CORPORATION

The attributes of NextGen supply chains stem from a mix of different technologies, innovations, and process improvements, many of which are front and center in our survey. This section takes a closer look at the supply chain innovations that appear to have the greatest potential for growth, disruption, and competitive advantage, which are:

- Robotics and Automation
- Predictive Analytics
- Internet-of-Things (IoT)/Sensors
- Artificial Intelligence
- Driverless Vehicles and Drones

These technologies can work together to not only create operational efficiencies, but to harness digital supply chain data that can lead to dramatic improvements in visibility, agility, and responsiveness to customer demands.

That being said, just as not all ingredients are right for every recipe, not all innovations are right for every supply chain. For example, 3D printing is a game-changer for a manufacturing operation with unique service parts, but is not applicable to a pallet manufacturer. In this report, we are focusing on the innovations with the broadest potential impact.



ZAPP2PHOTO/SHUTTERSTOCK.COM

### Robotics and Automation

Implementation of robotics and automation continues to expand as companies look for ways to remain competitive. Robots and automation can improve overall efficiency by performing traditionally manual tasks such as picking, sorting, inspecting, storing, handling, and classifying products.

According to the survey, adoption of these technologies is currently at 34%. However, adoption is predicted to reach 53% over the next two years, and 73% over the next five years (Figure 7).

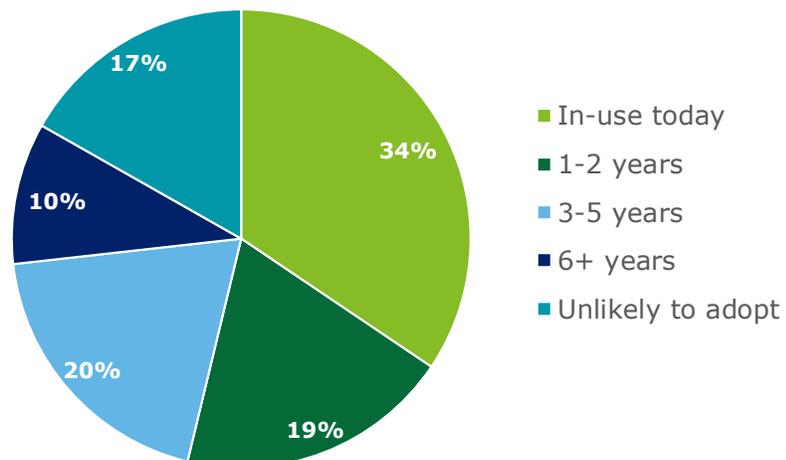
This expected rise in adoption suggests that firms recognize robotics and automation as integral tools to maintain and increase competitive advantage through NextGen supply chains.

In supply chains, the most common uses for robotics and automation are for warehouse operations: pick, pack, and sort; loading and unloading; and receiving and put-away (Figure 8).

As automation becomes smarter, safer, and more accurate, it is also becoming less expensive and easier to implement — helping to drive adoption.

Survey respondents view automation as a growing disruptor, with 65% indicating that it is currently disrupting the industry or providing competitive advantage (up from just 39% in 2015).

Figure 7: 2018 Survey Results - Robotics and Automation Adoption





ZAPP2PHOTO/SHUTTERSTOCK.COM

*“Humans aren’t being displaced; rather, they’re being given the opportunity to apply their higher-order brains to more advanced processes, creating augmented intelligence.”*

**Ryan Renner,**  
Principal, Deloitte  
Consulting LLP,  
Strategy and  
Operations Analytics  
Leader

**Improved flexibility and scalability**

While automatic guided vehicles have been part of supply chain operations for a while now, emerging technology advances are setting them free from set pathways (often created with visual beacons or floor wires), turning them into self-driving vehicles.<sup>1</sup> Self-driving vehicles use various types of sensors to detect information about the changing environment around them, and then respond intelligently to that input.

Scalability is rising, costs for the technology are falling, and ROI is accelerating, making it easier for firms of any size to take advantage of the benefits of automation. In addition, automation can improve employee engagement and retention rates by relieving humans of the duller, most repetitive tasks — greatly reducing the incidence of errors, and boosting productivity — especially with machines having the ability to operate 24-7.

**Figure 8: 2018 Survey Results - Robotics and Automation, Most Common Uses**



# Case Study - Increasing Efficiency with Robotics



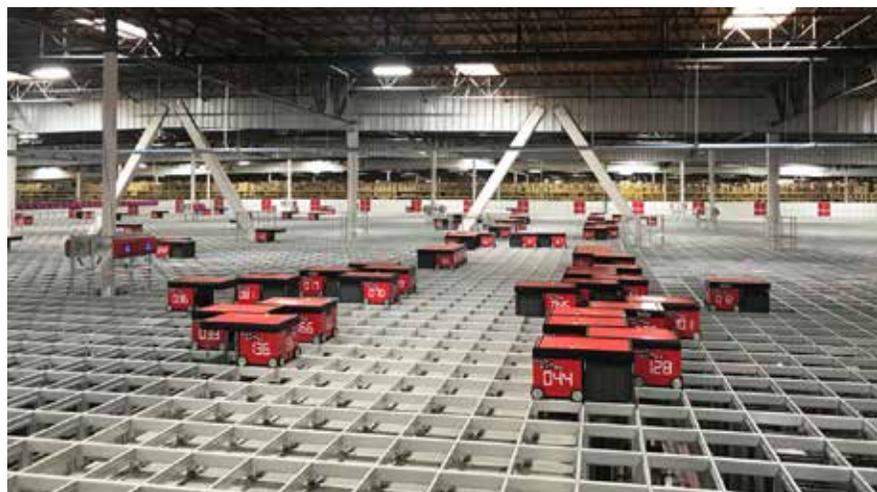
**Situation:** A top global sports brand has been developing product designs for premier athletes for nearly 70 years. Over the past few years, however, the apparel, footwear, and accessory provider's successes and growing e-commerce business have put tremendous pressure on its existing fulfillment operations. To address the challenge, the business created a proof-of-concept with a third-party operation in Torrance, CA to evaluate and select an automation solution capable of keeping up with future growth projections in the omnichannel space. As part of the effort, the company needed to increase its customer service metrics, while expanding its online catalog of offerings.

**Actions:** MHI member AutoStore was selected to help the company implement a storage solution to provide more density, energy efficiency, and shipping reliability for same-day orders. The solution consisted of tightly stacked bins in a dense aluminum storage grid, which are collected by battery-powered robots and delivered to the pick stations. The solution was chosen for its flexibility and scalability to help manage seasonality and robust promotional events.

The 152,000-square-foot Torrance system was built with six main modules, including a structural aluminum grid, 170 delivery robots, 171,000 durable plastic storage bins, and 23 operator ports, controllers, and access points. The products are inducted and retrieved by the software-guided robots with complete autonomy between robots, eliminating the full system shutdown that would otherwise result if one of the ro-

bots experienced a failure. The robots lift the correct bin and then have it delivered to a fulfillment operator. If the needed bin is buried beneath other containers in a stack, the robot repositions the obstructing bins to gain access to the correct one. Inventory planning keeps the high velocity SKUs close to the top, reducing the need to reposition bins. Operators at the carousel ports use a pick-to-light system to complete the order processing for outbound packaging and shipping.

**Result:** The enhanced facility has benefited from 2-3x productivity increases compared to the previous operations. Also, it has seen order fulfillment rates rise to approximately 175 units per operator hour for e-commerce, and 650 units per hour for wholesale units. As a result of the increased density and throughput, the company has been able to fully consolidate multiple operations into one facility. This project helped the company make a major push into next level e-commerce fulfillment, providing customers with better service and faster order delivery from a wider range of online products.



COURTESY OF AUTOSTORE



SERGEY NIVENS/SHUTTERSTOCK.COM

*“When we talk about predictive analytics today, we’re not talking about it as a mysterious box in the corner. We’re talking about it in the context of how you make better, smarter decisions; how you get ahead of the curve; how you think through your supply constraints and your product costs. It’s just part of the broader solution and discussion.”*

**Ryan Renner,**  
**Deloitte Consulting**  
**LLP Principal,**  
**Strategy and**  
**Operations Analytics**  
**Leader**

### Big Data and Predictive Analytics

What was once just a buzzword for the future of data analysis has shown itself to be a formidable lever for value creation and competitive advantage in many business areas. Predictive analytics is a powerful tool for uncovering insights from the data that digital supply chains provide. In addition to helping forecast consumer behaviors and risk, analytics is also becoming a valuable tool to improve efficiencies in supply chain operations by providing important information on the efficiency and maintenance of equipment and systems.

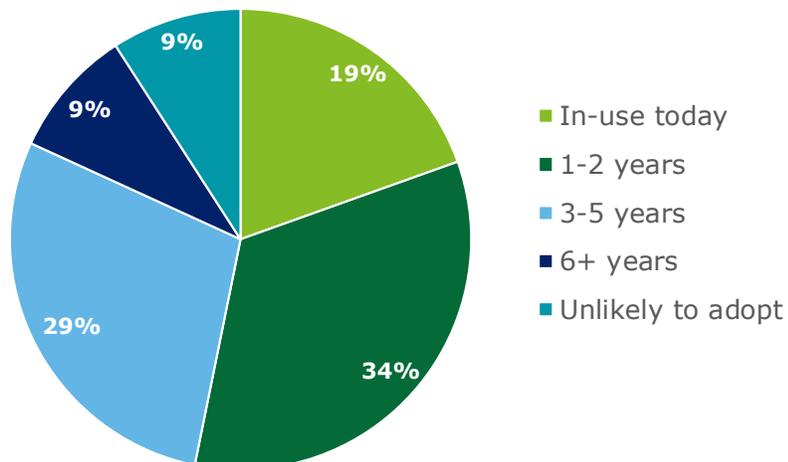
According to the survey, 62% of respondents believe predictive analytics will either be a source of competitive advantage or will disrupt the industry, up from just 38% in 2015. At the moment, only 19% of surveyed companies say they are currently using predictive analytics, but over the next five years the adoption rate is expected to jump to 82% (Figure 9). These numbers suggest early adopters may have a significant opportunity to get ahead of the competition in this important area.

### Predictive analytics help supply chains make better, faster decisions

Predictive analytics is not so much a standalone solution as it is a key component in the larger context of making better supply chain decisions.<sup>2</sup>

NextGen supply chains can generate enormous amounts of information. Analytics give decision makers the insight to take action on this information, helping supply chains exceed customer expectations through improved traceability, visibility, forecasting, and customer and vendor relationship management. By using analytics to not only monitor the efficiency of their vendors and supply chain operations, but also to more accurately predict demand, firms can give their customers what they want, when and how they want it.

Figure 9: 2018 Survey Results – Predictive Analytics Adoption



# Case Study - Lift Truck Fleet Management



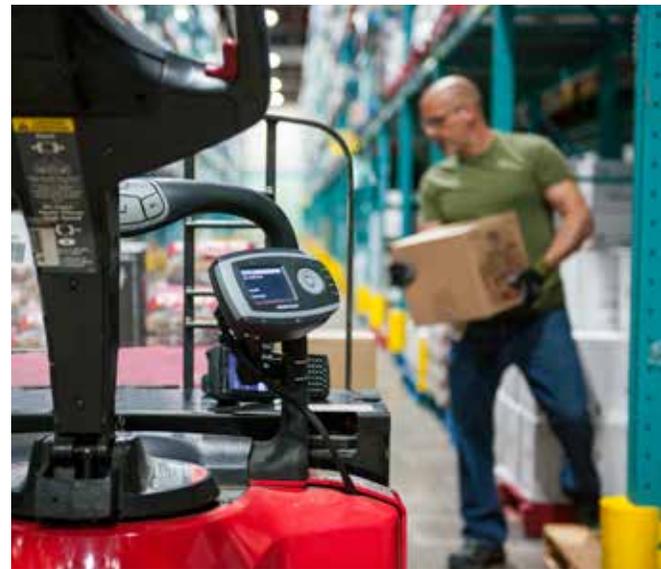
**Situation:** An alcohol beverage retailer was especially proactive in protecting its biggest asset — its people. Although the company encourages all employees to take personal responsibility for themselves and the equipment they use to do their jobs, management needed better insight into the daily activities of warehouse operators in order to support this approach. It also needed more information to make general warehouse decisions and improvements.

**Actions:** The company decided to implement iWAREHOUSE, a telematics system provided by MHI member The Raymond Corporation, to help manage its fleet of 40 lift trucks. Telematics involves the use of telecommunications and sensor-collected information to help plan and control vehicles on the move. The system allows managers to collect and report on operational and maintenance data for their industrial vehicle fleets and operators.

Alerts about damaged or improperly performing equipment were very important features, as were customizable startup speeds and records of service history to improve reporting.

**Result:** The system provided an immediate payback by enabling the company to manage its warehouse equipment and operators more efficiently and effectively. Employees were more accountable and responsible on their trucks, reducing damage to equipment and racking in the warehouse. Also, there was an immediate change in employee behavior. Operators appreciated knowing their equipment was

up-to-date on maintenance and would perform well. New employees embraced the ability to operate their equipment at customized reduced speeds. And managers were better equipped to provide a supportive operating environment for their people and machines, with a clear picture of exactly what was happening in the warehouse.



COURTESY OF THE RAYMOND CORPORATION



COURTESY OF OTTO MOTORS

### Internet of Things (IoT)/Sensors

Use of IoT and sensors in supply chains is expected to grow exponentially, and many believe that sensor technology — while already widely used in many formats — is just now on the cusp of becoming ubiquitous. Already, nearly half of respondents (45%) are using sensors in their supply chain operations, making it one of the most widely adopted innovations over the past five years.

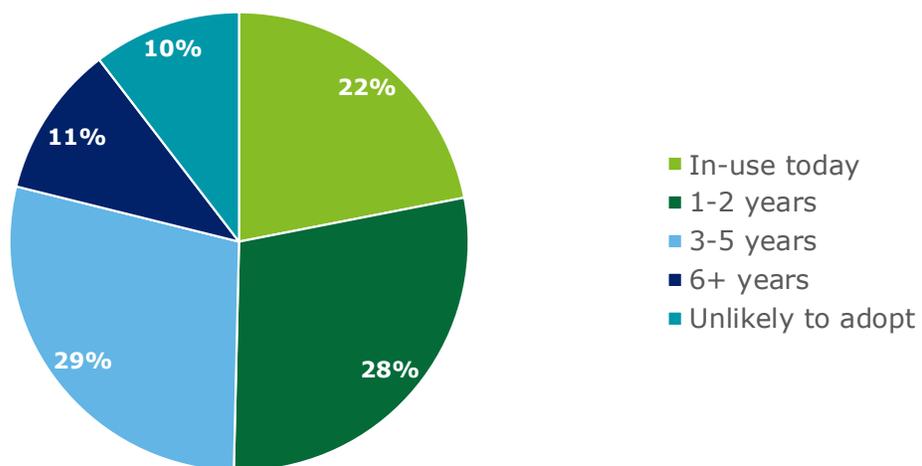
#### IoT Projected to Grow Along with Sensors and Predictive Analytics

A perfect storm of factors has led to increased interest in IoT for supply chains. Prices for sensors and other technologies have decreased significantly. Meanwhile, faster and more af-

fordable computing power, coupled with the availability of cloud storage, has made it possible to develop systems that can take in massive amounts of data and then use that data to generate insights that drive business outcomes.

The adoption rate for IoT in supply chains is currently 22%. However, it is expected to reach 50% within two years, and 79% within five years. (Figure 10). Sensors and automatic identification — upon which IoT relies heavily — are seeing similarly high levels of growth (the adoption rate is currently at 45% and is expected to reach 86% over the next five years), as is predictive analytics (currently 19% but expected to reach 82% within five years), which is fed with IoT-generated data.

Figure 10: 2018 Survey Results – Internet of Things Adoption



*“What good would it be to generate more data from sensors, yet not have a predictive analytics platform that’s able to handle the proliferation of data that’s coming in [and then] be able to provide insight that can become actionable in near time if not real time?”*

**Randy V. Bradley, PhD, Assistant Professor of Information Systems and Supply Chain Management, University of Tennessee**

**Real-World Impacts of IoT**

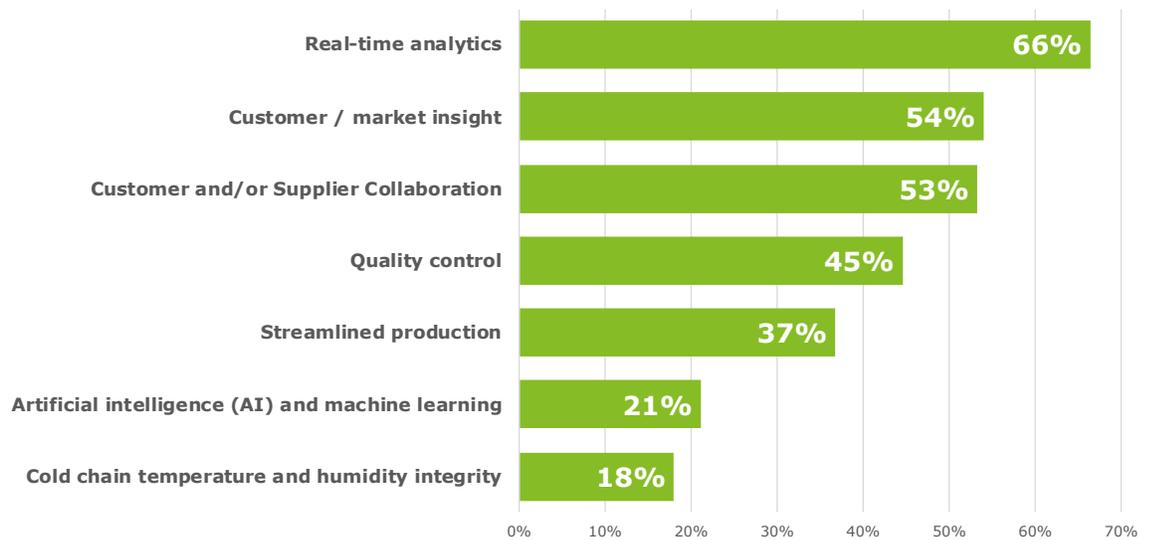
According to the survey, firms are most often using IoT for real-time supply chain analytics (66%), to gain customer/market insight (54%), to enhance customer/supplier collaboration (53%) and to improve quality control (45%) (Figure 11).

Companies that use IoT should see increased efficiency, speed, throughput, and quality in their operations. Many Fortune 500 companies have already begun quietly adopting IoT in their supply chains to gain a competitive edge. And given the high expected adoption rates for supply chain IoT over the next five years, other companies that want to remain competitive in the NextGen supply chain environment should start taking action now.<sup>3</sup>



GAUDILAB/SHUTTERSTOCK.COM

**Figure 11: 2018 Survey Results – Internet of Things, Most Common Uses in Supply Chains**



# Case Study - Cold Chain Visibility with Sensors and Internet of Things



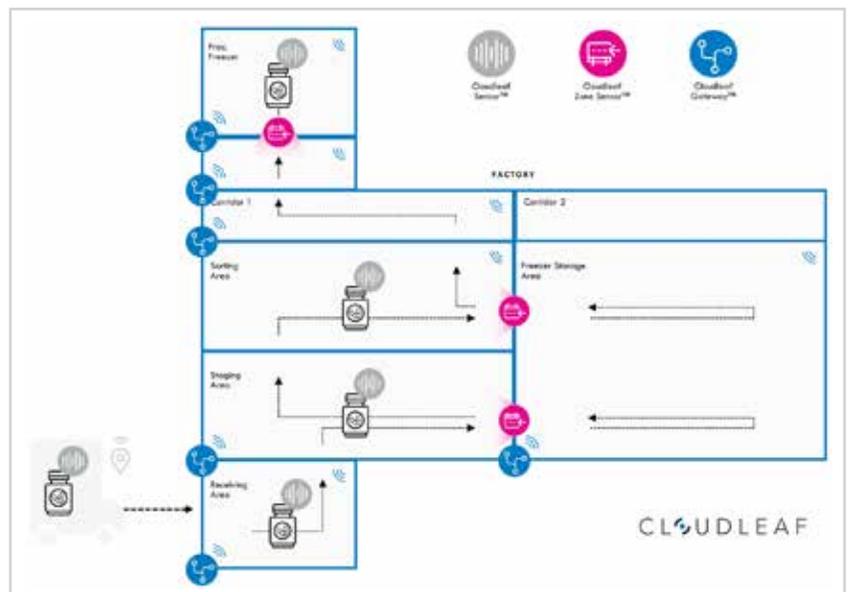
**Situation:** A large pharmaceutical company needed to improve the operations inside its manufacturing facility to keep up with federal regulations, and to cut unnecessary costs out of its operations to remain competitive. Some of the challenges faced were meeting FDA compliance regulations for chain-of-custody throughout the site, from dock door to finished product. Due to the nature of the operation, there was increased focus on avoiding infractions or material losses, which would cost the company millions of dollars per occurrence.

Preventing such actions was a daunting task because the team was managing the operations with hard copy paperwork, digital spreadsheets, and simple barcode scanners. Inefficient manual processes had difficulty keeping up with the thousands of pallets stored across the million square foot facility. In addition, a lack of visibility to insightful data (such as inventory dwell times, etc.) prevented the team from effectively managing the operations.

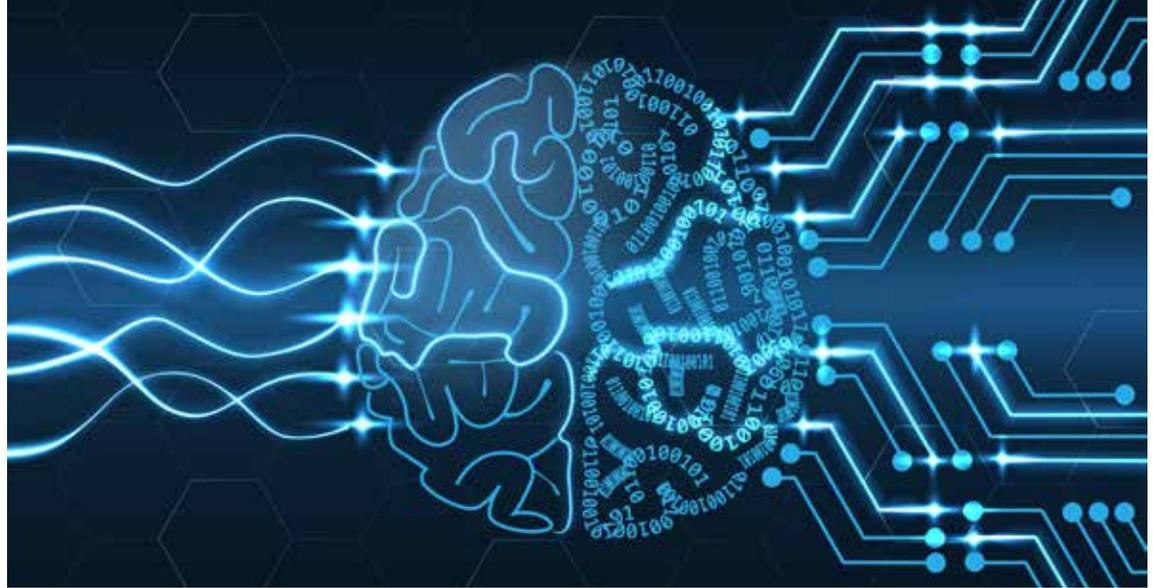
**Actions:** The company approached MODEX 2018 exhibitor Cloudleaf for an end-to-end solution that would provide real-time visibility, automation,

and data integrity to improve its operations. The solution involved a series of sensors and gateways that could track the ingredients at every stage of the custody chain. The project was set up to provide complete visibility and end-to-end, continuous monitoring — 24 hours a day, seven days a week. In addition to the visibility solution, Cloudleaf was to establish access to data such as inventory dwell times, aging reports, and cycle time metrics to enable proactive monitoring and continuous improvement initiatives.

**Result:** The company experienced significant improvements as a result of the enhancements to its operations. The company gained real-time audit and compliance reporting capabilities to help avoid high penalties and infractions from the FDA, increasing its incident free metric to 99%. Also, the company completely recovered its initial investment within the first year thanks to improved efficiencies and reduced product losses.



COURTESY OF CLOUDLEAF



LAURENT/SHUTTERSTOCK.COM

*“Those who are embracing predictive analytics, artificial intelligence, and higher analytics in general as part of their core business strategy are doing better financially than those stuck in pilot proof-of-concept mode.”*

**Ryan Renner,**  
**Deloitte Consulting**  
**LLP Principal,**  
**Strategy and**  
**Operations Analytics**  
**Leader**

### Artificial Intelligence

Artificial intelligence (AI) is intelligence exhibited by machines, or when machines mimic human problem-solving and learning. AI can perform tasks that typically require human intelligence, such as decision-making, speech recognition, visual perception, and language translation.

AI also has valuable uses in big data analytics. As noted earlier, firms increasingly rely on analytics to make sense of the mountains of data generated by NextGen supply chains. AI solutions can streamline and automate these processes as they learn and drive continuous improvement over time.<sup>4</sup>

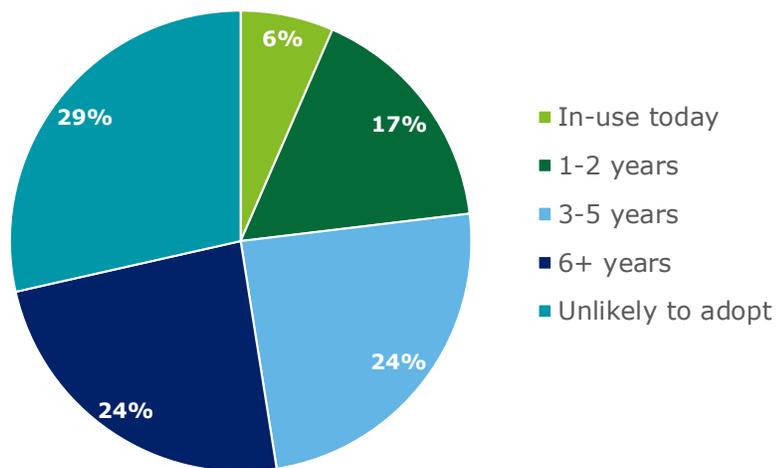
AI provides three major benefits for supply chains: flexibility, reliability, and speed. More broadly, 53% of survey respon-

dents believe AI has the potential to disrupt and create competitive advantage.

AI holds great promise for enhancing supply chains, including faster deliveries, improved analytics, reduced redundancies, and increased agility in response to changing customer demands. Although the current adoption rate is currently only 6%, it is expected to jump to 47% over the next five years (Figure 12).

Key applications for AI technology in supply chains include demand sensing, supply sensing, and advanced planning systems. For all of these applications, a key to success will be striking the right balance between highly optimized human labor and intelligent automation.

Figure 12: 2018 Survey Results – Artificial Intelligence Adoption Rates



# Case Study - Order Fulfillment with AI Robots



**Situation:** A large retailer with both an online and physical presence faced challenges fulfilling customer orders, largely due to rising customer expectations for faster delivery and access to a larger selection of products. The company's existing automation systems were not able to recognize and pick a wide variety of consumer products: odd shapes, blister packs, bags, cartons, tubes, bottles, etc. Consequently, the company had to deploy additional manpower at its distribution centers to handle the orders and ensure they reached the customers on time. This led to rising labor costs, manpower shortages, and increased human errors.

**Actions:** The retailer sought a long-term solution to fulfill orders more efficiently and quickly without the burden of additional labor costs. Ultimately, it decided to implement Goods to Robot (G2R) Robotic Cells by MHI member Universal Logic to provide high-speed automated piece-picking for order fulfillment. The solution combines the speed and flexibility of an industrial robot with the ease of deployment provided by collaborative robots.

The brain of the robotic cell is cloud-based AI software that uses data from smart IoT sensors and machine-learning al-

gorithms to provide real-time part recognition capabilities, making the robots highly versatile. The robotic cell continually learns and evolves, becoming smarter over time and adjusting to different parts, containers, and forms, thereby eliminating the need for frequent robot programming.

The retailer did not require any modifications to its existing facility layout because the entire solution – robot, gripper, sensors, software, and operating panel -- fit well within the facility's existing 4' x 4' work areas and was installed and operational within a day. Also, the company's existing warehouse management system smoothly integrated with G2R's cloud-based SaaS solution to provide reports and operational metrics for continuous performance measurement.

**Result:** With productivity rates 25% higher than past operations, the retailer was able to reduce its order picking costs by more than 50% while also achieving more than 99.5% order pick accuracy. The company now plans to leverage the speed, ease of deployment, flexibility, and cost benefits of the robotics and AI system across many of its locations with similar picking opportunities.



COURTESY OF UNIVERSAL LOGIC



HALFPOINT/SHUTTERSTOCK.COM

### Driverless Vehicles and Drones

Driverless vehicles have been used at industrial facilities for decades; however, deployment of this new generation of smart driverless vehicles and unmanned drones with sensor technology is creating both disruption and efficiencies in supply chains; 52% of survey respondents now believe driverless vehicles and drones have the potential to create competitive advantage and disrupt the industry, up from 30% in 2015.

Although adoption is currently low (11%), 50% of respondents say they will adopt these technologies within the next five years (Figure 13).

#### Real-World Applications

While there is a lot of media coverage about driverless vehicles and drones being tested for future freight and parcel delivery, this technology is already being widely deployed in manufacturing facilities and distribution centers for material and product movement, order picking, and cycle counting.

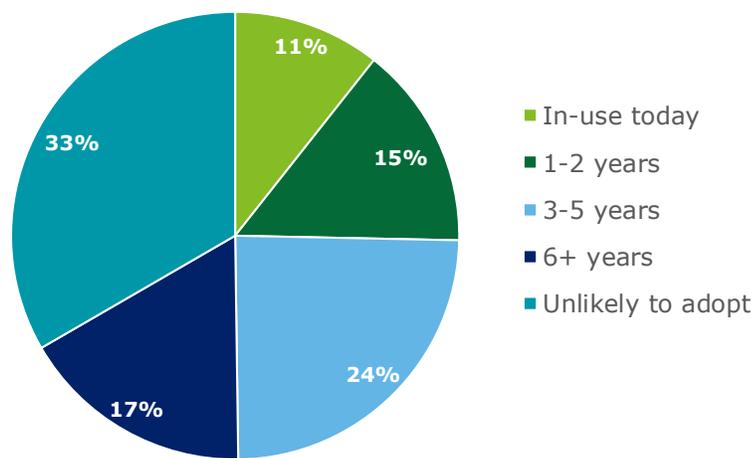
Many companies currently using the technology report significant improvements in accuracy, efficiency, and labor costs.

Driverless vehicles and drones offer automation that is flexible and scalable. A company can purchase any number of vehicles and still have them be effective tools. Driverless vehicles and drones are also transportable, unlike other forms of automation that are static fixed assets.

#### Driverless Vehicles for Product Delivery to Consumers

The idea of delivering consumer orders with this technology is still a work in progress. However, leading companies are keenly focused on using the technology for such deliveries, obtaining dozens of drone-related patents in recent years. For example, one firm has introduced a fleet of knee-high robots to handle food deliveries. The self-guided devices, which resemble ice chests on wheels, travel along the sidewalks of Washington, DC, navigating streets and crosswalks while avoiding collisions with pedestrians.<sup>5</sup>

Figure 13: 2018 Survey Results – Adoption of Driverless Vehicles and Drones



# Case Study - Robots on Autonomous Vehicles



**Situation:** A Tier 1 parts and equipment supplier for automotive OEMs faced increasing competitive pressures from global supply chains, forcing the business to optimize operating costs and increase margins. Manufacturers in this industry have an increasingly difficult time hiring, onboarding, and retaining staff to support the production process and keep pace with customer demands. Baby boomers are retiring, and fewer young people are entering the manufacturing industry, creating a significant labor shortage. In fact, some industry observers project that 60% of manufacturing jobs will go unfilled over the next decade.

**Actions:** The company viewed automation as a potential solution that could eliminate many repetitive, non-value adding tasks and make the business more cost competitive. To that end, it partnered with MHI member OTTO Motors to deploy a dual-arm robot, mounted on an OTTO self-driving vehicle, to perform specific tasks in the production process. Each vehicle receives a job request from the production system, then autonomously navigates through the facility to a workstation, while avoiding obstacles and people. Once at the workstation, the vehicle positions itself so the robotic arm can perform the process. It then moves to the next stage in the process.



IMAGES COURTESY OF OTTO MOTORS

**Result:** Robotic arms have been commonplace in manufacturing environments for decades; however, they have generally been stationary. This meant production lines had to be designed around the robot, limiting the scope of tasks that could be automated, and requiring costly and time-consuming changeovers.

This OTTO solution is unique in using self-driving vehicle technology to make the robotic arm mobile, enabling the cost to



be amortized over a wider range of processes by automating many discrete tasks in physically separate locations. For example, instead of requiring one robotic arm for every automated work cell in a plant, a single arm mounted on an autonomous vehicle can serve many work cells, reducing costs and increasing equipment utilization to improve both margin and throughput. Another benefit is that manufacturers can change their lines over faster and serve more processes with less equipment, making their operations more competitive.

Business imperatives addressed through this innovation included: reducing costs and improving efficiencies, aligning costs to business strategy, improving service quality, and conserving human capital.

# Overcoming Barriers to Adoption



“The time is now to think big, but start small and act fast. You don’t need to invest a lot to start testing these technologies.”

- Scott Sopher, Principal and Leader of the Global Supply Chain Practice, Deloitte Consulting LLP

PHONLAMAI PHOTO/SHUTTERSTOCK.COM

Companies around the world continue to make significant progress toward achieving the vision of NextGen, digital supply chains. However, today’s adoption rates are markedly lower than what survey respondents predicted back in 2014 (Figure 14).

This is actually a very common pattern for transformational technologies, and should not be viewed as an indictment of their potential long-term impact. Even the internet went through several years in which adoption rates and real-world uses cases fell short of sky-high expectations. Of course, the internet eventually went on to have a massive impact on how people all over the world live and work.

Today’s lower than expected adoption rates do, however, provide a useful reminder that technology transformation is extremely difficult, and that there are always challenging barriers to overcome (Figure 15).

According to this year’s survey, there are three main barriers to greater adoption of NextGen supply chain innovations:

- 1. Business case and ROI:** Difficulty estimating the full benefits and costs of disruptive technologies, leading to underinvestment and limited action.
- 2. Skills and workforce:** A shortage of leaders and workers with the vision and technical skills to drive

and execute NextGen supply chain innovations.

**3. Trust and cybersecurity:** Perceived lack of a mechanism for efficiently and reliably establishing trust when conducting transactions and sharing information across the supply chain. Also, rising risks from cyberthreats as supply chains become more digital and IoT becomes more prevalent.

Addressing these barriers will help supply chains accelerate adoption and reap the full benefits of NextGen supply chain technologies. The following sections provide practical advice and guidance to help companies overcome the barriers.

Figure 14: 2014 vs 2018 Survey Trends on Adoption

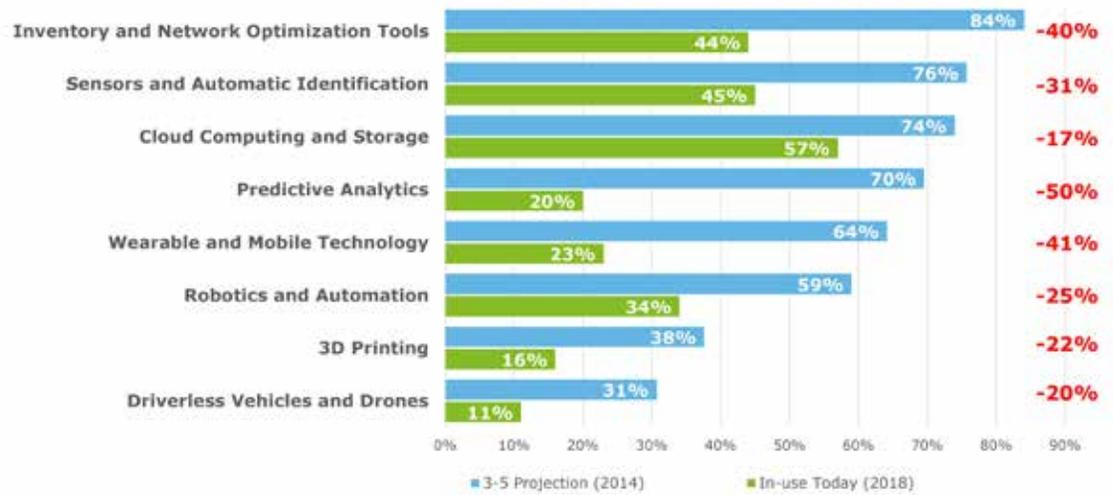
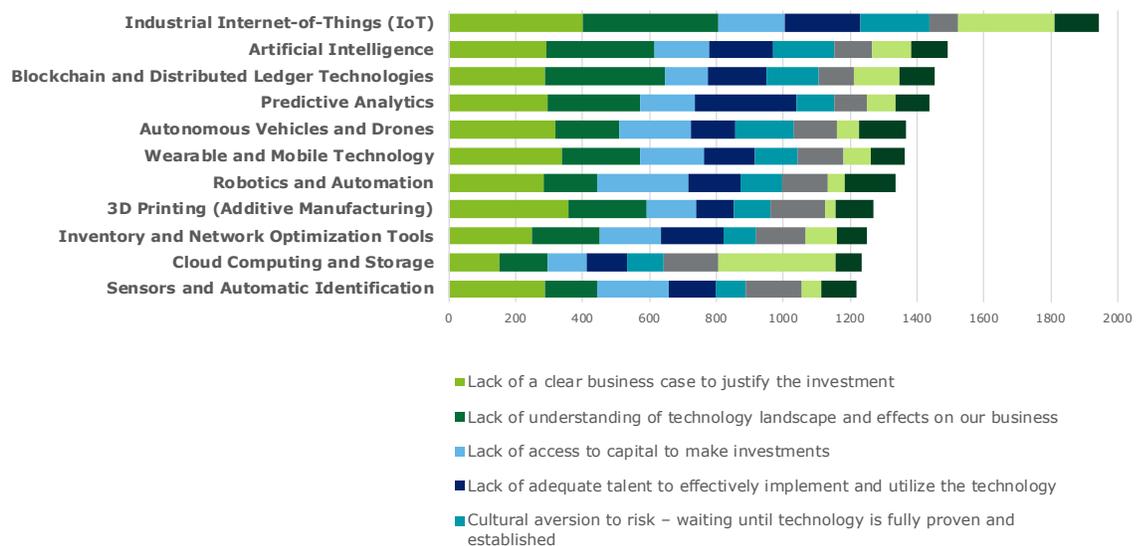


Figure 15: 2018 Survey Results – Barriers to Adoption





PIXFLY/SHUTTERSTOCK.COM

# Overcoming Barriers to Adoption

## Barrier #1: Making the Business Case for NextGen Supply Chain Investments

Justifying investments in established technologies is relatively straightforward. Vast experience from previous investment decisions and implementations provides a clear idea of what costs and benefits to expect. In many cases, there are even fill-in-the-blank templates that can help create a realistic business case. By contrast, justifying investments in new and innovative technologies is a much more ambiguous process. Innovation, by its very nature, is full of open questions — especially in the early stages — and information about costs and benefits is often imperfect and speculative.

Not only is minimal objective data available for innovative technologies, but the combined impact of innovations is often many times greater than the sum of their individual impacts, making it even more difficult to prepare a realistic business case.

Adding to the challenge is the fact that financial gatekeepers in many organizations impose a formal structure for preparing and evaluating business cases — a rigidity that is fundamentally at odds with the fluidity and uncertainty inherent with disruptive innovations.

There are numerous articles about the mechanics of building a business case. However, the key to constructing a success-

ful business case for breakthrough innovations will not be found there.

In fact, there is no single approach that fits all companies equally well or works under all circumstances. There is, however, much to be learned from companies that have successfully implemented new innovations. Here are some leading practices from successful companies on how to build business cases to justify innovation investments:

### **Think big...really BIG. Start small...really SMALL. Grow fast!**

This motto of successful technology and innovation implementations also applies to the business cases that launched them. An effective business case needs to convey the true value of the proposed innovation, and should therefore be presented in the broader context of an overarching program that may involve multiple innovations, as well as reflect the synergies enabled by the interplay between those innovations. For example, the value of sensors is amplified by the use of IoT to propagate sensor data, and by an analytics platform to turn data into insights that can be leveraged across the supply chain.

Like successful innovators, you need to consider a comprehensive range of possible future scenarios. Also, when contemplating improvements, you should think *leapfrog* and *breakthrough innovation*, not *incremental catch-up*. Otherwise, by the time the improvements are implemented the bar will have risen and your company will likely still be behind.

That being said, business cases of successful innovators generally start small in the context of thinking big. They break the value proposition into small, bite-sized pieces with provisions to pilot, learn fast, refine, and roll out quickly. Then they make big moves once their small steps have been validated and proven.

#### **Define the Impact of Inaction**

Effective business cases must evaluate and prioritize innovations against a baseline of inaction. When facing potential disruption, it is not safe to assume that the status quo will continue unabated. That's why it is very important to always consider the "do nothing" scenario, with realistic estimates for the consequences of inaction.

Potential costs and consequences of inaction include:

- Un-scalable operations
- Decelerating speed to market
- Increased risks
- Compliance slippage
- Loss of competitiveness
- Loss of market share

#### **Consider the Perspective of Customers**

Successful innovators consider more than the incremental value of an innovation. They get close to their customers to try and learn everything about them, and to find out where they are headed. It is crucial to involve customers in developing the value proposition for a new innovation so you can understand what they value -- and what they are willing to pay for.



COURTESY OF FETCH ROBOTICS



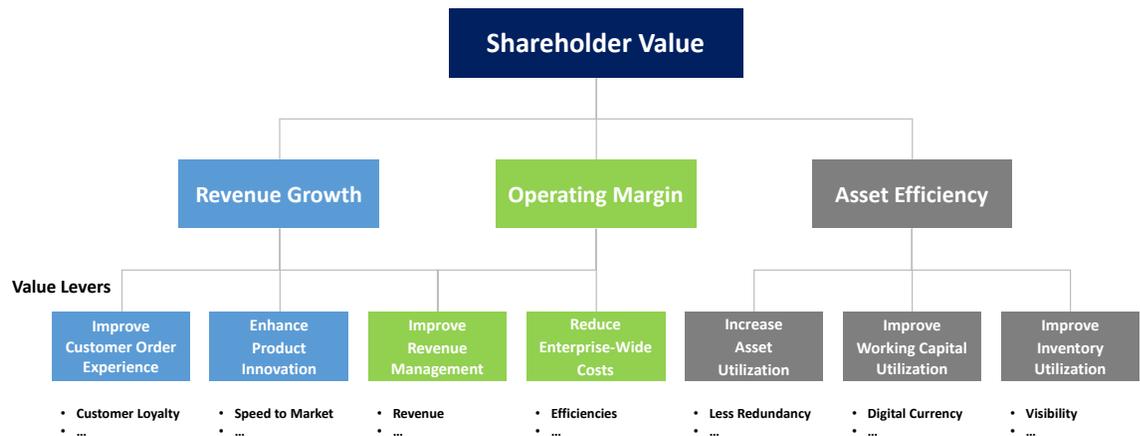
## Getting Started

### Develop a common framework for innovation business cases, mapping benefits to shareholder value

Successful innovators learn another language — the language of the CFO, who is typically the key decision maker in evaluating and approving business cases. Learn to think like a CFO.

To make investment decisions like a CFO, understand an innovation's benefits and then map them to shareholder value. Identify value levers for each of the three shareholder value categories — revenue growth, operating margin, and asset efficiency — and then quantify the benefits relative to each of the value levers. Finally, roll the benefits up to the three categories, communicating the business case in terms of how the innovation will contribute to shareholder value (Figure 16).

Figure 16: Example of Mapping to Shareholder Value<sup>6</sup>



### What Leaders Should Be Doing

- Foster a culture of innovation, providing freedom to fail on the path to success
- Focus on the overall program transformation, not individual investments
- Involve customers in the analysis and business case development
- Involve cross-functional stakeholders, including suppliers and/or strategic customers
- Include potential revenue gains
- Negotiate with technology providers for pilot programs
- Consider the labor cost increases due to the workforce shortage



COURTESY OF UPSKILL

# Overcoming Barriers to Adoption

*“What we find is talent of these two generations — because they’ve grown up immersed in technology — wants to work at places where they believe technology is an important focus and where it will give them a competitive edge.”*

**Angie Freeman,  
Chief Human  
Resources Officer at  
C.H. Robinson**

## Barrier #2: Tackling the Supply Chain Skills Gap and Workforce Shortage

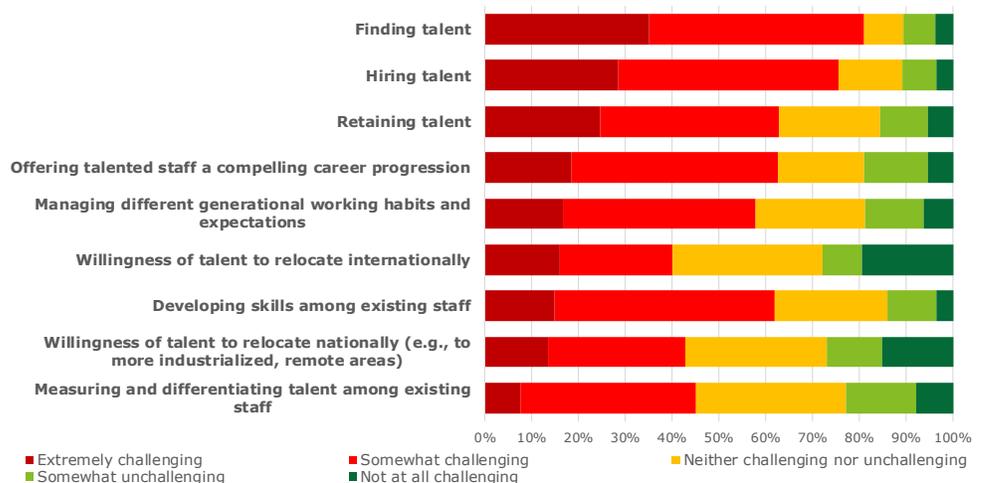
The supply chain workforce shortage has been well documented and studied in previous versions of this report. As in years past, the current survey results show that finding, hiring, and retaining talent remain top challenges for supply chain organizations — a trend that is unlikely to go away any time soon (Figure 17).

Solutions to the growing talent gap have eluded supply chain executives for a decade. To address the problem, companies should apply the same innovative mindset to people

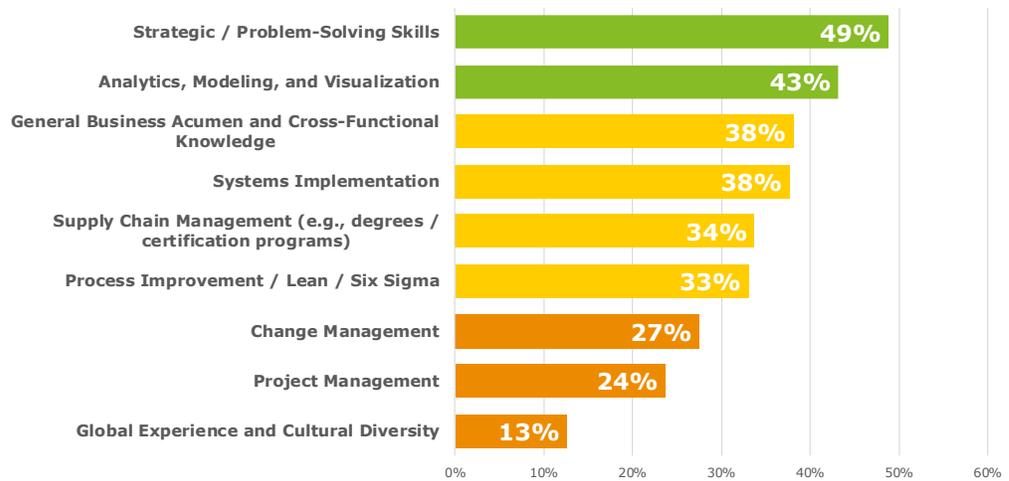
challenges that they apply to technology challenges. In particular, they need to find innovative ways to develop the increasingly technical talent required to support the NextGen supply chains. This will likely mean overhauling traditional supply chain jobs to attract a new mix of talent.

The adoption of innovative technologies in supply chain is not just a step towards the digital future; it is a necessity to attract the kinds of young professionals that will keep companies and their supply chains viable. A recent APICS sur-

**Figure 17: 2018 Survey Results – Workforce Challenges**



**Figure 18: 2018 Survey Results – Skills Needed for the NextGen Supply Chain**



vey<sup>7</sup> found that Millennials in the workforce are enthusiastic about careers in supply chain management; however, the survey also revealed that 66% of the people holding supply chain positions enjoy them because they get to work with the latest technologies.

To support the transition to NextGen supply chains, supply chain leaders should be applying a new, forward-looking talent model — not just trying to back-fill for yesterday’s traditionally skilled labor. Companies need people who can handle sophisticated data analysis (red skills), but who also have strong communication skills, business acumen, and political savvy (blue skills). Deloitte calls these multi-faceted workers “purple people” and predicts they will play a big role in achieving the vision of NextGen supply chains (Figure 19).

Analysis and research shows companies are facing a large supply gap of data analytics talent, with significant shortages at all levels (Figure 18). Entry-level positions are challenging to fill. However, the shortage of senior leaders who truly understand the power of analytics might be even more critical (despite the fact that fewer people are needed at that level) because they exert more influence over the future of the organization.

People who are not just number crunchers but can also deliver data-backed insights that create real business value are especially hard to find.

An insight-driven organization (IDO)<sup>8</sup> needs people who can 1) understand the right business questions to ask about the

*“We don’t need people to move the boxes; we need people who can manage the robots that move the boxes, and people who can analyze the data from moving the boxes.”*

**George Prest, CEO of MHI**

data; 2) create models to answer those questions; 3) present the resulting insights in a compelling way; and then 4) integrate and automate solutions into the company's day-to-day processes.

Although your organization might be lucky enough to find a few exceptionally talented individuals with all of these crucial skills, a team approach is often more practical and realistic. Required skills for the team include:

**Statistics/Quantitative Skills**

- Strong quantitative skills
- Able to research, develop, and correctly apply statistical models

**Data Manipulation Skills**

- Strong data modeling and management skills
- Understands structure and lineage

**Tech Integration/Apps/Automation**

- Strong IT skills
- Able to integrate and automate



MATEJ KASTELIC/SHUTTERSTOCK.COM

**Visualization/Graphic Design**

- Strong creative design skills
- Can visualize and design a satisfying user experience

**Domain and Sector Expertise**

- Strong business and process skills
- Understands content and context

Figure 19: Purple People®





## Getting Started

### Become an Insights Driven Organization (IDO)

Every organization is built differently, and a one-size-fits-all solution does not exist to help companies fill their talent gaps. However, the IDO framework is a great place to start for companies that hope to lead the way on NextGen supply chains.

The IDO framework outlines five essential building blocks required to become an IDO: Strategy, People, Process, Data, and Technology (Figure 20).

To become an IDO, develop a roadmap with detailed initiatives for each building block, along with recommendations for the organization's operating model and governance model. Expect to shift insight-driven decision making from an executive-level activity to an all-employee activity.

Figure 20: Example of Mapping to Shareholder Value<sup>6</sup>



Strategy	People	Process	Data	Technology
Analytics Vision	Leadership	Ideation & Prioritization	Information Model & Data Sources	Tech Disruptors & Vendor Strategy
Value Drivers & Business Case	Organization Design	Agility & Scalability	Data Quality & Management	Reference Architecture
Stakeholder Management	Talent	Process Re-engineering & Automation	Data Monetization	Discovery Zone
Operating Model	Change Journey & Decision Process	Governance	Ethics & Sharing	Cloud vs. On Premise
Innovation	Knowledge Management	Benefits Realization	Regulation & Compliance	Security, Reliability & Continuity



### What Leaders Should Be Doing

- Expect a competitive talent market for NextGen supply chain skills
- Find a C-suite champion for the new, forward-looking supply chain talent model
- Start by focusing on current and future business issues, not past talent models and back-filling
- Appoint a program lead, prioritize change, and communicate effectively
- Recognize that analytics and other NextGen capabilities require investment in continuous learning and development
- Collaborate with educational and vocational institutions along with industry associations to create needs-based curricula that help build a talent pipeline
- Establish an innovation think-tank within your organization to keep employees current with new ideas and encourage engagement
- Develop strategies for employee retention and recruitment



# Overcoming Barriers to Adoption

## Barrier #3: Building Trust and Security in Digital, Always-On Supply Chains

For all of their potential benefits, breakthrough innovations do not come without risk. The always-on supply chain is a crucial innovation that can help companies accelerate delivery, improve flexibility, pro-actively optimize inventory, and boost customer satisfaction and loyalty. However, it also presents increased cybersecurity risks — and no company is immune. Already, there have been widely publicized cyber-attacks on well-known companies that not only hurt their financial performance, but also harmed their customers and significantly tarnished their reputations.

Against this backdrop, it is no wonder that cyber risks are increasingly top of mind for supply chain executives (Figure 21). According to the survey, key issues include: the increasing ingenuity and sophistication of hackers; lack of awareness about cyber issues within supply chain organizations; and poor cybersecurity practices among small- and medium-sized suppliers.

Lack of adequate budget for cybersecurity programs is another common issue. The unfortunate reality is that companies often don't get sufficient funding for cybersecurity until after a major breach has occurred.

### Blockchain — an emerging solution for supply chain trust and security threats

Although there are many important reasons to invest in cybersecurity, the single most fundamental reason is trust. Without trust, it is impossible to conduct business effectively.

Recently, there has been a huge groundswell of interest in blockchain technology, primarily because of blockchain's ability to efficiently and reliably enable safe transactions and immutable records that can be trusted — without having to trust the other parties involved, or even know their identity.

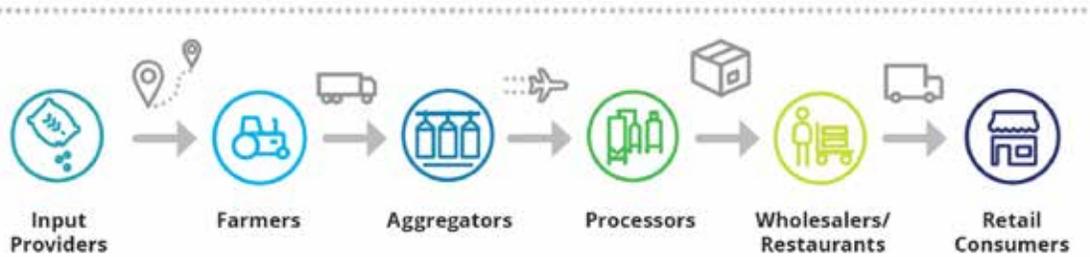
**Figure 21: 2018 Survey Results – Top of Mind Risks of Supply Chain Executives**



*“The rapid advance of blockchain technology and the Internet of Things (IoT) are felt throughout our daily lives. We are about to see more change than we could imagine with blockchain and IoT.”*

**Khwaja Shaik,  
Thought Leader,  
IBM Academy of  
Technology**

**Figure 22: The Food Supply Chain – Today**



Many articles have attempted to explain how blockchain works, and such an explanation is well beyond the scope of this report. However, the one thing every business leader should know about blockchain is that it is essentially just a shared database technology that uses extremely clever software techniques to enable shared access without fear of tampering. Blockchain records are tamper-proof and time-stamped, providing an immutable and reliable source of data.

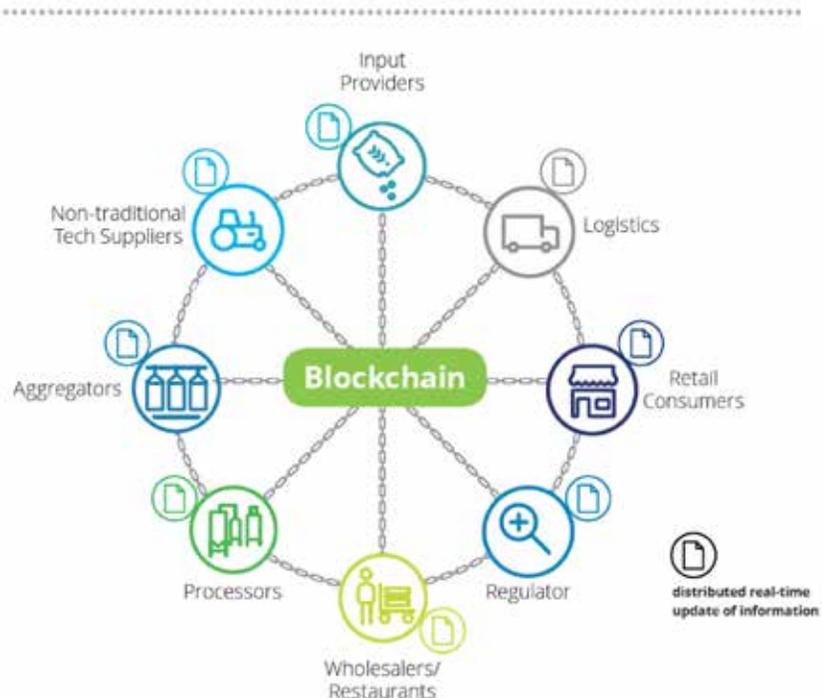
Blockchain’s unparalleled ability to enable transparent yet controlled data sharing in a way that is extremely reliable, efficient, and seemingly tamper-proof provides a powerful and robust platform for tackling some of today’s toughest supply

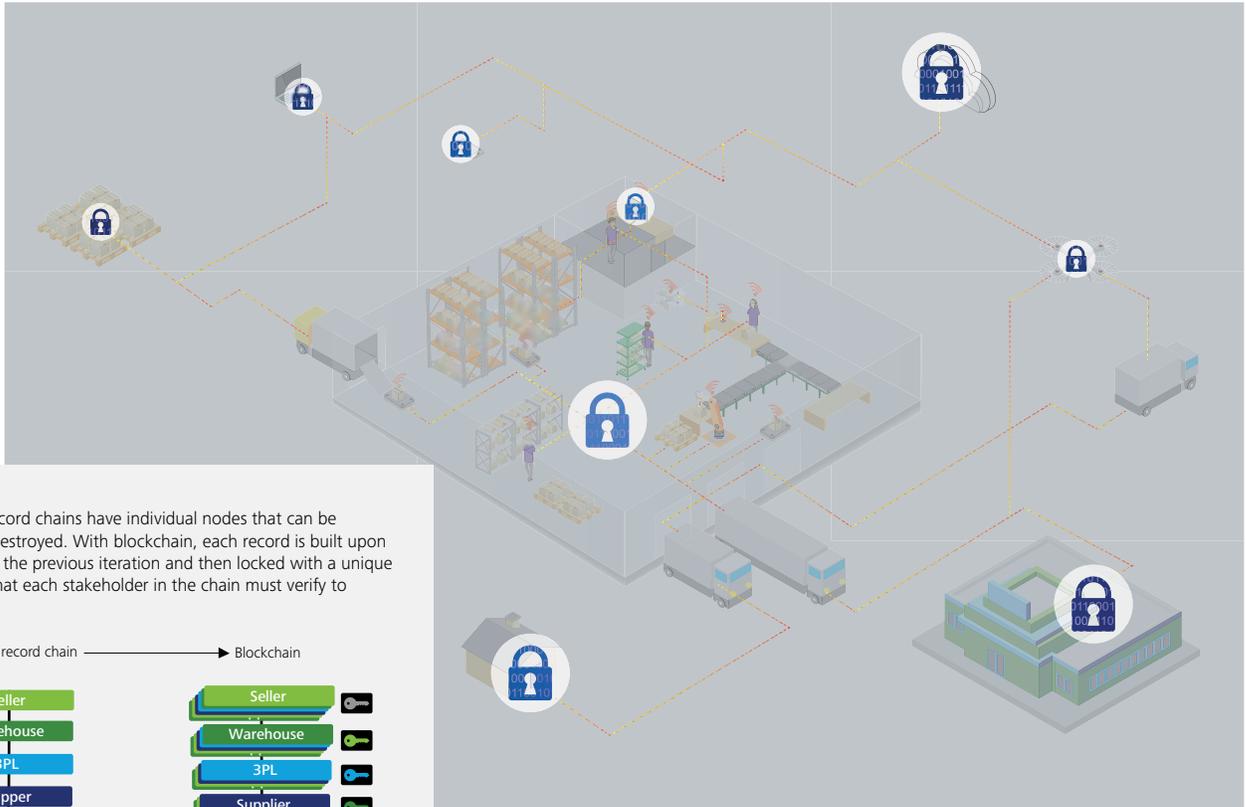
chain challenges, while also providing an unmatched level of cybersecurity.<sup>9</sup>

Although blockchain’s usefulness is most obvious in financial services, it also has great potential to improve efficiency, effectiveness, and collaboration in supply chain through improved connectedness and data sharing — without compromising security and privacy. Figures 22 and 23 illustrate how this might work for supply chains in the food industry.

Combining blockchain with IoT and other NextGen supply chain technologies can make it easier to develop innovative solutions that provide a high degree of data integrity, confi-

**Figure 23: The Food Supply Chain – Tomorrow**

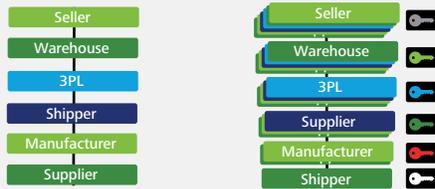




**Blockchain**

Traditional record chains have individual nodes that can be changed or destroyed. With blockchain, each record is built upon and linked to the previous iteration and then locked with a unique key – a key that each stakeholder in the chain must verify to unlock.

Traditional record chain → Blockchain



**Figure 24 : NextGen Supply Chains with Blockchain Technology**

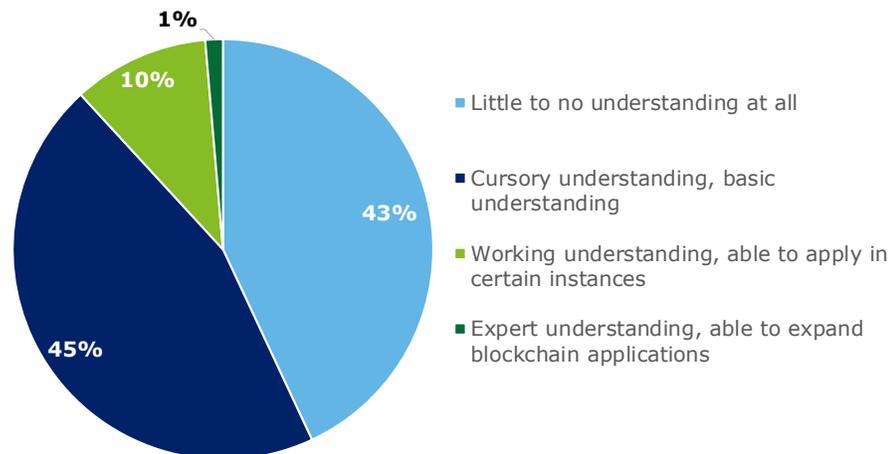
dentiality, and privacy. This can enhance trust not only with supply chain partners, but also with end customers. It also enables companies to conduct efficient transactions across the entire supply chain without having to pay middlemen (such as financial institutions) to serve as trusted intermediaries (Figure 24).

Another key benefit of blockchain is its potential to provide complete transparency at every step of the supply chain. Demand for this level of transparency is skyrocketing as consumers increasingly expect full information about the origin

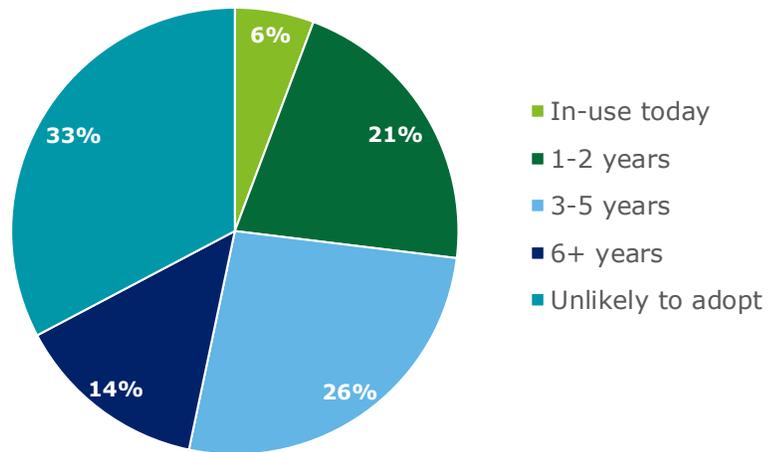
and history of the products they consume. For example, more and more consumers are demanding that the goose down in trendy jackets be completely traceable so they can be sure it was produced responsibly and humanely.

Right now, the biggest barrier for blockchain adoption is that very few people understand what it is or how it can realistically be used in their operations. According to this year’s survey, only 11% of respondents believe they have a working understanding of blockchain technology and how it might be applicable to supply chains (Figure 25).

**Figure 25: 2018 Survey Results – Understanding of Blockchain**



**Figure 26: 2018 Survey Results – Blockchain Adoption Rates**



This lack of understanding could change quickly, however. While the survey results show blockchain’s adoption rate is currently just 6%, it is projected to reach 54% over the next five years, and 71% in the years beyond (Figure 26).

Although 29% of survey respondents don’t believe they will ever adopt blockchain technology, that number may simply reflect the current lack of understanding. The fact is, supply chains have been trying to increase collaboration and data sharing for many years, but until now were deterred by concerns about security, privacy, and control over data. Blockchain addresses those concerns, opening the door to a wide range of benefits that are likely of interest to every supply chain leader (Figure 27).

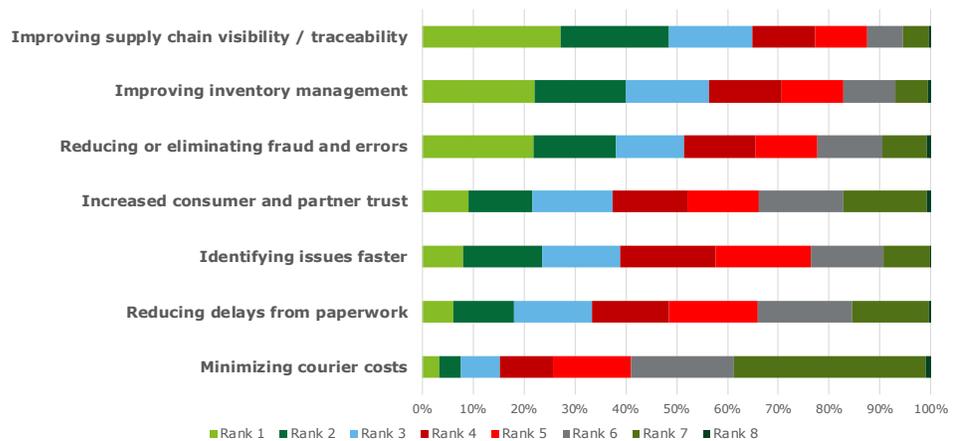
ous use for blockchain technology, compelling supply chain applications exist for every industry whose customers are demanding product transparency — not just financial services. In the automotive industry, for example, blockchain can be used to securely share vehicle sensor data with a wide range of involved parties, including dealerships, manufacturers, and even insurance providers.

Similarly, automotive manufacturers, food producers, and pharmaceutical manufacturers, among others, can take advantage of the immutable and transparent nature of blockchain to track product origin and quickly and discreetly recall products that may have been produced with a defect, minimizing brand damage, recall costs, and customer inconvenience.

**Blockchain Supply Chain Benefits Across Industries**

Although financial transactions are the first and most obvi-

**Figure 27: 2018 Survey Results – Blockchain benefits for supply chains**





## Getting Started

### Conduct a Capability Assessment to Identify Potential Value

To truly understand the specific benefits blockchain might offer, your company needs to conduct an in-depth, customized capability assessment that includes:

- Identifying specific use cases that could drive real business value
- Thinking about ways to supplement or replace projects that are currently underway
- Analyzing how competitors are implementing blockchain technology
- Collaborating with your supply chain suppliers and partners

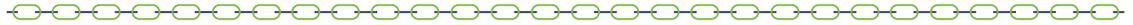
As it stands today, many companies are finding they need to at least dabble with blockchain initiatives so they don't get caught on their heels if and when the technology takes off exponentially.



### What Leaders Should Be Doing

- Consider how having access to more data (both upstream and downstream) could change your strategy and operations
- Develop and execute risk profile and vulnerability assessments
- Develop business continuity and contingency plans
- Establish a robust data management plan and records retention program
- Explore the potential applications for blockchain in your supply chain and initiate a pilot project; start with the parts of your organization that require the highest levels of trust
- Work with suppliers to improve visibility to cyber risks and collaborate on security measures (e.g., reviewing certifications of Tier 1 - Tier N suppliers)
- Conduct penetration tests that attempt to hack your systems in a controlled environment
- Explore the potential applications for blockchain in your supply chain (Look at your organization from the perspective of trust. Determine which parts of your operations require the highest levels of trust. Seek new partners based on confidence in their data and their promises. If you work with intermediaries whose only role is to "certify" trust, consider blockchain as a better and cheaper alternative.)

# Case Study - Blockchain Clinical Value Chain



**Situation:** A large biotech and pharmaceutical company wanted to modernize its clinical trial value chain and ultimately deliver a patient-centric R&D process. In the past, the processes for monitoring patient consent and tracking biological samples in clinical trials were highly fragmented and onerous. In particular, there was no simple way for a clinical trial provider, researcher, or tester to achieve end-to-end visibility into sample ownership, location, usage, consent, or clinical interpretation.

The complexity of biological sample collection and management raises many unique challenges, including:

- Lack of an integrated patient history, limiting the quality and confidence in scientific analysis, and potentially resulting in redundant testing
- Inconsistent tracking mechanisms and reliance on paper-based consent processing, making it difficult for researchers to react to changes in patient consent, and potentially putting trial sponsors at legal risk of misusing a biological sample
- Lack of auditability and transparency, exposing trial sponsors to great compliance risks in an ever-strengthening regulatory environment

**Actions:** The company decided to deploy a first-of-its-kind clinical trial management solution powered by blockchain technology. A design lab was conducted to explore “art of the possible” value drivers and use cases around patient needs, cross-functional collaboration, and digital strategies and capabilities. The company aligned leadership on functional requirements, and on joint design of end-to-end future-state clinical trial processes, from patient consent to clinical data generation.

A clinical trial management proof-of-concept (POC) was rapidly developed based on a blockchain application created in-house for supply chain traceability. The POC enabled patient consent collection and sharing in real time, while allowing patient bio-samples to be tracked throughout the clinical trials process.

**Result:** The clinical trial management POC successfully demonstrated that near real-time tracking of samples (while maintaining patient consent data in a complex supply chain)

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is a viable use for blockchain. Specifically, the POC demonstrated the power of blockchain capabilities by:

- Providing a single source of truth for consent and bio-sample management throughout the clinical trial process
- Allowing patients to have greater control over their biological samples, and to access insights and study outcomes
- Breaking down functional barriers and enabling real-time information sharing between doctors, trial sites, biobank managers, and researchers for the purposes of processing and decision-making
- Reducing regulatory risks through improved compliance and auditability

Developing a POC is the first step on the journey for a client to derive value from blockchain technology. By validating the feasibility and desirability of the technology, the clinical trial management POC established a clear value proposition for future applications in the area of clinical trial research, including:

- Genomic data integration for personalized healthcare
- Greater patient-centricity and control over samples and data collected
- Simplified research processes and unparalleled data standardization
- Automated regulatory compliance
- System and technology integration (e.g. mobile)
- Multi-partner alliances (e.g., creation of ecosystem consortium in the industry)

# Following Up on Smart City Logistics



“NextGen supply chain technologies can also help to solve the increasingly difficult challenge of moving freight and deliveries in and out of urban areas.”

- George Prest, CEO of MHI

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Last year, we introduced the topic of “Smart City Logistics” and began to examine how technologies are being leveraged to help cities address the growing challenges of congestion, noise, and pollution associated with the rising volume of last-mile deliveries within their growing populations. This year we continue our discussion of this important issue, and how NextGen supply chain innovations can help address some of the challenges.

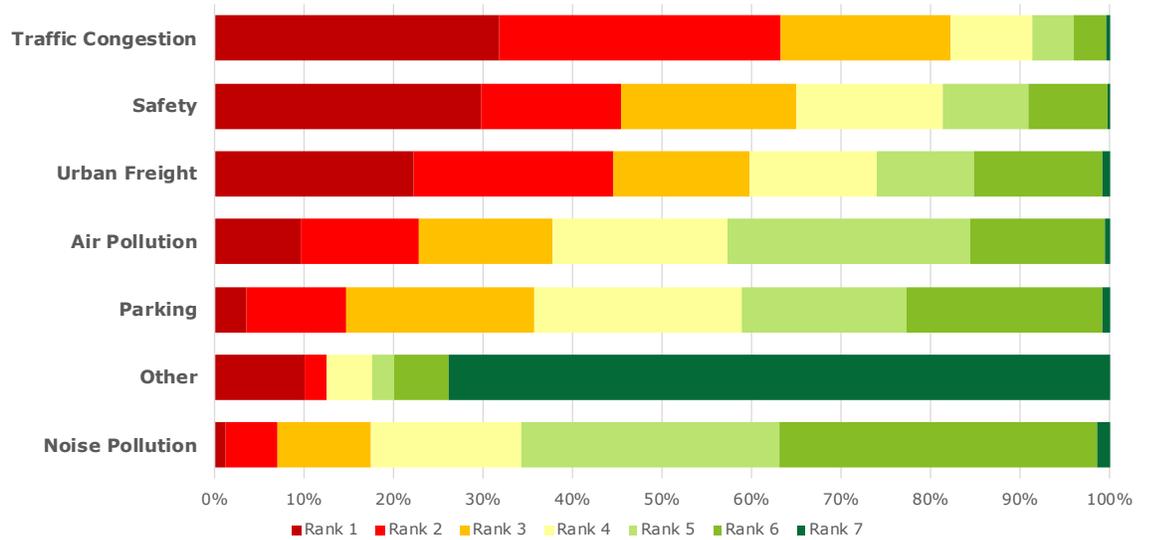
Efficiently getting orders from their last point of distribution to their final destination has always been difficult. And as the volume of e-commerce shipments has grown exponentially, this “last mile” problem — and similarly, the “last 50 feet” problem — has become even more critical. In fact, an inability to solve the riddle of the last mile has driven many promising companies out of business.

Now, as city populations continue to grow — both in size and density — the last mile riddle is becoming a major concern, not only for companies that ship goods to customers in cities, but also for the cities themselves.

One of the biggest challenges is figuring out how to serve people within cities without creating unsustainable traffic congestion, increased air and noise pollution, and heightened safety problems (Figure 28).

The collection and distribution of digital information likely holds the key to addressing these challenges. By harnessing the power of sensors, robotics, automation, IoT, drones, and wearables, NextGen supply chains could greatly improve service to customers in cities without adding to the difficulties of city life.

**Figure 28: 2018 Survey Results – Top Concerns for Smart Cities**



At the same time, involvement with smart cities can help stimulate and promote adoption of the key innovations that underpin NextGen supply chains. In particular, smart cities can be incubators to develop and pilot innovations for tackling the immense challenge of last-mile logistics in confined urban environments.

One of the recommendations from last year’s report was for supply chain leaders to begin collaborating with urban planners, city leaders, educational institutions, and even leaders from other potentially competing companies to develop solutions to smart city logistics challenges. However, according to this year’s survey results, only 12% of respondents have actively begun to seek out such collaborative partnerships as part of their development strategy (Figure 29).

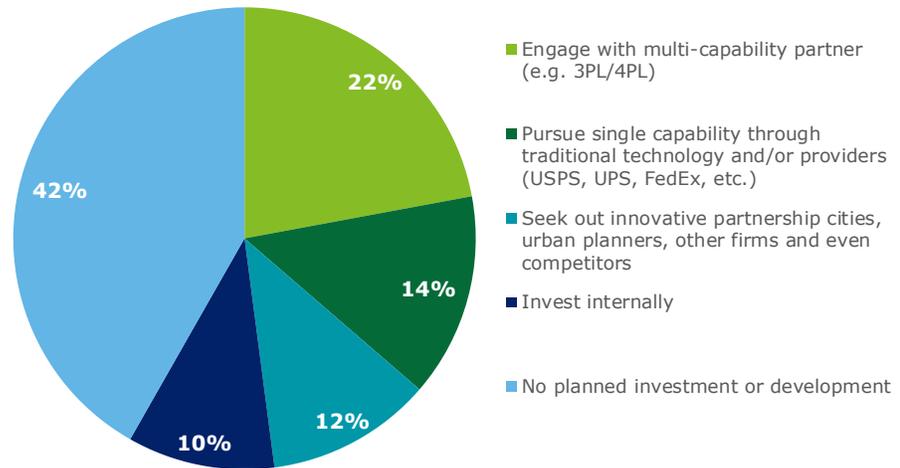
This is not surprising to Barbara Ivanov, Director of the Urban Freight Lab at the University of Washington. And the reasons

for this lack of collaboration are not simply that companies are not informed and engaged.

According to Ivanov, many cities believe their urban delivery problems are unique to them alone. As a result, there is no common problem statement, and therefore no common market for innovation — giving technology providers no economic incentive to build solutions. If cities want technology solution partners to collaborate, they must find enough commonality in their problems to attract partners.

Ivanov’s recently published research study, “The Final 50 Feet of The Urban Goods Delivery System”<sup>10</sup> is a model of how cities and companies can bridge the divide and begin to collaborate on innovative solutions that benefit both entities.

Figure 29: 2018 Survey Results – Development Strategies for Urban Freight Delivery Solutions



### What Leaders Should Be Doing

- Get involved and keep informed by staying close to industry and supply chain groups that cover smart city trends
- Support technology literacy on the front line by investing in the development of training materials and competency frameworks to ensure every employee has a base level understanding of supply chain innovations
- Understand that the smart city logistics concept is the emerging ability to invent and apply innovative capabilities, solutions, and services at the local level, based on the needs of the cities themselves
- Collaborate with urban planners, city leaders, educational institutions, and even leaders from other potentially competing companies to develop solutions to smart city logistics challenges
- Invest in local educational institutions, such as vocational schools, high schools, junior colleges, and universities; help the institutions design and deliver supply chain and technology-focused curricula

# Case Study - Final 50 Feet



**Situation:** Residents of Seattle, Washington, like the residents of many large cities, are increasingly ordering products online to be delivered to their doorsteps. And the range of products is expanding, from pre-portioned meals, to medicine, toiletries, and pet food. A new report projects that if online shopping continues to grow at its current rate, within five years there may be twice as many trucks delivering packages in Seattle's city center — and twice as many trucks looking for parking spaces.

A team of University of Washington researchers and students began analyzing delivery patterns for commercial vehicles in Seattle and discovered that 87% of all the buildings in the Downtown, Uptown, and South Lake Union areas rely on the city's curbs and alleys to receive deliveries, and only 13% of buildings have loading bays or docks that allow trucks to park on private property.

Based on this information, the researchers decided to focus their attention on what they call the "Final 50 Feet" problem: the last and perhaps most complicated leg of an urban delivery that begins when a driver must find a place to park a truck or vehicle — usually on a public street or alleyway — and ends when the customer receives the package.

**Actions:** In the report, the Seattle Department of Transportation (SDOT) and the University of Washington's Urban Freight Lab at the Supply Chain Transportation and Logistics Center (SCTL) analyzed solutions for alleviating urban congestion by making truck parking spaces more productive and reducing the growth of truck traffic.

The project is a part of a broader research initiative being



COURTESY OF URBAN FREIGHT LAB

led by the SCTL's Urban Freight Lab, which is partnering with SDOT and four large community-conscious corporations to re-think everything from how cities apportion curb and street space to how building owners manage the growing avalanche of packages delivered to urban towers.

**Result:** The team tracked real-world deliveries in a downtown office building, a hotel, a residential building, a historic building, and the retail mall at Westlake Center. What they discovered is that delivery drivers encounter logistical barriers that consume a significant portion of their time. Clearing security in urban towers took 12% of the total time, and looking for tenants and riding freight elevators took 61% of the total time. Overall, an estimated 73% of delivery time is spent in buildings.

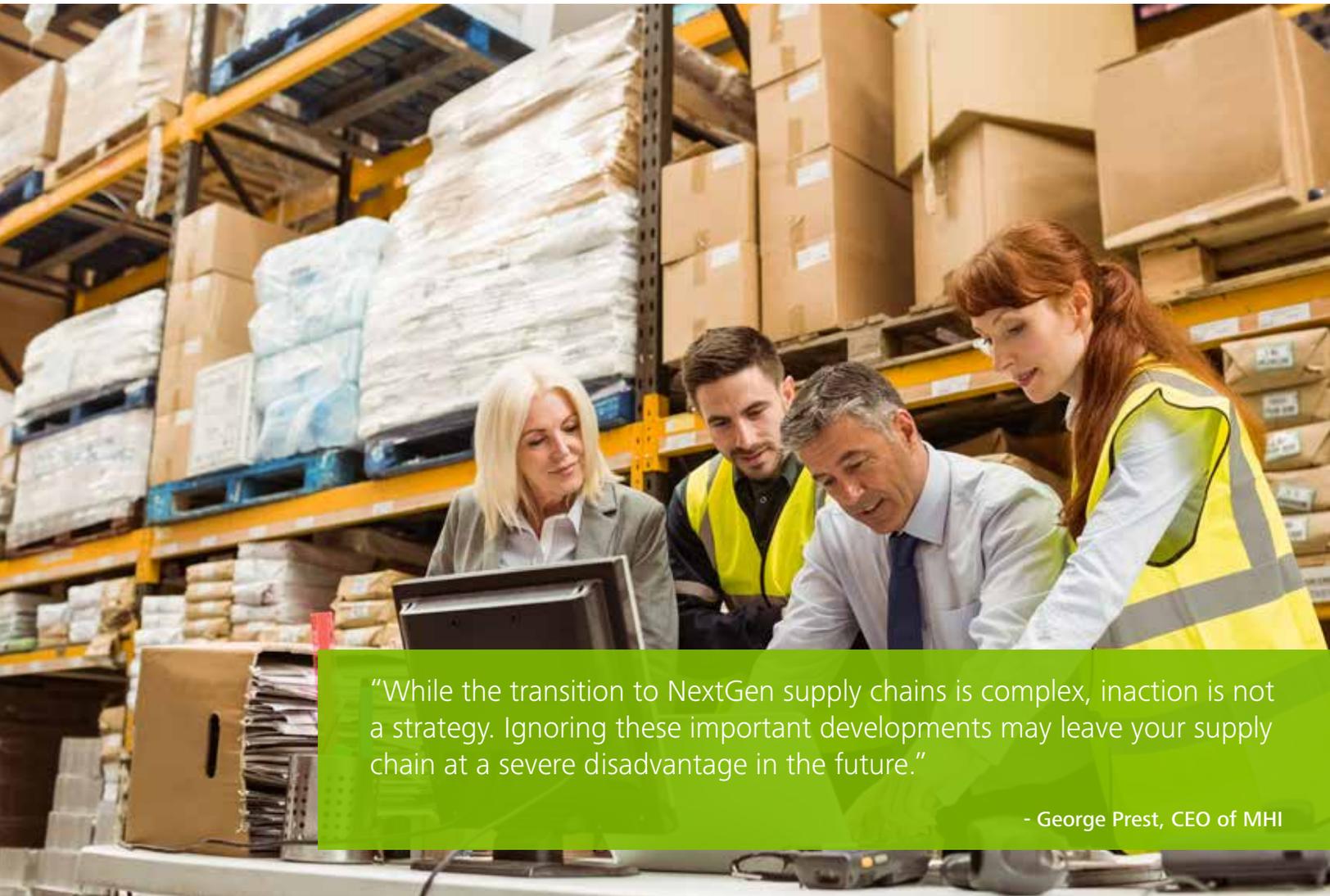
The Urban Freight Lab plans to pilot test a smart locker system in the loading bay of the Seattle Municipal Tower that could substantially reduce delivery time, failed first deliveries, and the amount of time delivery trucks occupy parking spaces that serve the building.

The smart locker pilot will allow drivers from multiple delivery companies to securely leave packages in the vestibule of the 62-story Municipal Tower. The locker system will then notify enrolled tenants of deliveries by text or email and send a lock code, allowing customers to pick up the packages at their convenience, rather than having to stop working and intercept a delivery person in the office. UW researchers and SDOT plan to test promising improvement strategies on the streets around the Seattle Municipal Tower this spring.

"Reducing the number of failed delivery attempts as well as the amount of time a delivery truck is parked in a loading space could reduce congestion and free up curb space for cars, buses, bicycles and other people who need to use that shared public space," said Barbara Ivanov, director of the Urban Freight Lab. "Those efficiencies have the added benefit of saving retailers and delivery services money, and getting orders into the hands of customers faster."

"Seattle is one of the fastest-growing cities in the country, and SDOT is committed to meeting the urban goods delivery challenges facing most big cities in the U.S.," said Christopher Eaves, project manager at SDOT.

# Conclusion



“While the transition to NextGen supply chains is complex, inaction is not a strategy. Ignoring these important developments may leave your supply chain at a severe disadvantage in the future.”

- George Prest, CEO of MHI

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Although adopting supply chain innovations is a complex challenge with many moving parts, interest and enthusiasm remain high. And the potential benefits are simply too compelling to ignore. As with many breakthrough innovations, the initial hype and enthusiasm may have led to unrealistic expectations for adoption rates in the short term; however, in the long term the actual impact of NextGen supply chains may very well exceed even the most optimistic predictions.

According to our survey, 8 of 10 respondents believe digital supply chain will become the predominant model within the next five years. What’s more, respondents believe that many of the supply chain innovations included in the survey have the potential to disrupt the status quo and create a lasting competitive advantage for companies that embrace them. This belief in the competitive and disruptive impact of supply chain innovations has risen steadily over the five years we

have been conducting the survey, and at some point in the not-too-distant future we expect these innovations to reach critical mass and explode into exponential growth and impact.

In the months and years ahead, organizations should keep a close eye on adoption rates and emerging trends, watching for signs that supply chains are turning the corner on innovation and approaching the exponential growth phase. That’s when being late or slow can be particularly disastrous.

When all is said and done, businesses that are able to deliver on rising customer service expectations at efficient cost through competency and innovation in their supply chain operations will likely emerge as the market leaders of tomorrow. Now is the time to tackle the innovation barriers and position your supply chain for future success.



## REFERENCES

[1] "Q3 2017, MHI Solutions: Industry 4.0; Supply Chain Transformers! How Robots and Automation are Changing The Game," 2017. [Online]. Available: <http://www.mhisolutionsmag.com/>.

[2] "Q3 2017, MHI Solutions: Industry 4.0; A Calculated Approach to Predictive Analytics," 2017. [Online]. Available: <http://www.mhisolutionsmag.com/>.

[3] "Q3 2017, MHI Solutions: Industry 4.0; IoT, IIoT, and Industry 4.0," [Online]. Available: <http://www.mhisolutionsmag.com/>.

[4] "Q3 2017, MHI Solutions: Industry 4.0," 2017. [Online]. Available: <http://www.mhisolutionsmag.com/>.

[5] "Q4 2016 MHI Solutions: Autonomous Vehicles and Drones," 2016. [Online]. Available: <http://www.mhisolutionsmag.com/>.

[6] "Deloitte University Press; "Enterprise value map, Practical paths to increase shareholder value,"" 2018. [Online]. Available: <https://www2.deloitte.com/us/en/pages/operations/articles/enterprise-value-map.html>.

[7] "APICS research report: Millennials in Supply Chain," 15 October 2017. [Online]. Available: [apics.org/millennials](http://apics.org/millennials).

[8] "Deloitte University Press; "Insight-driven organization, Putting data-driven insights to work everywhere, everyday,"" 2018. [Online]. Available: <https://www2.deloitte.com/us/en/pages/deloitte-analytics/solutions/insight-driven-organization.html>.

[9] "Deloitte University Press; "Break through with blockchain,"" 2018. [Online]. Available: <https://www2.deloitte.com/us/en/pages/financial-services/articles/blockchain-series-deloitte-center-for-financial-services.html>.

[10] "Supply Chain Transportation & Logistics Center, Urban Freight Lab, University of Washington; "The Final 50 Feet: Urban Goods Delivery System," 2018. [Online]. Available: <https://depts.washington.edu/sctlctr/research-project-highlights/urban-goods-delivery-0#>.

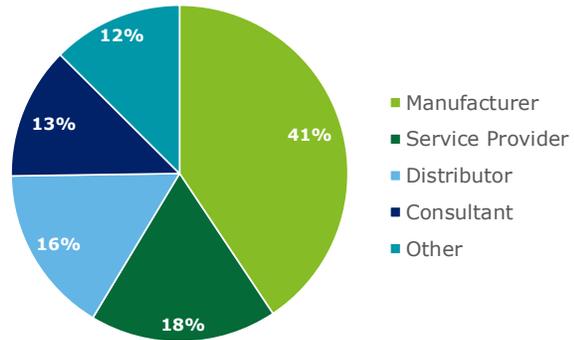
# Appendix

## About the Report

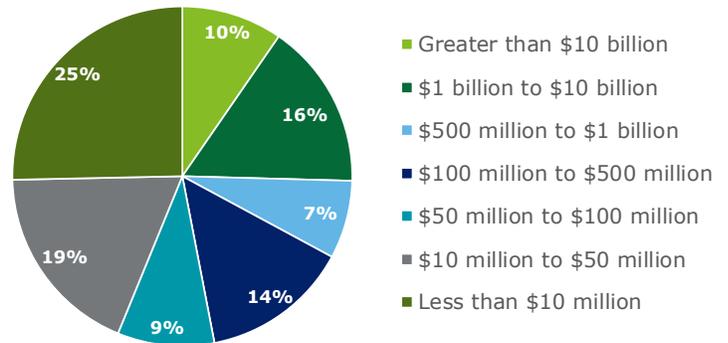
The 2018 MHI Annual Industry Report is our fifth annual study of emerging disruptive technologies and innovations that are transforming supply chains around the world. The findings are primarily based on an in-depth global survey conducted in late 2017, which involved 1,116 supply chain professionals from a wide range of company types and industries.

Half of 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 47% reporting annual sales in excess of \$100 million, and 10% reporting annual sales of \$10 billion or more.

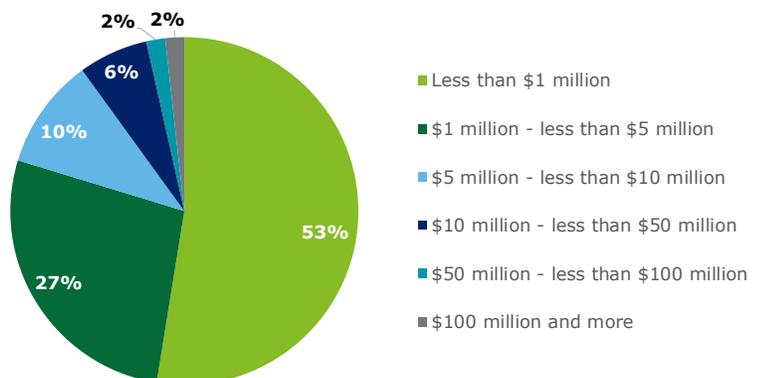
Responder's Company Type



Company Size by Revenue (USD)

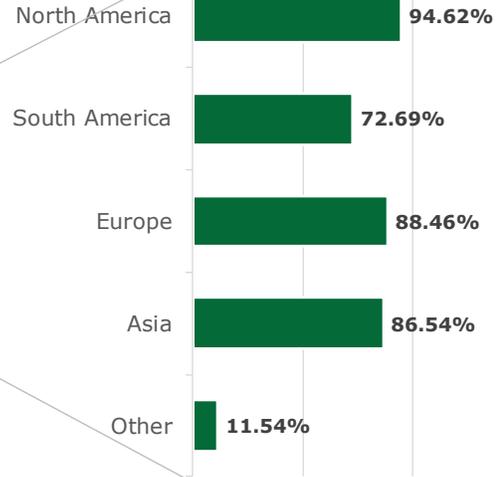
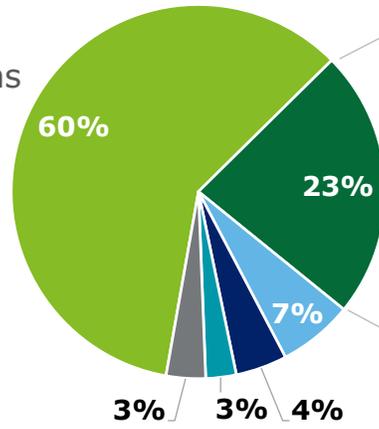


Investment Over Next Two Years (USD)

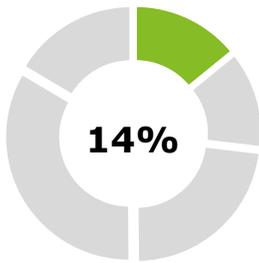


Responder Profile by Geography

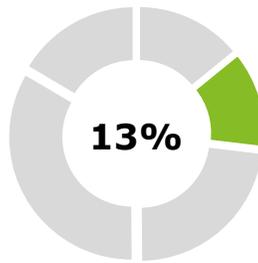
- North America
- Global operations
- Europe
- Asia
- South America
- Other



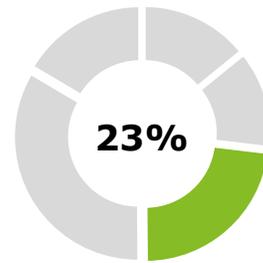
Responder's Role



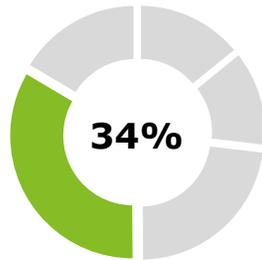
CEO or President



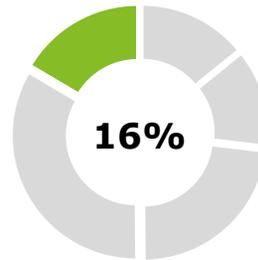
Vice President or Senior Vice President



General Manager or Department Head

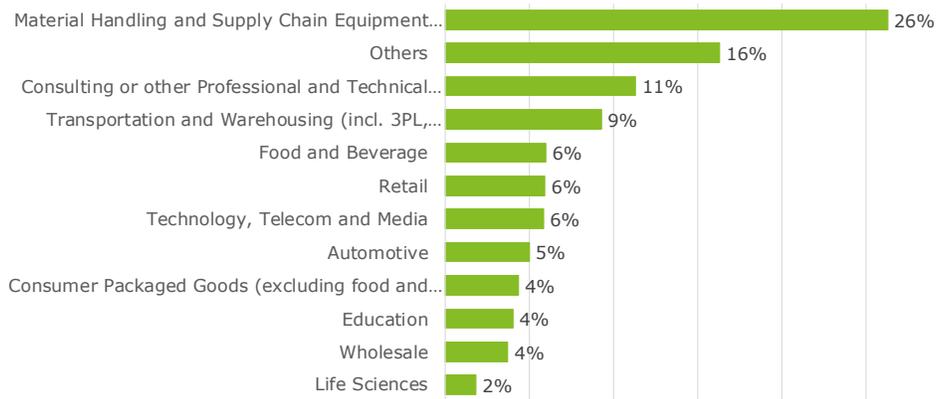


Manager or Engineer

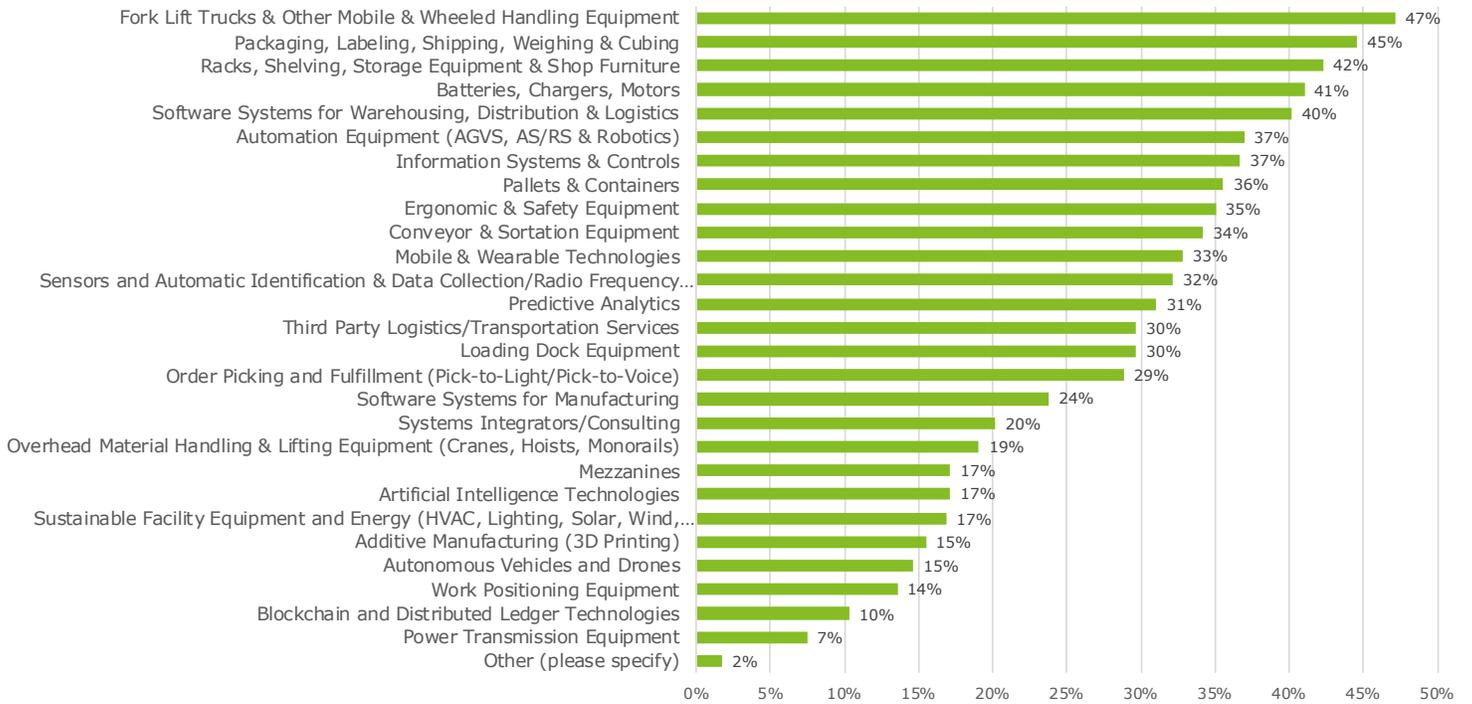


Other

### Responder's Industry



### Investment in Products and Services Over Next Three Years



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We would like to acknowledge the hundreds of organizations that participated in our survey. We would also like to thank the MHI Board for their contributions to the survey and conclusions.

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