KPMG

The future of supply chain

September 2023

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Foreword

A lot has changed in the world since we published the previous edition of this report in 2021. Between the COVID-19 pandemic, extreme weather events, and multiple geopolitical disruptions, the world's supply chains have been tested in so many ways, yet many have emerged stronger and more resilient than ever.

Although many events occurred that we didn't anticipate, three themes we predicted would be major concerns for supply chain leaders did end up being extremely important: a growing focus on **Environmental, Social and Governance (ESG) commitments**; the level of investment in **advanced robotics and automation**; and the **evolution of the supply chain workforce**. As we look ahead to the next one-to-two years, we see these themes becoming even more critical.

However, the world is not standing still. Beyond the immediate changes, in the next three to five years, we expect supply chain leaders will be thinking about the use of **distributed ledger technologies (DLTs) and digital money (DM)** for security and monitoring of cross-border trade flows; **how the supply chains of entire sectors will change** amid technological innovation; and **the potential of the metaverse** as a supporting technology.

This report starts by contextualizing the big picture challenges and opportunities that supply chain leaders are facing, from building resilience, to incorporating ESG, to future readiness, and more. It then goes into detail about the six themes outlined above. We hope you will use this report as a guide to where you should invest your time and energy now, whilst preparing to make the most of the emerging trends. This report draws on the KPMG Future of Supply Chain Survey conducted in November 2022. We reached out to 300 supply chain executives globally to ask about future trends in supply chain operations, and the key opportunities and issues that companies are prioritizing in the short and long term.

It's an anxious time in the supply chain world, but an exciting one as well. Within the function, we are on the verge of a variety of dramatic technological advances. At the same time, many of the industries that supply chains support are on the brink of innovative change. Companies that hope to maintain a competitive advantage should keep a very close eye on how technologies are developing, and which innovations they can embrace.

We hope you find this report as stimulating to read and discuss as we did to research and write. If you see something that sparks an idea, please don't hesitate to get in touch. We'll be delighted to help you think it through.

Peter Liddell
Global Operations Center of Excellence Lead,
KPMG International, Partner, KPMG Australia

Chapter 1

Executive summary

Executive summary

We begin by exploring the current context of the supply chain world and the issues faced daily by supply chain leaders. These challenges range from the need to build resilience, to meeting ever-growing multi-national regulations, bringing ESG concerns into supply chain operations, and preparing for an unknown future.

We then dive into the three key themes that supply chain leaders will need to address in the next year or two, before exploring three emerging trends that will likely become front of mind in the next three-to-five years.

Core themes: one-to-two-year focus

Chapter 1 **ESG**

Three years ago, an ESG program was a "nice to have". Now, it is a "must have". Between stakeholder demands and regulatory mandates, ESG goals are an increasingly important part of doing business. The supply chain can play a leading role in meeting ESG expectations.

Chapter 2 **Advanced robotics and automation**

The supply chain was once highly manual. Now, it's increasingly automated, with robots stacking pallets in the warehouse, and picking and sorting. Algorithms are planning pickups, and machines are studying years of results to optimize daily transport routing and future warehouse operations schedules.

Chapter 3 **Workforce of the future**

The "rise of the robots" was supposed to put people out of work. Instead, we are seeing humans and robots collaborate in new and innovative ways for more efficient and effective supply chains. Meanwhile, humans are increasingly turning to more strategic and value-adding tasks.

Emerging trends: three-to-five-year focus

Chapter 4 **Distributed ledger technologies and digital money**

DLTs, such as blockchain, have largely been viewed as an alternative to traditional money; however, they may have a more important future as a guarantor of trust in global supply chains. The ability of DLTs and DM to provide traceability could see them become enablers of smooth and secure global commerce.

Chapter 5 **Sectoral transformations**

Changes faced by different sectors are likely to directly influence their supply chains. For example, in healthcare and life sciences, precision medicine appears to be more complex and nuanced to deliver. In retail and distribution, retailers need to create a seamless experience around a unified commerce approach. In aerospace and defense, geopolitical issues are driving greater supply chain scrutiny and the need for advanced technology.

Chapter 6 **Metaverse**

In the beginning, the metaverse appeared to simply be an immersive gaming platform. Now we know better. Whatever its entertainment potential, supply chain leaders are increasingly excited about its prospect as a tool for designing and monitoring the supply chain, pinpointing weaknesses, and streamlining services in real time.

Survey details

The foundation of this report is the findings from the KPMG Future of Supply Chain Survey conducted in November 2022.

We surveyed 300 global supply chain professionals across industries including retail, industrials/manufacturing, healthcare/life sciences, technology, energy, power and utilities, and telecommunications.

The questions covered their current supply chain operations, how they plan to respond to changes, their supply chain visibility, their level of automation, use of the metaverse and digital twins, and their use of cryptocurrencies in supply chain operations. Findings from the survey are shared throughout the report.

Chapter 2 Current context

Current context

Years of supply chain disruption and variability in customer demand have led to a feeling of permanent crisis for many organizations. Many supply chain leaders don't believe the rollercoaster will stop anytime soon.

Amid the complexities, they have three immediate concerns:

- **Survival and resilience**
- **Macro mandates**
- **Future ready**

Survival and resilience

Today's supply chains are not set up to handle the new speed of delivery, customer convenience, and the blurring of channel boundaries, so their physical network design and future operating model may require major adjustment. Supply chains must "pivot or perish" in response to immediate risks and challenges.

However, our survey revealed that only 55 percent of respondents describe their supply chain as stable and well-positioned for the future, while 47 percent believe they are vulnerable to disruption.

47%
believe they are vulnerable to disruption

Over the next 12 to 18 months, respondents anticipate a variety of challenges, with the most pressing including:

71% | the rising costs for raw materials

70% | upstream supply disruption

67% | meeting customer expectations for speed

**62%** | labor shortages

62% | rising freight costs

Overcoming these matters to build resilience will require a concerted effort on visibility, embracing big data, enhanced planning, and risk mitigation.
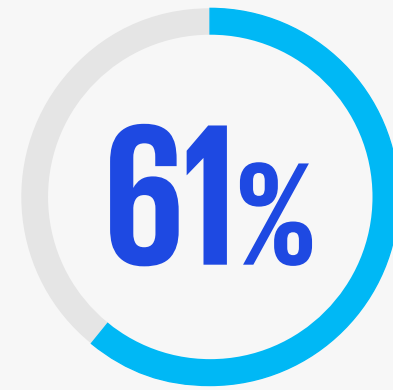
Visibility

Extended supply chain visibility and continuous monitoring of product flow supports resilience. Understanding how products flow across the value chain, with forward-looking/sensing capabilities, is essential for organizations that depend on global/regional complex supply chains with long lead times, as well as those exposed to volatile environments.

Supply chain visibility makes it easier to manage goods in-transit, essentially treating container ships as virtual warehouses.

This makes it possible to redeploy goods en route in response to real-time shifts in market demand. Our survey found that:
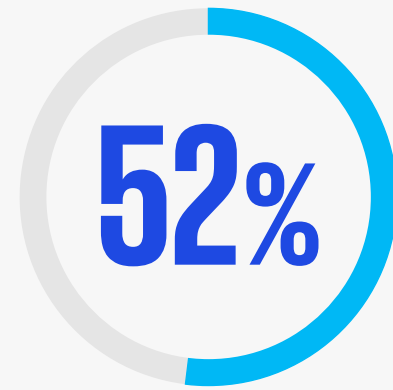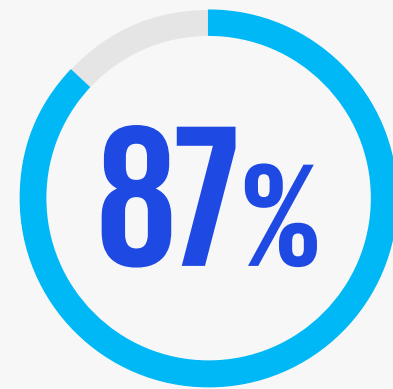
52%
Over half of executives said their organization is more concerned about supply chain visibility than last year
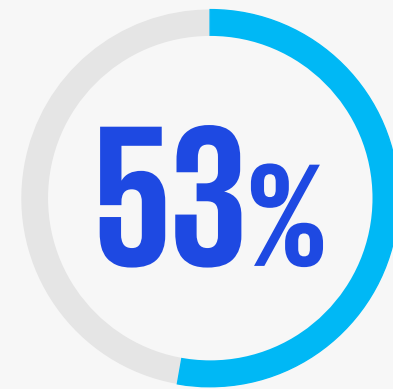
61%
Most respondents consider the development of more supply chain visibility a top priority
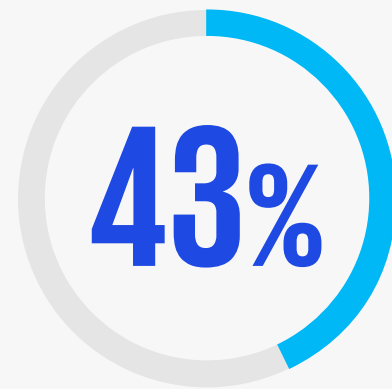
52%
52% consider reducing the number of suppliers based in geopolitically unstable geographies as a top priority

87%
87 percent now see visibility as critically important

53%
53% consider sustainable sourcing a top priority

43%
However 43% indicated they had no visibility, or were "largely unclear" about the performance of their Tier 1 suppliers

Respondents from each geographic region have different reasons for pursuing visibility. European participants typically want to improve customer service, whereas North American and Asia Pacific respondents want real-time information to minimize supply chain disruptions.

New technology is emerging as an enabler of visibility. For example, innovative companies such as Versed AI already provide solutions that can map entire value chains all the way to Tier 4. These firms generate knowledge graphs that identify supplier relationships, key sub-tier supply flows, and factory locations. Simulations can be run to forecast the knock-on impacts of global events to Tier 4, and the results of possible response strategies.

How to get there

European companies will need to work with Tier 1 suppliers.
They will need to gather more data and extend visibility of product flow beyond Tier 1.

North American and Asia Pacific firms should invest in technology.
The key will be to process and analyze data.

Build decision control towers.
Embed sophisticated sensing, monitoring, and predictive capabilities.

Create digital twins.
Leverage internal and external data sources to enhance the visualization of the extended value chain.

Collect and disseminate data.
Do this in real time with the help of alerts and notifications.

Use digital tools to collaborate.
Again, do this in near real time with your ecosystem of supply chain trading partners.
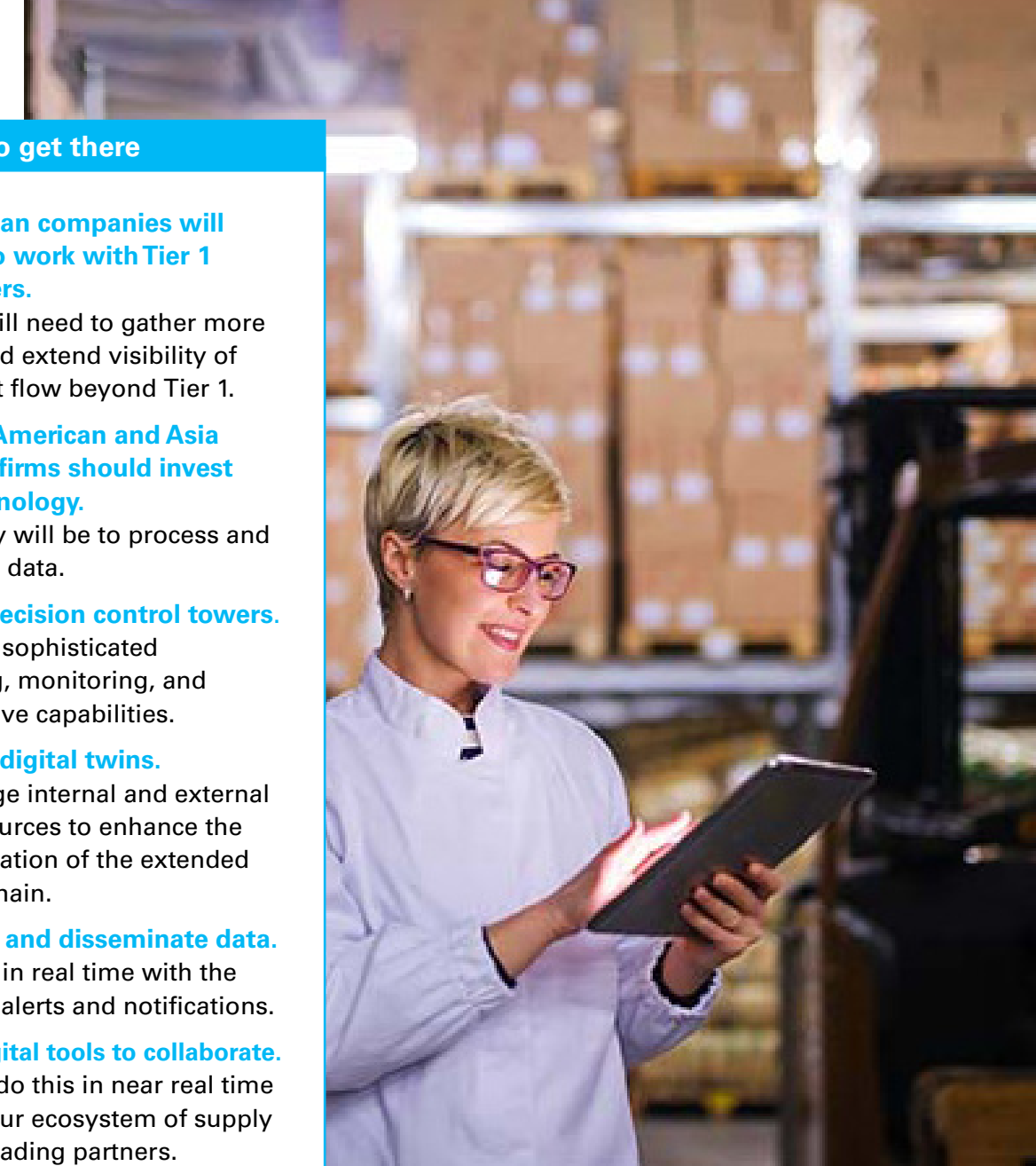
Embracing big data for collaboration

Supply chain leaders know they need to gather data, analyze it, and use the insights to fast-track decisions and be more responsive to unplanned events and opportunities. Some companies that we surveyed have collaborated with manufacturers to track inventory and fulfilment of orders using the closest warehouse to the customer to reduce logistics costs. This developed into a service offering that provides customers and suppliers with a variety of data uses and applications. This ranges from data warehousing and smart applications with predictive capabilities, to clickstream analysis for improved digital customer experiences and a better understanding of website performance.

How to get there

Create a data value proposition.
This should be grounded in business imperatives that holistically describe the challenges, problems, or hypotheses that the data will help address.

Build a scalable, flexible, and secure data architecture.
This should take advantage of technologies that already influence supply chains, such as automation, advanced analytics, AI and machine learning (ML), supply chain control towers, and Internet of Things (IoT) devices.

Improve your team's data fluency.
This requires a culture that respects data and has developed a capacity for genuine skills assessment, leadership development, curriculum design, and tools and data training.

Planning and prediction

Along with supply chain visibility and big data, companies are enthusiastic about advanced planning systems and predictive capabilities. Companies are investing in predictive tools that harness big data to create digitally enabled and predictive supply chain networks with the customer at the center. Such systems can better predict customer demand, improve forecast accuracy, increase supply stability, and drive data-led decision-making.

How to get there

Refine your internal planning capability.
Anticipate events that might disrupt supply and demand.

Drive better, faster planning.
Achieve this through decision automation, using advanced analytics supported by AI and ML, to enable real-time end-to-end transparency and visibility of product flows and cost-to-serve insights.

Model scenarios and simulate strategic outcomes.
Understand the impact disruptions, risks, and other unplanned events could have on the supply chain. Test changes to node locations and network structure/flows, or the impact of swapping a supplier.

Leverage machine learning.
Automate repetitive decisions so your team can focus on higher value-add projects and higher-level strategy.

Develop multiple sources of supply for critical raw materials or products.
Assess near-shoring options to reduce geographic dependence and shorten cycle times.

Evolve sourcing strategies that help drive value for customers.
Collaborate with other organizations, explore new international sources, and leverage local content.

Segment customers and develop purpose-built supply chain solutions.
Create interconnected, digitally enabled, and predictive networks, with the customer at the center.

Consider additional inventory at key nodes.
Move from just-in-time (JIT) to just-in-case (JIC) to protect against material access issues for critical components.

Build a contingent labor force.
Ensure this can be scaled up or down as needed to respond to disruptions.

Mitigate future supply chain risks

With so much change to supply chains, including strategy, structure, new trading partners and service providers, new supply chain and third-party risks such as cyber, material scarcity, and geopolitical issues have emerged. These threats are likely to continue as companies operationalize further changes to suppliers, adjust their manufacturing footprint, and implement new technologies. Mitigating these risks will require a multifaceted approach including advanced automation and robotics, predictive capabilities, cyber security, and supplier engagement and industry collaboration.

How to get there

Extend the supply chain risk strategy.
Reach the broader value chain ecosystem of partners to ensure threats are managed as widely as possible. This may include a broader assessment of geographic, financial, operational, workforce, brand, and regulatory risks.

Consider adopting AI or ML as part of the standard onboarding process of new suppliers.
Automation can help identify supply chain risks and potential threats. Provide real-time notifications and updates on factors that may affect the supply chain.

**Ensure cyber risk mitigation strategies keep pace with new technology.**
Some organizations have added IoT devices to enhance warehouse operations without being vetted for cyber vulnerability. Any new parties in the supply chain must undergo appropriate cyber risk assessment.

Deploy a consistent approach to risk management.
This should ensure consistency in language and common ways of talking about supply chain risk. What is "critical" can mean different things to different people and functions.

Collaborate across the value chain to share insights and innovate.
Participate in industry sharing sessions, treat stakeholders and suppliers as partners to collaborate on solutions, drive collective approaches in areas of mutual benefit, and focus on building trusted supply chain networks. For example, consider joining the Cybersecurity Infrastructure Security Agency's Shields Up campaign, the Minerals Security Partnership, and Intel and/or ASML's semiconductor technology collaboration.
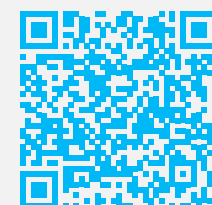
Mitigating cyber risks

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Macro mandates

Macroeconomic and macroenvironmental factors require supply chain leaders to adapt to new realities such as geopolitics, regulatory changes, and ESG mandates.

The manufacturing footprint across many sectors is also shifting because of limited access to critical materials, rising energy prices, and uncertain access to major supply routes. To protect against rising geopolitical tensions, supply chain leaders are pursuing shorter-range supply sources to create a more secure supply chain network. Network flows will likely be reshaped in the next few years by political alignments and evolving ideologies. Supply chain leaders may also need to prepare for even more ambitious sustainability goals, tighter industry regulation, incoming multinational tax initiatives, and changing customer demands.

Prepare for tensions and regulations

Rising geopolitical tensions are likely to affect supply chains as governments pick where makers of strategic products will and will not conduct business. How and where items flow, the location of key source/production sites, and selections of new partners for products and services will depend in part on these larger forces.

Supply chains will need to be reengineered to balance economic advantages with proximity and reliability of supply. For example, Taiwan Semiconductor Manufacturing's (TSMC) decision to build a semi-conductor plant in the US is likely a good business decision, but it's also a response to US trade sanctions that have limited TSMC's access to the Chinese market[1].

Supply chain leaders will also need to prepare for new tax regulations (such as Base Erosion and Profit Shifting (BEPS) 2.0), and new legislation (especially for precious cargo and dangerous goods).

How to get there

Cooperate closely.
Work with industry allies and supply chain partners that share your values.

Embrace external supply chain data collection and analysis.
This can be a powerful tool to navigate constant change and disruption.

Look for technological solutions that can monitor changes.
For example, tariffs, regulations, and shipping routes. The right tools can send alerts to the business with the news and a recommended response.

Closely consider multinational tax implications.
It is vital that supply chain and tax functions come together to avoid suboptimization and reduce the risk of losing previous gains across tax and transfer pricing.

38%

feel that addressing customer needs is the second major priority influencing supply chains over the longer term?

[1]TSMC, TSMC Announces Updates for TSMC Arizona, Dec. 2022
[2]BMAS - Supply Chain Act
[3]Uyghur Forced Labor Prevention Act | U.S. Customs and Border Protection (cbp.gov)

ESG concerns

Supply chain and procurement strategies will likely be heavily influenced by new corporate ESG initiatives as boards seek more environmentally and socially acceptable supply chains. Leaders are under pressure from regulators and investors to prove organizations are acting responsibly and are responding to ESG standards and expectations. Regulations such as Germany's new supply chain law, Lieferkettengesetz,[2] and the US's Uyghur Forced Labor Prevention Act[3] will likely grow in importance. To respond to regulations like these, it will become increasingly important to comprehensively perform carbon accounting, measure operational KPIs, and deliver ESG reporting.

How to get there

Promote wide-ranging product traceability.
Identify the source and distribution channels of products to ensure full traceability throughout the value chain, then identify ESG issues and concerns (e.g., high-energy-use sites, waste, carbon emissions, plastic usage, and human rights issues).

Capture real time operational data.
Do this along the supply chain to support measurement and reporting requirements for ESG improvement objectives.

Create a decarbonization strategy.
For example, establish a supplier evaluation criterion, understand partner sustainability credentials, and set a carbon price for products that have the most impact on the environment.

53%

believe that inflation will impact supply chains over the longer term

Delivering on customer needs

Beyond convenience and price, consumers are choosing brands that align with their values. Companies must design their supply chains around customer needs, starting with the customer first, and focusing on seamless processes, consistent experiences across channels, and customer-tailored delivery.

How to get there

Design the supply chain to deliver a seamless customer experience.
Make the brand experience consistent across different channels.

Maximize customer insights.
Use them to drive supply chain planning and product/service offering enhancements.

Broaden retail and distribution channels to respond to growing consumption mechanisms.
Consider how best to get goods into the hands of consumers. This could mean re-thinking warehouse and fulfilment locations and ensuring your future logistics strategy meets customer needs.

Future ready

In our survey, many respondents expressed concerns about how they should address emerging issues of global warming, geopolitical cooling, new regulatory demands, and the need for digital transformation.

Many are focused on creating operating model capabilities that set them up for longer-term success. Leading organizations are already investing in future readiness through the acceleration of digital foundations, understanding technology trends, and automating to unlock value.

Acceleration of digital foundations

Supply chain leaders are investing in core digital capabilities that advance the maturity of the planning team and set the foundations for long-term success (e.g., data and analytics supported by AI and ML, solutions to manage warehousing, transportation, and logistics, and leveraging automation to improve workforce outcomes).

39%

plan to invest in digital technology to bolster their data synthesis and analysis

There is little debate about the value of digital investment. For example, 94 percent of our survey respondents are optimistic that digital twins will add value in supply chain planning by making supply simulations easier to run.

How to get there

Establish a strategy to rapidly automate your manual supply chain activities.

Fast-track data management capabilities. Work toward a single view of the customer and stronger synergies between the front, middle, and back-office.

**Align technology initiatives to make sure the full investment is realized.** According to Gartner, the last three years of uncertainty have blurred the lines between business and technology strategies to the point that they must be considered together[4]. To avoid significant value loss, merging strategic, disruptive, and unavoidable technologies can help to mitigate underperformance, (e.g., merging digital supply chain and control tower initiatives).

Develop a roadmap for both emerging and mature technology solutions. Digitize manual tasks to become more agile and responsive.

Advance supply chain risk management. Allow your supply chain risk management function to support continuous supply chain monitoring that uses control towers, planning systems, supply chain risk management tools, AI-driven predictive analytics and advanced track and trace systems to create visibility and highlight where the organization has gaps to guide future investment.
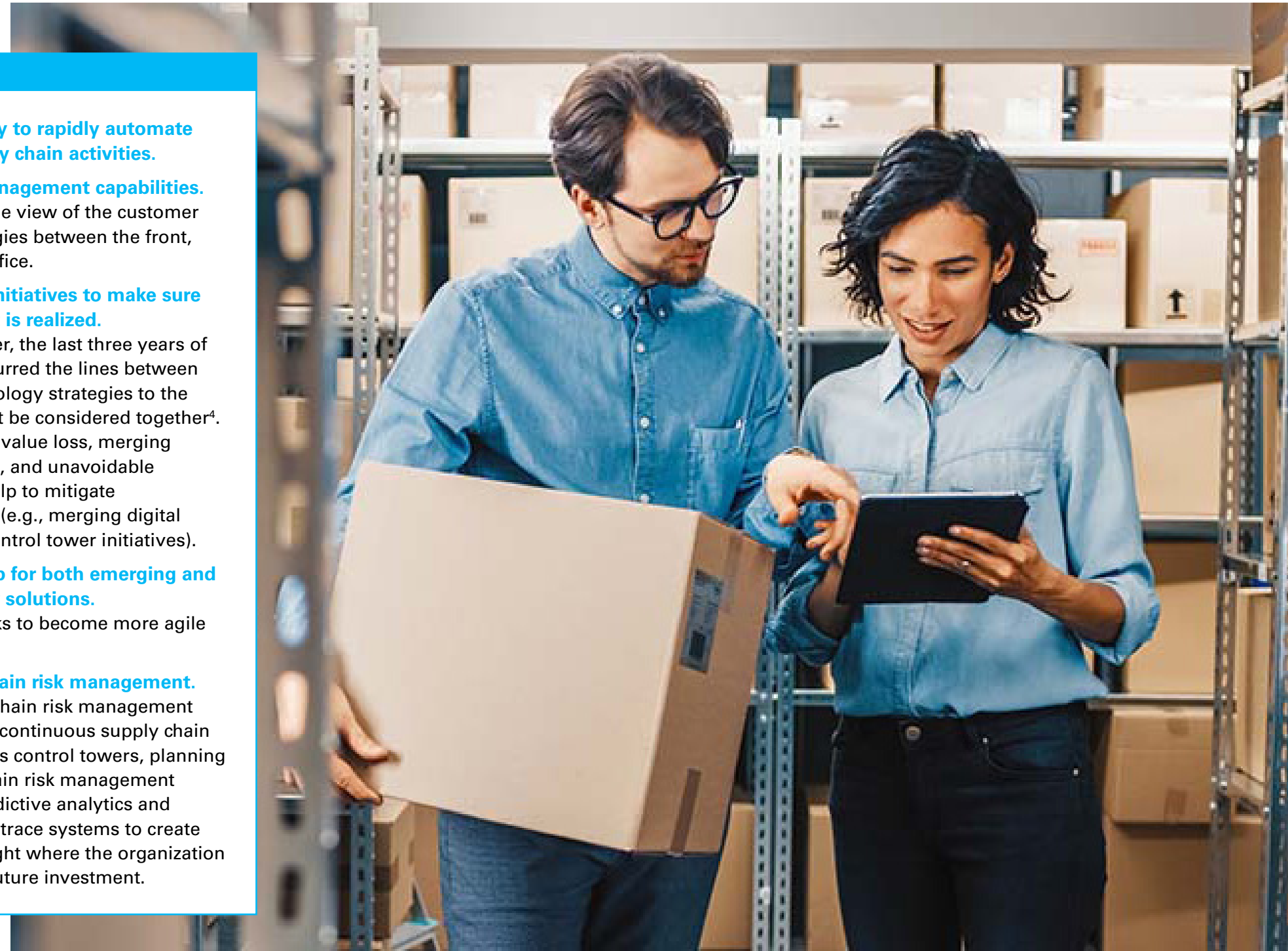
[4]Gartner Press Release, Gartner Reveals the Top Supply Chain Trends for 2023, May 2023. GARTNER is a registered trademark and service mark of Gartner Inc. and/or its affiliates in the US and internationally and is used herein with permission. All rights reserved.

Understand technology trends

Evolution in technology should also inform how supply chains operate. Web 3.0, for instance, will bring together several technology capabilities, including the ability to make peer-to-peer transactions through decentralization of ownership, moving away from interactions between people and websites to those between software and software.

For example, CureDAO (a permissionless, decentralized autonomous organization), is an alliance of non-profits, governments, businesses, and individuals working to discover how factors like food, drugs and supplements affect human health. Leveraging Web 3.0 technology, the alliance incentivizes open-source collaboration to accelerate innovation and democratize clinical research.

How to get there

Conduct a cross-functional survey.
Assess the specific supply-chain-related technologies needed by the business.

Apply bots and apps to help with e-commerce.
The way users interact with browsers and websites will evolve. Applications can help aggregate data, provide informative links, and recommend showrooms or store locations where a shopper can engage with products that they are interested in.

Increase privacy and transparency.
Digital identity, blockchain technology, and tokenization will likely boost transaction speeds, support allocation of capital, and reduce fees. Thanks to Web 3.0 and DLTs, processes should be more streamlined and simplify the way all parties engaged in a transaction are tracked without the need for third-party intervention.

Deliver AI for customers.
Instead of being bombarded by digital ads from large ecommerce players pushing recommendations based on customer data and AI, users will likely rely on AI to "pull" specific recommendations from the web based on data preferences they feed to AI to develop content that's uniquely tailored to their needs. This intelligence can drive supply chains that are smarter at serving customers.

37%
of organizations are already using automation or robotics to replace human labor in warehouse operations

Automate to unlock value

Automation isn't just for reducing inefficiencies; it can enable the wholesale removal of redundant or mundane activities from the workforce, making it possible to do more with less. More importantly, it can help employees make better decisions and provide better customer service so that organizations can further build on value propositions and create a competitive edge. Our survey shows that 37 percent of organizations are already using automation or robotics to replace human labor in warehouse operations. We expect this growth to continue. Furthermore, the number of automated activities should continue to increase, applicable to all nodes, sites, and activities within the supply chain.

How to get there

Invest in automation.
Define opportunities to replace manual supply chain activities, drive productivity gains, and protect against margin squeeze and cost increases.

Start with a pilot.
Show personnel how the automation works, give them confidence, and support the change journey.

Evaluate the overall health of the network infrastructure.
Identify areas of improvement that further optimize network flows using robotics and automation.

Conclusion

For the foreseeable future, there will likely be more disruptions brought on by geopolitical conflicts, inflationary pressures, the economic environment, climate change weather events, or other issues yet to emerge.

However, as we have explored, supply chain leaders can take control and respond in three ways:

Survival and resilience.
Build end-to-end visibility of the extended value chain, enhance the supply chain planning function, use big data to enable collaboration and improve risk management practices

Macro mandates.
Reshape network flows, navigate geopolitical tensions, address ESG concerns and deliver on evolving customer needs

Future-readiness.
Accelerate digital foundations, understand and act upon technology trends, and embed automation in the supply chain.

As short-term supply chain issues dominate board-level discussions, it is easy to lose focus on building capability for the longer term. Instead, act on the lessons learned in recent crises while preparing to respond to future crises with longer-term strategic thinking.

Chapter 3

Sustainable supply chains

Sustainable supply chains

Shareholders, consumers, and employees have increasingly high expectations of the businesses they invest in, buy from, and are employed by. As a result, business leaders face more pressure from regulators and the market to prove that their organizations are acting responsibly and sustainably.

Many of those Environmental, Social and Governance (ESG) concerns fall under the purview of the supply chain. It is inevitable that ESG agendas will affect supply chain and network designs.

In the next one-to-two years, companies need to be ready to make substantive advances on the following six fronts:

- Responsible sourcing
- Due diligence
- Decarbonization
- Circular economy
- Human rights in manufacturing and production
- Technology enabled ESG reporting

1/3

plan to increase their focus on sustainable sourcing as part of their future supply chain strategy

Responsible sourcing

Businesses are grappling with how to respond to growing demand from regulators, shareholders, and customers to ensure what they produce and procure is free from exploitation.

Underlying the ever-increasing range of human rights regulations is the UN Guiding Principles Reporting Framework (UNGP),[5] which provides businesses with a pragmatic framework to approach responsible sourcing.

> The UNGP demands that companies undertake a three-part effort that includes:
>
> 1. A policy commitment to respect human rights
>
> 2. A human rights due diligence process to identify, prevent, mitigate, and account for any adverse human rights impact
>
> 3. Clear and accessible processes for the remediation of any human rights violations

What responsible sourcing means for supply chain leaders:

Have a clear policy commitment and framework.
Include guidelines about the role each actor (staff, suppliers, and industry associations) can play to achieve objectives.

Develop a clear supplier code of conduct that takes ESG into account.
Include guidelines about how to apply that code to sub-suppliers.

Take a top-down approach to embedding your responsible sourcing strategy.
Leadership support that considers both risk and impact is required to embed commitments.

Identify and prioritize material risks and impact.
Focus on where material ESG issues are most prevalent in the supply chain and where you can have the most influence in driving change.

Keep people at the center of your response.
Deeper engagement and collaboration with government, NGOs and workers throughout the supply chain can lead to greater capability for suppliers and better outcomes for directly affected workers. Engagement with affected stakeholders may prove challenging if not impossible, particularly in complex and extended supply chains. A lack of first-hand information about workers' experiences should be interpreted as a signal that greater scrutiny is required.

Create grievance mechanisms to remedy and prevent future human rights violations.
Make sure the concerns of workers can be heard. Establish remediation frameworks to remedy prior harm and prevent future harm.
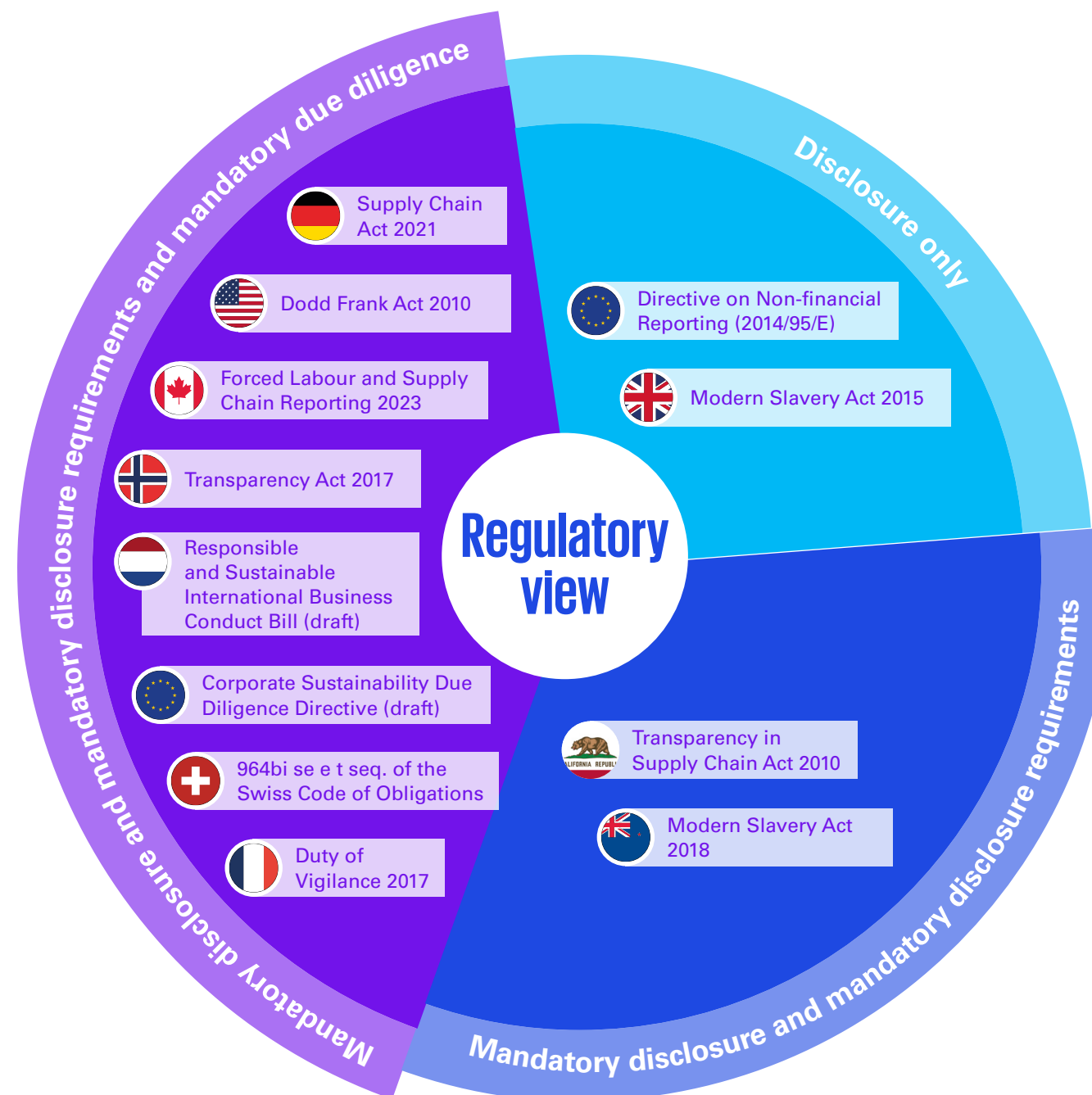
Measure impact.
Regular monitoring and reporting of responsible sourcing on business operations, workers, and broader communities is key to driving improvement.

[5] UN Guiding Principles Reporting Framework

Due diligence

Regulations requiring due diligence and mandatory disclosures have strengthened over time, with further regulations pending. (See figure to the right.) New regulations are requiring companies to assess, identify, prevent, remedy, and report on human rights risks.

Regulatory view

Disclosure only
- Directive on Non-financial Reporting (2014/95/E)
- Modern Slavery Act 2015

Disclosure requirements and mandatory due diligence
- Supply Chain Act 2021
- Dodd Frank Act 2010
- Forced Labour and Supply Chain Reporting 2023
- Transparency Act 2017
- Responsible and Sustainable International Business Conduct Bill (draft)
- Corporate Sustainability Due Diligence Directive (draft)
- 964bi se e t seq. of the Swiss Code of Obligations
- Duty of Vigilance 2017

Mandatory disclosure and mandatory disclosure requirements
- Transparency in Supply Chain Act 2010
- Modern Slavery Act 2018

Notable compliance requirements now mandate:

- Stakeholder engagement (EU).
- Timely responses to public inquiries relating to human rights practices (Norway).
- Reports on human rights key performance indicators (Canada).

However, obeying the law is only the beginning of truly responsible sourcing. A process to understand the inherent and residual risks present in a company's supply chain should be conducted regularly. Due diligence should also reflect the company's understanding of the relative risks that different suppliers pose. A useful guide to that process is the EU Corporate Sustainability Reporting Directive (CSRD), adopted by the EU parliament in November 2022[6]. CSRD demands detailed sustainability reporting and expands the companies required to submit sustainability reports, including many non-EU companies. One requirement is to report on the due diligence processes implemented to identify actual and potential sustainability issues in the company's operations and supply chain.

What due diligence means for supply chain leaders:

Establish internal policies and a governance structure.
This needs to support due diligence practices within the supply chain, be purpose-led to mitigate the risk of harm to people, and be completed at least annually.

Build transparency across the supply chain.
Achieve this with collaboration with suppliers, and the use of data solutions like Versed AI to support identification of suppliers down to Tier 4.

Monitor the regulatory landscape.
Cover all countries of operations to ensure compliance with regulations as they come into effect globally.

Integrate due diligence into enterprise risk management (ERM) processes.
Consider the risks to the rights-holders.

[6]Corporate sustainability reporting (europa.eu)

Decarbonization

A growing number of organizations have formally committed to ESG outcomes through voluntary global standards such as Science Based Targets (SBTi) for emissions reduction.

Many are also working to stay compliant with the regulations driving greenhouse gas (GHG) emission reductions, like the CSRD. While Scope 1 and 2 emissions are frequently monitored and reported, Scope 3 emissions are more complex to determine.

Many governments are also considering the implementation of a carbon tax, which could directly affect how organizations run their supply chains. For example, the Carbon Boarder Adjustment Mechanism (CBAM) is one of several tax and carbon reforms proposed as part of the EU's Green Deal.

Many governments are also considering the implementation of a carbon tax, which could directly affect how organizations run their supply chains.

What decarbonization means for supply chain leaders:

Decarbonization plans will need to identify the categories, products, materials and/or countries where risks are greatest.
Plans will require partnerships with prioritized suppliers and industry groups to support a more effective transition to a lower GHG emission footprint. Organizations can streamline this by leveraging the work of other major buyers, such as government agencies. The UK's National Health Service (NHS), for example, is identifying the source and distribution channel for 80 percent of its supplies to map its ESG risks.[7] It is also installing track and trace technologies to identify opportunities to reduce waste.

Technology can underpin sustainability strategies.
Leveraging technology can help with routing products through different logistics lanes and nodes based on emissions and carbon footprint.

Data-based insights can drive logistics and last mile strategy.
Innovative last mile delivery solutions such as Adiona help supply chain leaders to create more energy efficient transport management and route optimization decisions.

They apply data analytics to optimize existing delivery fleets and make smarter use of their resources, redesigning their distribution networks, or switching from diesel fuel-based vehicles to electric vehicles. These insights can drive consumer choice and price/speed offerings by providing visibility into how much carbon is emitted by each delivery option. Furthermore, there is an opportunity to bundle deliveries into a service offering that reduces the firm's overall environmental footprint.

Set expectations that suppliers must deliver strong ESG performance.
Integrate a supplier code of conduct into the contracting process and provide suppliers with insights into ESG learning opportunities. For more strategic suppliers, consider ESG performance audits and data-sharing. For critical suppliers, consider offering direct investment to drive better ESG performance. It may prove advantageous to fund the supplier's training, contract incentives, or joint business planning.

Development and collaboration.
To ensure carbon reduction initiatives reach maximum scale, consider working with other companies with common suppliers to pool technical and financial support.

[7]NHS, Supply Chain Business Plan 2022/2023, July 2022

Circular economy

In addition to reducing supply disruptions and mitigating price volatility, a more circular supply chain could create USD $4.5 trillion in material value opportunities by 2030[8].

The elements of this new supply chain can include:

Critical raw materials
The EU and US have respectively identified 30 and 50 critical raw materials that have potential to disrupt supply chains and drive significant increases in cost of goods sold[9].

Sustainable packaging
Spurred by consumer demand, *Management Enthusiast* reports that the market for sustainable packaging is expected to reach $451.7 billion USD by 2028[10]. Governments and regulators are also likely to continue to apply pressure to transition to more sustainable packaging.

For example, in 2018 Australia established the ambitious 2025 National Packaging Targets to create a sustainable pathway for managing packaging in Australia. The 2025 Targets are supported by the Federal and all Australian State and Territory Governments and were included in the 2019 National Waste Policy Action Plan and the 2021 National Plastics Plan as an important step in the journey towards a circular economy for packaging.

They apply to all packaging that is made, used, and sold in Australia and include achieving 100% of packaging being reusable, recyclable or compostable; 70% of plastic packaging being recycled or composted; 50% of average recycled content included in packaging and the phase out of problematic and unnecessary single-use plastic packaging.

At an Environment Ministers' Meeting late last year, all Australian Environment Ministers committed to working with the private sector and industry to design out waste and pollution, keep materials in use, and foster markets to achieve a circular economy by 2030.

First established in 2018, the 2025 Targets require a complete and systemic change to the way Australia creates, collects, and recovers product packaging, and are an important step in the journey towards a circular economy for packaging. The targets dictate that 100 percent of Australian packaging must be recyclable, compostable, or reusable by 2025. As governments continue to tackle packaging pollution and their carbon footprint, we expect some companies will make proactive changes before the regulators require them[11].

Limited access to critical materials

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What the circular economy means for supply chain leaders:

Rethink the business and operating model.
The push to design waste out of manufacturing and supply chain processes and to incorporate recycling will require a critical rethinking of many business and operating models, containerization, and other logistics. For example, the shift from single-use plastics has pushed grocery retailers to use more reusable containers to store, move, and display fresh produce.

Cultivate partnerships with companies that provide new assets, services, and solutions.
For example, stores will need vendors who can help them with the pick-up and distribution of reusable plastic crates to supermarkets, tracking of crates via RFID tags in the store network and the supply chain, and washing/servicing the crates before returning them to the distributor.

Design reverse logistics processes to give products destined for landfill a second life.
This should entail designing reverse logistics processes to accept products and materials back into points of the supply chain where they can be recycled, disposed of, or transformed into reusable resources. This may involve partnerships or collaboration across industries to identify common solutions.

Prepare for transport management systems (TMS).
Some organizations will design reverse logistics processes that transform inbound and outbound logistics flows to give products more circularity. TMS will be essential, as the software can provide insights into how to optimize outbound and reverse flows, reduce waste, and improve visibility to drive circular decisions.

Ensure a strong ESG data foundation.
To drive circularity, organizations should measure the materials that go in and out by following analytics protocols such as the Circular Transition Indicators developed by the World Business Council for Sustainable Development[12].

Sustainable packaging will affect the whole supply chain.
The impact of more sustainable solutions (such as moving from a plastic bag/packaging with printed barcodes and barcode scanners to reusable containers with RFID tags or IoT sensors) on supply chain technology will need to be considered. Link sustainability strategies, automation technology, and the investment roadmap to build a whole-of-supply-chain view.

[8]Lacy, Peter and Jakob Rutqvist, Waste to Wealth, Published by Accenture Strategy, 2015
[9]European Union, Critical raw materials for the EU - EPRS, 2022
[10]Trivedi, Shantanu, Sustainable Packaging and Its Importance in Supply Chain, Management Enthusiast, Nov. 2022

[11]ACO, Australia's 2025 National Packaging Targets
[12]Circle Economy & KPMG, Circular Metrics for Businesses, Introduction to the Circular Transition Indicators Framework, Nov. 2021
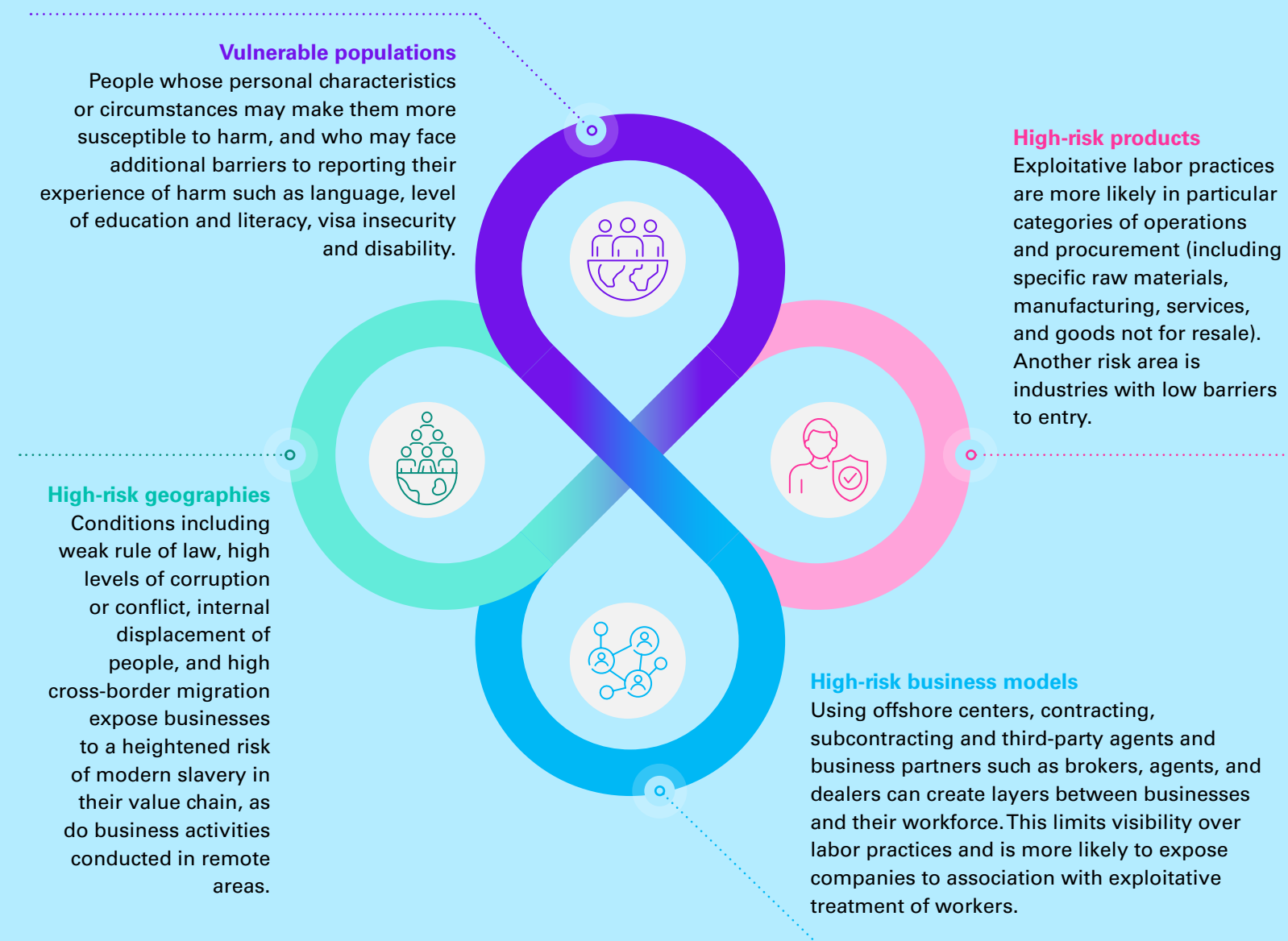
Human rights in manufacturing and production

Businesses are now expected to ensure that high standards of human rights, decent work, and labor rights are upheld throughout their supply chains, but they aren't there yet.

99%

A recent study by the World Benchmarking Alliance found that ~99 percent of 1,000 key companies across more than 60 countries failed to demonstrate the fundamentals of socially responsible business conduct[13]

Human rights are at greatest risk in any sector where one or more of these factors is present:

Vulnerable populations
People whose personal characteristics or circumstances may make them more susceptible to harm, and who may face additional barriers to reporting their experience of harm such as language, level of education and literacy, visa insecurity and disability.

High-risk products
Exploitative labor practices are more likely in particular categories of operations and procurement (including specific raw materials, manufacturing, services, and goods not for resale). Another risk area is industries with low barriers to entry.

High-risk geographies
Conditions including weak rule of law, high levels of corruption or conflict, internal displacement of people, and high cross-border migration expose businesses to a heightened risk of modern slavery in their value chain, as do business activities conducted in remote areas.

High-risk business models
Using offshore centers, contracting, subcontracting and third-party agents and business partners such as brokers, agents, and dealers can create layers between businesses and their workforce. This limits visibility over labor practices and is more likely to expose companies to association with exploitative treatment of workers.

The harvesting of agricultural materials and mining of minerals are characterized by a range of human rights risks. This includes the presence of often vulnerable workforces, poor transparency and regulation in source countries, and the lack of supplier visibility. At least 22 percent of forced labor victims work in the harvesting and production of raw materials, including agriculture, forestry, textiles, mining, and quarrying, due to a reliance on migrant and base-skill workers, who are often hired through recruitment agencies on temporary or informal bases in high-risk geographies.[14] New labor risks are also emerging where the mining and agricultural industries intersect with the transition to renewable energy – for example, the global increase in demand for materials such as cobalt for lithium batteries, primarily from the Democratic Republic of Congo. With visibility of these areas of supply chains limited, businesses need to be proactive in identifying and acting to mitigate the risks of human rights violations.

22%

of forced labor victims work in the harvesting and production of raw materials, including agriculture, forestry, textiles, mining, and quarrying

In addition to resources, there are also issues in the areas of low-cost manufacturing of finished goods and last mile delivery, where only low-skilled labor is required. Some companies are experimenting with blockchain as a tracking device to create more transparency and reduce exploitation. Ford, for example, is partnering with suppliers and service providers to implement blockchain technology to prevent child labor in cobalt mining.[15] This blockchain technology facilitates wide-ranging traceability of cobalt mined in the Democratic Republic of Congo, all along the supply chain, up to the finished batteries used in Ford's electric vehicles.

[13]World Benchmarking Alliance, The Social Transformation Baseline Assessment 2022
[14]Australian Human Rights Commission & KPMG, Property, construction & modern slavery, 2020
[15]Baydakova, Anna, Ford, LG to Pilot IBM Blockchain in Fight Against Child Labor, Coin Desk, September 13, 2021

What human rights risk means for supply chain leaders:

Identify risk hot spots and improve traceability.

KPMG has found that the most significant human rights risks stem from raw materials, products, and services imported from developing countries. Hot spots include the mining of metals and minerals for the electronics industry and renewable energy, the entire apparel supply chain – from cotton fields to factories – and certain food and beverage ingredients that are typically produced by small holder farmers, such as cocoa, tea, coffee, vanilla, and tropical fruits. In such supply chains, child labor and extreme poverty are common, making input traceability critical. ChainPoint, Versed AI and other specialist software providers offer wide-ranging solutions to trace raw materials back to the source for specific sustainability labels. Furthermore, technologies such as **KPMG Origins** and **Supply Chain Predictor** provide digital twins that can add visibility. These tools should become a core component not only for managing day-to-day operations, but to further embed ESG within a broad range of the company's operations.

Leverage AI and data analytics to tackle ESG at scale.

Data analytics will likely in future be used to systematically analyze supplier audit results and predict which companies may subject workers to long working hours, poor environmental management, and other problems. This insight should help companies remain vigilant against potential risks when onboarding new suppliers. Likewise, data analytics can help identify strong supply chain auditors versus those that are reluctant to cite a client for non-compliance, or worse, those that are corrupt. The application of advanced analytics to data captured in real-time can facilitate longer-term and smarter management of weak nodes – for example, by leveraging data to visualize offshore manufacturing sites that have started to miss delivery schedules on days with abnormally high temperatures. Such an early warning could enable the buyer to help the contractor keep its labor force cool and get its shipments back on schedule.

Data analytics can help identify strong supply chain auditors versus those that are reluctant to cite a client for non-compliance, or worse, those that are corrupt.

Technology enabled ESG reporting

The application of technology in supply chains will likely be a key factor that creates transparency to show whether companies are meeting their ESG goals. Supported by governance, risk and compliance (GRC) systems, ESG considerations will likely be part of every business function. Together, functions can control, monitor, and trace performance across wide-ranging supply chain interactions. A robust GRC system can create transparency that gives stakeholders and investors confidence in a company's reports.

Now is a good time to find and implement the right technologies to standardize, rationalize and analyze large volumes of vendor data. New Scope 3 emissions intelligence solutions like Avarni can enable supply chain leaders to not only better manage spend categories, but also provide a deeper level of supplier emissions calculations, material flow and transparency to ensure ESG goals can be achieved, and that progress can be verified.

What technology enabled ESG reporting means for supply chain leaders:

ERP-supported ESG reports.
The supply chain and procurement functions will likely be the source of much of the data generated for measuring and reporting ESG matters, but they won't have to carry this responsibility alone. They need to work with Finance, HR, IT, Transport, Manufacturing, and Commercial teams to embed ESG into both their day-to-day activities and their long-term strategy.

Distributed ledger technologies.
Ledger-based solutions can be used to build more transparency and traceability into supply chains while enabling data standardization. Longer term, we are likely to see multiple blockchain platforms harnessed to support reporting of emissions through a single blockchain super-platform, and the creation of a standardized space for data to be collected and tracked. Companies can leverage these tools with real time supply chain data to validate and report key KPIs.

ESG data traceability.
A strong ESG foundation can allow companies to effectively pinpoint sustainability attributes tailored to customer and consumer needs.

Supply chain visibility.
Traceability can be vital to identifying, managing, and measuring the most material ESG issues up and down the value chain. Visibility also enables a "control tower" view of the supply chain in real-time to deal with fast emerging supply chain disruptions. This tech-enabled visibility can help solve real supply chain challenges while driving critical ESG performance improvements.

Advanced data and analytics to identify risk hot spots in supply chains.
When you systematically analyze your supplier audit results, you can predict which risks related to long working hours, poor environmental management, and other problems you can expect to find in other suppliers in the same region. Advanced data analytics can also help predict supply chain disruptions due to physical risks from extreme weather, including floods and extreme temperatures.

Advanced technology to support ESG reporting.
From start-ups (Versed AI, Adiona, Avarni, etc.) to major platform providers (SAP, Salesforce, Oracle) technology may vastly improve the tracking and reporting of ESG progress.

Conclusion

The impact of key strategic supply chain decisions on ESG goals needs to be understood at the time of the decision. Therefore, the formal supply chain planning processes will need to include sustainability goals and initiatives, incorporating the six areas outlined above. To recap, these are:

Responsible sourcing
Ensuring production and procurement are free from exploitation

Circular economy
Creating a closed-loop supply chain to unlock residual material value

Due diligence
Assurance that businesses are acting responsibly and sustainably along the entire value chain and are compliant

Human rights in manufacturing and production
Ensuring that global standards of human rights, decent work, and labor rights are upheld

Decarbonization
Committing to a reduction of carbon emissions from activity across the supply chain

Technology enabled ESG reporting
Utilizing technology to create transparency of ESG goal performance.

ESG is now a must-have, not a nice-to-have. Investors, regulators, consumers, and employees are showing increasing interest in how companies are performing in all six of these areas. Successful ESG leaders will likely view their interest as a trigger for greater risk mitigation, and as an opportunity for value creation – a shift that will bring the supply chain into the heart of ESG strategy.

ESG is now a must-have, not a nice-to-have.
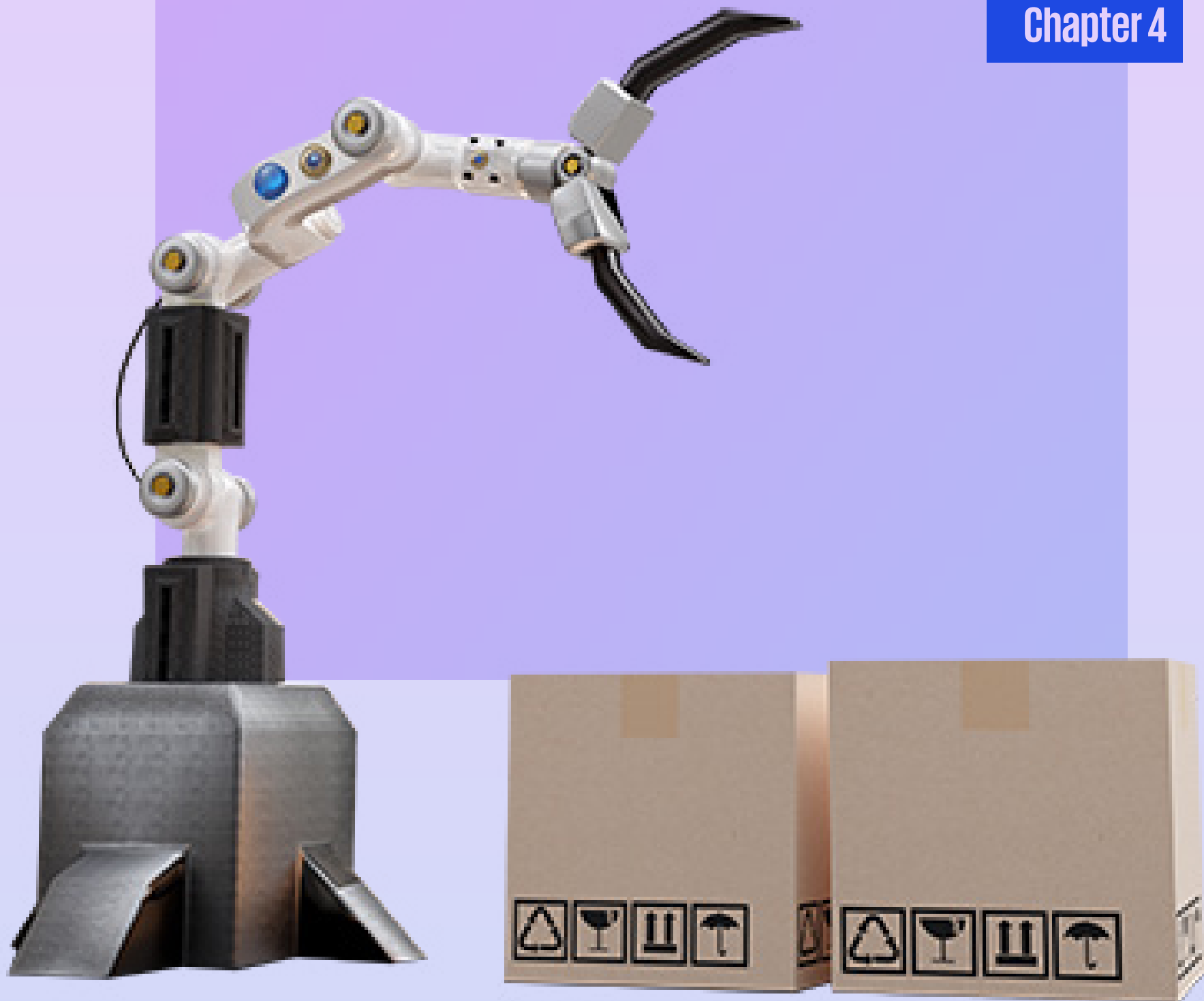
Advanced robotics and automation

37%

The KPMG Future of Supply Chain Survey revealed that 37 percent of companies have recently replaced manual labor with advanced robotics or automation in their warehouse operations.

Many businesses have worked to automate key middle- and back-office processes such as transport and route planning, trade tax reconciliations, and supply chain analytics. Automated storage and retrieval systems (ASRS) are being used in warehouses to increase inventory turns and manage complexity of inventory mix.

When ASRS are tied in with warehouse automation on conveyors, automated guided vehicles (AGVs) and bots, they generate productivity benefits. Automated warehouses also benefit from integrating 5G technology with IoT devices to reduce latency and deliver real-time tracking and tracing of goods, especially when coupled with warehouse management systems (WMS) and transport management systems (TMS). AI, machine learning, and cognitive algorithms are increasingly used to take customer orders, and chatbots and social media apps are assisting with customer service support.

Automated warehouses also benefit from integrating 5G technology with IoT devices to reduce latency and deliver real-time tracking and tracing of goods.

Over the longer term, we expect substantial growth in the number of companies taking up advanced robotics and automation, expanding the range of activities these tools will perform across the supply chain. Robotic process automation (RPA) should take over mundane tasks from humans, driving more responsiveness and efficiency throughout the value chain. Importantly, we expect to see ecosystems of smart devices proliferate, while there will be recognition that the challenge is not to have humans versus machines, but humans working with machines in a collaborative ecosystem.

We expect to see high levels of robotics and automation in:

Supply chain planning
Analytics evaluation and decision-making, scenario planning/modeling, demand forecasting, and market intelligence can all be handled increasingly by AI and ML, with bots making many prescriptive decisions.

Warehousing/middle mile
The "middle mile" between manufacturers, suppliers, and last mile delivery offers great potential for automation to drive efficiencies in order processing, warehousing, and logistics tasks. Initially, organizations will likely invest in islands of automation to mechanize key parts of this supply chain. Eventually, we expect these islands may evolve into intelligent ecosystems that enable automated network tools, devices, and applications, such as drones, robots, or connected vehicles to work seamlessly with each other. Drones are being leveraged by some retailers to perform inventory counts within warehouses to manage diverse and complex mixes of SKUs.

Distribution/last mile
Rising labor costs should accelerate automation – particularly in the warehouse where there is a higher proportion of manual tasks performed – with advanced conveyor sorting, packing/stacking, and automated guided vehicles leading the way.
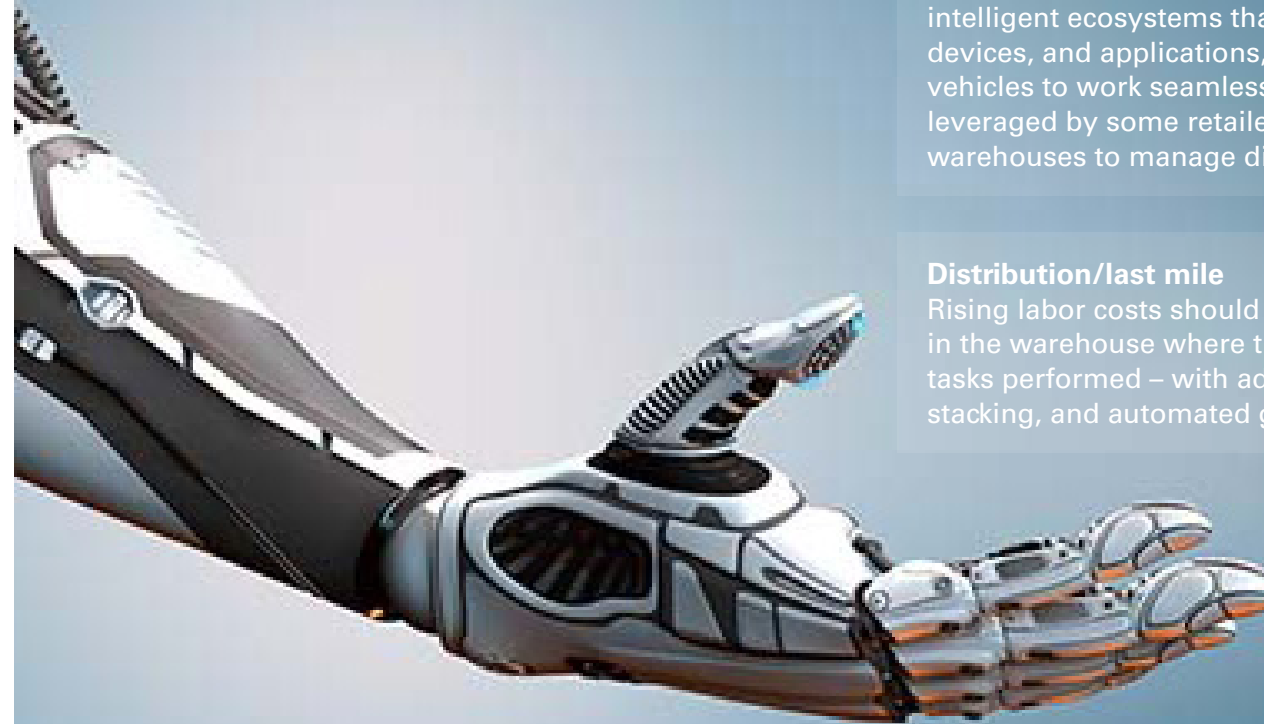
Advancing sectors

The future of robotics and automation will be different in every industry. We have seen automotive and consumer and retail leading the way. in this space, but these five sectors are following in close pursuit:

Five advancing sectors

01

Agriculture

Although agriculture in developed countries is already highly automated, more is on the way. One case in point is Robs4Crops, a robotic platform that can assist farmers with different tasks, which is now being piloted in Greece, Spain, France, and the Netherlands. The solution offers two different approaches to automation: a partially automated option, where tractors are still driven by human farmers but retrofitted with a smart box that takes over some processes, including navigation if desired, and a fully automated solution, where unassisted robots weed and spray.

02

Food and beverage

In many harsh environments, from humid greenhouses to freezing meatpacking plants, automation can help relieve employees of repetitive, sometimes dangerous tasks. For example, deep learning for machine vision enables bots to classify, segment, and detect abnormalities in food products and packaging. From flagging foreign objects in bulk raw ingredients to identifying damaged products, AI can help food and beverage manufacturers improve quality control while reducing associated costs and enhancing worker safety. Meat packing plants, for example, can now use robotic saws to prepare difficult cuts of frozen meat, decreasing the risk of worker injury while boosting productivity.

03

Healthcare

Leading healthcare organizations are accelerating adoption of automation to increase capacity, respond to healthcare challenges, and build a flexible and secure digital workforce. Hospitals and clinics are leveraging bots to reduce compliance risk and update records with 100 percent accuracy, monitor compliance with quality protocols – such as ones from the US Agency for Healthcare Research and Quality16 (part of the US Department of Health and Human Services) – and improve the patient experience by reducing heavy administrative workloads and streamlining interactions between healthcare professionals and their patients.

04

Manufacturing

In the next one-to-two years, site operations will likely be reimagined to maximize productivity and minimize errors by leveraging advanced robotics and automation. Leading manufacturers are automating back office and operational processes to eliminate waste, accelerate speed to market, and help innovation flourish. Companies are leveraging bots to work around the clock to track inventory, deliver real-time inventory analysis, and keep pace with demand fluctuations. They are also automating customer/vendor support with RPA, and deploying virtual assistants to handle data and systems. Cyber physical systems or intelligent systems (mechanisms controlled or monitored by computer-based algorithms) can also be used to oversee quality and new product manufacturing simulations. Factories and plants can be reshaped to reflect multi-autonomous mobile robot capabilities. Digital twins can be used to enhance productivity and upgrade safety.

05

Public sector

Automation is also being used to improve government services. Both RPA and AI chat bots are reducing contractor costs by handling complex government process tasks quickly and securely.

Despite these gains, every industry will need a human workforce, and humans and robots will likely work side-by-side for the foreseeable future.

[16]Home | Agency for Healthcare Research and Quality (ahrq.gov)

Ecosystems of smart devices for efficiency

The next wave of supply chain automation will likely involve teaching devices that are already deployed to work seamlessly as a single ecosystem. AI programs and devices can capture vast amounts of data and share it in ways that make the entire supply chain smarter.

For example, smart watches/vests/lanyards may be connected to other technologies operating in warehouses, such as RFID or location beacons. They could monitor safety risks and human fatigue, and send products to packing stations only when humans are ready for them, reducing or eliminating backlogs. These technologies will also be applied in transport. Smart vehicles can measure truck utilization, while equipment such as "smart pallets" can pinpoint the location of a particular pallet in the supply chain.

A large Australian logistics company is already exploring such capabilities to track containers/loading devices across its national network. Vypex, an Australian tech company, provides the logistics firm with smart pallet technologies that leverage GPS tracking, motion detection, Wi-Fi, and Bluetooth. The smart pallet devices know when they are on a company site and turn off when tracking is not required. When the containers leave the site, the devices automatically turn on again to enable tracking until the pallet reaches its destination. Unlike previous GPS-alone solutions, which were too expensive for companies to deploy at scale across an entire supply chain, these smart devices are more economical to operate, and can create greater value for the business.

Allocating activities for machines and humans

63%

Our survey shows that 63 percent of respondents believe many repetitive tasks humans do will be replaced by automation

59%

In addition, 59 percent expect activities that have a high risk of injury will become automated

We believe this shift will be a gradual process that may include steps such as:

- Redefining human roles to focus on higher-value customer services

- Preparing for transition by focusing on training and redesigning human roles; new jobs should emerge that require the acquisition of new skills even as some jobs disappear

- Placing an emphasis on talent and capability management that prioritizes strategic and value-adding skills and enables collaboration between humans and machines

- Teaching employees and machines to collaborate smoothly.

Rise of the cobots

Early adopters of robotics and automation within supply chains are building an environment where "collaborative robots", or "cobots" actively assist workers. Cobots can help workers pick, pack, and palletize items or transport goods across the warehouse.

These machines can complement human capabilities and provide relief from strenuous and risky tasks. Typically available for a fraction of the cost of an industrial robot, cobots can be deployed and programmed within hours, allowing organizations to quickly realize benefits. Cobots are highly versatile, flexible, and easy to reprogram and relocate. They provide businesses with the ability to respond to changing needs by automating new processes and accommodating small batch runs and frequent line changes. They require much less space than conventional robotics and automation solutions, which allows them to be applied in smaller nodes of the supply chain or in new settings (such as outlets where retailers are converting stores to a combined DC and customer collection point).

[17]Universal Robots, Cobots do the Heavy Lifting at L'Oréal India, March, 2020
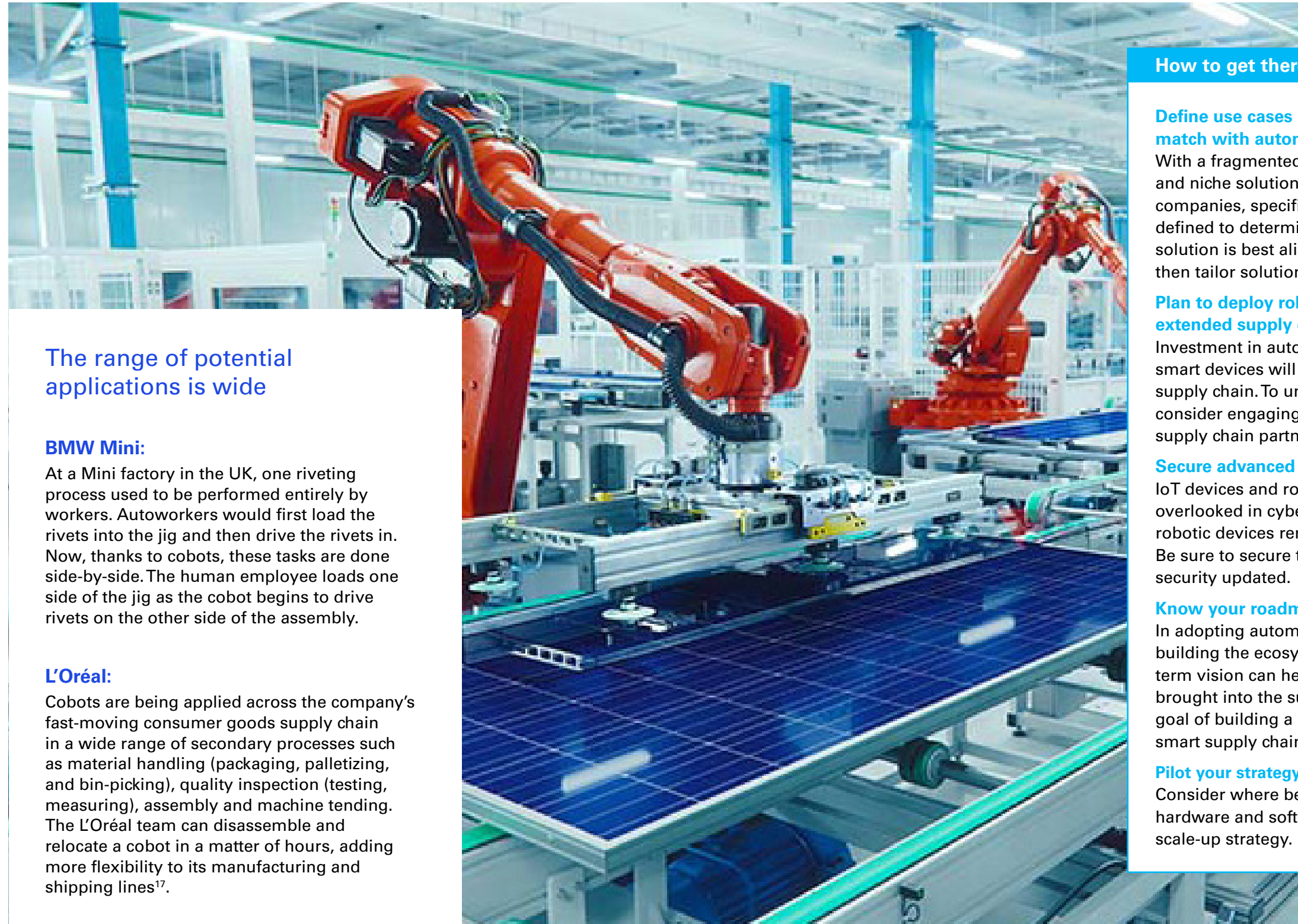
The range of potential applications is wide

BMW Mini:
At a Mini factory in the UK, one riveting process used to be performed entirely by workers. Autoworkers would first load the rivets into the jig and then drive the rivets in. Now, thanks to cobots, these tasks are done side-by-side. The human employee loads one side of the jig as the cobot begins to drive rivets on the other side of the assembly.

L'Oréal:
Cobots are being applied across the company's fast-moving consumer goods supply chain in a wide range of secondary processes such as material handling (packaging, palletizing, and bin-picking), quality inspection (testing, measuring), assembly and machine tending. The L'Oréal team can disassemble and relocate a cobot in a matter of hours, adding more flexibility to its manufacturing and shipping lines[17].

How to get there

Define use cases and ensure the best match with automation solutions.
With a fragmented automation domain and niche solutions offered by multiple companies, specific use cases should be defined to determine which automation solution is best aligned to drive ROI, and then tailor solutions that are fit for purpose.

Plan to deploy robotics across your extended supply chain.
Investment in automation, robotics, and smart devices will likely lead to a smart supply chain. To unlock broader benefits, consider engaging with the capabilities of supply chain partners.

Secure advanced technologies.
IoT devices and robotics have typically been overlooked in cyber strategies, so many robotic devices remain open to cyberattacks. Be sure to secure these devices and keep security updated.

Know your roadmap.
In adopting automated solutions and building the ecosystem, defining your long-term vision can help ensure new capabilities brought into the supply chain fit within your goal of building a connected ecosystem and smart supply chain.

Pilot your strategy and implementation plan.
Consider where best to test and pilot hardware and software to help inform your scale-up strategy.
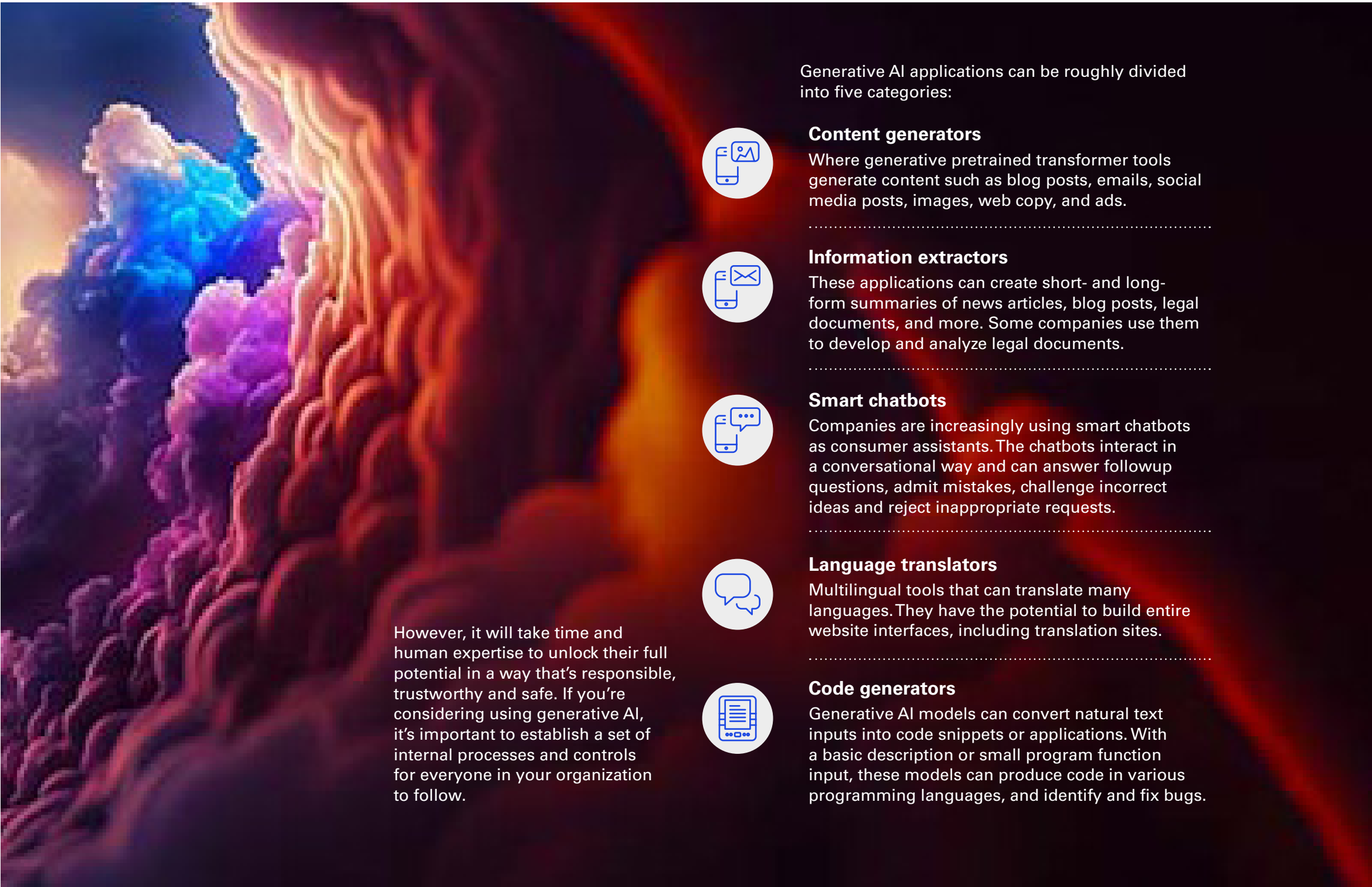
Generative AI

Generative AI refers to artificial intelligence that can generate content rather than simply analyze or act on existing data. Generative AI models, such as GPT-4, are built and trained on a collated set of data.

They can be generalists or specialists built on predefined data collections and are designed to produce output that helps realize certain human-directed requests.

We believe that generative AI models have the potential to transform businesses through automating and executing certain tasks with unprecedented speed and efficiency

Some models can, for example, predict the next word based on previous phrases or the next image based on descriptions of images that came before. We believe that generative AI models have the potential to transform businesses through automating and executing certain tasks with unprecedented speed and efficiency. This is particularly true when human expertise and ingenuity is paired with deep understanding of how to use these programs and effectively harness their capabilities.

However, it will take time and human expertise to unlock their full potential in a way that's responsible, trustworthy and safe. If you're considering using generative AI, it's important to establish a set of internal processes and controls for everyone in your organization to follow.

Generative AI applications can be roughly divided into five categories:

Content generators

Where generative pretrained transformer tools generate content such as blog posts, emails, social media posts, images, web copy, and ads.

Information extractors

These applications can create short- and long-form summaries of news articles, blog posts, legal documents, and more. Some companies use them to develop and analyze legal documents.

Smart chatbots

Companies are increasingly using smart chatbots as consumer assistants. The chatbots interact in a conversational way and can answer followup questions, admit mistakes, challenge incorrect ideas and reject inappropriate requests.

Language translators

Multilingual tools that can translate many languages. They have the potential to build entire website interfaces, including translation sites.

Code generators

Generative AI models can convert natural text inputs into code snippets or applications. With a basic description or small program function input, these models can produce code in various programming languages, and identify and fix bugs.

When it comes to the supply chain, generative AI may offer supply chain managers an opportunity to reimagine many aspects of their operational processes. Some early possibilities being considered across industry include:

Procurement

- Query product vendors, compare features and contracts, or generate purchase requisition, orders and invoices
- Undertake category/product research and initiate the Source to Contract process prior to key vendor contracts expiring

Supply chain planning and reporting

- Automate report generation for internal and external supply chain measures
- Automate the periodic supply chain planning cycles leveraging ERP and external data sources

Customer service and account management

- Provide a hyper-personalized concierge for order delivery enquiries, 'how-to' directions, and language translations

Fraud detection

- Identify unusual trends in supply chain analytics data to identify new areas or participants to be reviewed for fraudulent behaviors
- Produce new training data for unseen fraud examples

Human resources

- Create tailored learning content for operations team members based on functional KPI measures
- Other content generation such as job descriptions and KPIs

Ultimately, Generative AI should help to support supply chain leaders to accelerate their productivity and cost management agendas while supporting value protection and identifying differentiated value creation strategies. Of course, it is still at a very early stage in development and while the pace of improvement is moving quickly, there is a lot of work to be done in terms of understanding all the risk factors versus benefit trade-offs.

For example, we have already seen how generative AI can be used to create "deep fake" images which could be misleading, and auto-generated copy is not always verified for accuracy, while the source material can be hard to track. It is also not possible to produce wholly original data, as Generative AI requires input data which it blends to create new output. It can also be difficult to manage the behaviors of Generative AI, and it requires an immense amount of data, deeper computational power, and importantly, robust data governance and ethics.

While there are challenges, there is also potential, and innovative supply chain leaders will find ways to make Generative AI deliver an impact.

Conclusion

Connectivity and automation bring agility and efficiency that leading supply chain leaders are seeking. Future supply chains will likely no longer be focused on what technology solution will be needed, but on the skills and competencies required to enable this vision of the future – and what can be performed by technology/automation and humans? Future supply chains will likely:

Involve automation and advanced robotics. What this looks like within each sector will vary – from helping navigate harsh environments within food and beverage, to increasing capacity for patient care within the healthcare sector

Smart ecosystems will connect smart devices and new technologies, making supply chains smarter and more efficient

As more of the supply chain becomes automated, roles can be redefined to focus on higher-value customer services, and new roles will emerge for humans that drive strategy and innovation. Automation should not replace humans, but rather complement and collaborate with human capabilities.

The next generation of supply chains are set to harness the power of automation to analyze and synthesize large amounts of data, perform repetitive tasks, learn, and make recommendations – all whilst humans oversee and manage the supply chain and make key decisions.

Chapter 5

Workforce of the future

Workforce of the future

As supply chain transformation agendas move forward, new roles and skills will be required to help execute new activities and tasks. Companies are approaching this challenge in different ways, for example, trying to manage short-term pressures while planning for the long-term, recruiting and hiring resources who are prepared to work within a more digitally enabled supply chain.

As companies implement advanced robotics and automation, they must reinvent roles to cater for digital and human coexistence. They will need to address the impact on the workforce and think about how technology can inform a future Employee Value Proposition (EVP). Enhancing soft skills, supporting innovation, rethinking roles, and creating a culture that drives transformation will all need to be on the agenda.

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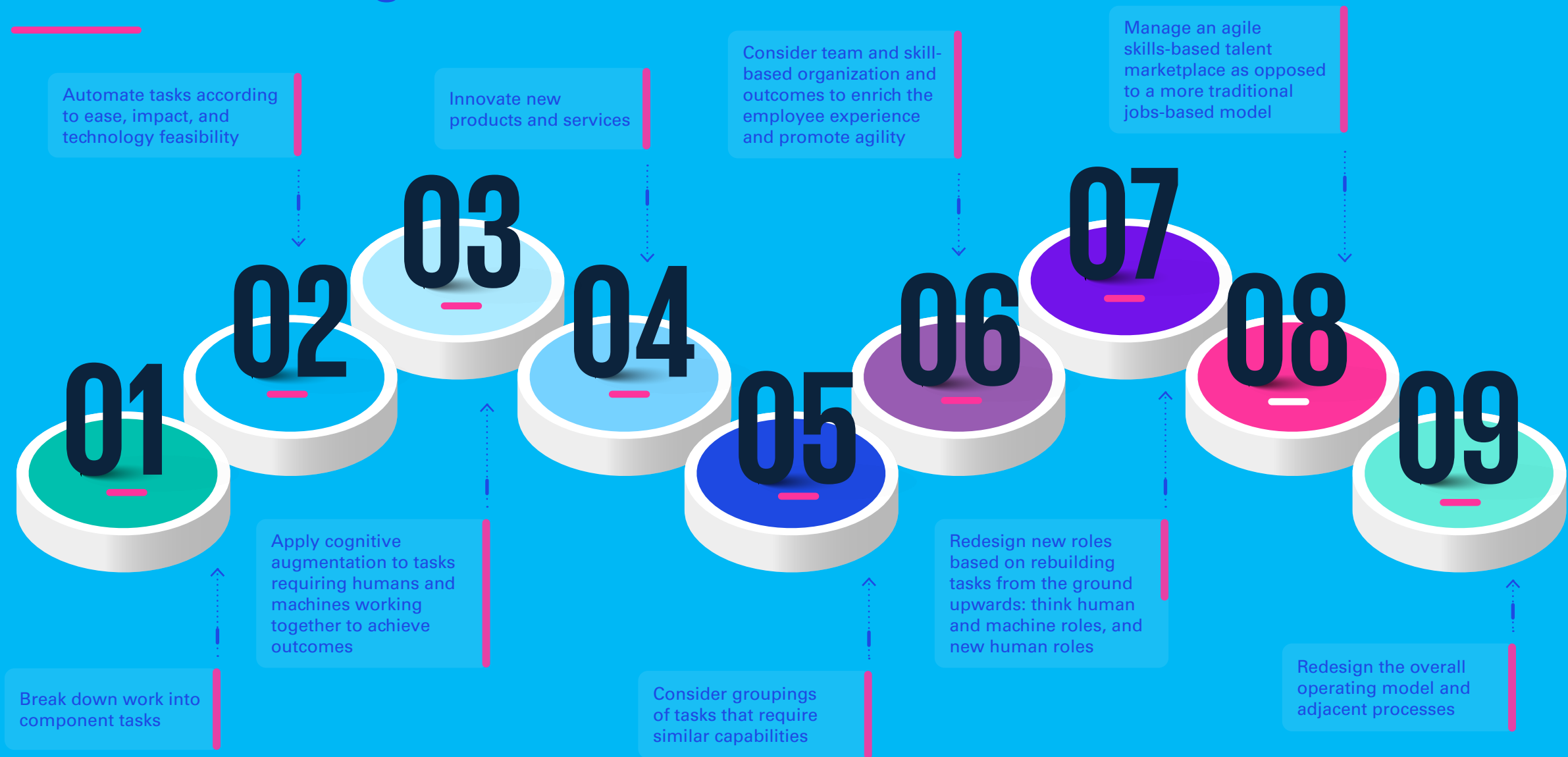

36%

Labor shortages impacting supply chains - 36% believe this is an issue in the short-term and 37% in the longer term

Digital and human coexistence

With supply chains expected to evolve from islands of automation to integrated ecosystems (i.e., connecting warehouse automation, smart devices, IoT sensors, and wearable technologies, etc.), a better understanding of how humans and machines will communicate with each other is critical. It is time to move towards a human-led, digitally enabled way of working, delivering services that provide a better customer experience.

Organizations can look at processes through intelligent design to understand whether to eliminate, optimize, or automate tasks across the front-, middle-, and back-office to reduce costs, improve efficiency, and focus on customer centricity. This may require adoption of a blended human-robot workforce. Knowledge work can be performed by humans in leadership, management, and team lead roles, with human and digital labor in sales, operations, transactions, and compliance. With the progression of AI technology, what would previously have been an algorithm could morph into a "digital human" that can work across different roles. An example is "Nola," a virtual shopping assistant in Noel Leeming stores in New Zealand, created by AI company UneeQ.

Building a blended workforce – humans and digital

01 Break down work into component tasks

02 Automate tasks according to ease, impact, and technology feasibility

03 Innovate new products and services

04 Apply cognitive augmentation to tasks requiring humans and machines working together to achieve outcomes

05 Consider groupings of tasks that require similar capabilities

06 Consider team and skill-based organization and outcomes to enrich the employee experience and promote agility

07 Manage an agile skills-based talent marketplace as opposed to a more traditional jobs-based model

08 Redesign new roles based on rebuilding tasks from the ground upwards: think human and machine roles, and new human roles

09 Redesign the overall operating model and adjacent processes

Workforce impacts from automation

The impact of automation and digital transformation means organizations need to recognize that the workforce they have at any one point in time is not what they will need in just a few years. Supply chain leaders and their teams will likely need new skills, while roles will need to be reshaped.

To support the creation of a future fit workforce, supply chain leaders need to adopt a digital mindset that involves:

Emphasis on the power of human skills
Creativity, innovation, human-centered approaches and design, collaboration, and leadership are and will remain critical capabilities that cannot be replicated by machines.

Awareness that everyone is an innovator
The breakdown of tasks between humans and digital solutions may create new roles or jobs and can support the delivery of products and services across new or existing supply channels.

A growth mindset
Create a cohesive work environment in which roles can evolve and people can collaborate across role boundaries, e.g., warehouse operations, fulfilment centers, and customer facing roles.

Courage to act and challenge
Employees must have autonomy and the freedom to act, while being accountable to meet business objectives (e.g., being able to respond to post-service delivery needs).

A people strategy that includes industrial relations and employee relations
Proactively review roles that may be reshaped to help future-proof the workforce. Demonstrating how transformation can create sustainable jobs will be key in engaging employees and stakeholders.

Supply chain leaders and their teams will likely need new skills, while roles will need to be reshaped.

Reshaping roles

With the coexistence of humans and machines the way forward, human roles will need to be reshaped accordingly.

With AI advancing the quality of planning decisions, human roles can focus on strategy, longer term decision-making, and managing alerts.

Planning

The future supply chain planner's role will likely leverage AI to predict supply chain disruptions and identify not only impacts but the next best course of action. With AI advancing the quality of planning decisions, human roles can focus on strategy, longer term decision-making, and managing alerts. As a result, planners can manage the supply chain with greater speed and responsiveness, with a deeper and more accurate view of what is occurring across it.

Team members can utilize data that drives business outcomes, solve supply-demand balancing issues, analyze problems down to root causes, and better serve customers. Advanced skills in data and analytics will become a core competency, enabling planners to take data-rich outputs and translate them into different business functions to help facilitate improved decision-making. Role success measures will likely move from metrics that focus on forecast accuracy to the commercial impact and benefits generated for the business.

Manufacturing

Factory managers will likely be supported by advanced automation, bots, and algorithms to help optimize plant operations. Managers may leverage simulations in the metaverse to model different options that drive efficiencies. Similarly, they may implement new automation/tools in the manufacturing process virtually to determine the best outcome before making changes to production, or to collaborate with the best skilled team members from around the globe in virtual factories or warehouses.

Warehousing

The warehousing workforce could be digitally fluent and focused on overseeing activities performed by automation. Staff could work side-by-side with robots, relying on automation to perform unsafe, dirty, and repetitive tasks so they can focus on higher value activities.

Managers could use the ecosystem of connected sensors, IoT devices, automation, and wearable technologies to drive efficiencies, ensure safe site operations, and see a macro view of service, costs, and productivity through the data collected across these technologies and fed into the control tower.

Logistics and last mile

Logistics roles will likely be reshaped with the adoption of DLT such as blockchain. For example, roles connected to managing customs and trade activities will likely become totally automated and leverage blockchain solutions to complete manually intensive tasks in managing compliance requirements.

These roles may also support the digitization of logistics processes, control tower implementation, management of semi/automated logistics technologies, and "training" of AI to support decision-making and monitoring across the supply chain.

Those working in last mile could become customer service leaders and customer concierges. With services being bundled (i.e., leveraging the last mile network and fleet to perform pick-up, deliveries, returns), these customer concierges/customer service officers could work with customers to fulfill needs and provide troubleshooting support.

Last mile leaders can be equipped with the latest TMS systems that are connected within the organization, enabling them to optimize delivery fleets and activities across cost and service, and to proactively manage risks/issues. These roles can also act as the operational front line of ESG, with a focus on driving transformation through circularity initiatives such as reverse logistics and repurposing materials or products.

The 5Bs of
workforce shaping

Workforce shaping is an ongoing scenario- and probabilistic-based activity. Workforce shaping should be undertaken by a small, dedicated team to constantly update the most likely workforce scenarios. The aim is to inform and make decisions about the optimal composition of the workforce. Five helpful considerations are:

Buy	**Who to recruit from the external market**
Build	**Who to upskill and reskill, and in what areas**
Borrow	**Which tasks to outsource**
Bot	**Which tasks to automate or cognitively enable**
Base	**Where to locate roles, and where the base of operations, including hybrid, virtual, etc., is located**

Power of
People data

With the growing adoption of new technologies in the supply chain, and the subsequent need to reshape roles and provide appropriate training, it will be important to utilize People data to help make the best decisions for both people and the business.

Supply chain leaders can work with HR leaders to consider people analytics as a value chain consisting of five key parts:

1. The right questions
Understanding exactly what the business units need to know is the first step to ensure you produce analytics with real commercial value. Who to have conversations with will vary from project to project, however in many cases, it will be the business partners. Not all business partners will be data literate and may need to be trained in what analytics can and cannot answer, and how to ask the analytics team the right questions.

2. Relational analytics
The future of workforce analytics is relational, with insight drawn together from different sources to create a clearer picture of what is really happening.

3. Rich presentation
The deeper insights from relational analytics can be presented in more meaningful ways. Setting out the narrative behind the data creates a visceral connection for decision makers and gives them a clearer understanding of the actions to take.

4. Agile execution
Playing back your findings is not the end of the analytics value chain. The next stage is to move from insight to action. This is best done in small, multidisciplinary teams, working in agile sprints to rapidly deliver what is needed. These teams will sit outside the workforce analytics unit.

5. Robust data integrity
An analytics team's "license to operate" is based on trust. Employees must believe that the team is doing the right thing by them and the business and is treating their data securely and confidentially. Without that level of integrity, employees won't feel comfortable disclosing their data, which means you won't be able to provide meaningful insights.

Tech for enhancing the EVP

Not only can new technologies reshape roles, they can also be used to form part of the new EVP. The metaverse offers a good example. The initial applications of the metaverse within supply chain organizations are well suited to training, collaboration, and engagement. Companies are exploring the metaverse to run virtual inductions and site tours, and to facilitate more engaging, collaborative meetings in a virtual immersive space. For example, Samsung uses metaverse platform Gather. Town to create a virtual job fair as a recruitment pathway to meet job seekers[18].

Potential recruits can meet with human resources managers from other companies through their avatars. Other 3D experiences may also be used to further build on the EVP, such as moving from a job description to a virtual "day in the life of a typical employee," or reimagining the employee experience during onboarding to virtually showcase the various facilities and work environments the employee can visit, while also completing induction and training through simulations.

[18]Samsung, Samsung Biologics hosts its first metaverse Job Fair, March 2022

How to get there

Understand the key components of EVPs.
EVPs are vital when attracting, developing, and retaining talent, including culture, company values and purpose, fair pay, and flexible working.

EVPs should be human-centered.
They should focus on all types of workers to create competitive advantage in a climate of low unemployment and skills shortages.

Ensure as many people as possible can find a career path.
This is essential amid the fragmentation of work into skills and tasks.

Soft skills and innovation

As automation and digital capabilities are adopted, data analysis and repetitive or manual tasks can be given to machines, bots, and RPA. Meanwhile, humans can focus on agility, transformation, customers and innovation. Skills that are difficult for machines to replicate, such as sociability and emotional awareness, will likely rise in value.

Capabilities such as strategic value creation, entrepreneurship, decision-making, and creativity may also be in high demand. Humans may need to learn to manage an ecosystem of automated and digital solutions to drive customer outcomes, and work across a hybrid workforce of humans, digital technologies, and automation. The ability to collaborate and drive outcomes may become a core competency, and companies could build interpersonal resilience by coming together to collaborate across functions. This will require truly connected organizations across front-, middle-, and back-office functions to drive faster and more agile transformation. We are likely to see more organizations leverage the metaverse to establish collaboration hubs as a way for employees, clients, and communities to connect, engage and explore opportunities for growth.

How to get there

Nurture soft skills development.
Deliver this with a high level of control for the learner to shape their learning and their working environment. Encourage continual growth in the face of challenges.

Consider Innovation Time Off (ITO).
Companies such as 3M and Atlassian all leverage the time allowed by automation activities to provide employees with ITO. Collaborative innovation forums can be established to solve customer problems, enhance service, and work on new products or business ideas.

Culture to drive transformation

Culture to drive transformation

Culture and leadership will likely be used to drive transformation into supply chains and be the keys to how organizations develop the workforce of the future. This includes how companies view talent, how they create a strong sense of purpose, and how they define where the business and future supply chain is headed.

Prospective employees are drawn to companies that prioritize people, give back to the community and broader society, and treat their mission with the same seriousness they reserve for business performance. Purpose and culture can become a source of competitive advantage, with stakeholders, investors, customers, and potential employees using these credentials to decide if they should do business with, work with, or invest in the organization.

How to get there

Modify how you attract and manage talent to align with culture and purpose.
Review internal core services, consider the best mix of workforce strategies across gig economies, and refine how you work with external partners.

Adopt a "grow your own" approach to talent in an ever-competitive labor market that has previously focused on recruitment and external search.
Organizations that leverage data and analytics can also build a digital view of workforce capabilities, current skill levels, and plans to close skill gaps.

Conclusion

Conclusion

Future supply chains will still need people working closely with technology to accelerate business outcomes. Organizations need to place people at the heart of their supply chain strategies, as it's people who can make supply chain technologies succeed, drive innovation, and focus on the customer.

The future of the supply chain workforce will likely be characterized by:

The coexistence of digital and humans.
Supply chains will likely merge the best of both worlds, driving efficiencies and streamlining operations through automation and digitizing, while leveraging human talent to drive strategic value and innovation

The reorganization of digital and human work.
Success with tomorrow's automated supply chains will depend on how well you train your people today

Fostering soft skills and innovation.
Knowledge and information sharing and freedom from repetitive work should enable employees to drive more value, personalize service, and identify new business offerings

Culture and purpose.
People will likely value organizations that put culture and purpose at the forefront.

Supply chain leaders need to prepare their teams for these shifts to make the most of the opportunities they present for both the business and their people.
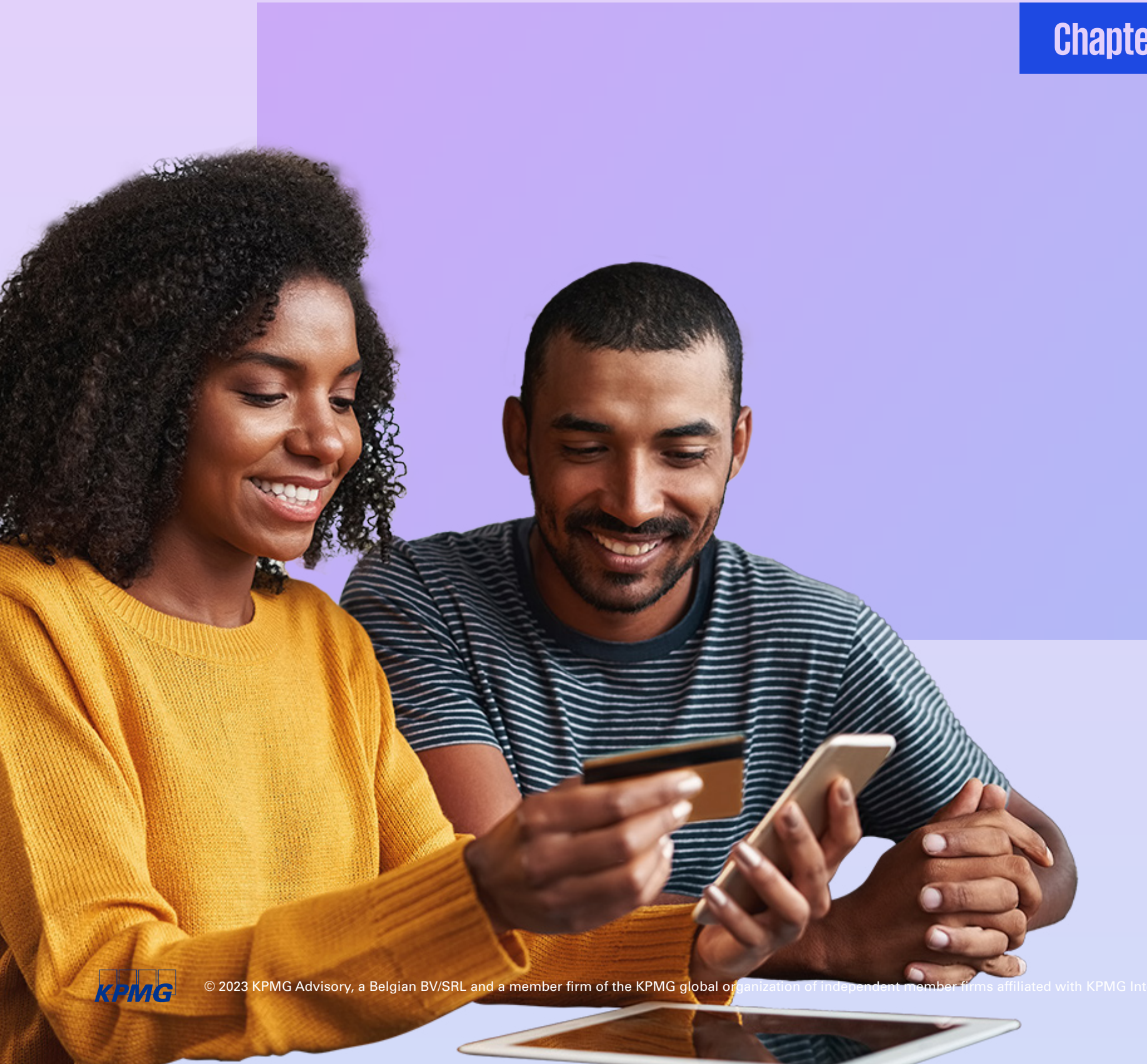
Chapter 6 # Distributed ledger technologies and digital money

Distributed ledger technologies and digital money

For almost a decade, the global supply chain community has cast a skeptical eye on the potential of digital ledger technologies (such as blockchain) and digital money as mechanisms to promote trade flows. Despite some logical use cases (such as anti-counterfeit, serialization, tracking, etc.), only a handful of companies have successfully managed to use DLTs and DM. This is unfortunate because there are a variety of validated potential applications.

Bilateral and regional trade regimes continue to thrive, leading to a proliferation of standards, rules of origin, and tariff and non-tariff measures. For supply chain leaders, such cross-border trade also involves significant documentation that varies by market, including customs declarations, manifests, product licenses, packaging requirements, export evidence and invoices, to name a few. Certain product categories (e.g., alcohol and tobacco, critical minerals, etc.) and hazardous goods (e.g., fertilizers, chemicals, etc.) are heavily regulated and their restriction/prohibition into certain markets needs to be checked before documentation is finalized. This makes supply chain and logistics activities more time- and labor-intensive, as much of this documentation is still prepared and managed manually.

To help with this complexity, we expect to see DLT and DM investments grow over the next three-to-five years, facilitating trusted trade by standardizing data across the value chain. DLTs and DM can assist with supply chain visibility and enhanced traceability, optimizing inter-company coordination, and improving access to financing among many other potential benefits.
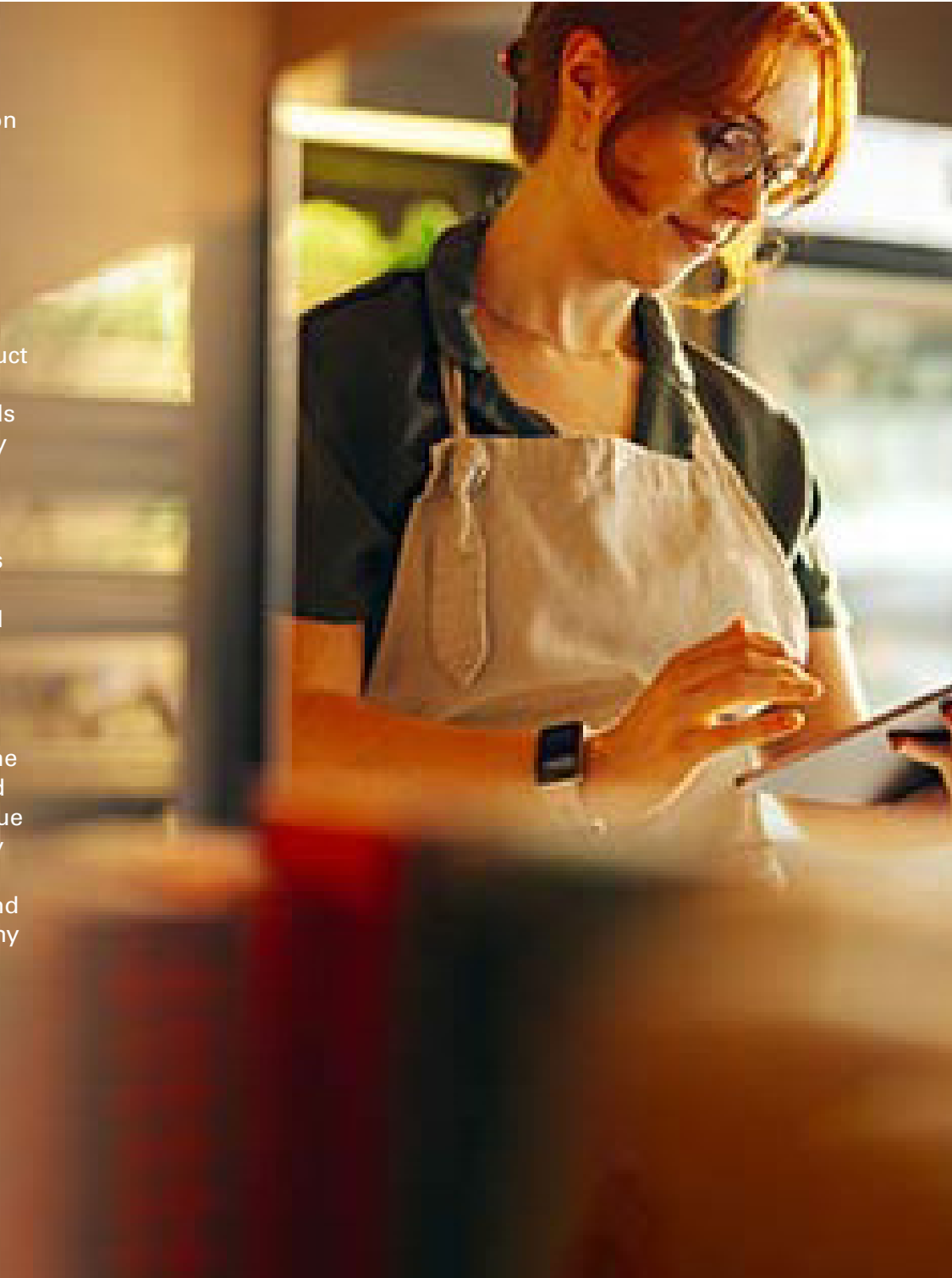
Enable supply chain visibility with enhanced traceability

According to our survey, only 28 percent of companies had clear visibility into their Tier 2 suppliers, while 43 percent of companies had no visibility or were "largely unclear" about the visibility of even their Tier 1 suppliers. This may change as some early adopters are already using DLTs to extend their visibility into Tier 2 and beyond.

The ability offered by DLTs for data visibility, to trace every transaction, and identify the actors involved can enhance the reliability and accuracy of product traceability and tracking.

28%
of companies had clear visibility into their Tier 2 suppliers

43%
of companies had no visibility or were "largely unclear" about the visibility of even their Tier 1 suppliers

Optimizing inter-company coordination

The immutability and automated execution of blockchain optimizes inter-company coordination by enabling real-time communication and collaboration between stakeholders.

Here are three examples of how blockchain can assist:

01

Common registry of ownership

The use of blockchain technology provides a common registry of ownership, enabling stakeholders to reduce stocks and improve JIT inventory management. It can help to speed up the flow of imports and exports, improve access to trade finance for SMEs, and digitize other trade documents (such as purchase orders, invoices, packing lists and transport documents), helping to reduce inventory holding costs and improve cash flows.

02

Standardization of data for ESG

As companies seek to better track their environmental impact, DLTs are being used to create digital assets that capture data and support corporate ESG strategies. Detailed origin tracing allows companies to identify issues or risks associated with raw materials used in their products. Organizations connected to ecosystem platforms can understand the true flow of products, identify opportunities to measure and reduce various asset carbon emissions, reduce waste and optimize energy usage.

An example of such multi-party collaboration using ecosystem platforms is the construction sector. Measuring embodied carbon (Scope 3) for a building is complex, takes time and is expensive.

To address such a broad sector-based challenge, the NSW Government Office of Building Commissioner in Australia collaborated with **KPMG Origins** and various industry players (developers, builders, and material producers) to bring a new product to the sector (**Asset Impact**) to measure easily and accurately the "as-designed" and "as-built" embodied carbon of construction projects. Asset Impact combines data about building materials, and improves calculation accuracy by combining supply chain data, latest Environmental Product Declarations, and a rich set of generic emissions factors.

Organizations connected to ecosystem platforms can understand the true flow of products, identify opportunities to measure and reduce various asset carbon emissions, reduce waste and optimize energy usage.

## 03

Supply chain resilience and trust

The use of blockchain technology can enhance supply chain resilience by enabling stakeholders to anticipate bottlenecks, build alternative supply chain routes, and minimize the impact. For example, the Global Shipping Business Network (GSBN), a not-for-profit technology consortium comprising of major global carriers and terminal operators, has built a blockchain enabled data exchange platform designed to improve global trade. The GSBN intends to begin with cargo release, but also plans to explore trade finance and electronic bills of landing[19].

Over the next three-to-five years, we expect to see many governments and industries incorporate DLTs into their systems. These systems can underpin supply chain flows as organizations see the benefit of faster calculations and greater accuracy in customs duties and fees, as well as improved speed through ports and lanes for goods that no longer need to be attached to letters of credit.

Examples of public/private partnership using DLTs are the ones deployed in NSW, Australia, where the local government has partnered with industry and platform providers to bring trust and transparency to the construction sector with a new **Building Trustworthy Indicator (BTI)**. BTI enables the regulator and construction developers to differentiate between trustworthy and untrustworthy buildings by capturing data about how the building was built, who was involved, and what materials were used.

These solutions rely on trusted and immutable data (using blockchain technology) across very complex supply chains, stretching multiple jurisdictions and regulatory regimes.

Over the next three-to-five years, we expect to see many governments and industries incorporate DLTs into their systems.
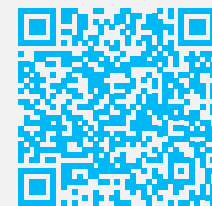
Technology perspective

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19 GSBN, Cargo Release, 2022

Improve access to financing

Validation of global payments often takes days, exposing buyers and sellers to significant foreign currency, counterparty clearing, and settlement risks. Fully collateralized and audited forms of digital money, such as Central Bank Digital Currencies (CBDCs) or regulated corporate issued stablecoins, could play an important role to enable such technology and data driven payment infrastructure. DM could help with trade finance, efficiency in payments, and streamlining cross-border trade.

Trade finance

The use of blockchain technology can enable stakeholders to streamline trade finance processes by providing a secure and transparent platform for transactions. This can reduce the risk of fraud and enable faster settlement times, resulting in lower transaction costs and improved cash flow. It may also improve accessibility to financing by providing a transparent and secure platform for stakeholders to share information with lenders. These platforms could become a standard tool for trading partners to secure and better manage in-transit inventories and protect financial flows, thereby ensuring cost, quality, and integrity of supply are maintained for cross-border transactions.

Efficiency in payments

The use of DLTs and DM enables efficiency in payments by leveraging smart contracts (programs that trigger pre-defined actions) to provide near-instant settlements. Smart contracts can execute after a particular stage in a defined process is reached. For example, once a shipment reaches a particular distribution center, a payment can be triggered. Smart contracts reduce the need for intermediaries and enable stakeholders to save on transaction costs.

Efficiency in payments may lead to the following benefits:

Reduced counterparty risk
CBDCs are issued and backed by central banks, which are considered among the most secure and trustworthy financial institutions. This reduces the counterparty risk associated with using stablecoins or other digital currencies, which may be backed by private entities or have limited regulation.

Guaranteed liquidity
CBDCs are issued by central banks, which typically have an unlimited capacity to issue and redeem the currency. This guarantees the liquidity of the CBDC, ensuring it can be used for settlement within the supply chain without any concerns about its availability or acceptance.

Greater stability
CBDCs are designed to be stable and maintain their value over time. This stability reduces the risk of price fluctuations, which can be a concern when using stablecoins or other digital currencies.

Enhanced regulation
CBDCs are subject to regulatory oversight by central banks, which helps ensure their stability, security, and compliance with legal and regulatory requirements. This enhanced regulation can provide greater transparency and trust in the use of CBDCs for settlement within the supply chain.

Integration with existing systems
CBDCs can be integrated with existing payment and settlement systems, which can help to reduce the cost and complexity of adopting new technologies. This integration can also improve interoperability and standardization within the supply chain.

Cross-border trades

The use of DLTs and DM also enables cross-border trades by providing a secure and transparent platform for transactions. Programmable money, also known as smart money, is a form of digital currency that includes embedded rules and conditions for how it can be used. In the context of cross-border trades, programmable money can offer several benefits, including increased transparency, reduced fraud, and improved efficiency.

Smart contracts are then used to enforce the terms of the payment. For example, the smart contract can specify that payment will only be made once certain conditions are met, such as the delivery of goods or the completion of services. Smart contracts can also be used to automate other processes, such as invoicing, tax reporting, and compliance checks. Once the smart contract conditions are met, settlement can occur in just a few seconds, compared to traditional cross-border payments, which can take days or weeks to settle.

Here are two examples of programmable money being implemented to facilitate cross-border trading:

IBM World Wire:
This blockchain based payment system uses a digital currency called Stronghold USD (SUSD, a stablecoin pegged to the US dollar) for cross-border payments. The system uses smart contracts to enable near-instant settlement of transactions, with funds transferred in seconds rather than days[20].

China's Digital Yuan:
China's central bank has been developing a digital version of the yuan, which could be used for cross-border payments as well as domestic transactions. The digital yuan is designed to be programmable, with embedded rules and conditions that can be used to enforce compliance with regulatory requirements and ensure the security and traceability of transactions[21].

Case study

SunRice embracing DLT

KPMG Australia worked with SunRice to explore the potential benefits of applying DLT blockchain to promote sustainability and trust across its global supply chain[22]. The project, built on the KPMG Origins platform, harnessed DLTs to demonstrate how the company could enhance communication across its global network and allow its customers to connect more closely with their products as they moved through the value chain.

KPMG focused on three areas:

01 Value chain visibility
When sourcing rice from other countries, SunRice wanted to demonstrate visibility to customers and stakeholders while ensuring they would continue to enjoy an equivalent product, not only with respect to taste and quality, but also environmental performance and ethical treatment of its labor force. The use of blockchain provides stakeholders with a holistic view of the entire supply chain process. This enables stakeholders to identify bottlenecks, anticipate disruptions, and optimize operations, resulting in improved efficiency and customer satisfaction.

02 Real-time information
SunRice wanted complete traceability of its products certificates in real time. These certificates had to be made available to the consumer, investors, and regulators to meet their demands for more transparency for the quality of the sourcing and manufacturing. The platform enabled SunRice to trace a packet of long grain rice from paddy to plate, to provide wide-ranging visualization of its business and, in the process, inform the company's broader enterprise data strategy. The use of blockchain technology provides real-time information on the movement of goods and services, which enables stakeholders to make informed decisions on inventory management, production planning, and delivery schedules, resulting in improved efficiency and cost savings.

03 Authenticity and safety benefits
SunRice end-consumers and corporate buyers demand that their food meets high standards for ethical sourcing, sustainability, fair labor practices, and more. Previously, consumers/buyers only had the supplier's word that the product met those standards. Today, ecosystem-based platforms using DLTs offer supply chain participants the ability to trace the origins of their food, see exactly who performed what task (along the supply chain), and then provide visibility/proof of these actions. For SunRice marketers, the pilot enabled the business to validate its hypothesis that an open and transparent supply chain would help maintain and even strengthen consumer trust. The use of blockchain technology provides authenticity and safety benefits by ensuring the integrity of the data recorded on the blockchain. This enables stakeholders to trust the information recorded, thereby reducing the risk of fraud, and improving consumer confidence.

The use of blockchain technology provides authenticity and safety benefits by ensuring the integrity of the data recorded on the blockchain.

[20]IBM, IBM Blockchain World Wire revolutionize cross-border payments, March 2022
[21]People's Bank of China, Progress of Research and Development of E-CNY in China, July 2021
[22]KPMG, SunRice pilots Blockchain to connect farm to plate
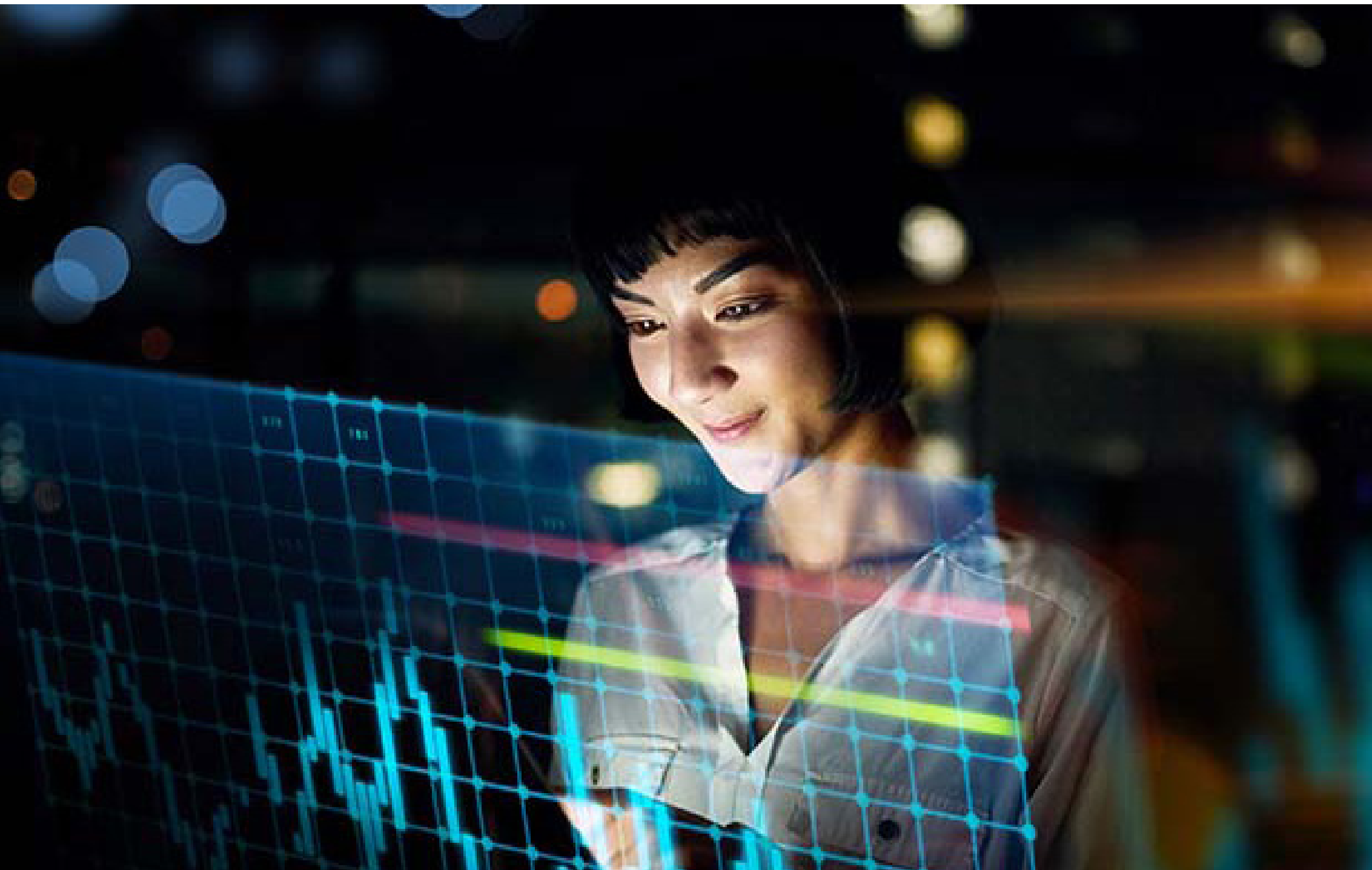
Conclusion

The KPMG Future of Supply Chain Survey revealed that only 4 percent of organizations are currently exploring blockchain technologies, mostly in the technology, retail, and manufacturing sectors.

Despite this slow start, we remain optimistic about the value of DLTs and DM in logistics. While there are still challenges to overcome, promising results of pilot projects and the increasing urgency to improve global trade flows suggest a brighter future for the adoption of DLTs and DM into supply chain management policies and procedures. DLTs and DM technologies may enhance the supply chain ecosystem in three ways:

Enhance traceability to provide real-time information, visibility, and authenticity of goods in the supply chain

Optimize inter-company coordination using a common registry of ownership that standardizes data and improves supply chain resilience

Provide better access to financing via trade finance, increasing efficiency for payments and cross-border trades.

To maximize the benefits of these technologies, it is important for organizations to focus on building a strong ecosystem that includes suppliers, manufacturers, distributors, retailers, and consumers. Collaboration can help to establish common standards and protocols, ensuring interoperability and seamless integration of DLTs and DM within existing supply chain systems. Additionally, education and training programs should be put in place to help stakeholders understand the benefits of these technologies and how to implement them successfully.

Chapter 7 Sectoral transformations

Sectoral transformations

In addition to global disruptions, supply chain leaders will likely see major industry sectoral shifts driving transformational changes to supply chains. These transformational changes could create opportunities; however, capturing these gains will require mastery over a host of new complexities. Examples of expected industry shifts can be found in healthcare and life sciences, retail, and aerospace and defense. Here are some insights into what the changes are and what they could mean for supply chain leaders.

Healthcare and life sciences

This industry will likely drive supply chain innovation at a fast pace thanks to a shift toward precision medicine, advances in MedTech and Data-as-a-Service.

Precision medicine

The shift in patient treatments from a "one-to-many" approach to a "one-to-one" offering, or "precision medicine", could affect how supply chains operate. Precision medicine provides highly customized treatments based on an individual's genetic and protein makeup. This approach considers a patient's unique risk profile (including phenotype and genotype) to inform individualized diagnostics, interventions, and treatments.

More precise medicine will demand more precise logistics, including robust scheduling and sophisticated coordination capabilities.

More complex supply chains could include cold chains and cryo-chains; managing the complexities of biomatter transportation (timeliness, temperature controls and monitoring, and maintaining viability), through to coordination of nurse/doctor availability on arrival to protect product shelf life.

Notifications will be needed to advise stakeholders of a product's location during its journey and when to expect the product's arrival, with updates via GPS technology (including GPS, RFID, Wi-Fi, or cellular data).

Future supply chains may also need to accommodate "at home" models (i.e., from B2B to B2B2C and B2C), where the last mile becomes critical, including managing controls and transparency requirements.

The next-generation medical supply chain is likely to look like the digital platform that Nippon Express has been developing with Intel. The platform is the revised ICLP system, a cloud-based tracking system that relies on small electronic tags contributed by Intel that can log temperature, humidity, light, shock, and tilt. When these tags pass through reader gateways, their data is uploaded along with GPS-based location information into the cloud system[23].

A lot of work is still to be done to achieve this future vision. The product development cycle requires managing extended lead times and heavy regulatory burdens on the long journey from clinical trial to commercial production. Operational complexity arises from the challenge of tracking an individual's genetic material or proteins, and different supply chain paths will be needed depending on the treatment required and on the high labor intensity involved to make customized drugs.

MedTech

MedTech (medical technology) supply chains are complex largely because of the number of components that go into the final product. These components depend on different supply chains and various partners. Inventory and delivery must be closely monitored, with careful maintenance of the devices. This requires high quality demand planning and forecasting, and strong traceability/visibility of the supply chain up to Tier 3. As the number of personalized solutions grows, the need to control costs, comply with regulations, and maintain transparency will add further pressure to the entire product lifecycle.

New business models within the MedTech industry will likely emerge to meet these evolving requirements. These new models may include direct-to-consumer and as-a-service models, as well as services built around products. Eventually, supply chains will likely be re-shaped to focus on new industry services/solutions, providing new combinations of products and services supported by user-friendly platforms. MedTech organizations are considering their future footprint strategy (what to make versus buy, where partnerships are beneficial, and the potential value of a merger or acquisition), which must also be factored into the network design. Leading organizations are already leveraging asset-light models and moving toward the creation of an ecosystem of partners, allowing them to focus on creating core capabilities that drive greater value in their supply chains.

Data-as-a-Service

For most healthcare and life sciences organizations, data continues to grow in importance. Companies already collect data through electronic healthcare records, social media, mobile apps, patient summaries, clinical trials, pharmaceutical data, IoT sensors, and socio-economic indicators, but DaaS vendors should make it easier for healthcare and life sciences companies to manage and interpret these large data sets. Organizations could consider DaaS as an opportunity to monetize their data and gain a competitive advantage, acknowledging the need to manage data privacy and storage requirements.

By taking a more data-centric approach, Komodo Health, has built a real-time healthcare map platform that documents important disease prevention and treatment goals and plans for patients. This platform can cross-link the patient's care data, medical records, and information to help better predict diseases. Leveraging DaaS can also streamline or integrate activities within the organization to improve productivity, increase efficiencies, and reduce costs and lead times.

[23]Nippon Express, Nippon Express partners with IntelR and Honeywell to develop IoT-based "Global Cargo Watcher Advance" service for visualizing transport status, Feb. 2019

Retail

New supply chain models across domestic and global networks will likely be driven by progress toward mass personalization, and the impact of customer buying and receiving/collection behaviors on last mile deliveries.

Supply chain leaders will need to adopt a more agile network model and support "many-to-many" network flows.

As highlighted in the *KPMG Retail Outlook Report 2023*, delivering a message to a customer that directly relates to the precise stage they are at in the purchase journey can amplify the impact exponentially[24]. A good example of this potential is coffee giant Starbucks' app in the US, which uses geolocation to identify when a customer is near a Starbucks store and asks them if they want to order their favorite coffee so it's ready to be picked up the moment they pass by.

Retail and distribution perspective

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Personalization
Consumer behavior has continued to change as more trade has shifted from brick-and-mortar stores to virtual transactions. Consumers demand services and products that are tailored to their unique needs based on selection, assortment, and delivery. In response, retailers are leveraging more analytics and real-time data to predict buying triggers that drive foot traffic and stimulate purchases.

Predictive analytics is likely to move from prescriptive engagement based on user profiles and outbound push campaigns, to inbound personalized experiences based on signals as they are dynamically identified.

In addition to tailoring services, product customization continues to be a key trend. Some brands now opt to delay the configuration of a final product until an order is placed by the customer to enable made-to-order additions. For example, sunglass brands Ray-Ban and Oakley allow customers to build their own customized style through selection of the shape, color, frame, and lenses.

Brick-and-mortar stores will likely be changing too. In physical retail stores, personalization and the delivery of true customer centricity will dramatically alter the shopping experience. Consumers in the future may select items on their digital wish list to try on, and those items could already be waiting for them in the fitting room upon their arrival. To enable this, leading organizations are developing capabilities and processes across their front-, middle-, and back-offices to deliver both customer and cost outcomes.

The rethinking and tailoring of shopping experiences online and offline should spur greater inventory accuracy and delivery capabilities. It could also drive innovation through the emergence of smaller players, creating an ecosystem of partners that brands can draw on to implement these new, more advanced supply chain requirements. Organizations will need to consider which areas of their supply chain require customization and how these needs align to future customer requirements. This may include expanding support from suppliers or amending the requirements of contract manufacturers or distribution partners.

E-commerce and last mile delivery
In a multichannel world there could be numerous ways to fulfill and return a single e-commerce order. Therefore, supply chain leaders will need to adopt a more agile network model and support "many-to-many" network flows. This involves not only accommodating a mix of "ship from" locations, but also supporting the growth of "ship to" locations. Leading supply chain leaders are planning technology investments to help optimize and automate order fulfillment based on key business rules (i.e., optimizing and aligning to customer service propositions and revenue growth objectives).

We anticipate that retailers in the future may create a unified view of the supply chain that shows item availability at each node, for each channel, at any time. Some retailers already achieve this by using stores for both sales and fulfillment, and by unifying distribution assets between online and in-store. During the COVID-19 pandemic, Australian retailer Officeworks pivoted to this model to provide faster fulfilment of its orders, leveraging stores for picking and distribution activities. In the US, Target is leveraging its retail stores as small distribution hubs to reduce customer lead times.

Despite its convenience, e-commerce has not yet replicated the ease and immediacy of the collect and return experience. Some retailers, however, are trying to solve this.

[24]KPMG Retail Outlook Report 2023

Aerospace and defense

As geopolitical issues impact international trade flows, aerospace and defense could face higher scrutiny from regulators, trading partners, and investors.

This may require companies to increase their capacity to monitor and secure supply sources and cross border trade flows. Appropriate and timely data is therefore vital.

Two ways the industries are addressing this include:

Engaging with Edge computing

This sees more efficient processing of data at the point of collection/consumption and is expected to help revolutionize the efficiency, effectiveness, and speed of the supply chain and distribution network. The availability of information should increase, and it can be shared across the ecosystem of supply chain partners in real-time to drive more agile and responsive operational performance.

Embracing 5G and IoT

These provide an opportunity to accelerate delivery of almost real-time decision support and a common operating picture, as well as hyper-converged connectivity of trading partners. In addition, IoT devices may provide instant feedback on asset performance and maintenance to upstream part and service suppliers.

We expect to see many aerospace and defense companies move to a more automated enterprise model that combines robotics and real-time availability of information to drive automated decision-making on a larger scale. There will likely be a significant increase in RPA to drive efficiency in the middle- and back-office functions. Humans are increasingly likely to be replaced with robots or remotely piloted vehicles to conduct operations.

Another promising technology being used in the sector is the digital twin, which Boeing already uses in designing aircraft. By simulating the performance of an aircraft in a virtual environment, the company can test different design options and identify potential issues before building a physical prototype. This helps ensure the final design is as efficient and safe as possible, with the company achieving a 40 percent improvement rate in first time quality of parts and systems[25].

One thing that may hinder innovation in these areas is our expectation that sovereign supply chain aspirations are facing growing distrust amongst usual trading partners, which could make it difficult to share innovation across these two sides of the ecosystem. It may even exacerbate strains inside each industry (e.g., a stretched workforce and talent demand challenges etc.).

We expect to see many aerospace and defense companies move to a more automated enterprise model that combines robotics and real-time availability of information to drive automated decision-making on a larger scale.
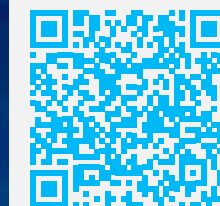
A geopolitical perspective

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[25]Bellamy, Woodrow, Boeing CEO Talks 'Digital Twin' Era of Aviation, Aviation Today, Sep. 2018

Conclusion

The significant industry shifts outlined above will likely drive transformational changes to supply chains.

To summarize:

Healthcare and life sciences companies may drive new supply chain solutions to support advances in precision medicine and MedTech, such as the hyper-precise tracking of goods, and engage DaaS to manage the growing volume of data.

Retail companies will need to drive predictive analytics and personalization in both virtual and brick-and-mortar customer experiences.

Higher scrutiny within aerospace and defense industries could require almost real-time decision support and hyper-connectivity.

Similar to when Dyson leveraged industrial cyclones to reinvent vacuum cleaners,[26] or when clothing company Nike used waffle irons to reinvent running shoes,[27] companies should look towards other sectors to explore innovations, as well as connecting with partners to spark ideas, and unlock opportunities to collaborate, test, and adopt new solutions.

[26]Dowling, Stephen, Frustration and failure fuel Dyson's success, BBC Future, March 2013
[27]Peterson, Hayley, The bizarre inspiration behind Nike's first pair of running shoes, Business Insider, July 2015

Chapter 8 Metaverse

Metaverse

The metaverse is a promising technology platform that loosely integrates virtual reality, augmented reality, PCs, devices, gaming consoles, and smartphones. The most popular metaverse use cases for corporations today relate to virtual meetings, virtual office space, creation of digital twins, and product design brainstorming.

The KPMG Future of Supply Chain Survey highlights that roughly one-third of today's supply chain leaders have begun to experiment with the metaverse. We believe supply chain leaders may eventually adopt metaverse technologies in their day-to-day roles, proceeding in three stages. In horizon 1, the metaverse could provide supply chain leaders with real engagement and learning experiences. In horizon 2, it could deliver an enhanced digital twin capability, and in horizon 3, it could deliver the opportunity to fully digitize supply chains with enhanced demand forecasting, hyper-precise modeling, and scenario-planning with suppliers and customers.

We believe supply chain leaders may eventually adopt metaverse technologies in their day-to-day roles.

94%

A metaverse moment is coming, with 94% optimistic that digital twins will add value

Horizon 1

Real engagement and learning experiences

Metaverse applications give businesses a new way to interact with their trading partners, employees, and customers, providing a more immersive environment for communication. In the supply chain, metaverse tools could be used to engage more deeply with customers and external organizations, enhancing communication and facilitating real-time collaboration.

The initial benefits of metaverse applications may include a greater ability to connect with clients, employees or suppliers, and less need for in-person meetings. Other benefits may include improved employee engagement and retention, greater opportunities for workforce training, and more rapid knowledge sharing.

To offer an example of the metaverse in practice, our survey found that 33 percent of healthcare companies already use the metaverse and/or digital twin technology to enhance patient care and health treatment.

33%

Our survey found that 33 percent of healthcare companies already use the metaverse and/or digital twin technology to enhance patient care and health treatment

An additional 36 percent that aren't using these technologies today are exploring the capabilities. Some healthcare organizations are using the metaverse along with spatial computing technologies, video conferencing, and 5G to provide real-time virtual support and analysis of surgical procedures occurring in an actual operating room.

The introduction of augmented reality and metaverse also opens the door to augmented care models. By removing physical boundaries and facilitating the transfer of knowledge, healthcare services may be provided to patients regardless of location. For example, Brainlab (a company that creates software-driven medical solutions that digitize, optimize, and automate clinical workflows) is leveraging advances in virtual reality to project a digital twin of the patient on a screen in the corner of the operating room to enable remote collaboration. The company recently conducted surgery training on a virtual patient for 2000 people. In a few years, digital "human twins" may even enable surgeons and other specialists to leave training to computers, allowing senior practitioners to focus more on strategic, value-creating activities[28].

In another healthcare example, GigXR, a global provider of holographic healthcare training, has partnered with leading medical and educational institutions to co-create extended reality (XR) applications for healthcare simulation. They have also partnered with 3D interactive medical experts to integrate detailed anatomy content to the Gig Immersive Learning Platform, which centralizes, manages, and delivers third party partner content, as well as XR applications created by GigXR, and modules co-created with healthcare institutions. GigXR uses XR to create hyper-realistic holographic patients, medical equipment, and anatomy models.

This enables students to master vital medical and nursing skills in safe-to-fail, real-time environments that enable collaborative XR learning for enhanced knowledge retention and critical thinking skills. Immersive learning also helps democratize access to leading healthcare expertise by bridging resource gaps among institutions around the world. Learners can join from any location using an XR headset, smartphone, or tablet[29].

[28]Nicholls, Jane, Unleashing the potential of digital twins, CSIRO Resourceful, Issue 20
[29]GigXR, GigXR Holoscenarios Named to Time's List of The Best Inventions of 2022

Horizon 2

The digital twin in the supply chain

As metaverse technology matures, companies could increasingly use these tools to streamline their supply chains, develop new products, mitigate supply chain risks and drive efficiencies in planning. They could virtually create "digital twins" to model "what if" scenarios and strategic options, such as, "what if I change this aspect of my production," or "what happens to my costs if we ship via a port other than Singapore" to evaluate outcomes.

Within warehouse operations, different stakeholders could collaborate more easily and provide immediate feedback regarding the design of the facility. Their ideas could be shared digitally, experienced virtually, and redesigned in the metaverse before the physical structure is built, saving time and money and de-risking capital intensive projects. Although the concept of digital twins is not new, the metaverse could accelerate adoption and increase their value across a wide range of sectors.

For manufacturers, running different production scenarios should greatly reduce factory downtime.

In horizon 2, augmented reality and virtual headsets could drive further enhancements to warehousing environments. For example, smart glasses are already being used in many warehouses to support more efficient item picking. Smart glasses provide a visual reference as to where items should fit on carts or pallets within the warehouse. As warehouses become more digitized and connected, paper and handheld scanners will no longer be required. Picking lists could be managed by technology and kept in the user's view as a "digital pick list". Such glasses and headsets can also help people identify the most efficient route through the warehouse.

The capability could reduce errors, increase productivity, and speed up the onboarding process. As this technology is adopted at scale, we may also see this being combined with other capabilities, such as computer vision, to drive further value into supply chains.

The metaverse could accelerate adoption and increase their value across a wide range of sectors.

For example, leveraging computer vision with wearable technology can provide real-time status of warehouse operations as if the person "watching" was on the warehouse/operational floor observing what the pickers or frontline staff are seeing.

They are therefore informed to make rapid and precise decisions. Similar tools could also reach the end-customer. Retailers could make 3D design tools available to their consumers, ushering in a new era of mass customization and product personalization.

Customers could virtually interact with a product in the digital environment, then redesign it to meet their unique needs and preferences. This will require an orchestrated future, where new or refined operating models, technology, and ongoing connectivity across internal business functions ensure the creation of fully flexible capabilities and optimized resources across the front-, middle-, and back-office to deliver enhanced customer service outcomes.

Retail, in fact, may be one of the first places consumers experience highly immersive, personalized, and engaging metaverse encounters.

One such example is Bloomingdale's, the US luxury department store chain, which has partnered with Emperia, a virtual store designer, to create a multi-brand virtual store aligned to key events (i.e., Fashion Week, Bloomingdale's 150th anniversary, seasonal holidays). Virtual showrooms provide a 360-degree immersive shopping experience for customers that allows them to connect with the brand without time constraints.

Customers can engage with and customize products aligned to their preferences via 3D models and real-life animation. These virtual spaces open the door to additional possibilities, such as being able to involve customers in virtual prototyping of new products to seek their feedback before manufacturing[30].

[30]Emperia, 2022, Bloomingdale's

Horizon 3

Physical supply chains go virtual

In the longer term, companies may use metaverse tools to fully digitize their supply chains and thereby eliminate physical boundaries.

This stage of metaverse development could provide more advanced benefits to planning teams, including enhanced demand forecasting, hyper-precise modeling, and scenario-planning with suppliers and customers. Companies should also be able to operate at accelerated speeds, respond in real-time to events and risks, and collaborate with suppliers, customers and other trading parties through virtual spaces created in the metaverse.

More accurate modelling and forecasting through the metaverse could facilitate the automation of supply chain planning activities, decision-making and execution. An example could be automatic replenishment of stock, allowing for JIT manufacturing.

This could enable better prediction and decision automation (near perfect information and execution), which also means that supply chain leaders could reapply JIT inventory policies and place less importance on manufacturing location.

In a medical example, companies could use metaverse tools to consolidate personal data from a range of different information sources such as smart phones and watches, blood tests, and DNA analyses, to build a digital representation of the patient.

This data could allow for modeling of different treatment scenarios based on health data, resulting in personalized treatments.

Scenario modeling at such hyper-precise levels could drive the creation of more hyper-personalized products and services tailored to customers' specific needs, and not only in healthcare. Such detailed scenario modeling should also shorten new product development timelines.
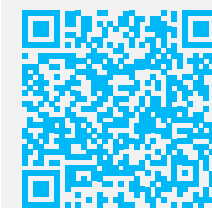
Manufacturing footprint changing

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Implementation challenges

We should acknowledge that reaching this third horizon may take more time than we forecast. Significant barriers to adoption of metaverse technology remain, including:

Technology capability and hardware

Challenges related to the integration of different hardware components must be overcome. For example, the ability to simulate manufacturing scenarios and model different outcomes in real-time may depend on having smart/IoT devices and sensors to capture information and feed that data into the metaverse. Metaverse solutions will need to be truly device agnostic to be successful, and such devices must also address current challenges around lack of interoperability.

Data

Through metaverse technology, organizations and users can connect data points and build a full virtual picture. However, strong data governance, management and systems integration are required to ensure virtual platforms do not become dated, while also managing data ownership, privacy, and protection imperatives.

Security

Sufficient security will be essential for metaverse applications. It will be vital to prove the identity of users and make it possible for them to safely interact with others. With bots able to mimic human identities, new verification methods will be needed.

Regulatory barriers, laws, and jurisdictions

Moving to a virtual world may remove international borders, but consideration must be given to how current trade laws are implemented virtually. Organizations will also have to manage an additional layer of complexity related to how taxation may be applied (i.e., how to tax an intangible product/service in an intangible world).

Ownership and property

Consideration will need to be given to how ownership rights are granted for creators of digital assets, and how ownership of digital assets in the metaverse can be verified.

Countdown to your metaverse

3. Build a strong data governance and management system

This is essential to ensure digital twins and digital platforms keep pace with change. Data interoperability will be needed to build a virtual person or scenario. Similarly, being able to connect and harness the data generated from IoT devices and sensors will be a fundamental requirement that determines the capacity for scenario planning and modeling outcomes in virtual simulations.

2. Boost cyber-security

Make sure your cyber-security measures keep pace with innovation. Data in virtual worlds must be protected, especially if hyper-personalized offerings are planned.

1. Set priority use cases

Model your organizational strategy on a few of the most promising metaverse use cases. Decide where you should test, pilot, and invest in metaverse capabilities.

Conclusion

Despite a somewhat slow start to practical uptake of the metaverse, the outlook for the application of this technology by supply chain leaders and their teams is strong, with over 90 percent of investors in the *KPMG Metaverse Investor Perspectives Survey 2023* predicting it will be increasingly utilized in business environments in the future[31].

We believe supply chain leaders will eventually adopt metaverse technologies, proceeding in three stages:

Real engagement and learning experiences.
Engaging more deeply with customers, employees and businesses, enhancing communication and facilitating real-time collaboration

The digital twin in the supply chain.
Utilizing the metaverse to virtually model scenarios on interconnected digital twins that replicate physical networks, people and processes

Physical supply chains go virtual.
Companies using metaverse tools to fully digitize their supply chains and thereby eliminate physical boundaries.

Adoption of metaverse technology will not come without challenges, as to leverage the benefits, businesses will need to overcome regulatory and legislative headwinds and make significant investment in cyber security, data capability and tech hardware. Successful adopters are likely to be those who move quickly past exploratory phases and find ways to use the metaverse to train employees, engage customers and streamline their supply chains. All companies need to be attuned to developments, begin planning for what the metaverse could look like in their industry, and be ready to act quickly when opportunities arise that could add value to their organization.

[31]KPMG Metaverse Investor Perspectives Survey 2023

Chapter 9 Conclusion
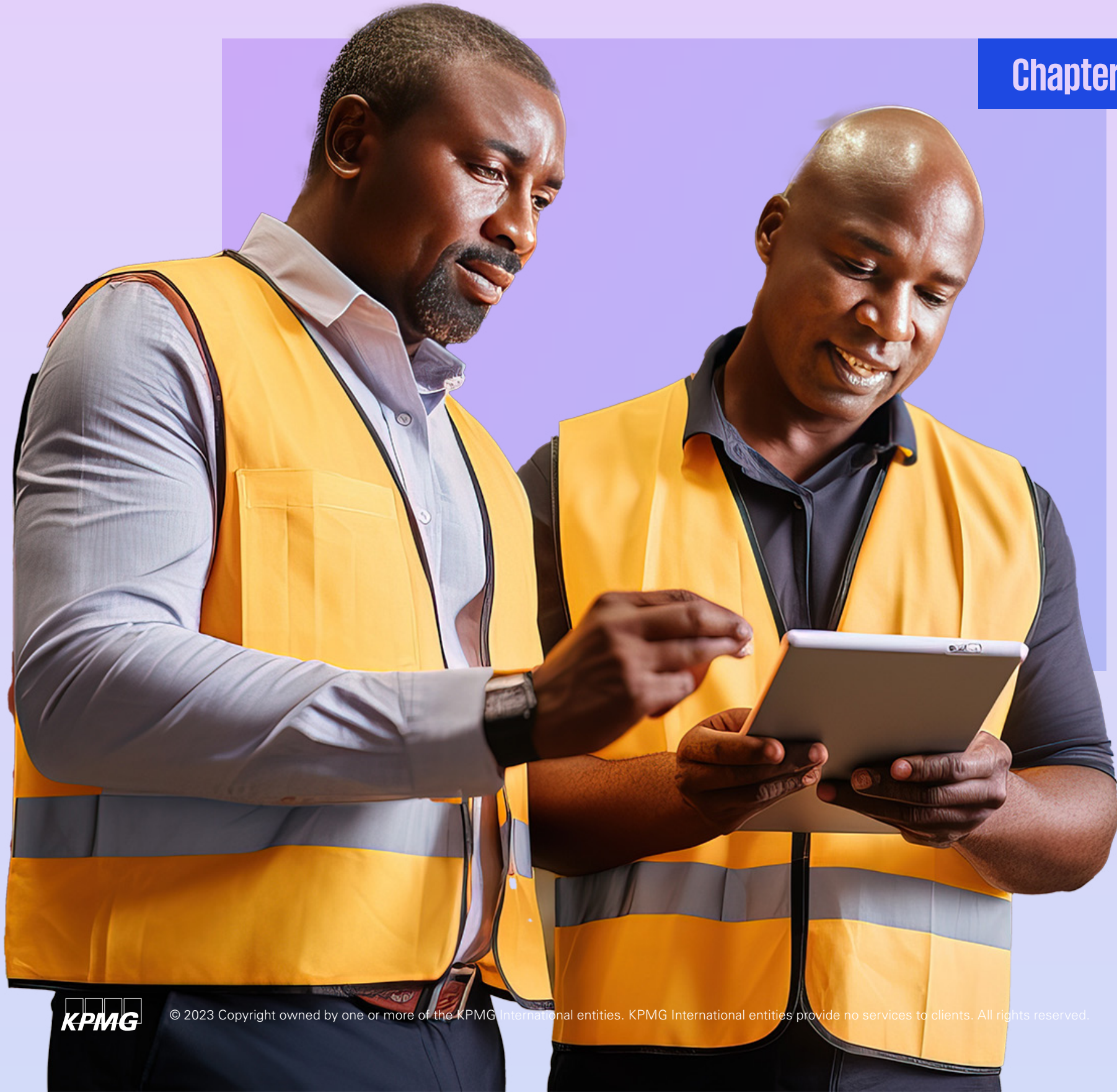
Conclusion

This KPMG *Future of Supply Chain 2023* report set out to support supply chain leaders in recognizing and tackling three essential short-term focuses, while also preparing for three significant sector themes emerging in the next three-to-five years.

Before exploring these trends, it began by examining the current context of the supply chain industry following years of disruption and variability. Challenges include, first and foremost, survival and resilience, with the need to prepare for new ways of delivery, customer convenience, and the blurring of channel boundaries.

We argued that operating models need to "pivot or perish," with big data, end-to-end visibility, and agile planning and prediction just some of the tactics that need review. We also explored the impact of various macroeconomic and macroenvironmental factors on supply chains, whether they be ongoing geopolitical issues, regulatory changes, or ESG mandates. Dealing with these challenges includes steps such as pursuing shorter-range supply sources and relevant partners to create a more secure supply chain network.

Thirdly, we highlighted the need for supply chain leaders to adapt to future challenges – whether they be climate change concerns, further geopolitical tensions, increased regulatory demands around ESG matters, or the need for digital transformation.

With the context of today's supply chain clear, the report dived into the three current themes we believe should be the core focus for supply chain leaders over the next year or two. The first theme was ESG commitments and how supply chains can play a vital role in helping their organizations meet regulatory and stakeholder expectations.

A company's connection to human rights and climate change mitigation must be transparent and understood at every step along the chain. From sourcing to due diligence, to decarbonization and engaging in the circular economy, ESG will be a major undertaking. The next theme was the investment that needs to be made in advanced robotics and automation to enhance supply chain operations and minimize risk.

Creating ecosystems of smart devices and allocating activities suitable for machines versus humans are just some of the essential changes.

Thirdly, we explored how the supply chain workforce needs to evolve as automation plays a greater role in daily operations.

A key shift is how humans and automation will work together, and redirecting human focus towards creative, innovative, and collaborative tasks that elevate the supply chain's potential.

A key shift is how humans and automation will work together, and redirecting human focus towards creative, innovative, and collaborative tasks that elevate the supply chain's potential. New skills and training will be required, as will exploring how technology can boost the EVP for current and future employees.

With the short-term focus clear, the report then raised the three emerging themes we expect will come to the fore in three-to-five years. We started with the evolution of distributed ledger technologies such as blockchain, and digital money, and how they could smooth out cross-border trade, increase traceability and trust, enhance real-time insights, and mitigate risks.

There is also potential for these to improve access to financing and increase payment efficiencies with smart contracts. Next, we considered how the supply chains of entire sectors will change amid technological innovation, with healthcare and life sciences, retail, and aerospace and defense among those set for a shakeup. Finally, we opened our minds to the potential of the metaverse – currently most famous for gaming and entertainment – as a supporting technology for optimal supply chain operations.

Engaging the metaverse could in fact provide opportunity for greater learning experiences, cross-border communication, supply chain journey simulations, and real-time risk mitigation, giving supply chains greater assurance.

We hope this report has inspired supply chain leaders to think differently and boldly about how to take things forward in the short and longer term. Of course, our global team of KPMG supply chain professionals are always here to explore any themes that resonate, and to help you on your journey to supply chain success.
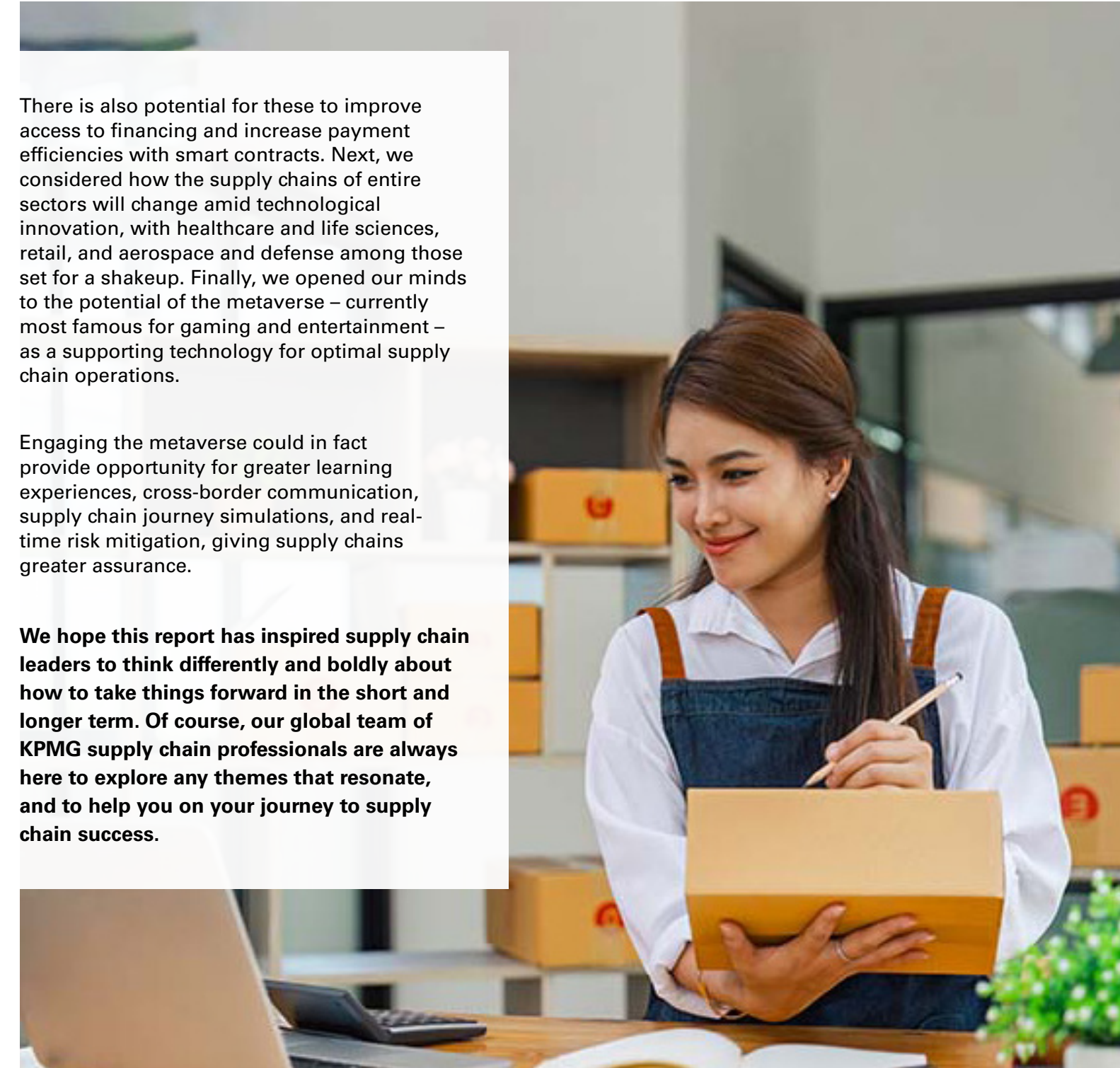
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