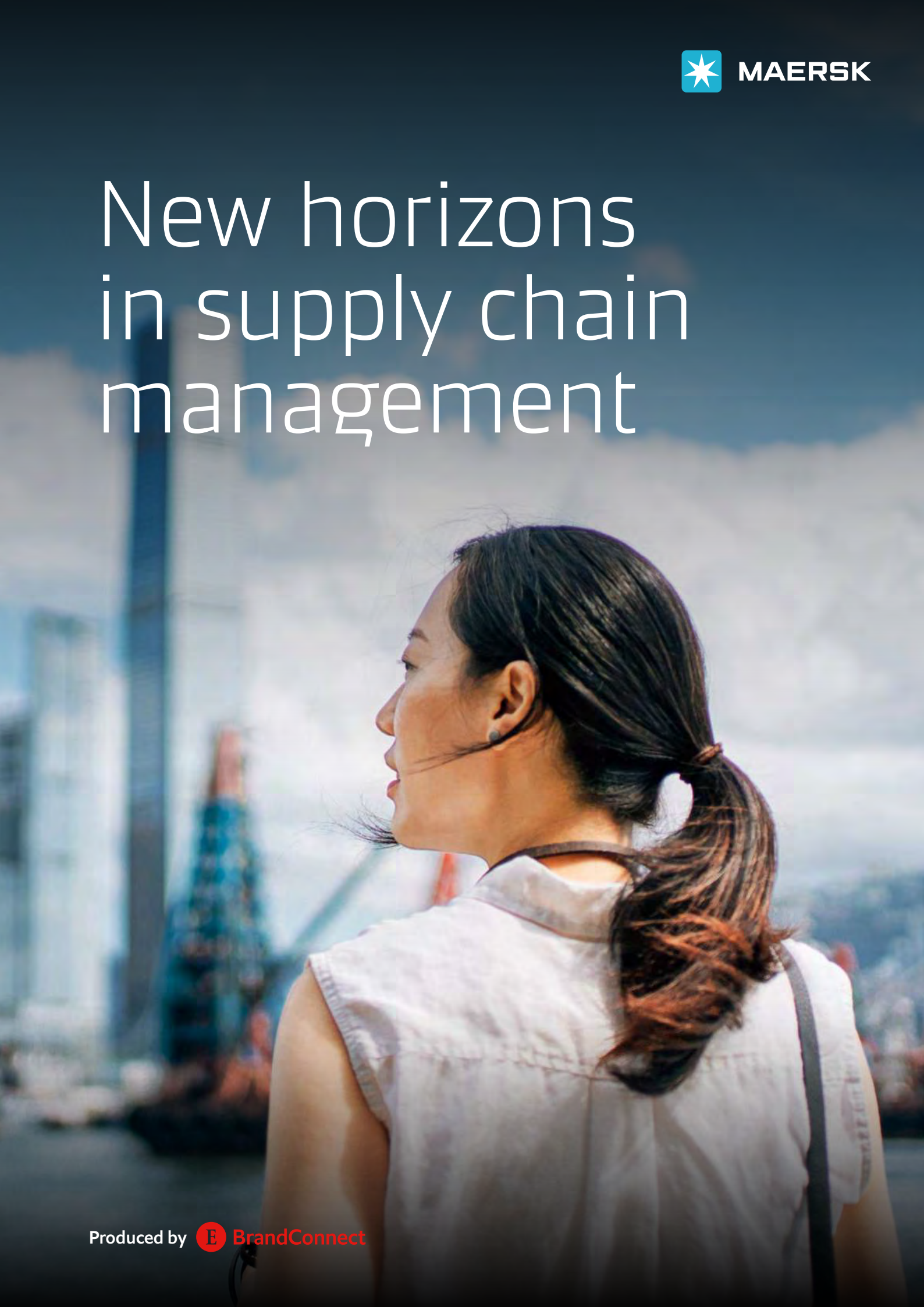
MAERSK

New horizons in supply chain management



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Executive summary

Companies and their logistics providers are finding themselves at a critical juncture, faced with a need to rethink their supply chain strategies. Massive disruptions during the past two years have laid bare latent vulnerabilities in supply chains. Nearly every industry has been impacted by supply problems as the existing system was overwhelmed by traffic volume, causing bottlenecks and delays.

This ordeal has brought supply chains to the attention of the C-suite and is prompting far-reaching changes, as the traditional set-up has been exposed as unable to cope with these strains. New supply chains are emerging, harnessing nascent technologies, the multiplying potential of data and new approaches to strategic thinking. Both the supply chains and the associated thinking are replacing a transactional linear approach with a more flexible network approach.

This transformation has profound ramifications for how companies and their supply chain partners position themselves and operate. The orientation towards networks and the accelerating flow of data enable – and also demand – a greater degree of collaboration with clients, suppliers, service providers and even competitors. Relationships are shifting towards a more collaborative culture, both for developing solutions for clients and for joint industry efforts such as strategies to reduce carbon footprint.

The new breed of supply chain marks a departure from the traditional, cost-driven just-in-time model to more flexible, agile and sustainable types that feed on data and employ predictive analytics to discern patterns that signal problems as well as opportunities.

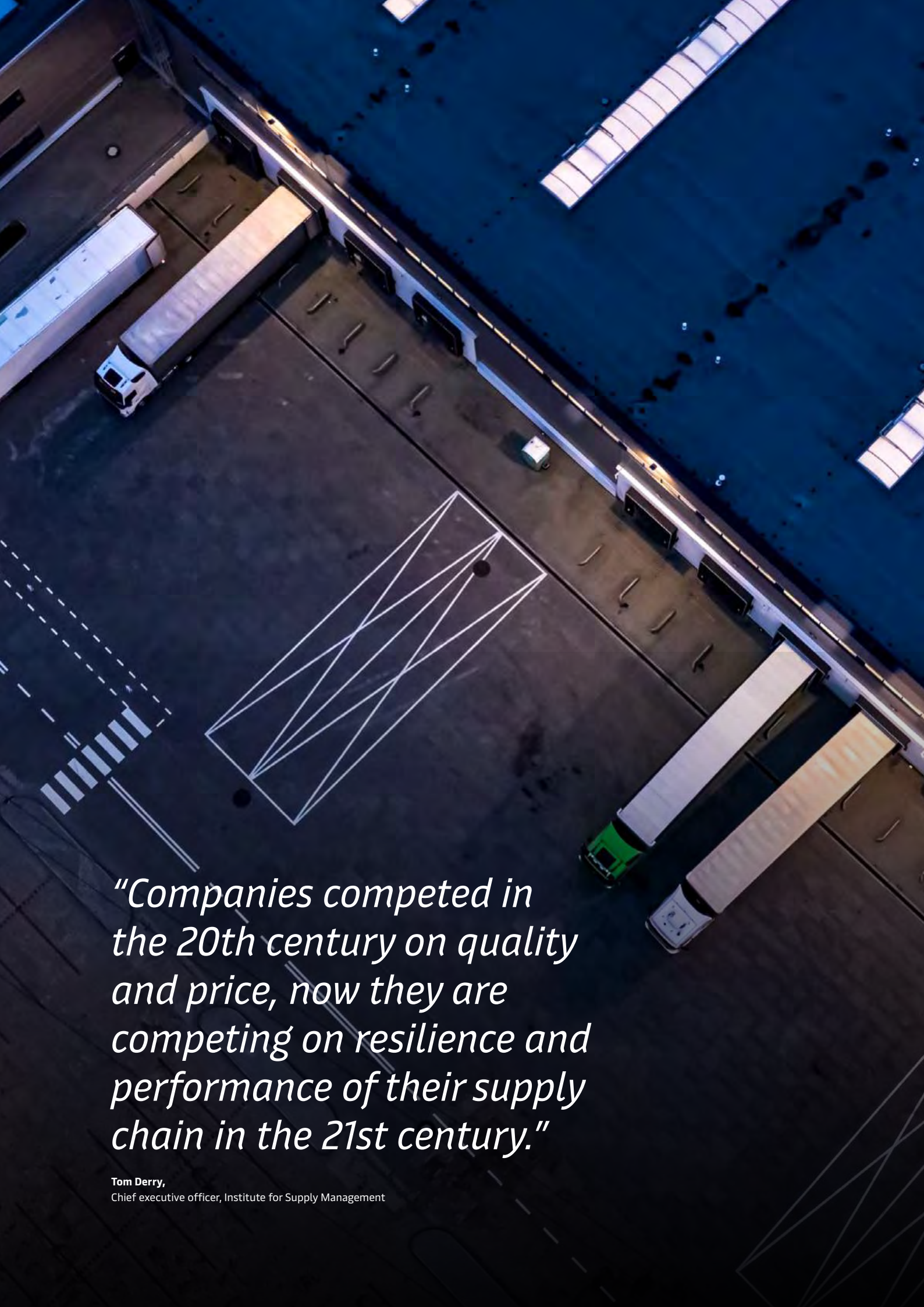
Traditional skill sets and structures are no longer adequate. For the sake of visibility, risk management and optimisation, companies are digitising and automating processes. The data-driven supply chain poses new challenges for companies, as it requires new skill sets that have to be placed in new roles that hitherto have not existed. Change transcends the supply chain itself to encompass strategic thinking as well as corporate structure.

Beyond the changing dynamics and requirements of emerging supply chains, sustainability is also increasingly determining choices of technology adoption, fuelled by a growing sense of urgency to chart a path to net-zero emissions. Massive efforts are required to accelerate transformation, and it seems that disruptive developments will be necessary to get there.

All these changes bring about a transformation of supply chains that affects all facets, from logistics strategy over corporate structure and skills requirements to engagement with partners and clients, resulting in an open architecture that has change built into its DNA.

Contributors

- **Matthew Comte**, operations transformation practice leader, PwC
- **Tom Derry,** chief executive officer, Institute for Supply Management
- **Professor Philip Greening**, director of the Centre for Sustainable Road Freight and the Centre for Logistics and Sustainability, Heriot-Watt University
- **Kim Pedersen**, global head of sales and marketing, A.P. Moller - Maersk
- **David Shillingford**, chief strategy officer, Everstream Analytics



"Companies competed in the 20th century on quality and price, now they are competing on resilience and performance of their supply chain in the 21st century."

Tom Derry,
Chief executive officer, Institute for Supply Management

Chapter 1

A changing landscape

According to a study by Accenture, 94% of Fortune 1000 companies experienced supply chain disruptions from covid-19, and 75% reported negative impacts on their business.

These experiences elevated supply chain management to become a priority for the C-suite and brought about a strategic re-evaluation that is leading to broad transformation. "Companies competed in the 20th century on quality and price, now they are competing on resilience and performance of their supply chain in the 21st century," comments Tom Derry, chief executive officer of the Institute for Supply Management.

The nature of supply chains is also changing. The disruptions of the past two years have forced management to re-evaluate the just-in-time model, which has defined supply chain orthodoxy for decades. Its linear structure, with an emphasis on a transactional, cost-driven approach, is being replaced by more flexible models that build in greater resilience and sustainability. These have the capability to accommodate different operational modes. David Shillingford, chief strategy officer of Everstream Analytics, describes them as "J-I-T Plus" – as lean as they can be, but dynamically taking risk into account. They can be both just-in-time and just-in-case, but they are achieving this in a very targeted way, he says.

These changes bring about a supply chain that is more geared to collaboration with partners, sometimes even competitors. It is also more geared towards the customer. The rapid spread of e-commerce has put the focus on customer experience, reinforcing the need to develop supply chains that are customer- and purpose-centred.

One element facilitating this is the fact that supply chains are increasingly data-driven. With rapidly proliferating data at their fingertips and new tools to mine them, companies are getting better insights into developments both upstream and downstream.

"By knowing and being able to predict when the cargo is there, customers can manage their sale and divert inventory to various markets," says Kim Pedersen, global head of sales and marketing of A.P. Moller - Maersk.

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Chapter 2

Logistics 4.0

Aircraft-maker Boeing is planning for new ways of aircraft production and maintenance. In the factory, robots that communicate with each other will be linked to immersive 3D engineering designs. Mechanics around the world are going to wear HoloLens mixed reality smart glasses to perform inspections and repairs.

Like Manufacturing 4.0 concepts, the emerging supply chains of the 21st century harness nascent and established technologies, from robotics and drones to electric and autonomous trucks, and connect them for instant flow of data. They use predictive analytics to identify early signs of problems and are connected to analytics of customer behaviour and demand planning. This connectivity transforms supply chains themselves from cost centres into opportunities to share information and jointly develop solutions.

"We see evidence that predictive and prescriptive analytics are transformational for supply chains."

David Shillingford,
Chief strategy officer, Everstream Analytics

In its 2021 report on supply chain technology, Gartner predicts that by 2023, 50% of global product-centric enterprises will have invested in real-time transport visibility platforms. This will quickly progress from visibility to data analysis. In addition, Gartner forecasts that by 2024, 50% of supply chain organisations will invest in applications that support artificial intelligence (AI) and advanced analytics capabilities.

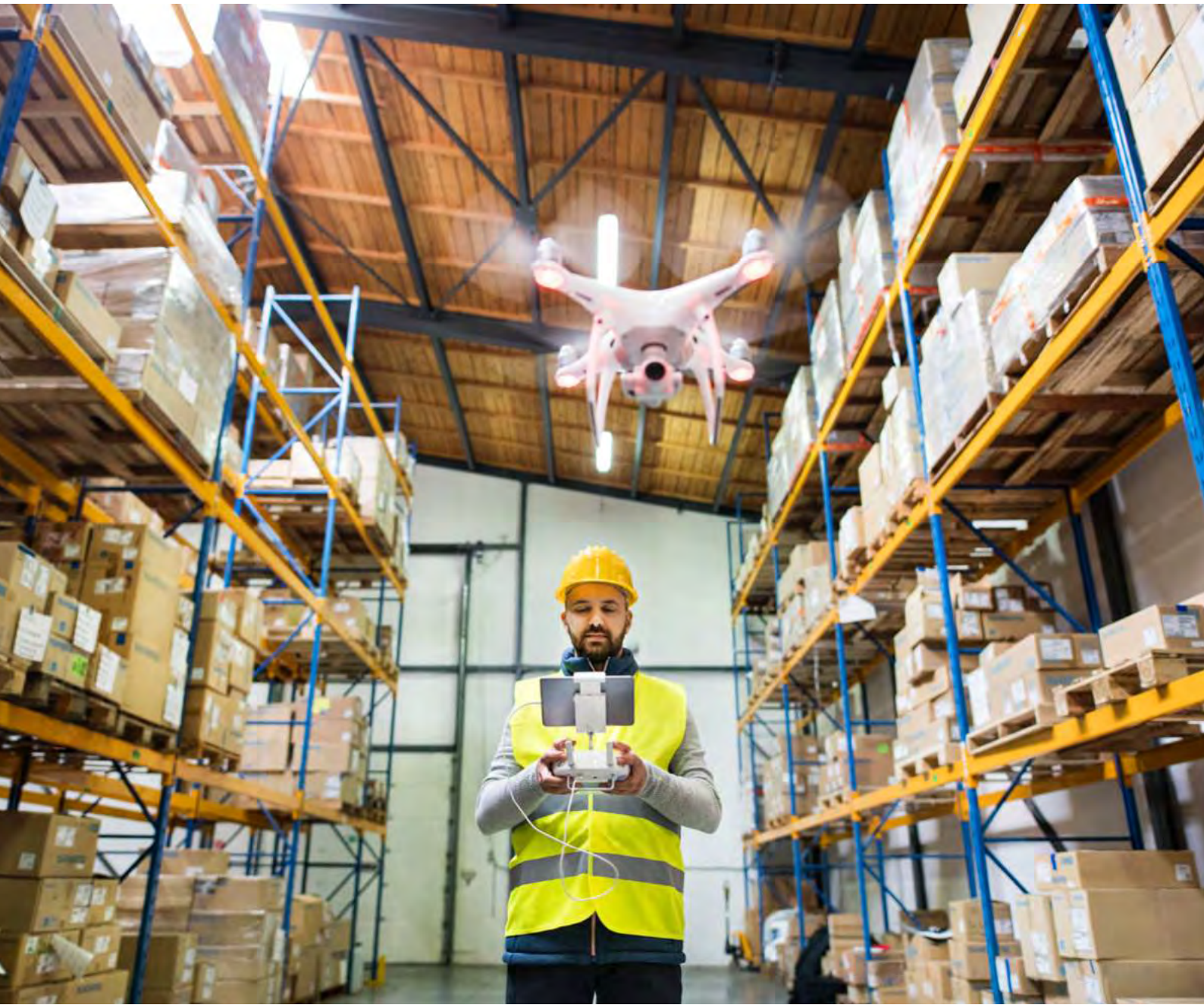
"We see evidence that predictive and prescriptive analytics are transformational for supply chains," says Mr Shillingford. "Progress is going to look incremental, but ultimately it is transformational."

The transformation of supply chains is both aided and shaped by emerging technologies. Additive manufacturing profoundly alters the shape of the supply chain, as a product can be produced when and where it is needed.

In the warehouse, limited space and labour shortages are fuelling a rapid deployment of robotics. Autonomous mobile robots can more than double productivity with assisted order picking, as well as performing other functions such as property mapping and surveying. Earlier models required significant adjustments in the environment, but newer ones can be introduced with only minor changes (such as installing a rail on the side of a rack to enable the machine to climb it).

It is a longer journey to the open road for autonomous technology. Mining company Rio Tinto is already using self-driving vehicles at mining sites, but the regular use of autonomous trucks on motorways, let alone neighbourhood streets, is still far off, notwithstanding the need to compensate for the chronic driver shortage in many markets, notes Mr Derry. These vehicles are still too expensive for most industries, although the cost of not being able to move goods is giving pause for thought.

Mr Derry adds that petrol/diesel-powered versions are closer to implementation than electric models, but warns that they may run into regulatory obstacles, as a growing number of countries encourage the use of trucks that do not burn carbon-based fuels.



Logistics firms are moving to electric trucks, but sceptics question the range that existing battery technology permits. Their use requires extensive charging infrastructure, which has yet to be developed. Mr Derry believes that only a major government effort similar to the US highway-building programme of the Eisenhower era in the 1950s can establish this.

The roll-out of electric vehicles will also transform the use of warehouses, as they assume the additional function of serving as charging stations for trucks, notes Professor Philip Greening, director of the Centre for Sustainable Road Freight and of the Centre for Logistics and Sustainability at Heriot-Watt University.

Like autonomous trucks, drones still face considerable regulatory constraints, which are confining their deployment largely to rural, often remote areas. The technology itself has been proven in niche operations of significant scope, such as the delivery of vaccines and urgent healthcare shipments to rural areas. Models that are operating commercially at present have limited payload capability, typically under 20 kg, but larger cargo drones are poised to enter the market, such as a model designed to carry loads up to 350 kg over distances up to 2,500 km. The developer claims that it can operate at a cost that is 50% lower than commercial airlines.

Although drones, self-driving vehicles and autonomous robots can be deployed in isolation, their transformative potential will unfold fully through connectivity, with unimpeded flow of data to allow AI to identify potential issues and possibilities. It is the utilisation of integrated data that will be truly transformative for business.

Chapter 3

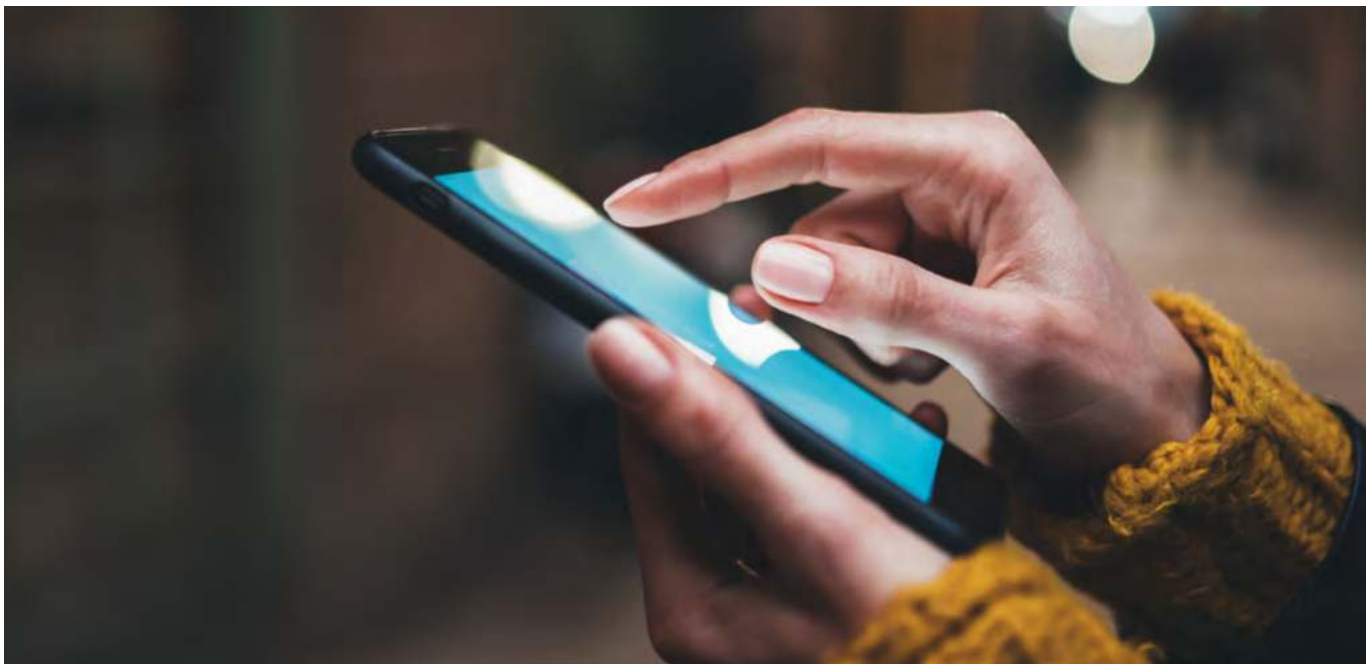
Digital transformation

The early months of the covid-19 pandemic revealed that for most companies, upstream visibility scarcely extended beyond their first tier of suppliers, which prompted frantic efforts to connect the dots and establish digital channels to track shipments and spot problems as they emerge. Soon, this led to the realisation that visibility was not enough, that businesses need visibility as well as predictability and a mechanism to act upon it.

At the core of this is a connected supply chain with end-to-end visibility that allows a company to see current and potential bottlenecks and plan accordingly. In addition, it enables the firm to intervene where necessary and to manage inventory at all stages.

The new type of supply chain requires new approaches and tools. Traditional methodology is not adequate for the analysis of the data that flow along the digitalised supply chain. As the pandemic sent shockwaves through supply chains, companies found historical data and experience to be of little use for predictions on flow and availability of supplies, let alone for demand sensing and forecasting. Increasingly, they have been looking to AI to mine the rising flow of data for insights into patterns that can translate into decisions on procurement.

Firms are also training the predictive analytics lens on the opposite end of the chain. "Demand planning and forecasting is the holy grail," says Mr Derry. By using a wide array of factors, including age of guests, time of day and weather, a resort was able to predict the amount of alcohol consumed at a given time to within a range of $5, he reports.



Predictive analytics is the key to success – in logistics, arguably more so than in most other sectors – and is critical for taking the next steps, according to Mr Shillingford.

He outlines a three-stage route on this journey. "To be predictive, you've got to know what's likely to happen; to be prescriptive, you've got to know what your options are; to be automated, you've got to know which is the best one," he says.

"Getting visibility but reacting before it's too late is something our customers are constantly challenged with. That's why digital accessibility becomes so crucial, allowing for supply chain management at all hours."

Kim Pedersen,
Global head of sales and marketing, A.P. Moller - Maersk

With improved data flow, supply chains are becoming more flexible and agile, less static. Within the next three years they will be able to function on a just-in-time paradigm some of the time, and in just-in-case mode at other times, says Matthew Comte, operations transformation practice leader at PwC. To process all the data and juggle the variables, an AI engine will be necessary that can generate solutions almost in real time.

This goes hand in hand with a change in thinking. "We used to think linearly; now it's almost a spider web. You have to have tools like AI," he says.

The shocks to supply chains have raised C-suite awareness of risk management. In a supply chain designed on a just-in-case rather than a just-in-time basis, it plays an elevated role. "It's very difficult to be good at predictive analytics without taking risk into account. Risk analytics is a cornerstone to successful predictive analytics," remarks Mr Shillingford.

At this point, its use is largely directed towards specific tasks, but by definition AI refines itself as it processes more and more data. Maersk is analysing data from multiple sources through predictive analytics to compute arrival times of shipments. The updated information helps customers to make adjustments ahead of time.

The digital infrastructure to feed data to artificial intelligence has expanded rapidly. Research on procurement indicates that most of the 32 discrete steps in the sourcing process are on their way to being automated, reports Mr Derry.

Challenges remain in the area of connectivity. Linking up to legacy IT systems is one of the major issues, but customers increasingly demand information through mobile devices.

"Getting visibility but reacting before it's too late is something our customers are constantly challenged with. That's why digital accessibility becomes so crucial, allowing for supply chain management at all hours, for instance via mobile phone," Mr Pedersen says.

Chapter 4

Data at the centre

The adage that data are the lifeblood of supply chains has been reinforced exponentially over the past two years. The emergence of more circular, resilient supply chains with a new breed of warehousing capabilities is inextricably linked to the availability of data and digitisation.

A survey conducted by PwC found that 81% of companies are increasing their investment in technology in 2022. "Boards of directors don't want a repeat of the supply chain problems of last year. Step one is to see where things are, and you do that with better data," Mr Comte explains.

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For everything that builds from there, such as predictive analytics to spot potential disruptions or AI-powered demand planning, the quality of the data in the ecosystem constitutes the main barrier. For a host of reasons, PwC has encountered data problems at most companies it works with. "Data is very rarely clean," observes Mr Comte.

Amid uncertainty over questions of data ownership and liability – not to mention concerns over cybercrime – data are increasingly flowing into shared spaces. Fears of disclosing potentially competitive information have given way to the realisation that it is necessary to share data along the supply chain for the benefit of all parties involved. PwC has seen a rapid proliferation of data lakes to pull together information that allows members of the respective ecosystems to identify issues along the chain and communicate about possible solutions and likely outcomes. As recently as three years ago, data sets were primarily enterprise resource planning (ERP)-based with point solutions to solve individual supply chain problems, notes Mr Comte.

Beyond supply chain resilience and optimisation, Mr Pedersen sees a need for the industry to move away from owning data in order to enable collective progress on common issues, such as tackling climate change, which no player can solve individually.

"We need to democratise the data so it does not become a competitive situation to provide data to each other in the industry, but it becomes seamless and standardised," he says. "We can move away from data as a competitive element. It's what you do with the data that should be the competitive edge."

Chapter 5

Culture of transformation

The need to migrate to data-driven supply chains that utilise emerging technologies has prompted a veritable stampede to technology. A PwC survey of COOs in October 2021 showed that 81% of companies were increasing their investment in technology.

Technology enables the changes that are shaping new supply chains, but it is not transforming them itself. Executives have to define their vision of a resilient supply chain of the future and define the issues they want to resolve before they bring in the tools, emphasises Mr Comte.

"Collaboration is the way forward. It is driven by customers and their needs. You depend on players working together to have a seamless supply chain."

Kim Pedersen,
Global head of sales and marketing, A.P. Moller - Maersk

They also need to change their thinking. To meet rising client expectations, logistics providers have to develop a deep understanding of their customers' goals and issues. Ultimately, this reverses the solution-building process. "Instead of bringing in digital capabilities to manage the operation, they have to bring in capabilities to manage outcomes for customers," remarks Mr Pedersen. He regards this process of working backwards from customer needs as one of the biggest challenges for the logistics industry.

Thought processes are changing, however. Mr Shillingford believes that the move in supply chain strategy away from the linear, just-in-time model marks a profound transformation because it constitutes a shift in awareness and mindset.

New skills and new ways of thinking are needed to handle the new tools and the insights they offer. Traditional skill sets for the logistics arena are not geared to data mining and new avenues to supply chain optimisation that can be gleaned through new tech tools.

"You need people who understand how supply chains work, and you need people mining data, and you have to combine the two. How do I find that talent?" asks Mr Derry.

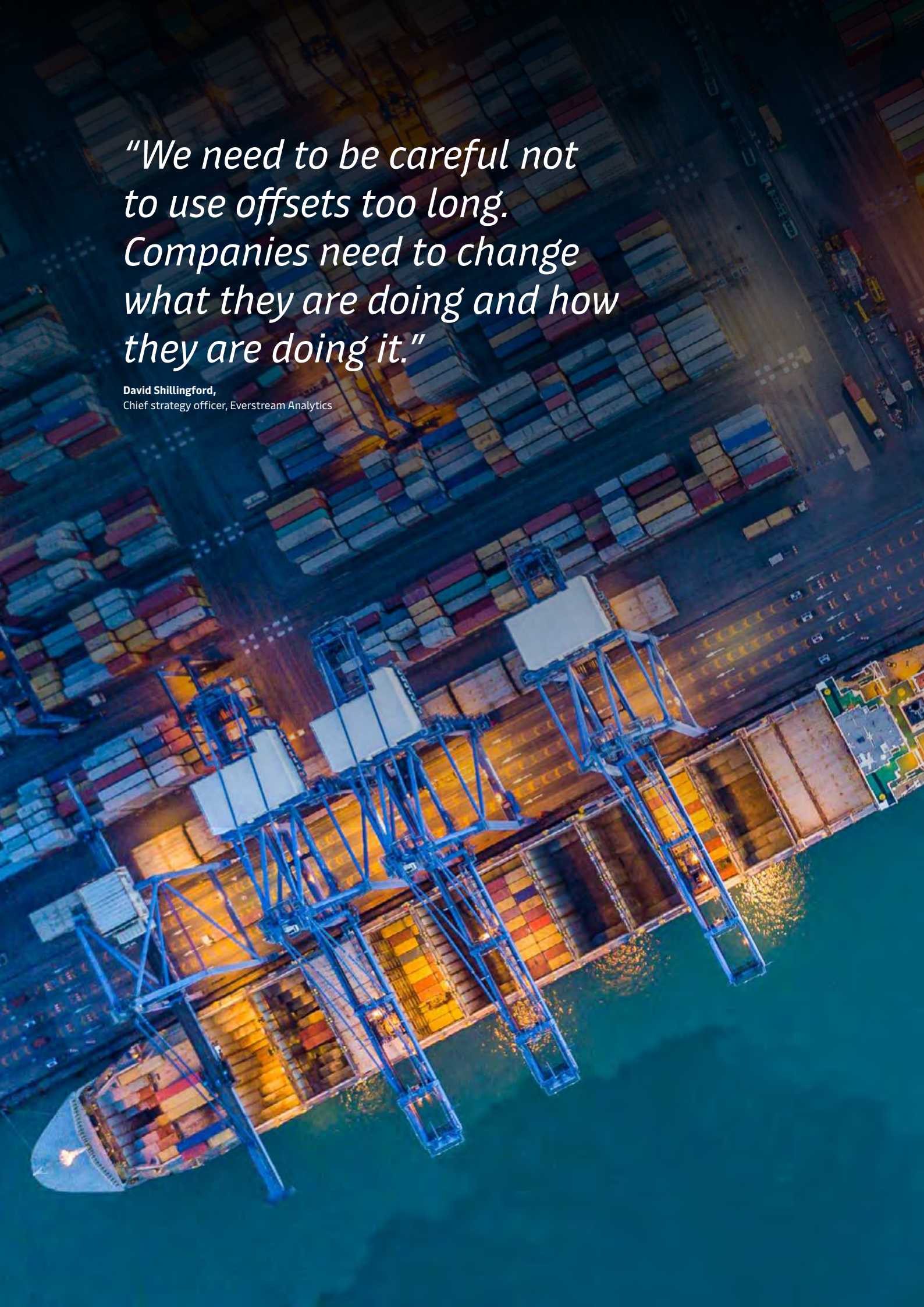
"Most supply chain people are used to linear thinking. That's how you managed inventory, that's how you managed production. We're talking about a gigantic change in the capabilities required to succeed," says Mr Comte. "You can't become an expert at new capabilities without changing over the workforce and kind of incubating those capabilities."

Mr Comte adds that the roles which the new generation of supply chain professionals have to perform do not exist in current set-ups, which have no place for them. "That organisational structure is where clients are struggling the most. This takes a different set of capabilities. How do you find, build and train those people?" he asks.

Mr Pedersen views the development of new skills and thinking in the workforce as a challenge for leadership. "Leadership skills and the way we lead people need to change," he says. Instead of asking people to build preconstructed solutions, they should be told what problem the company is facing and what opportunity a solution to this offers, he adds.

Another necessary change in mindset is a broader focus on collaboration. Companies that collaborate better are going to have more resilient business, Mr Derry insists. "To be resilient and sustainable, you have to partner with suppliers and bring them along," he says, adding that collaboration is also key to innovation.

In Mr Pedersen's eyes, this is a game changer that allows the logistics industry to raise its game, both in the quest for improved sustainability and in other areas. "Collaboration is the way forward. It is driven by customers and their needs. You depend on players working together to have a seamless supply chain," he says.



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David Shillingford,
Chief strategy officer, Everstream Analytics

Chapter 6

Sustainability – path to net zero

Any transformation of supply chains would be incomplete without a mechanism to measure carbon footprint and a defined strategy and tools to pursue sustainability goals. Consumers judge retailers on their green credentials, and retailers look to their supply chains to reduce their carbon footprint. Increasingly frequent disruptions from extreme climate events have injected a rising sense of urgency into sustainability efforts.

According to the latest report on net-zero targets published by the Energy & Climate Intelligence Unit, a non-profit organisation that aims to support informed debate on energy and climate change issues, 21% of the world's 2,000 largest public companies have made net-zero commitments, representing annual sales of nearly $14trn.

Supply chains are in the crosshairs of corporate efforts to diminish their carbon footprint. According to a report by CDP, a not-for-profit charity that runs the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts, supply chain emissions are on average 5.5 times as high as a corporation's direct emissions. As companies seek to establish their green credentials through commitments to science-based sustainability targets, they lean increasingly on their suppliers and logistics providers to reduce emissions and waste and offer solutions to reduce their carbon footprint.

The journey is still somewhat hazy. Mr Greening laments the absence of a national or international repository for corporate emissions data, which would be helpful in various ways. Research would have a more solid basis for computer modelling (which would also generate commercial benefits outside the research community), and governments could use it to develop regulations, incentives and penalties.

Another obstacle is the absence of a common standard to compare available data, Mr Greening adds. "There are emerging standards of data, but they are driven by past needs, not future needs," he says.

For all their shortcomings, existing sustainability scores offer the prospect of progress. If organisations begin to use these criteria to calculate the benefit of investment, money would flow to outfits that score higher, which would make those firms more competitive, he suggests.

Today, some sectors rely heavily on carbon offsetting strategies. The International Air Transport Association, a global airline interest group, estimates that in 2021-25 some 97% of aviation's carbon footprint reduction will come from offsets.

"We need to be careful not to use offsets too long. Companies need to change what they are doing and how they are doing it," warns Mr Shillingford.

He sees much potential in supply chain optimisation. "It's really a case of operationalising sustainability and being able to deploy a more sustainable supply chain in a way that's more resilient and more optimised," he says.

According to Accenture's Business Futures 2021 report, businesses are not just putting sustainability on the agenda, they are building it into the fabric of their operations.

Mr Greening believes that retailers could achieve improvements in sustainability as well as commercial benefits if they were to embrace distributed systems, as opposed to centralised ones. Inventory on the move could be turned into a shared commodity, reducing emissions and improving the bottom line.

"Do retailers who sell the same thing have to own that inventory, and does it matter from which warehouse it is shipped?" he asks. If ownership changed based on demand, retailers could save inventory costs and get product faster to consumers, while reducing their carbon footprint.

There is growing consensus that collaboration – including with competitors – is necessary to make progress in sustainability. A white paper from Smart Freight Centre, a non-profit organisation dedicated to sustainable freight, concludes that collaboration is needed to develop and advance emerging concepts such as carbon insetting.

"Currently, there is not enough supply of green methanol, which is our preferred choice of sustainable fuel, and this will be the bottleneck for decarbonising the industry. Investing in vessels that can burn methanol will stimulate the development further. If we can create a real market at a reasonable price point, we believe that the combined effort and collaboration of developers, manufacturers, financers and carriers can accelerate the supply quite fast," Mr Pedersen explains.

The use of alternative fuels is a vital ingredient on the journey toward net-zero goals. On the roads, pilot projects are in progress involving trucks running on bio-LNG fuel or hydrogen, alongside electric trucks. Several airlines offer cargo products that charge a premium for the use of sustainable aviation fuels. In its strategy to reach net zero by 2040, Maersk is investing in new container ships powered by methanol.

On the roads, there are no clear winners at this point. Electric vehicles are more energy-efficient than models powered by hydrogen fuel cells, but the latter have operational advantages, such as range comparable to diesel-powered trucks. Electrification of road transport would also require vast investment in the establishment of charging infrastructure.

These uncertainties are looming over a rapidly shrinking timeframe to move ahead. According to Mr Greening, the window for truckers in which to change to a new technology base is one vehicle change away. "With ships, it's not even that," he adds.

After extensive scrutiny of different pathways towards a carbon reduction rate of 80% in trucking, the Centre for Sustainable Road Freight came to the conclusion that this would be impossible to achieve with existing technology and operational models. Radical change would be required.

The International Civil Aviation Organisation has come to similar conclusions. It finds that "radical disruptive innovation is necessary to deliver the levels of decarbonisation required".

Conclusion

Under the impact of severe disruption, traditional supply chain models and strategies are giving way to new concepts. Companies must incorporate flexibility and resilience as well as sustainability. This process is aided and shaped by the proliferation of data and the emergence of new technologies.

The evolution of new supply chain models and the adoption of novel technologies require fresh ways of thinking, as traditional approaches and methodologies are no longer adequate and data-driven analytics assume a larger role. This entails new skills requirements and the definition of new roles, accompanied by changes in the organisational structure to accommodate them.

Competitive paradigms have to be redefined as the challenges that the industry faces, as well as the emergence of supply networks, call for a significant increase in collaboration with clients, suppliers, service providers and even competitors. Companies have to share data and make decisions about what constitutes competitively sensitive information.

Sustainability, which has risen to an integral element of supply chain structure and management, is bringing new challenges. It also offers an opportunity to take customer relationships to new levels, at a time when customer experience and demand forecasting are assuming a more prominent role in the evolution of new solutions.