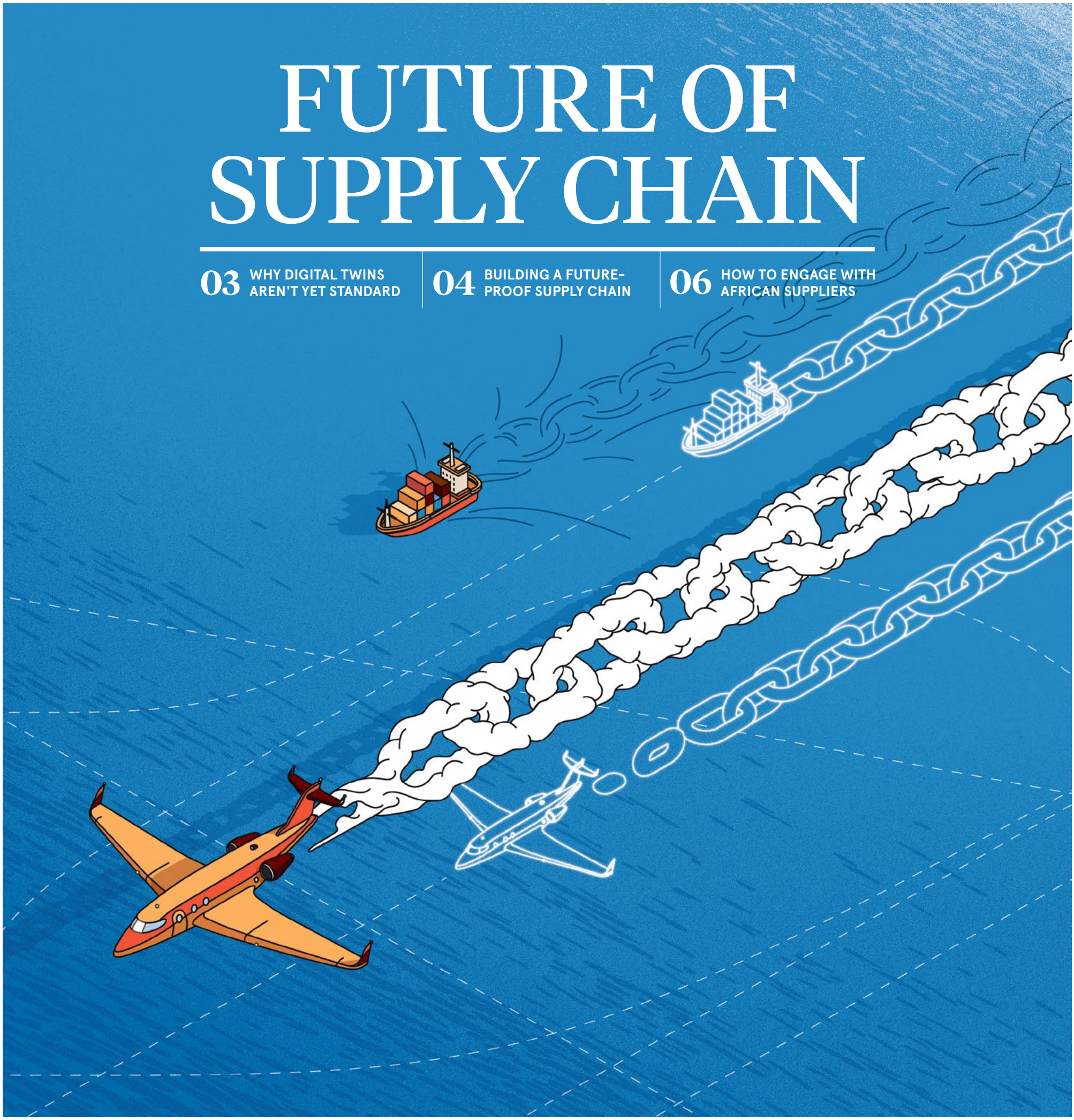
FUTURE OF SUPPLY CHAIN



THE RACONTEUR 50

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Meet the 50 CEOs changing British business.

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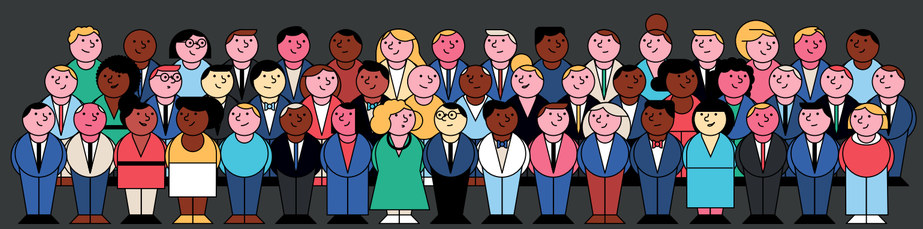

FUTURE OF SUPPLY CHAIN

Distributed in THE TIMES

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TECHNOLOGY

Will digital twins ever be standard in supply chains?

Detailed digital simulations could help to model supply chains and offset risks. But there are high barriers to widespread adoption

Daniel Thomas

Supply chains are the central nervous system of the global economy, facilitating the movement of billions of dollars in trade every day. But as the past few years have shown, disruptions are hard to predict and can be severely impactful.

As companies look for ways to offset these risks, attention has turned to digital twins. These are detailed simulations of real-world objects, systems or processes built with real-time data. They provide snapshots that can help firms to monitor threats, test different scenarios and improve decision-making.

So far digital twins have mainly been trialled in manufacturing, but firms such as SAP and Oracle are starting to explore their use in supply chains. The hope is that they can help to identify trade bottlenecks, predict fluctuations in demand and tackle transport and inventory issues. But the technology is still at an early stage and its implementation comes with challenges that must be overcome.

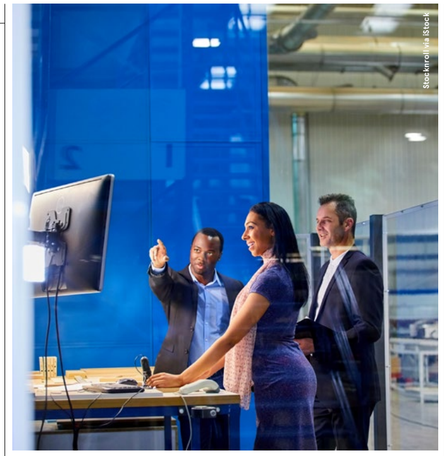
Joseph Buckley, director at Control Risks, a global risk consultancy, is something of an evangelist for digital twins. The potential benefits of using the technology to manage supply chain risk are "vast and verging on revolutionary", he says.

"By combining critical data, intelligence and indicators from the technologies represented by digital twins, decision-makers will be able to make more effective, proactive and well-informed decisions," Buckley explains. As a result, they could substantially improve the efficiency and resilience of supply chains, increase productivity and reduce cost, he adds.

Buckley points to supply chains in the shipping industry. Digital twin technology could help the maritime industry map supply chain vulnerabilities more effectively, prevent mechanical failures before they happen and identify optimal shipping routes using data from sources such as GPS, ports, warehouses and shore-side operations.

It sounds exciting, but to date only a few pilots of digital twins in supply chains are underway. The market for supply chain twins also remains relatively small and is only forecast to hit $6bn by 2030, according to Grand View Research.

Complexity is one obstacle. Most digital twin pilots have been run in areas such as process manufacturing or drug development, where developers build a digital doppelganger of a cell to model its interaction with a medicine or of a machine to monitor wear and tear.


Stockbroker/iStock

But accurately modelling a sprawling supply chain is arguably much more challenging, given the many variables involved, from changes in the weather to political decisions made by far-off governments.

To succeed, firms will need to cooperate closely with multiple suppliers – and potentially even competitors – across industries and countries. Digital twins also rely heavily on emerging technologies that most firms are only beginning to adopt. These include internet of things (IoT) sensors that collect real-time information on the ground or communication technologies capable of moving large volumes of data.

Businesses must overcome the technical challenges and costs associated with storing and using large volumes of data in various formats, as well as the cybersecurity concerns associated with sharing commercially sensitive data across multiple organisations.

"Many businesses lack the technical expertise to embark on transformational initiatives," says Marcin Figurski, technical director at Qodea, a consultancy that supports companies with the creation and application of digital twins. "This is particularly true for supply chain and logistics companies, which haven't traditionally been viewed as technologically advanced."

Figurski says many companies already have the data they need to run effective supply chain digital twins, but it is often fragmented and siloed across departments.

"Organisations now need to properly digitise and consolidate this fragmented knowledge. By centralising this information and leveraging technology, companies can create more reliable and objective digital twins," he says.

This will likely require considerable resources. But as it becomes increasingly difficult to predict disruptions to global supply chains thanks to geopolitical uncertainty and climate change, the need to model risk will grow.

The technologies required to implement digital twins are also improving rapidly. "The concept of digital twins has been around for a while. But only in the past five years have the key technology building blocks – like IoT and machine learning – evolved enough to enable digital twins to become a reality." So says Sameer Kher, senior director of product development, systems and digital twins at Ansys, a provider of engineering simulation software.

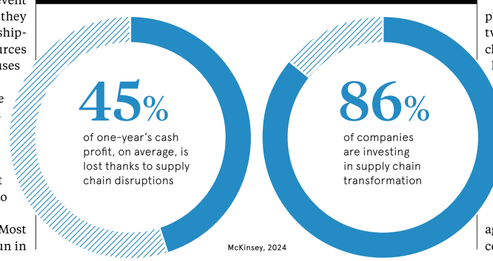
Successful pilots in manufacturing and pharma should build confidence in digital twin technology, says Kher. Meanwhile, the Digital Twin Consortium – an industry group that seeks to accelerate the market – is helping to drive digital twin adoption and best practices across the globe.

"Earlier this year, the US announced $285m in funding to build digital twins of semiconductor manufacturing equipment. And in the UK, a new Digital Twin Centre backed by government funding is set to open this year," Kher says.

Experts think advances in AI could also accelerate the use of digital twins in supply chain management. For instance, AI tools could help overcome some of the data-management challenges associated with digital twins. And the granular data captured by digital twins could be used to enhance the accuracy of generative AI models.

For firms seeking to model complex supply chains with digital twins, there is still a steep hill to climb. Key technologies such as IoT have developed significantly over the past decade, but the obstacles that have thus far prevented the use of digital twins in supply chain management remain in place.

Given the many barriers to deployment, Buckley believes that the widespread use of digital twins in supply change management "remains unlikely in the coming years".



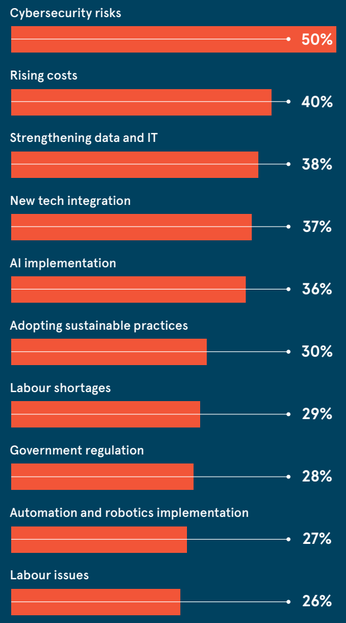
McKinsey, 2024

DIGITAL SUPPLY CHAINS

Organisations are facing plenty of supply chain risks over which they have little control. With threats of disruptions, cyber attacks and regulatory uncertainty growing, firms are turning to digital technologies to mitigate uncertainty and ensure smooth operations

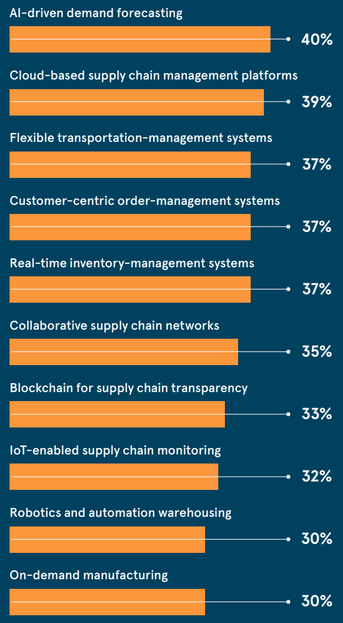
AS SUPPLY CHAINS GO DIGITAL, CYBERSECURITY TOPS THE LIST OF CONCERNS

Share of executives ranking the following as key supply chain challenges



DATA AND AI ARE KEY TO THE FUTURE OF SUPPLY CHAIN MANAGEMENT

Share of executives citing the following as key to effective supply chain management in the next 10 years

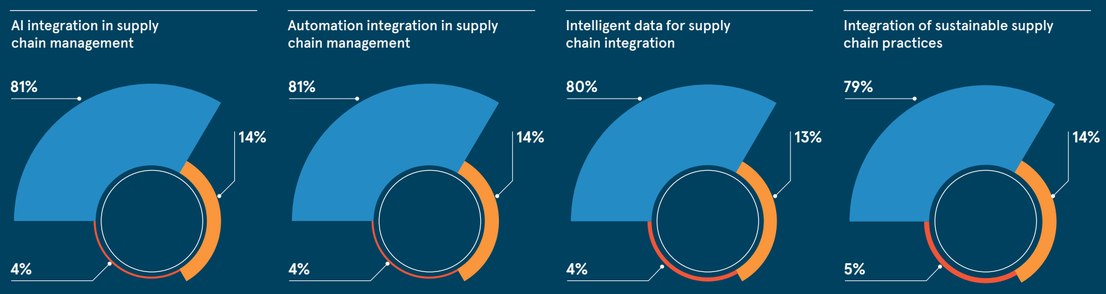


ROUGHLY THREE IN FIVE ORGANISATIONS ARE UNPREPARED FOR A CYBER ATTACK ON THEIR SUPPLY CHAIN

Share of executives who feel their organisation is prepared for the following supply chain threats

MOST FIRMS EXPECT TO HAVE INTEGRATED AI IN THEIR SUPPLY CHAIN BY 2030

Share of executives saying the following initiatives will be a priority for their supply chain operations, by target dates



Prologis, 2024

Commercial feature

Gateways to tomorrow: the vital role of ports in trade and sustainability

From trade gateways to energy transition enablers, ABP's ports are pioneering the UK's transition to net zero, combining sustainable practices with critical infrastructure for the industrial sector

Ports have been vital to the UK's identity as an island nation for millennia. They have long served as the country's main gateway for global trade and exchange.

This is still the case today, with 95% of the UK's physical trade passing through its seaports. A quarter of that trade passes through the ports operated by Associated British Ports (ABP). But a new and equally important role has emerged for ports. They are now key players in the UK's sustainable future.

With society's renewed focus on decarbonising the global economy, businesses must become more sustainable while also maintaining resilient supply chains. This can be particularly daunting for sectors such as manufacturing, construction and steelmaking. Yet, it is essential that these sectors have a fair and viable pathway to transition as we work toward a clean-energy future.

ABP is the UK's leading ports group, handling nearly £160bn of trade annually. "With 21 locations across England, Scotland and Wales, we get a bird's-eye view of many industries, giving us a unique perspective into the challenges they face," says Tim Morris, group head of corporate communications at ABP.

He continues: "Take automotive, for example; a key sector for us. With 40% of all UK vehicles passing through our ports on the Humber and Southampton each year, ABP links the UK to Europe, Asia and the Americas via major short-sea and deep-sea shipping routes. Our ports at Immingham, Grimsby and Southampton offer access to rail connections and major manufacturing hubs and key distribution points in the UK"

These ports are not just logistical gateways; they are essential infrastructure supporting industries across the country. By integrating transport networks with sustainable practices, ABP is helping to future-proof supply chains and enable the transition to greener operations. "Our commitment to serving our customers is at the very heart of our business. That is why, as the needs of our customers have changed, the role of our ports has also undergone an evolution," he says.

ABP has embarked on a strategic transformation to enable the energy transition, from being a traditional port operator and keeping Britain trading to becoming a major provider of green-energy infrastructure and enabling the energy transition. A key milestone on this journey was the publication last year of ABP's sustainability strategy, *Ready for Tomorrow*.

The document sets out the company's plans to invest £600m in decarbonising its own operations by 2040 and allocate £1.4bn to clean-energy infrastructure projects to enable the UK energy transition. "Over the past 12 months, we have invested over £5m in decarbonising our own operations. We are also proud to report that 18 out of our 21 ports already have renewable-energy generation projects on site, including solar panels and onshore wind," adds Morris.

Green Port Hull (GPH), for instance, is a fantastic success story. The £310m joint investment between ABP and Siemens Gamesa has created a renewable-energy hub with world-class offshore wind-turbine blade manufacturing, assembly and servicing facilities as its centrepiece. "This project is an example of how locating businesses on ABP's ports can bring a range of benefits, including access to prime brownfield land at the heart of the UK's largest industrial hubs, space for growth and a link to supply chains via world-class port infrastructure," says Morris.

ABP's plan for a transformational development of the port of Port Talbot is another example of a major green-energy project in the UK's ports. "This would enhance a port that historically has fed the adjacent steel works, with the carbon-intensive commodities of iron ore and coal, to be a hub for the mobilisation, assembly and, crucially, supply for the Celtic Sea floating offshore-wind sector," says Morris. In addition to contributing to the UK's clean-energy mission, the development would create thousands of jobs to meet the needs of the region.

"Another major project we are working on is the proposed Immingham Green Energy Terminal (IGET) which would provide a vital part of the infrastructure that will enable the UK's first large-scale, green-hydrogen production facility," adds Morris. "The project will bring a wide range of benefits to Immingham and the UK, including around 1,600 indirect jobs for supply chains and local businesses."

IGET is also a key enabler of the Viking CCS Cluster, a CO_2 transport and storage network located in the Humber. The Viking CCS Cluster is the UK's most industrialised region with its seaborne transport access providing unrivalled high-volume options for both decarbonising the UK industry and opening up export opportunities for European trade. The project has the potential to create 20,000 local jobs at peak construction and safeguard thousands of industrial jobs.

"It is widely recognised that both public and private organisations need to accelerate the pace of innovation if we are to combat the effect of climate change and win in the global energy race. This can only be achieved through effective collaboration," Morris adds.

To help foster collaboration, ABP launched the Energy Ventures Accelerator (EVA) in partnership with innovation platform Plug and Play. The EVA programme aims to enable the energy transition by creating clusters of innovative ventures in the UK's most important industrial hubs. ABP has thus far hosted two successful events as part of the programme, including its EVA Inclusive Energy networking session in London, which connected diverse founders and investors, and its EVA Humber Innovation Day in Hull in November, which brought together a vibrant community of innovators across industry, government and academia.

"Building the supply chains of tomorrow, which are both resilient and highly sustainable, is one of the greatest challenges of our time. But the opportunity is huge – economic growth, a greener planet, jobs and prosperity for local communities. ABP is up to the task and we look forward to working with partners to deliver on this vision," concludes Morris.

> **Businesses must become more sustainable while also maintaining resilient supply chains**

18 out of 21

ABP ports already have renewable-energy generation projects on site

£2bn

of identified investment in greening our ports and for projects enabling the energy transition

Scan to watch 'United by Water', or for more information visit abports.co.uk

ABP ASSOCIATED BRITISH PORTS

RISK AND REGULATION

African supply chains offer challenges and opportunities

Africa is home to nine of the world's fastest-growing economies, but maintaining supplier relationships presents unique challenges for Western companies

Georgia Lewis

UK and European firms are forging supplier partnerships across Africa, seeking to tap the continent's vast economic potential. However, they must tackle significant challenges, ranging from human rights to sustainability.

British and European companies already have long-standing partnerships with suppliers in countries such as South Africa, Ghana and Nigeria, but there are growing opportunities in other parts of the continent. Indeed, Africa is home to nine of the world's fastest-growing economies – Benin, Côte d'Ivoire, Djibouti, Ethiopia, Gambia, Libya, Niger, Rwanda and Senegal.

As African economies continue to grow, so will their integration into international supply chains. But businesses need to ensure supply chain transparency when considering cross-border ventures with African partners.

Many African countries have significant problems with labour rights and environmental protection. For instance, in the Democratic Republic of Congo and surrounding countries, mineral extraction supply chains have long been plagued by reports of forced and child labour, human rights abuses, corruption, violence and environmental damage.

These issues are a barrier for European and UK businesses thanks to supply chain transparency laws, such as the EU's Corporate Sustainability Due Diligence Directive 2024 (CSDDD) and the EU Deforestation Regulation 2023 (EUDR). The CSDDD currently applies to EU-based businesses with more than 1,000 employees and an annual turnover of at least €450m. These companies and their international partners must ensure compliance with the regulation along their entire supply chain. This means stringent requirements for risk management, monitoring and reporting.

In the UK, the Modern Slavery Act 2015's guidance on supply chain transparency affects businesses with an annual turnover of at least £36m. It requires firms to provide publicly available statements on slavery and human trafficking and take swift action when such crimes are reported.

African companies keen to supply goods and materials to the EU and UK must meet requirements that may be stricter than local laws, says Sujeet Morar, a partner in Kearney's strategic operations practice. "Standards and regulations often vary widely between markets," he says, meaning that companies making the same product in Europe versus West Africa, for instance, must often adjust to fit local requirements and pricing expectations.

"Different rules bring higher costs, particularly when businesses need to exceed local standards on emissions or waste reduction, for instance, which can require a big investment," Morar adds. "Parts of the supply chain can be quite in formal, with smaller players lacking the resources to meet these demands, making compliance more difficult."

Nancy Fischer is an international trade partner and global head of regulatory at Pillsbury Law. She says concerns about environmental sustainability and human rights compliance in Africa are amplified because of the region's role in processing raw materials – which often leads to environmental degradation – and the unique socio-economics of its countries.

But Fischer reiterates the impact of supply chain regulations on businesses. "Regulations such as the CSDDD and the EUDR bring a significant compliance burden, especially for companies with complex, global supply chains," she says.

Consider an EU paper importer that must trace the origin of wood pulp to verify it is not associated with deforestation. "This requires geolocation capabilities and real-time monitoring tools," says Fischer. "Manually gathering and verifying this information across multiple tiers of suppliers is costly and logistically challenging, particularly for materials sourced from regions with limited transparency or regulatory infrastructure."

Consumer pressure can also help to improve supply chain transparency. Nigel Street is senior vice-president of EMEA and APAC operations at Loftware, a global supply chain labelling company. He says many consumers "see themselves as catalysts for change, intertwining sustainability into their purchase decisions".

Street says consumer pressure forces brands to implement sustainable business practices that meet or exceed customer expectations. This leads to higher ethical standards and greater transparency.

> **Engagement leads to transparency, which promotes collaboration, which leads to improvement**

Digital technology is playing a large role in supply chain transparency, as it enables organisations to trace materials in their supply chains more effectively. Street notes that digital tools can be used to track and authenticate products at various stages in the supply chain. This will become increasingly important as regulatory requirements grow, he says.

AI, satellite imagery and blockchain can help companies to trace raw materials back to their source and identify risks in real time, Fischer adds. "For instance, AI can analyse patterns to detect signs of deforestation or illegal logging by cross-referencing geolocation data with satellite imagery."

Empowering people to report poor human rights and environmental practices in supply chains can be difficult, especially if whistleblowing has not been commonplace or is associated with negative consequences. Limiting this strategy to merely setting up a hotline may not be enough to properly report and manage concerns, even if whistleblower anonymity is protected to reduce risks of retribution.

"It's easy to publish a hotline that allows external entities, including suppliers, to report on issues in operations, but it's even more valuable to have the ability to engage suppliers to identify the positive changes being made," says Jared Connors, sustainability director at Assent, a supply chain solutions company. "Engagement leads to transparency, which promotes collaboration, which leads to improvement," he adds.

Onyekachi Izukanne is CEO and co-founder of TradeDepot, an importer of African food to the UK market. He says all workers, partners and stakeholders need to be educated on the role of whistleblowing in safeguarding ethical practices, with leadership from investors who can set high expectations for reporting any wrongdoing. "Investor-driven demands for robust reporting systems foster accountability and help embed a culture of integrity across all supply chain participants," he says.

According to Fischer, the African Continental Free Trade Area – an agreement that covers most of the continent and reduce tariffs, among other measures – is helping to promote integrated digital trade systems that could facilitate real-time tracking and traceability in African supply chains.

Fischer says: "Advances in supply chain transparency across Africa are evident through the adoption of blockchain and other innovative solutions in sectors such as agriculture and renewable energy."

Izukanne adds that Nigeria and Kenya have made great strides to improve supply chain transparency. He says the Nigerian government's "push towards formalising sectors and improving regulatory oversight has played a crucial role", including wider use of digital platforms to track transactions between suppliers, distributors and retailers.

A combination of digital investment and supportive policy is also paying off in Kenya, where the government is promoting the use of digital programmes to track agricultural produce from farm to market to ensure compliance and build confidence among consumers and international buyers.

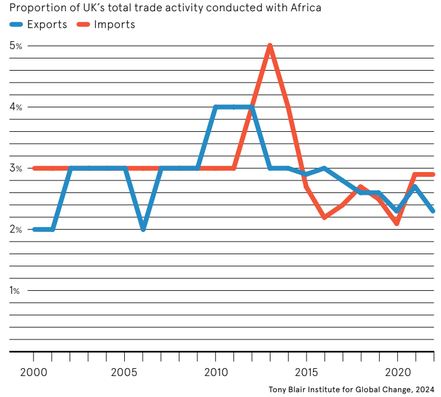
"This blend of policy support and technological solutions has made the supply chain more visible and trustworthy, ultimately benefiting small shop owners, distributors and consumers," says Izukanne.

For Connors, there are plenty of partnership opportunities in Africa that will benefit all parties. By first assessing the "common pitfalls associated with manufacturing at lower costs", he believes businesses can forge new supplier relationships that are ethical and transparent.

"Organisations must set expectations for labour and environmental practices, maintain an open dialogue with their suppliers and establish practices to ensure sustainable products," he says. "As we see more manufacturing shift to Africa, maintaining transparency and setting clear expectations is the only way to see real success stories in the region and break the history of exploitation."

UK TRADE WITH AFRICA HAS DECLINED SINCE 2012–13

Proportion of UK's total trade activity conducted with Africa



Tony Blair Institute for Global Change, 2024

Commercial feature

The role of AI in navigating supply chain uncertainty

With the right AI tools, companies can predict and navigate supply chain disruptions more effectively than ever before

Geopolitical tensions, climate change and the lingering effects of Covid-19 have caused serious supply chain issues. Frequent attacks on vessels have also disrupted shipping routes in the Red Sea, and port congestion and logistics bottlenecks are now all too common in many regions.

Disruptions can quickly cascade through today's intricately connected global supply chains, leading to soaring operational costs and longer supplier lead times. Quickly responding to these challenges is therefore essential if businesses are to remain competitive and keep customers happy.

Spreadsheets and static dashboards aren't really up to the task. "With supply chains becoming more complex – lots of different sourcing regions, routes to market and transit times – it's difficult to use intuition, a spreadsheet or a static dashboard, because there are just too many changes to contend with," says Anthony Plummer, group chief technology officer at Ligentia, a provider of global supply chain solutions.

Artificial intelligence (AI) and machine-learning tools cut through all this complexity. As well as supporting real-time visibility across every step of the supply chain, these technologies can also help companies to anticipate and address problems in a timely fashion.

"You need continuous monitoring of suppliers, routes and potential disruptions," says Plummer, adding: "If something happens you should be constantly alerted and prompted [to take action]."

AI can also simulate countless what-if scenarios and assess their impact on the supply chain, helping companies to anticipate disruptions, evaluate potential vulnerabilities and craft the right contingency strategies.

However, even the best AI tools can still be caught out by black-swan events – ones that are rare, difficult to predict and have a large impact.

Because black-swan events do not follow past trends or patterns, AI trained on historical data is unlikely to foresee them. But even when it doesn't understand what has caused a ship to suddenly change course, for example, it may still be able to predict the impact on the supply chain.

"AI has data on what happens if the Suez Canal is shut, [for example], and transit time increases by two weeks," says Plummer. "You can model all of that and understand the impact a lot quicker."

Digital tools can also suggest ways of minimising these disruptions, which could be game-changing for many organisations. "It might say, 'you're going to be short of this jumper coming from China, but here's an alternative sourcing location that could plug the gap'," Plummer explains.

Other benefits stem from AI-powered demand forecasting, which can reduce the chances of stockouts or surpluses. "When it comes to demand forecasting, intuition and [assuming], 'the same as last year plus 10%', doesn't meet today's needs," says Plummer.

"You need to look at different data sources. If you get that demand forecast wrong, it creates horrible ripple effects all the way up the supply chain," he adds.

While AI can now automate many routine tasks, such as tracking shipments or scheduling deliveries, human expertise remains crucial for complex decision-making.

> **It's AI and people working together that will ultimately enable companies to respond to supply chain disruption**

"Questions like, 'Where's my container? When does the vessel arrive?' – AI can answer those all night long. But for the more complex stuff, you're going to need experienced people working alongside the AI," he says.

Plummer believes this will remain true even as the adoption of more advanced tools, such as agentic AI systems, which can carry out tasks autonomously, become more widespread.

"It could mean that we build our own customer-service AI agent, a customs clearance agent, a delivery agent, a finance one – and they'll actually do things for you rather than just spitting out a reply. They'll book a delivery, they'll raise an invoice. If you tie all of that together it could be hugely powerful."

Despite the potential of these next-gen tools, Plummer believes they will still augment rather than replace most jobs. In other words, it's AI and people working together that will ultimately enable companies to respond to supply chain disruption in an agile, effective and intelligent manner.

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