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THE GREAT DIVIDE

Closing the communication chasm between terminals and shippers

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FOREWORD

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In the world of global logistics, the conversation around cargo visibility has become almost ubiquitous, echoing in boardrooms, trade shows, and strategy sessions across the industry. Over the past decade, I have attended countless meetings with shippers and Beneficial Cargo Owners (BCOs), who often lament the absence of clear, timely information about their cargo once it reaches marine terminals. This information gap—what they commonly call "the black hole"—continues to perplex and frustrate. For years, I listened to questions with genuine intrigue: "How can we share real-time import availability?" and "Why can't we alert shippers when their export is rolled over?"

Years have passed, and despite the steady march of technology, the problem persists. We've built new Electronic Data Interchanges (EDIs), new data standards, sophisticated Application Programming Interfaces (APIs), and state of the art data streaming solutions. We've experimented with artificial intelligence, devices on the edge, microservices, and cloud computing to create integrated and scalable solutions. Marine terminals have invested in infrastructure to support data sharing, often establishing revenue-sharing agreements and Data-as-a-Service (DaaS) offerings. Yet, despite all these initiatives, shippers still report feeling left in the dark. Marine terminals, meanwhile, bear the brunt of the blame, often unfairly, as they struggle to balance the demands for transparency with operational realities and evolving technology standards.

Marine terminals are, in many cases, marvels of technology and coordination. They must orchestrate fleets of equipment, synchronise complex schedules, and provide a safe environment for labor to handle cargo on which economies depend. On the other side of the equation, shippers, BCOs, and freight forwarders grapple with challenges of their own, urgently needing accurate and actionable information to ensure the efficient movement of goods. These logistics players rely on timely data not only to manage their costs and schedules but also to ensure the continuous flow of essential goods that sustain our economies and help relieve inflation.

A disconnect between what terminals offer and what shippers need exists, and it is costly. This gap isn't just a question of technology products; it's about objectives alignment, monetary incentives, and the clear definition of visibility itself. That's the purpose of this research on what we call "The Great Divide." It explores the deeper factors contributing to this persistent communication chasm. By shedding light on this, we aim to bridge the understanding between marine terminals and shippers, identifying ideas to bring the two sides closer. Through a focus on technology adoption, realignment of monetary incentives, and practical strategies for collaboration, this research hopes to contribute to a future where cargo visibility isn't just an aspiration but an industry standard.

INTRODUCTION

In October 2024, it was estimated that supply chain disruptions cost organisations an average of US $184 million every year.[1] These disruptions stem from a variety of causes including natural disasters, worker strikes, and other global issues. For example, Hurricane Katrina in 2005 severely impacted supply chains, particularly along the US Gulf Coast, affecting the production, refining, and transportation of oil. Labour strikes, like the West Coast Port Strikes of 2014-2015, caused worker slowdowns and delays in shipping, while the 2020 pandemic paused the transport of goods worldwide. In 2021, the six-day blockage of the Suez Canal by the containership Ever Given single-handedly affected 12% of total global trade passing through the canal.[2]

These events serve as stark reminders that the ripple effects of supply chain disruptions are huge, unpredictable, and increasingly unavoidable. While we can't necessarily prevent them, we can work towards building an agile and resilient global logistics ecosystem that will boost the ability for different components in the supply chain to mitigate the impacts.

One aspect of a resilient supply chain is visibility. Visibility refers to the ability to track and understand the status of cargo as it moves through each node in the supply chain. These nodes are different points where cargo is processed or stored, such as factories, warehouses, or distribution centres. Links that connect these nodes include ships, railroads, trucks, and drones. Operations visibility is critical for a terminal operator to make informed decisions on the allocation of equipment and resources. But what's more important, is the connection of different visibility solutions with execution platforms that enable this visibility to be transferred to shippers and shared throughout the wider supply chain.

While there has been a rise in real-time data use since COVID-19, this trend has failed to keep up with the complexity of our modern world and fails to provide the efficiencies expected from pure visibility. Our research shows that lack of visibility is a result from multiple factors related to data privacy and security concerns, organisational silos and systems not designed to work together, and lack of standardisation of execution systems. These challenges result in a highly complex disconnected array of objectives that hinder the overall productivity of the supply chain. What shippers think they should receive in terms of visibility on the movement of their cargo, and what terminal operators believe they are providing is misaligned. Visibility into cargo movement alone is insufficient for supply chain efficiency. A successful visibility strategy has at its foundation a comprehensive execution vision. To optimise terminal and shipper operations,

1 Swiss Re (Oct, 2024) Quantifying business interruption

2 World Economic Forum (Mar, 2021) The Suez Canal in numbers

improve efficiency, and ensure seamless cargo handling to meet customer expectations, capable execution systems are required.

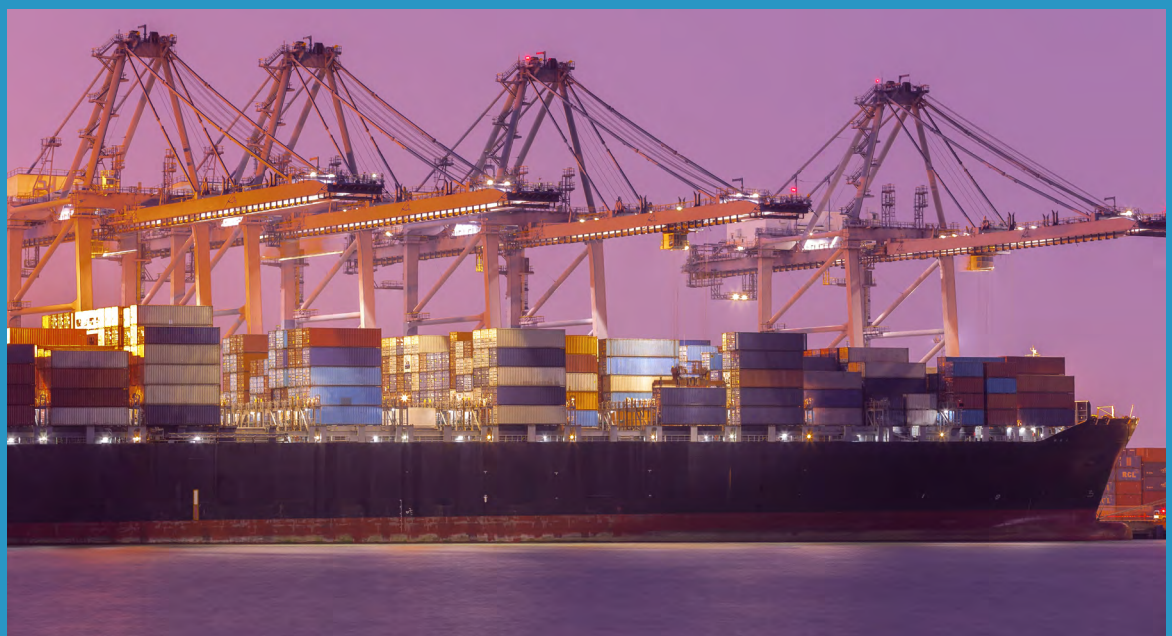
This research explores how and why this disconnect exists and what impact this has on the efficiency of terminal operations and the entire supply chain. It looks at the core components needed to eliminate this visibility gap and build a resilient and agile supply chain that is able to adapt to changing market conditions.

In conclusion, what the Great Divide research uncovers and highlights is:

- The fragmented digital ecosystem in the supply chain is a challenge contributing to The Great Divide.
- Technology products that we will cover in this research, for each node of the supply chain are rarely designed to work together.
- Gaps in communication between today's key supply chain technology systems contribute to data silos.
- Silos and disconnect nodes in the supply chain exist and undermine productivity by not sharing data because of conflicting objectives.
- The lack of interoperability is a major challenge holding back the industry. This is due to:
  - Lost productivity due to manual transfer of information – out of the TOS, email to shipper, into the shipper's YMS and TMS, etc.
  - Visibility alone does not provide efficiencies, better execution systems are required to address visibility concerns.
  - Data security concerns – especially with manual transfer – it's actually far more secure for the data to be shared via API then exported out of the system and emailed.
- The solution lies in prioritising a better use of executions systems:
  - Terminals, truckers and shippers should prioritise better execution systems that are used to the fullest.
  - Execution systems should have interoperability and standardisation of communication as a foundation of their strategy.
  - Execution systems must be designed to work together in real time to bridge organisational silos.

The key aims of this research are:

1. To highlight the visibility gaps that exist between terminals and shippers regarding cargo visibility.
2. To examine the impact of these gaps on supply chain efficiency and agility.
3. To identify the key components that are needed to build better transparency and visibility.



TERMINAL OPERATIONS VISIBILITY IN A POST-PANDEMIC WORLD

In a pre-pandemic world, operations visibility focussed on estimating where cargo was in the supply chain, and when it might arrive at its destination. Cargo was monitored and tracked but the ability to communicate the information to stakeholders was limited by siloed processes. The approach and unexpected delays to disruptions were often reactive rather than proactive, inhibiting the potential for widespread visibility.

The 2020 outbreak of COVID-19 magnified the vulnerabilities of the supply chain and highlighted how susceptible and fragile it is to disruptions. Mass panic-buying of essential products combined with global lockdowns and staff shortages affected supply and demand and the ability to move goods. During this period of turbulence and uncertainty, supply chain players lacked the real-time information needed to anticipate and respond effectively to these challenges. The pandemic intensified existing issues and made it clear that there is an urgency to address them.[3] As a result, today there is an emphasis on real-time access to information to support operations visibility. Shippers and other supply chain players are not just asking for visibility and communication, they are expecting it.[4] The ability to gather, analyse, and share operational data at every point in the supply chain with the stakeholders who need it has become critical for managing potential delays and avoiding disruptions.

The data must be reliable, communicated via the right protocol, delivered on time, and sometimes transmitted to outside parties with no contractual relationships.

LAYING THE FOUNDATIONS FOR A RESILIENT SUPPLY CHAIN

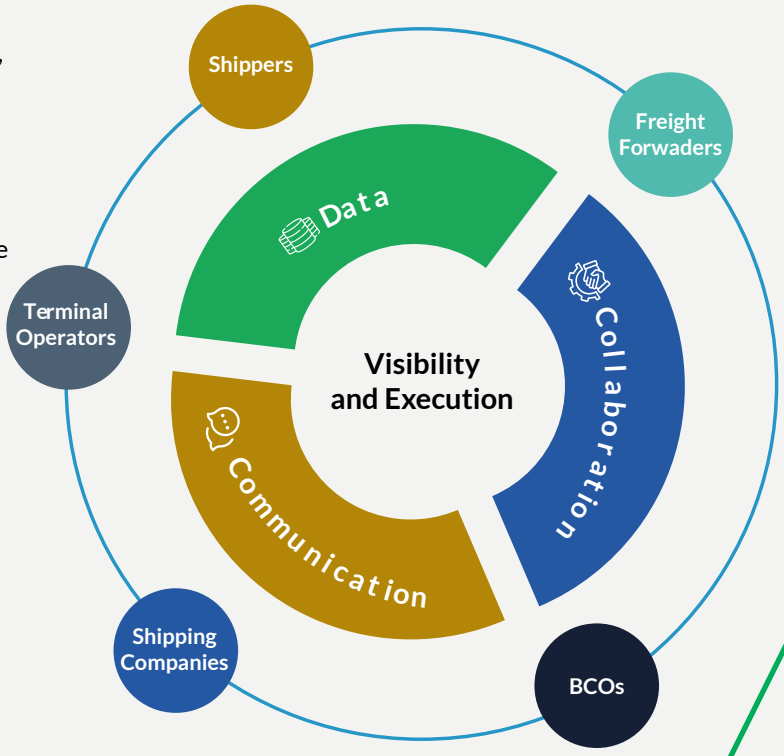
To support an agile and resilient supply chain through operations visibility, continuous monitoring, analysis, communication, and collaboration of cargo status among trading partners is paramount. How a supply chain player such as a terminal or shipper monitors and shares their operations data, which is heavily dependent on the effective use of technologies, will determine the visibility of operations. In turn, this supports a flexible and agile supply chain.[5]

3 Russell, D et al., (Oct, 2020) Managing supply chain uncertainty by building flexibility in container port capacity: a logistics triad perspective and the COVID-19 case

4 The Loadstar (Jul, 2022) Shippers jockey for position with supply chain visibility critical in a declining market

5 Angkiriwang, R et al., (Mar, 2014) Managing uncertainty through supply chain flexibility: reactive vs. proactive approaches. Production & Manufacturing Research, volume 2, issue 1, p50–70.

While there are a multitude of factors that affect operations visibility, data, collaboration, and communication sit at the core.



DATA

Collecting and aggregating data from multiple sources is critical for gaining insight and making informed decisions. It also helps to identify where and why bottlenecks exist. Data needs to be cleaned and verified in order to use it to maximise decision making. Terminals process an enormous volume of goods and there are plenty of opportunities to collect and analyse data. Four of the key areas where data is collected to analyse and optimise operations include berth and vessel operations, yard management, rail operations, and gate operations.[6]

COMMUNICATION

Once the insight has been gained thanks to the data, it must be shared among stakeholders to ensure widespread visibility and operational awareness. This enables it to be used to make informed decisions and minimise disruption. Communication of data goes beyond simply sending information to other parties; the data must be reliable, communicated via the right protocol, delivered on time, and sometimes transmitted to outside parties with no contractual relationships.

COLLABORATION

Collaboration is critical to achieving common goals. It is fundamental for improving operational efficiency and customer experiences, building trust and long-term relationships. Effective collaboration requires investment in supply chain technologies that enable all stakeholders to share processes, identify and resolve problems, and facilitate a seamless flow of goods.[7] In the context of this research, the key element to reiterate is that the collaboration we are referring to is between parties that do not exchange monetary benefits or penalties via contracts. For all intents and purposes, the collaboration we refer to here is between complete strangers with no relationships.

TECHNOLOGIES FOR OPERATIONS VISIBILITY

Technology is critical for providing visibility on operations around cargo movement. It's fundamental to allow data to flow between sources and to ensure all parties are informed. Historically, achieving visibility into cargo movement was nearly impossible due to the absence of technology at every stage of a container's journey. Door to door logistics for instance, can contain as many as 6 or 7 supply chain nodes with 6 or

6 Kaleris (Jul, 2024) Navigating terminal efficiencies with affordable data insights

7 Fintech (Aug, 2024) Supply chains and the collaboration gap: are you ready?

7 supply chain segments, all of which require visibility to be transmitted. Containers would leave one destination and arrive at another but updates on its progress were few and far between. If a container fell overboard, it might take weeks for shippers to discover this.

Thanks to the rise of advanced communications networks provided by the likes of Starlink and OneWeb, data can be moved seamlessly between ship and shore, providing the ability for multiple stakeholders to see where the cargo is and why. This opened the door to a range of technologies, which are outlined in the table below. These systems provide real-time insights on cargo movements at various points in the supply chain from their production to delivery. However, a major challenge is

If a container fell overboard, it might take weeks for shippers to discover this.

that there is often a lack of interoperability between these systems. This leads to information being confined within individual systems. While this information is useful, it ends up in silos and is inaccessible to stakeholders across the upstream and downstream supply chain.

The solutions below must often be integrated with one another to provide complete visibility on the movement of cargo.

Technology and Key Uses	Key Visibility Benefits	Key Visibility Limitations
Terminal Operating System (TOS) Manages and tracks cargo movement within the terminal, optimises assets, labor, and equipment, plans works loads, analyses operations data to inform decision making, and improves overall operating efficiency	To track the location of cargo, ETAs (estimated time of arrival), monitor loading/unloading operations, and get real-time updates on cargo status.	May not provide full supply chain visibility beyond terminal operations.
Real-Time Location Systems (RTLS) RTLS uses GPS (Global Positioning System), RFID (Radio Frequency Identification), or other sensor technologies to provide real-time tracking of cargo within the terminal.	Customers can use RTLS to track the exact location of their containers or cargo within the terminal.	High cost of infrastructure and challenges in integrating with legacy systems. Accuracy depends on sensor quality and network reliability.
Port Community Systems (PCS) To track the real-time location and status of cargo containers within the terminal. Terminal operators use this to communicate with their customers.	A PCS allows terminals and shippers to access real-time information about cargo, terminal processes, customs status, and the overall port ecosystem through a single platform. Today's PCS are highly sophisticated, cloud-based digital platforms that enable real-time information sharing, integrated logistics, and enhanced supply chain visibility.[8]	The effectiveness of PCS can be limited by a lack of standardised data and inconsistent sharing practices among stakeholders. They also require maximum stakeholder engagement, which can be difficult to achieve due to some opposition to change.

8 World Bank Group (2023) Port Community Systems: Lessons from a global experience

Technology and Key Uses	Key Visibility Benefits	Key Visibility Limitations
Electronic Data Interchange (EDI) Systems Terminal operators use EDI, which is a standardised system, for the electronic exchange of documents and data between their terminal and shippers and carriers.	Shippers use EDI to receive real-time notifications about cargo status, including arrival times, delays, or customs clearance.	EDI systems require accurate and consistent data to function but this is not always provided due to data errors. This can cause incomplete transactions, leading to business disruptions, financial losses, and strained relationships with trading partners.[9] In addition, EDI is often designed to meet specific business requirements and is therefore not always flexible enough to meet changing business needs.
Warehouse Management Systems (WMS) WMS provide real-time tracking of inventory levels across locations.	This leads to clearer insights into stock movement from inbound to outbound processes, and detailed tracking of order status, enabling precise updates to customers.	WMS systems may not seamlessly integrate with legacy systems or other supply chain platforms, creating data silos. Connecting a WMS to any new system will require a development team to build a new integration solution from the ground.[10]
Fleet Management Systems (FMS) FMS provide real-time tracking and monitoring of vehicle locations, routes, and statuses to help stakeholders manage fleet activities and performance.	FMS can optimise routes to improve delivery times and reduce fuel consumption. They also help to better allocate vehicles to optimise resources.	It can be difficult to integrate FMS with existing systems. Excessive data from sensors and reports can also overwhelm users if not managed or filtered properly.
Yard Management System (YMS) A YMS supports the efficient flow of work, equipment and materials through the normally enclosed area outside of a warehouse, distribution center or manufacturing facility (the yard).[11]	It provides an overview of yard operations and supports the planning, direction and control of scheduling, movement, parking, inspection and reassignment of trucks, trailers and containers in the yard. YMSs typically oversee the gate/kiosk, the yard itself, and the inbound and outbound dock door scheduling activities.[12]	Warehouse yards are often overlooked when it comes to optimizing supply chain nodes with technology. Organizations may limit themselves through reluctance to adopt yard technology. YMS offerings from application megavendors and supply chain management suite vendors may lack robust capabilities.

9 30DC (Apr, 2024) The dark side of EDI: Uncovering the disadvantages of Electronic Data Interchange

10 Maxima Consulting (Sep, 2024) Is it the time to update your Warehouse Management System?

11 Gartner (2024) Best Yard Management Reviews and Ratings

12 Gartner (2024) Best Yard Management Reviews and Ratings

Technology and Key Uses	Key Visibility Benefits	Key Visibility Limitations
Transport Management Systems (TMS) A TMS provides information needed to manage and monitor transportation activities in freight forwarding and logistics.	A TMS reduces distribution costs, improves customer satisfaction through delivery responsiveness, and operational efficiency through process automation.[13] Some TMS providers enable GPS integration to enable real-time visibility into shipment location and ETA.[14]	Implementation of a TMS can fail if there is a lack of standardisation. Cloud-based TMS solutions also require a reliable Internet connection to function correctly. In addition, there may be concerns about data ownership and control as the data is stored on servers managed by the provider.[15]
Digital Twins Digital Twins provide a complete 3D replica of a terminal, providing total visibility of the terminal environment, its equipment, container inventory and more.[16]	Digital Twins are used to increase flexibility in operations and to support operational decision-making based on real-time information.[17]	Digital Twins can be expensive to implement and integrating them with existing systems such as a TOS can be difficult. This lack of integration can lead to data silos and limited visibility, affecting the potential benefits of the digital twin.
Internet of Things (IoT) Sensors and Devices Different types of IoT sensors exist to detect the movement of cargo and provide real-time updates. GPS trackers can be used to provide real-time location data for cargo containers, trucks, or vessels, allowing terminal operators to track the movement of cargo throughout the supply chain. Another example is Radio Frequency Identification Tags (RFID), which are attached to cargo containers and can be scanned automatically by RFID readers as they pass through various checkpoints in the terminal.	Shippers rely on environmental sensors to monitor the condition inside containers that are carrying sensitive goods like food, pharmaceuticals, or electronics. IoT sensors allow terminal operators to optimise cargo placement, retrieval, and transport within the terminal, reducing congestion and improving turnaround times. For example, RFID tags combined with GPS trackers can help operators know exactly where each container is, enabling quicker retrieval and movement.	Some IoT devices may struggle to integrate with TOS' or other systems, while a lack of standardisation can lead to disconnected workflows across terminals. Some container tracking solutions that rely on IoT sensors offer valuable insights but are limited by a lack of real-time updates. Delays or errors in data input can result in outdated or incorrect tracking information. For example, tracking information may show planned movements, and so relies on timely and correct data entry at various shipment stages to ensure accuracy of the tracking progress.

13 Saragih, N.I et al (2020) Trends, challenges, and perspectives in logistics systems during and after (New Normal) Covid-19 Pandemic in Indonesia. Journal of Industrial Systems Engineering, 2(9), 77–86, referenced by Hidayat, M. C and Kinoro, I (Oct, 2023) Comparative efficiency of fleet management system versus transportation management system on transportation vehicle tracking system efficiency

14 Tech Target (Nov, 2023) 7 advantages, disadvantages of using a TMS

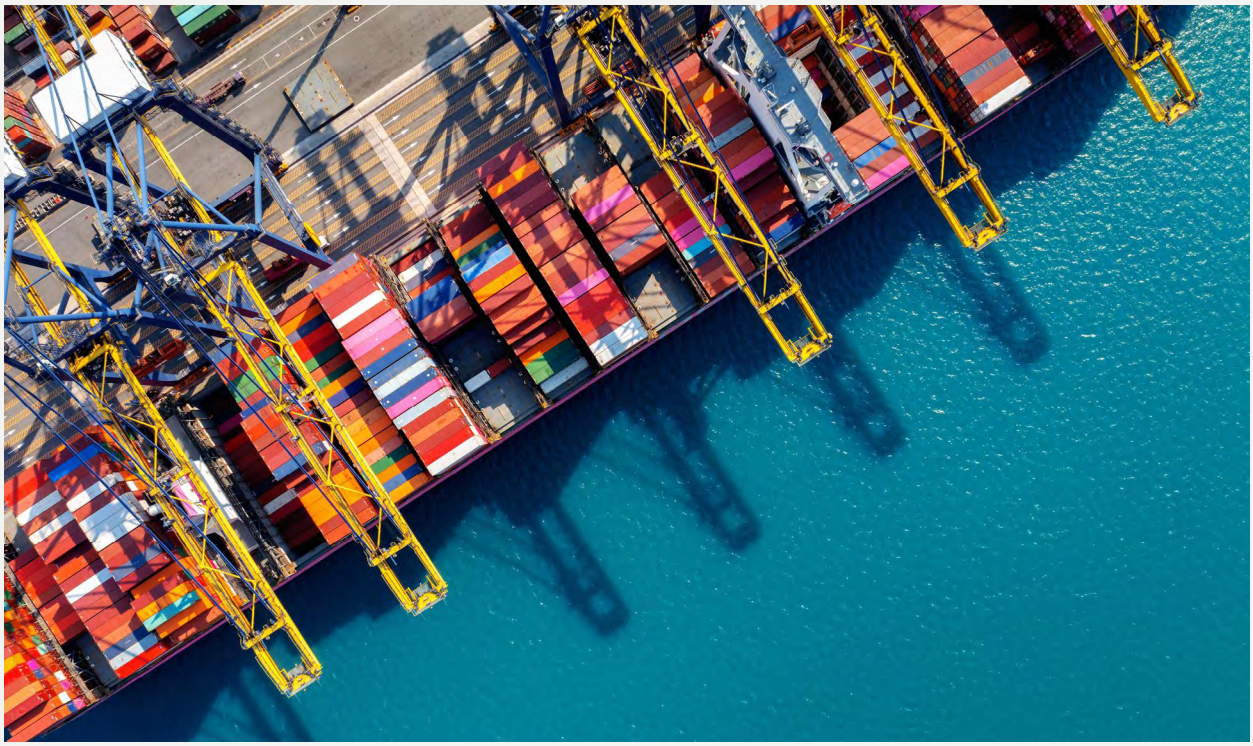
15 Lynch, K (Jan, 2024) The benefits and drawbacks of cloud-based TMS for transportation management

16 Container terminal automation conference (2024) Five reasons you need a super intelligent digital twin for your terminal

17 Kastern, M et al., (May, 2024) Insights into how to enhance container terminal operations with digital twins

Technology and Key Uses	Key Visibility Benefits	Key Visibility Limitations
Automated Gate Systems Automates the process of tracking cargo entering and leaving the terminal. They also reduce the time trucks have to wait at the terminal gates.	Shippers receive real-time updates on when their cargo enters or exits the terminal.	Automated gates rely on data inputs from various systems such as RFID tags. If there are delays in processing or data transfer can affect real-time visibility. If vehicles or containers bypass automated gate checks, for example for maintenance or manual processing, the system may lack critical data.
Advanced Analytics and AI Systems AI and machine learning can provide insight and analytics on supply chain movements and cargo delays.	Shippers can use predictive analytics to foresee potential disruptions in terminal operations and make data-driven decisions about routing and scheduling.	AI systems are only as good as the data they process. Errors, missing information, or outdated data can reduce the accuracy of their output. AI systems also require historical data to train algorithms effectively. Newly implemented systems may lack sufficient data for accurate predictions. A lack of integration between systems can also restrict the scope of visibility.

Figure 1. Typical execution technologies used to deliver cargo visibility to terminals and other supply chain players.



WHAT LEVEL OF VISIBILITY DO SUPPLY CHAIN PLAYERS EXPECT TODAY?

The shipper, shipping company/carrier, beneficial cargo owner (BCO), and freight forwarder are some of the main supply chain players that interact with terminals. Each stakeholder requires cargo and operations visibility from their terminals to meet their goals.

Terminal operators need visibility into their operations to optimise resource allocation, streamline cargo handling, and support broader supply chain efficiency. For terminal operators, operational visibility forms the foundation of a wider execution strategy, enabling data-driven insights for proactive decision-making, risk mitigation, and improved customer satisfaction. Having real-time data on cargo movement is essential not only for managing day-to-day operations but also for maintaining the flexibility and agility needed to respond to external disruptions that remain beyond an organisation's control.

The table below illustrates some of the key operational visibility requirements from different supply chain players.

Supply chain player	Operations visibility requirements from terminals
Shipper	Shippers require visibility to track and understand the movement of their cargo. They expect efficient handling of cargo at the terminal, smooth customs processes, and real-time communication about the status of their shipment. While shippers do not have a contractual tie with terminals, there is a need for highly visible operations to ensure seamless movement of cargo through terminals.[18]
Shipping company	Shipping companies/carriers work directly with terminals and require visibility to coordinate ship arrivals and departures. It is the shipping company that has contractual ties with terminals, they are effectively the paying customers for a terminal.
Beneficial cargo owner	BCOs take direct control of cargo entering ports.[19] They engage directly with terminals and demand real-time updates on their cargo, minimal delays, and clear communication from terminals. In 2021, more than 80% of BCOs did not have full tracking of their shipments.[20] Again, BCOs, just like shippers, do not have any contractual tie with a terminal.
Freight forwarder	Freight forwarders arrange the transportation of goods on behalf of shippers and require access to terminal systems for cargo tracking and coordination. Freight forwarders also do not have any contractual tie with terminals.

Figure 2. The interactions of each supply chain player with terminals today and their expectations for operations visibility.

18 UNCAD (Oct, 2024) A bigger role for terminal operators in global value chains

19 Vizion (Aug, 2022) Why haven't BCOS adopted end-to-end visibility?

20 Drewry (Mar, 2021) White paper: Global supply chain disruption – Visibility solutions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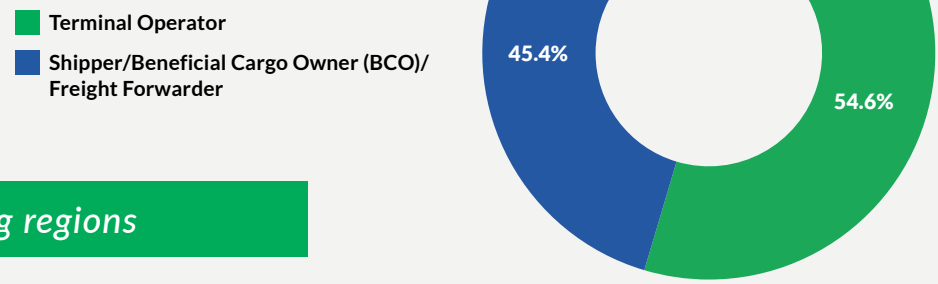
PERCEPTION VS REALITY: WHY TERMINAL OPERATORS AND SHIPPERS LACK ALIGNMENT ON VISIBILITY

Despite the benefits of operations visibility and the technologies that are available today to facilitate it, this research has found that there is a disconnect between the visibility that terminal operators believe they provide and the visibility that shippers feel they receive.

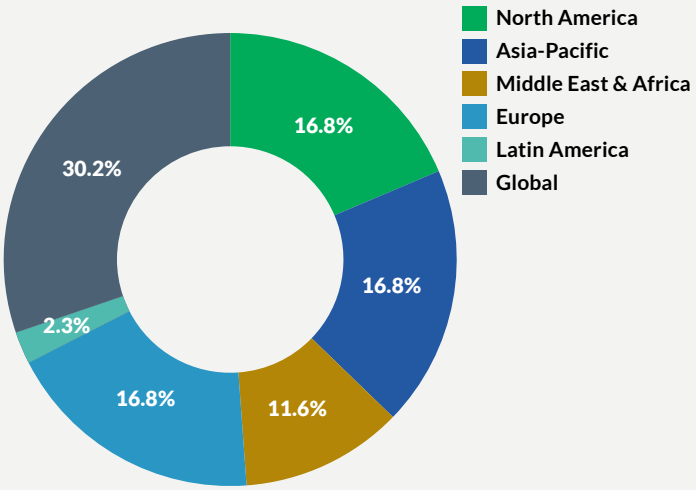
SURVEY RESULTS

Role of survey participants in the supply chain

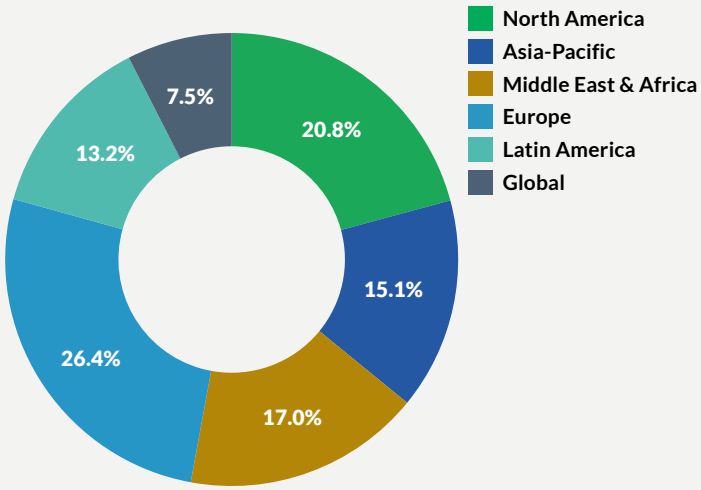


Primary operating regions

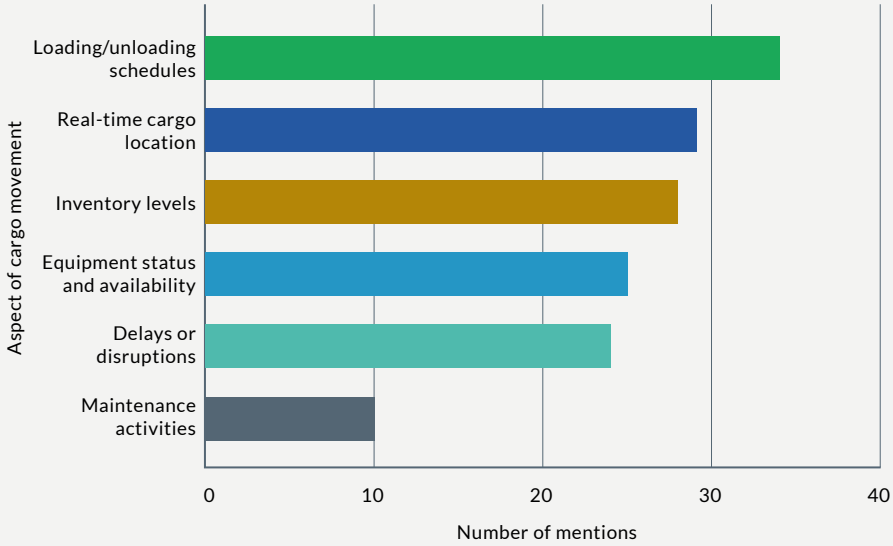
Shippers/BCOs/Freight Forwarders



Terminal Operators



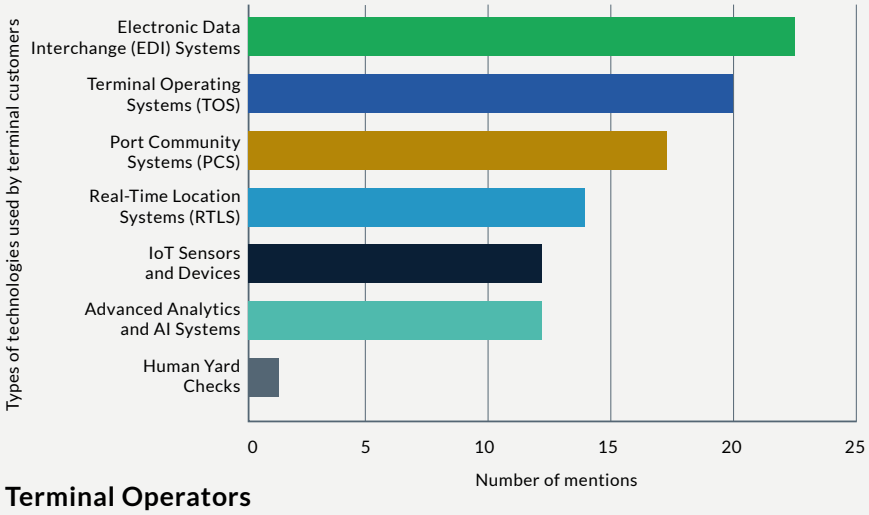
Which aspects of cargo movement or operations activity do terminals actively share with their customers?



The most common aspects of cargo movement shared with terminal customers are loading/unloading schedules and real-time cargo location, according to terminal operators.

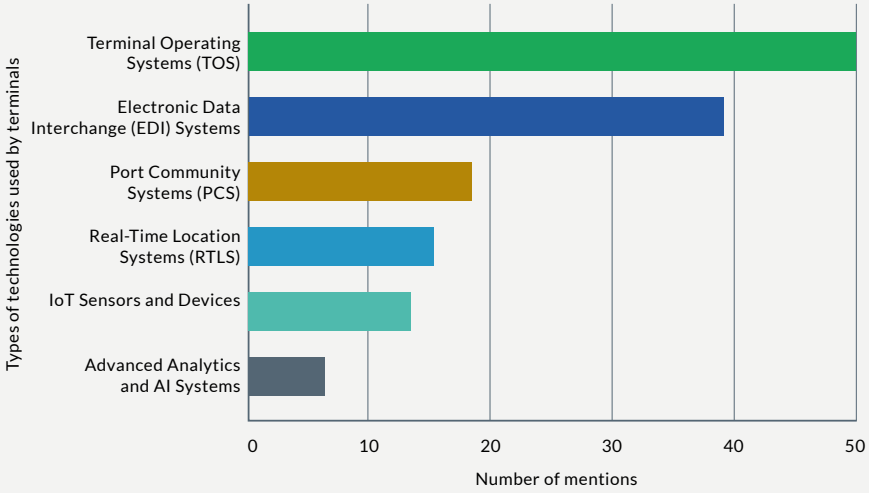
What are the most popular systems used for cargo visibility today?

Shippers/BCOs/Freight Forwarders



EDI and TOS are the systems most commonly used by terminal customers for cargo visibility.

Terminal Operators

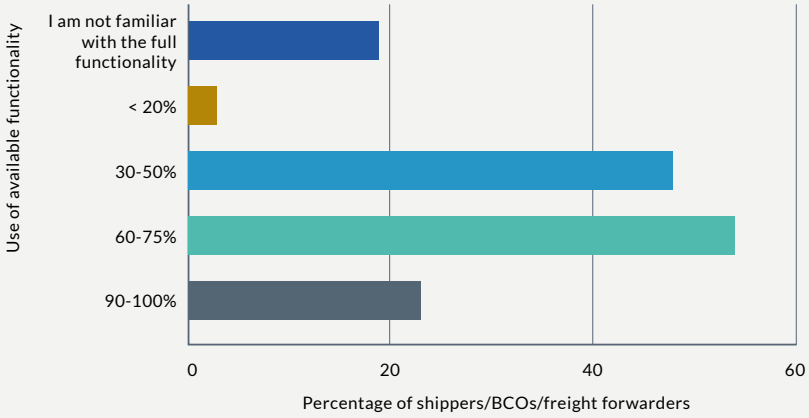


EDI and TOS are the systems most commonly used by terminals for cargo visibility.

How well is execution technology utilised?

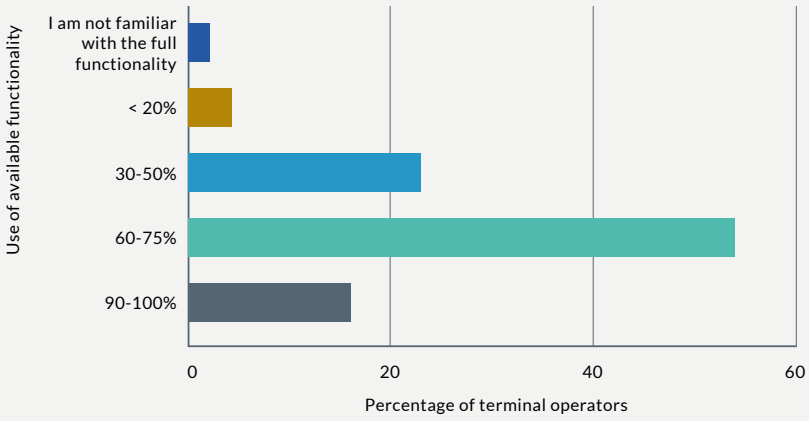
Shippers/BCOs/Freight Forwarders

Only 36% of customers use 60-75% of the available functionality of their execution technology.



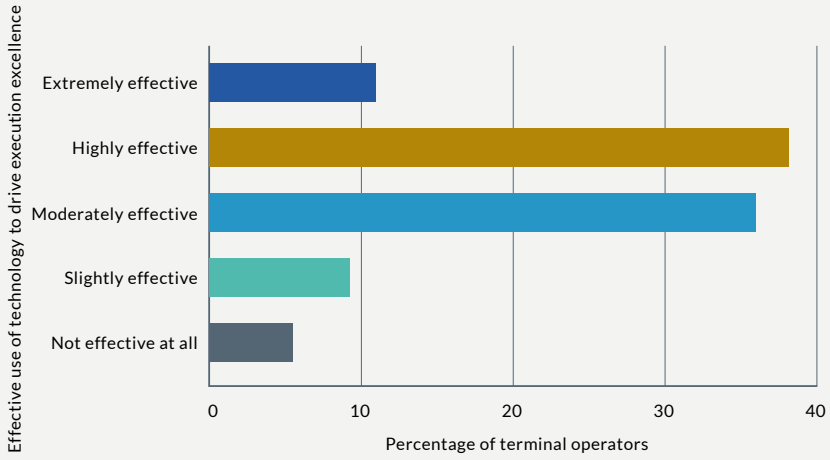
Terminal Operators

The majority of terminal operators (55%) use 60-75% of the available functionality of their execution technology.

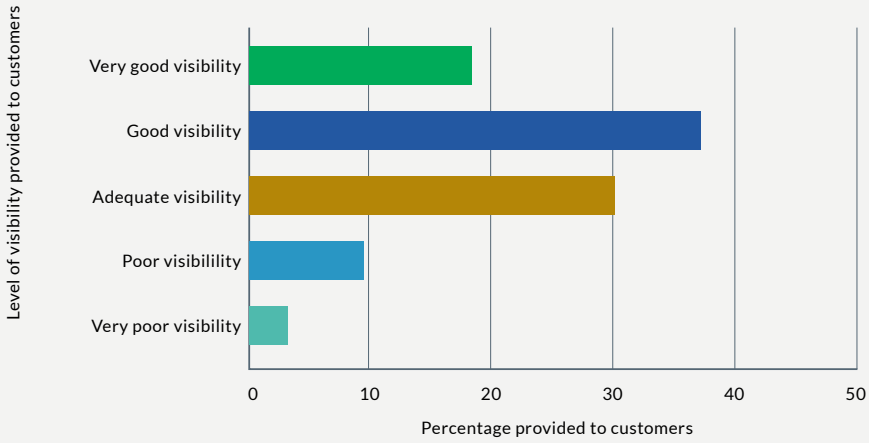


How effective do terminal operators believe their technology systems are for driving operations and execution excellence?

The majority of terminal operators believe that their systems are highly effective in driving execution excellence.

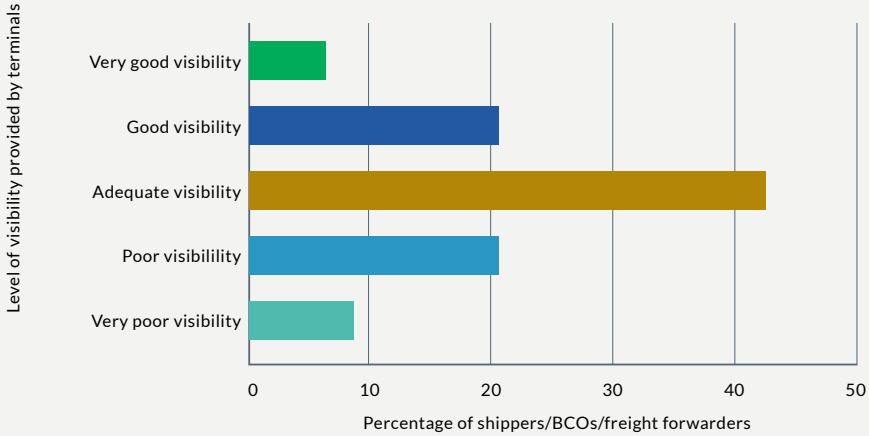


What level of visibility do terminal operators believe they provide to their customers?



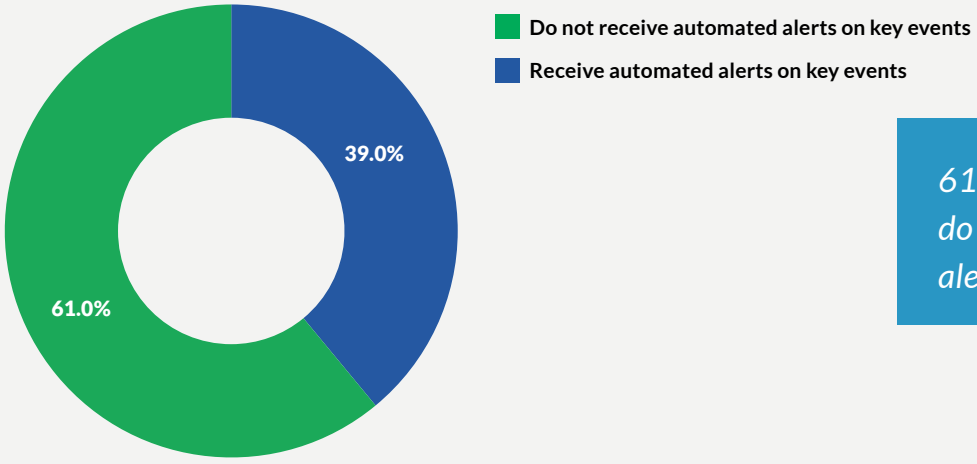
Nearly 57% of terminal operators believe they provide good or very good visibility to their customers.

What level of visibility do shippers feel they receive from their terminals?



43% of terminal customers believe that their terminals offer adequate visibility. Nearly 30% feel they receive poor to very poor visibility.

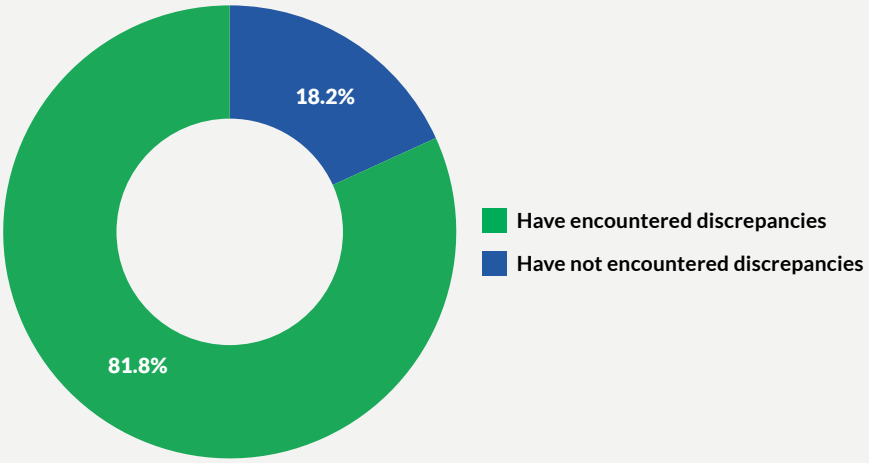
Do shippers receive automated alerts for key events such as arrivals, unloading, or customs clearance?



61% of customers report they do not receive automated alerts on key events.

Have shippers encountered discrepancies between the information provided and the actual status of their shipments?

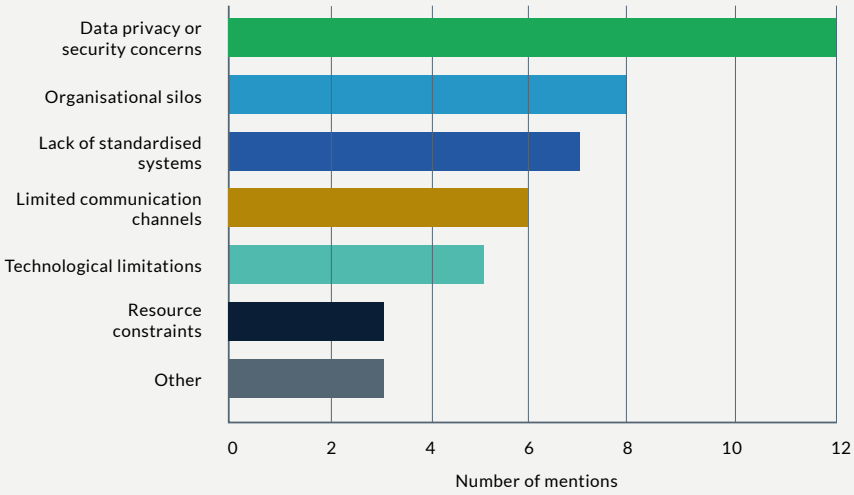
Nearly 82% of shippers have faced discrepancies between the information provided and the actual status of their shipments.



What are the main barriers to visibility?

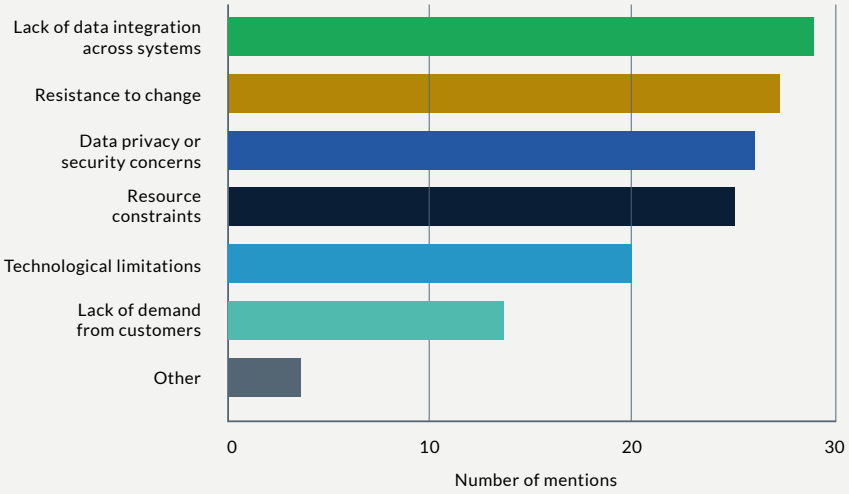
Shippers/BCOs/Freight Forwarders

Data privacy concerns are the primary challenge shippers face in achieving cargo visibility.

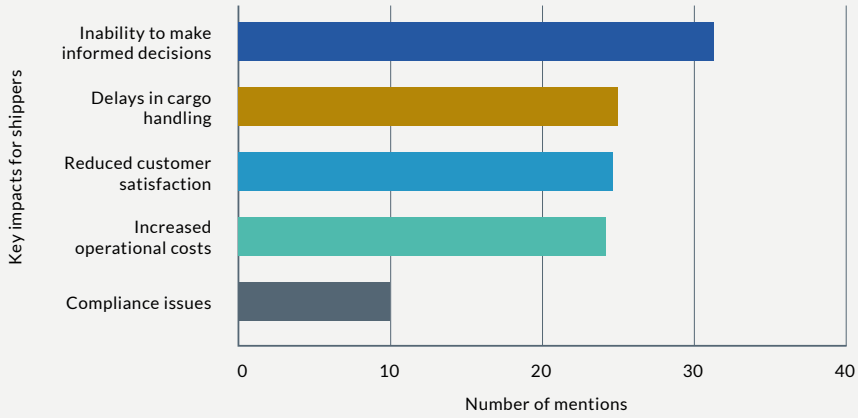


Terminal Operators

The lack of data integration across systems is the main reason terminals struggle with cargo movement visibility.

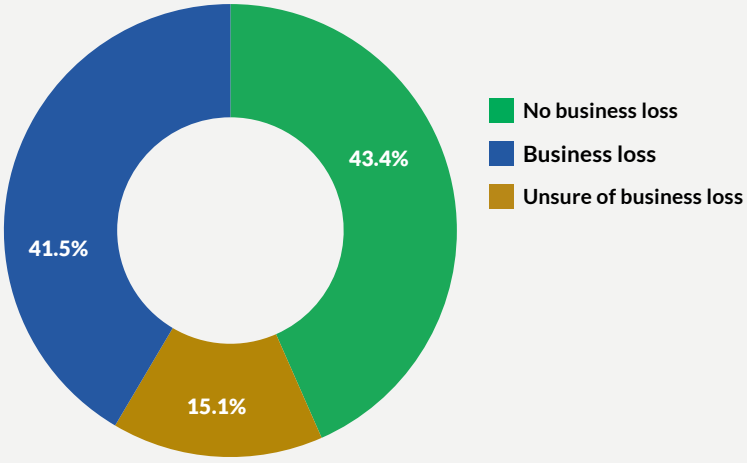


What impact does poor visibility have on shippers?



An inability to make informed decisions and delays in cargo handling were most frequently cited as consequences of poor visibility for terminal customers.

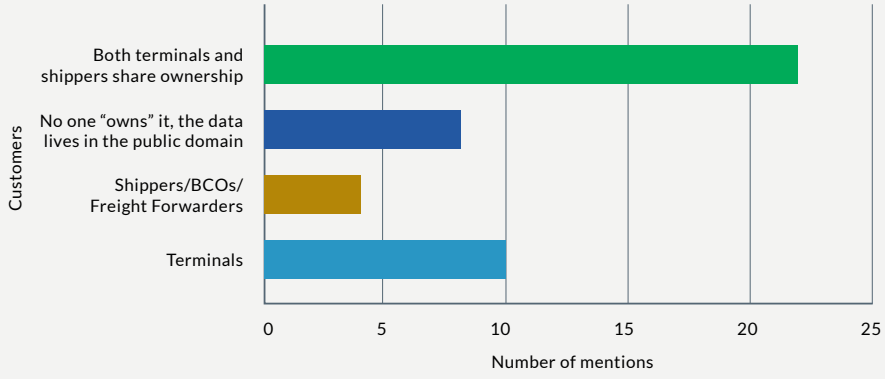
What impact does poor visibility have on terminal operators?



Nearly 42% of terminal operators said they are aware of business loss due to a lack of visibility provided to their customers.

Who owns cargo movement data?

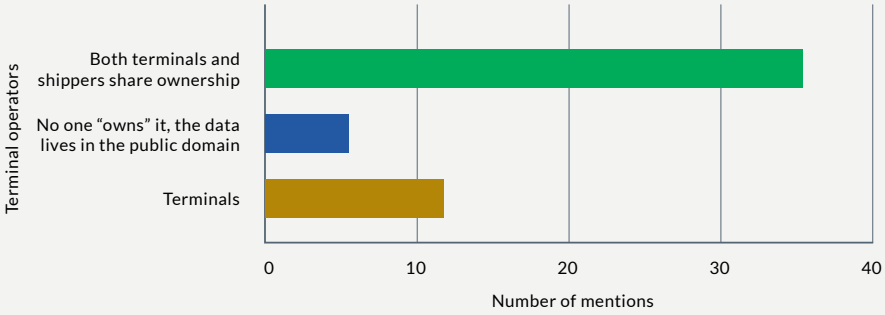
Shippers/BCOs/Freight Forwarders



The majority of shippers believe that the terminal and shipper share data ownership.

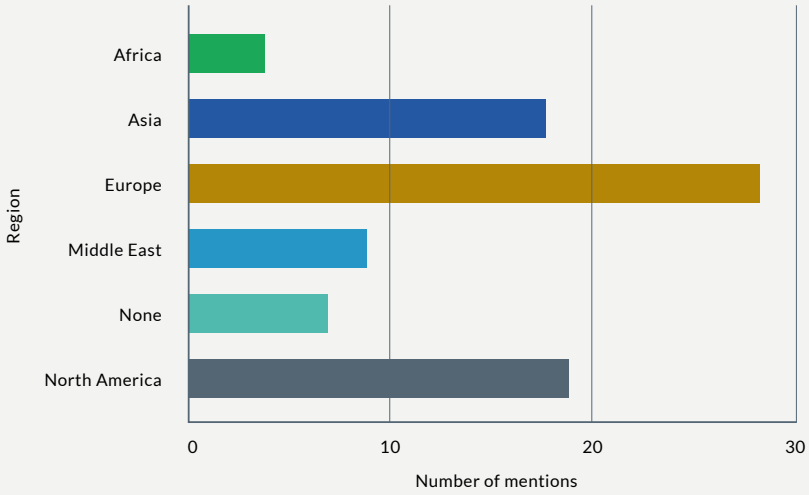
Terminal Operators

The majority of terminal operators believe that the terminal and shipper share data ownership.



GEOGRAPHICAL VARIATIONS

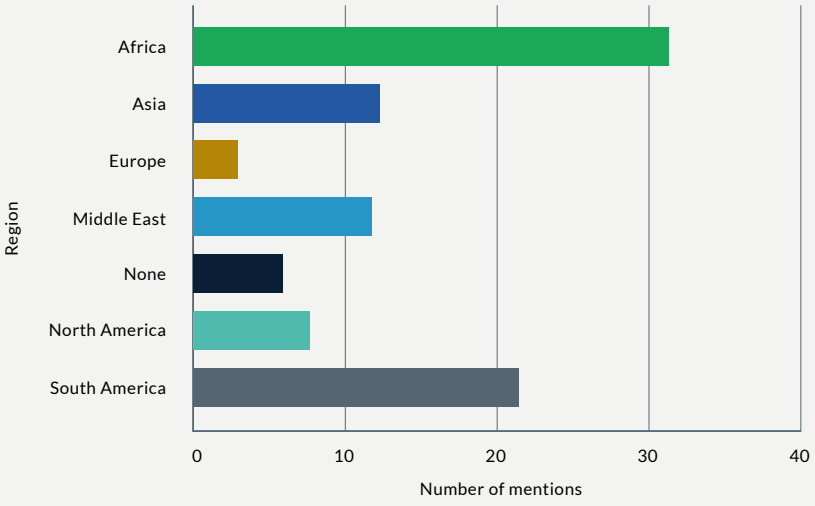
Where is terminal visibility particularly good for shippers?



European and North American terminals were most frequently cited as providing good visibility for shippers.

Where is terminal visibility particularly poor for shippers?

Terminals in Africa and South America were most frequently cited as providing poor visibility for shippers.



DRIVERS AND CONSEQUENCES OF THE VISIBILITY GAP

Stakeholders across the supply chain are investing in technologies to improve operational efficiency. But this research has found that many systems that improve visibility in each node in the supply chain rarely work effectively with others. This leads to an underutilisation of the functionalities of these technologies, gaps in communication between today's key supply chain technology systems, a high level of data silos and ultimately, decision-making based on incomplete information. This section explores these drivers and consequences further.

POOR SYSTEM INTEROPERABILITY

System interoperability refers to the ability of different systems, technologies, or applications to communicate and exchange data with one another. Terminals, shippers, and other supply chain players often use Port Community Systems (PCS), Maritime Single Window (MSW), and Trade Single Window (TSW) systems to collect and exchange information internally. However, these systems often lack interoperability and standardisation. This prevents the systems from exchanging data in real-time, making it inaccessible to stakeholders and blocking them from gaining a unified view of supply chain operations.[21]

One of the reasons for this interoperability is due to inconsistent data formats and a lack of standardisation. Systems on either the terminal or customer side use various data standards and protocols, which makes it difficult to aggregate data. A chartering manager who was previously working in another industry told Thetius that the lack of effort towards standardisation in maritime is concerning. It leaves data completely open to interpretation and means that people spend enormous amounts of time they don't have trying to understand it.

Fenix Marine Services' R&D director of terminal development, John Alvarez, told Thetius that he believes some vendors are resistant to providing or sharing data because they want to control the flow of information through their own systems. The lack of standardised protocols or tenders makes it difficult for terminal operators to enforce consistency and accountability with vendors. He explained that having a standard or common protocol would allow terminal operators to better manage the flow of information and force vendors to comply with more structured requirements.

One port operator Thetius spoke with agreed that poor system interoperability is a major barrier for terminal operational visibility today. "There is significant potential in the data available, but interoperability prevents it from being leveraged for better decision making. A wealth of valuable information exists but it sits unused, often confined to paper, spreadsheets, or forgotten in inboxes," he explained. Stakeholders end up implementing multiple solutions to try and exchange information with their partners,[22] but the systems still lack interoperability, making this a costly and redundant exercise.

A DISCONNECTED NETWORK OF SYSTEMS

Systems used across the supply chain also tend to lack integration capabilities. Real-time automated data sharing is limited, leaving data siloed within specific terminal systems rather than integrated across the broader supply chain. This means that other supply chain players struggle to access and extract it to advance their execution.

For instance, terminals might deploy a TOS to execute and monitor metrics like vessel, truck, or rail car turnaround times, cargo dwell times, equipment usage, and terminal processing capacity. While this information helps terminals to make internal operational decisions, such as allocating yard equipment or berths, these systems do not always deliver the same visibility into cargo movement to the terminal's customers.

21 World Bank Group (2023) Port Community Systems: Lessons from a global experience

22 DCSA (Sep, 2024) The power of supply chain visibility in container shipping

Dennis Monts, President & Chief Operating Officer of PayCargo Labs.

"Terminal operators may think they have visibility because they can see what's going on internally, but this isn't getting translated down the supply chain, which is where the biggest problem is."

For example, if a TOS has not been integrated with the Enterprise Resource Planning (ERP) or logistics management systems used by shipping companies, terminal operators and shippers will be using separate and incompatible systems to access the same information. The disconnect leads to information silos, meaning that decisions are made based on each individual's view of that information rather than a unified view.

Even highly advanced systems such as a Port Community System (PCS) cannot provide a unified view of operations without effective integration with other systems. A PCS is based on electronic data exchange between multiple systems that are operated by a range of supply chain players, including ports, terminals, customs, carriers, and others.[23] While a PCS provides value for enabling cargo throughput across all terminals in a port, the visibility it provides doesn't extend to the wider supply chain. Despite its ability to deliver real-time updates on vessel schedules, cargo status, and customs clearances specific to port operations, it is not a gateway into the operations activities of each terminal. The system needs to be integrated with MSW systems to transfer data from ship to shore or a TSW system to transfer data between traders and border agencies. Without this integration, the PCS will only provide visibility to the immediate port community and not the wider supply chain.

UNDERUTILISED TECHNOLOGY

A knock-on effect of poor system integration and interoperability is that the capabilities of technologies are often underutilised. There are two primary causes of this. One is down to unfamiliarity of the full functionalities and the other is a lack of technology proficiency.

55% of terminal operators surveyed for this research said they use 60-75% of the full functionality of their execution technology. Only 15% confirmed they use 90% or more.

On the shipper and customer side, 64% believe they use no more than 60% of the available functionality of their execution technology and 14% admitted they are not familiar with the full functionality of their systems at all.

88% of terminal operator participants also admitted that they do not receive adequate training on their execution technology the majority of the time.

Only 15% of terminal operators use more than 90% of their technology's full functionality.

23 Ramis-Pujol, J and Rodon, J (Jun, 2006) Exploring the intricacies of integrating with a port community system

A Senior Director of Container Operations at a Port Authority told Thetius.

"People get thrown into the fire really fast. They might be trained on specific tasks that they're responsible for, but often training doesn't go beyond key handling requirements. There's a tremendous amount of information that's accessible but I don't think people either know it or understand how to access it."

The result of this is digital friction. This refers to the unnecessary efforts employees outside of IT spend on analytics and technology activities to complete a task.[24] Eventually, employees become frustrated and less motivated to engage with these technologies. In turn, this can reduce productivity and increase the risk of poor decision making.

One example where this problem exists is with the application of the PCS. Research by the World Bank Group found that many stakeholders lack clarity on the functionalities, benefits, and potential challenges associated with these systems.[25]

One port operator told Thetius that sometimes the operational functions that are performed at a terminal are handled by union employees. There is very little training involved around data, which often leads to input errors. The port operator explained that streamlining operational processes to shift the focus for union employees from just inputting data to verifying that the data is correct is important.

The knock-on impact of employees not receiving the support and training they require to use technologies is high supply chain turnover. This is a significant barrier to optimising supply chain operations as it results in a loss of critical knowledge that is not effectively passed down. New hires require time to familiarise themselves with the organisation and its processes. This has the potential to lead to a dip in productivity and customer satisfaction as new hires may not perform as efficiently as experienced employees.[26]

Another impact is the concept known as innovation standstill. This happens when talented workers leave an organisation because they do not feel that their skills are being fostered. This leaves organisations vulnerable to competitors taking over.

More than half of terminal operators surveyed only use 60-75% of the full functionality of their execution technology.

Despite these findings, it is important to note that according to our survey, 49% of terminal operators are prioritising better leveraging their current technology investments to the fullest potential through additional training and process improvements. This indicates that there is a desire to work towards using existing technologies more effectively.

24 Gartner (2020) Eliminating Barriers to Technology Work Across the Enterprise

25 World Bank Group (2023) Port Community Systems: Lessons from a global experience

26 Serrano, S.F (Feb, 2024) Navigating the revolving door: tackling supply chain talent turnover in 2024

MANUAL PROCESSES

In many cases, the exchange of data between terminals and supply chain players still relies on manual processes such as email or phone updates, which are prone to delays and errors.[27] This lack of automated data sharing makes it difficult to align operations.

For example, data may be extracted from a TOS and shared with a shipper via email before they input into their YMS, TMS, or other system. BCOs in particular rely heavily on manual processes and data collection, making it a challenge for them to collect, analyse and process information into reports that can help to determine the company's quality of visibility.[28]

Manual processes also impact the ability of terminals to balance the demands for transparency with operational realities and evolving technology standards. Mert Budak, Senior TOS & Core Applications Manager at Fenix Marine Services told Thetius that manual data management and input due to jurisdictional boundaries have caused the majority of these problems. He said that it also affects terminals' ability to follow the newest and most effective technology trends and solutions.

As well as being time consuming and prone to human error, data often ends up duplicated. The same data is generated or recreated in multiple places. This is costly, further exacerbates the silos of information, and delays communication and decision making between stakeholders.

Moreover, the manual transfer of data creates security concerns. It's far more secure for the data to be shared via API as it is controlled, automated and encrypted, ensuring that only authorised stakeholders can access the data.

THE ABSENCE OF AUTOMATED ALERTS

In addition, not all terminals provide automated alerts. Our research found that 62% of customers do not frequently receive automated alerts regarding key events such as container arrivals, unloading, customs clearance, or delays. Furthermore, 83% of shippers who responded to our survey noted they have encountered discrepancies between the information provided and the actual status of their shipments. One terminal operator told us that they can only address issues once customers report problems or irrelevant data transmissions. He noted that this is common in many cases, leading them to be more reactive than proactive.

27 McKinsey (Oct, 2022) The multi-billion-dollar paper jam: Unlocking trade by digitalising documentation

28 Vizion (Aug, 2022) Why haven't BCOS adopted end-to-end visibility?

According to our interview study, terminals sometimes only share information manually when an incident arises. This can mean that shippers receive inaccurate information regarding the status of their shipments.

A lack of real-time updates forces the customer to take a reactive approach. If a shipper's cargo is delayed and this is not communicated with the customer for some time, their window of opportunity for them to mitigate the impact is severely minimised. This could mean shippers have to retain inventory for extended periods. Effective inventory management is crucial for a company to meet customer demand, control costs, and ensure smooth supply chain operations.[29]

Furthermore, a lack of real-time shipment data can result in critical windows for cargo movement being missed. If a shipper or forwarder is unaware that a container has arrived or is awaiting customs clearance, they may miss the chance to retrieve it, leading to the possibility of demurrage and detention fees. While some charges are unavoidable, poor management can cause these fees to escalate, potentially costing a company millions in penalties.[30]

If customers' expectations are not met consistently, the terminal risks losing business and reputational damage that is hard to recover from. Moreover, when dissatisfaction sets in, it can create uncertainty about who is responsible when there are delays in cargo movement. Shippers might blame terminal operators for delays, while terminal operators may argue that shippers failed to provide the necessary information on time to manage the cargo efficiently. This conflict often arises due to miscommunication and a lack of data flow between different actors in the supply chain.[31]

A Director of IT from a Port Authority told Thetius *"that bigger shippers often trade data with Electronic Data Interchange (EDI) messaging or API, but smaller shippers avoid these tools. While they are designed to facilitate information exchange between different stakeholders, smaller shippers still avoid using them, citing concerns about high setup costs and maintenance, as well as the time required for implementation. In addition, the standardised format of EDI messages is often seen as inflexible, making it difficult to adapt to changing business needs as an organisation grows. This means that EDI is often perceived as too rigid to accommodate real-time changes, which contributes to the hesitation among shippers to adopt the technology.[32] EDI only works well if both parties are fully committed to using it. This means that if terminals are using it but not their customers, it's much harder to realise the benefits".[33]*

29 Windward (accessed Oct, 2024) Inventory management

30 Portcast (Oct, 2024) Detention and demurrage: New FMC regulations and the role of visibility in reducing D&D fees

31 UNCTAD (Oct, 202$) A bigger role for terminal operators in global value chains

32 Seeburger (Jan, 2020) EDI challenges: The top 6

33 Schneider (accessed Oct, 2024) Understanding the differences between an EDI and API

MISALIGNED PRIORITIES

One of the findings of this research is that shippers and terminal operators have different priorities. Terminals are focused on maximising revenue by serving their paying customers, the shipping lines, and on how cargo moves through the terminal to optimise their cost. For instance, terminals may examine how to optimise processes such as vessel loading and unloading or allocation of equipment. Shippers on the other hand, want to know where their cargo is from beginning to end, which does not help terminals to directly increase their revenue or decrease their costs.

This misalignment can lead to terminal operators providing visibility into specific terminal operations, while shippers are seeking total end-to-end visibility to make decisions based on the exact progress of a shipment.[34]

Dennis Monts, President & Chief Operating Officer of PayCargo Labs. explained to Thetius that a common impact of misaligned priorities is that business processes that optimise one stakeholder inadvertently sub-optimise another. Systems also do the same thing. This means that systems tailored to optimise one aspect of cargo movement or visibility may not integrate well with other systems, leading to siloed information. When systems prioritise individual efficiency over collective transparency, it further exacerbates information silos.

In turn, data silos hinders the adoption of other technologies like AI[35] and IoT, which could otherwise be used to streamline terminal operations. AI needs high quality data to function properly. Even if shippers have AI systems installed they cannot maximise its capabilities if the quality of data is poor.

"When systems prioritise individual efficiency over collective transparency, it further exacerbates information silos" ***Dennis Monts, President & Chief Operating Officer of PayCargo Labs.***

VARYING LEVELS OF DIGITAL MATURITY

Digital maturity is defined as "The degree to which organisations have adapted themselves to a digital business environment."[36] An organisation that shows greater levels of digital maturity will benefit from improved operational efficiency, enhanced safety, greater carbon reduction, and will achieve a higher competitive advantage.[37]

Shippers, carriers, and terminal operators are often at different stages of digital transformation, and therefore achieve different levels of digital maturity. This could mean that while a terminal operator is using a TOS to capture the real-time location and movement of cargo and containers within the terminal, its customers have not reached the level of digital maturity that enables their systems to communicate with the TOS.[38]

The reverse situation is also common. Large shippers and carriers may have sophisticated visibility tools that track cargo from end to end, while small terminals may still rely on legacy systems.

This lack of communication and coordination can generate visibility gaps and hinder operational efficiency.

34 Freightwaves (Mar, 2024) How end-to-end visibility can mitigate effects of supply chain disruptions

35 McKinsey & Company (2018) Notes from the AI frontier: AI adoption advances, but foundational barriers remain

36 Kane, G, C et al., (Jun, 2018) Coming of age digitally

37 Kuo, HM (Sep, 2021) The effects of institutional pressures on shipping digital transformation in Taiwan

38 Freightwaves (Aug, 2016) The container terminal visibility blind spot

A LACK OF CLARITY AROUND DATA OWNERSHIP AND PRIVACY

In the maritime industry, there is often a debate and lack of clarity on who owns the data and therefore how it can be analysed and shared. According to this research, 59% of all respondents believe that both the terminal and the customer own the data, and 24% believe that the terminal owns the data. Only 17% believe that no one owns the data as it lives in the public domain, creating a shared responsibility for its accuracy and timeliness.

Some argue that the terminal owns the data because it controls the physical infrastructure and systems that generate the data. They might view certain operational data as proprietary or sensitive, leading to a reluctance to provide full transparency. In some cases, it may also be difficult for them to see the financial benefit of investing in the technologies and processes needed to provide full visibility to shippers.

One train of thought is that the increased adoption of integrated platforms such as the PCS has blurred the lines of data ownership. These systems are designed to enable data exchange between stakeholders, which could reinforce the perception of shared ownership.

According to terminal customers spoken with as part of this research, doubts around data privacy is the primary reason shippers believe they lack visibility into cargo movement and operational activities. Shippers are hesitant to share or integrate data due to privacy or compliance concerns, which limits collaboration between stakeholders and restricts the flow of critical information needed for end-to-end visibility.

GEOGRAPHICAL FACTORS

The research has also shown that geographical disparities further contribute to the visibility gap. According to the survey results gathered for this research, terminal customers are more satisfied with visibility in North America and Europe with concerns over visibility in Africa and South America.

One reason for this could be that some countries have mandatory technology implementation in their ports, such as PCS. According to a report by the World Bank Group, the United Kingdom, France, Germany, Netherlands, Belgium, Spain, Singapore, Japan, and South Korea are among the leading countries in PCS adoption.[39] Other countries are actively pursuing better visibility strategies but are limited by resources and specialist technical expertise. For example, Brazil's port infrastructure lags behind by approximately 15 years compared to countries with large port complexes engaged in international trade.[40] Challenges include insufficient depth at ports like Santos, limiting the size of vessels that can be accommodated, and a lack of real-time visibility for trucks arriving at ports, leading to bottlenecks and delays. Implementing advanced tracking systems and automating processes could help, but these require significant investment and technical expertise.

Political instability or economic challenges in certain regions can further hinder the implementation of technology solutions or disrupt supply chain operations. Ports with higher trade volumes, resources, and higher levels of interconnected technologies are likely to be more resilient to supply chain disruptions than those with fewer resources.

39 World Bank Group (2023) Port Community Systems: Lessons from a global experience

40 Datamar News (Oct, 2023) Brazilian ports face 15-year infrastructure lag

BRIDGING THE GAP: THE COMPONENTS NEEDED TO ALIGN TERMINAL AND CUSTOMER EXPECTATIONS

A successful visibility strategy lays the foundations for an execution strategy that optimises terminal operations, improves efficiency, and ultimately ensures seamless cargo handling to meet customer expectations. This section explores how supply chain players can better leverage existing and new technologies to build a connected digital infrastructure.

REAL-TIME CONNECTIVITY

Real-time connectivity ensures that all supply chain players have immediate access to relevant data, enabling faster, proactive decision-making. This is crucial for handling delays, such as equipment failures or congestion, and allows stakeholders to adjust schedules or reroute cargo as needed.

Terminal customers require live information to optimise cargo handling and routing, mitigate delays, and make decisions that improve customer satisfaction. For example, a shipper might reroute cargo to avoid congested terminals or adjust downstream logistics, such as warehouse scheduling, in response to a hold up in processing at a terminal. If the terminal experiences a failure in equipment that slows down the transfer of cargo across the terminal, the shipper also needs to know in real-time so that they can make proactive and timely decisions to minimise the risk of delayed cargo. This agility is especially useful when handling time-sensitive or high-value shipments.

Real-time connectivity also supports automated alerts. These have the potential to significantly improve a terminal's visibility success. For example, if there is a delay in unloading due to high vessel volumes, automated alerts to stakeholders allow them time to adjust schedules, reallocate resources, or notify their customers or partners. Another example where automated alerts are critical to the business outcome is in the transport of perishable goods. For instance, a company is importing perishable goods and there are delays, resulting in temperature changes within a container. The shipper needs to be informed immediately so that it can contact the shipping company and potentially reroute its container to a temperature-controlled facility to save the shipment. By using container tracking alerts, all stakeholders involved in that shipment can be made aware of the issues and proactive decision making can be made to avoid costly losses.[41]

Standardised data is foundational for uniting supply chain stakeholders and achieving interoperability.

41 Sinay (Feb, 2024) Understanding different alert types in container tracking

STANDARDISED AND ACCURATE DATA

Robust data validation, cleansing processes, and standardised formats are essential for ensuring accuracy and reliability across the supply chain. Automated quality checks further enhance this by identifying and correcting inconsistencies, helping terminals and shippers avoid errors such as incorrect ETAs or cargo status updates.

Standardised data is foundational for uniting supply chain stakeholders and achieving interoperability. Consistent standards facilitate seamless data flow across applications, ensuring users can trust and effectively utilise the information. By enhancing data quality at the source, data standards eliminate the need for costly, time-consuming data sourcing and cleaning.[42]

Clearly defined access protocols are equally important, specifying who can access what data, under what conditions, and at what frequency. This prevents redundancy, unauthorised access, and ensures stakeholders receive only the information relevant to their operations. Protocols like Electronic Data Interchange (EDI) and API-enabled standards enable swift and consistent data sharing, preventing silos and fostering integrated views of inventory, demand, and transportation. This integration leads to better forecasting, enhanced customer service, and stronger supplier relationships.

It is also important to clarify data ownership to make terminal operators feel comfortable in sharing their data up and downstream.

Dennis Monts, President & Chief Operating Officer of PayCargo Labs told Thetius,

"The more we can stop protecting our information and be open to sharing it, that will help. There's been a real guarded nature relative to what information they want to share because it's considered proprietary."

42 Reimagined Mobility (Apr, 2023) The importance of data standards and interoperability in global supply chains

Thetius asked a Port Authority how they manage their data to ensure it is shared with relevant stakeholders but also remains secure and protected. They ensure that only those on the Bill of Lading (BoL) have access to the information, and each stakeholder only has access to information relevant to their cargo.

Data has the potential to bridge the visibility gap between terminal operators and supply chain players, but a strong foundation is vital. A terminal's data strategy is an ongoing journey. Data must be continuously collected, refined, and used effectively. Thinking of data as a journey can support the concept of "visibility innovation", enabling technologies and strategies that enhance transparency and accessibility.

For terminals, this includes cleaning data, employing AI and advanced analytics, and sharing insights with stakeholders to drive optimal decision-making. Shippers and customers also need modern tools, up-to-date systems, and synchronised vendors to access the right data at the right time.

Ultimately, no matter how high-quality the data is, it must be delivered in real-time to terminal operators and shippers. Without timely data, stakeholders cannot make informed decisions about cargo status, equipment availability, or operational delays.

INTEGRATED SOLUTIONS

While tools used in isolation can be useful for providing visibility to those in the immediate community, in order for this to be transferred up and down the supply chain, solutions need to be integrated to enable seamless connections and transparent, data-based decision-making. For example, terminals can integrate visibility data and container tracking API into a Transportation Management Systems (TMS).[43] This is fundamental for companies managing complex, multi-node supply chains

that require real-time tracking and execution tools across diverse logistics activities.

From 1st January 2024, the International Maritime Organization (IMO) made it mandatory for member states to use a single, centralised data platform known as a Maritime Single Window (MSW) to collect and exchange information with ships when they call at ports.[44] This means that crews can now submit a single report instead of multiple ones, simplifying the process. Integrating other systems like a PCS to the MSW further streamlines the process by enabling automated report generation and submission based on data that exists within the PCS. This ensures seamless data flow between vessels, ports, and authorities, further streamlining the entire port call process.[45]

According to the World Bank Group, the overlap between systems such as PCS, MSW, and TSW systems is critical for supply chain visibility.[46]

43 Visiwise (Dec, 2023) How to use visibility platforms: an ultimate guide for freight forwarders

44 IMO (accessed Nov, 2024) Maritime Single Window

45 Lloyd's List (Nov, 2024) Linking port community systems with the Maritime Single Window

46 World Bank Group (2023) Port Community Systems: Lessons from a global experience

To extend visibility across the broader supply chain, these solutions must be connected to a TOS or a DaaS platform, which enables real-time tracking and execution tools for more comprehensive operations visibility. When connected to a Data-as-a-Service (DaaS) platform, these other systems can translate operations visibility as a useful by-product. This is necessary for companies managing complex, multi-node supply chains that require real-time tracking and execution tools across diverse logistics activities. This is critical for building trusted relationships.

Another reason for integrating data sources and infrastructure is to enable scaling. Different technologies and solutions scale in different ways. If data suddenly increases for one system, it needs to be able to scale because system failure is not an option.[47] An integrated and connected platform approach enables systems to be scaled.

Trading partners and technology companies should therefore prioritise integrations and maximise the use of existing solutions to build a digital infrastructure that supports operational visibility.

LEVERAGING TECHNOLOGY TO ITS FULLEST POTENTIAL

As the survey and interview study found, technologies used for terminal operations visibility are underutilised, limiting the seamless flow of data and information between stakeholders. Better execution therefore requires users to take advantage of the full capabilities their existing technologies offer.

Proven modern solutions are available today. They have served their purpose for many years. It is not about rolling out more solutions but ensuring that everyone who will operate them has a full understanding of their capabilities and how to use their

Another reason for integrating data sources and infrastructure is to enable scaling.

different functions. But it's also important to think about their future capabilities. Picking a vendor that is committed to continuous upgrades that enable you to access the visibility innovation is a good first step.

In order to use 100% of the software available, people need to be placed at the centre. This can be done with the right approach to training. People often emphasise the importance of training, but it's crucial to focus on tailoring it to meet specific needs and requirements, rather than simply offering training as a check box exercise.

Providing training for employees and external stakeholders on using new visibility tools, understanding data analytics, and managing automated workflows is essential to maximise technology adoption. This not only enables them to use the tools effectively right away but also equips them with the skills to adapt to future updates and new features.

A balanced approach is needed, focusing on both adopting new solutions and optimising existing systems.

A UNIFIED PLATFORM

A unified execution platform connects multiple nodes in the supply chain network by integrating data from multimodal systems, such as a TMS, YMS, WMS, and more. It serves as a single source of truth for all supply chain players, facilitating transparent, data-driven decision-making. Its main purpose is to provide holistic end-to-end supply chain visibility via integration execution features.

47 Builtin (Jun, 2024) Without this component, your AI solution is useless

Think of a grand hall that holds concerts with thousands of people in attendance. The hall provides the space and structure that brings the musicians together and enables them to interact. A PCS is similar. It provides the space for stakeholders within the port community to gather and share critical information.

Now think of the conductor in an orchestra. The conductor has a holistic view of the entire performance and makes sure everyone does what they are meant to do at the right time. They guide the players, keeping everyone in sync and making adjustments in real time to facilitate a seamless performance.

A unified execution platform is like the conductor. It provides a complete view of each system's behaviour, generates real-time insights, and synchronises operations across the supply chain. This ensures visibility and execution across terminals, transportation modes, and warehouses.

One example of a unified platform is Kaleris' Execution Visibility Platform (EVP). The cloud-based logistics solution acts as a DaaS delivering relevant cargo movement data among TOS, YMS, TMS, and Maintenance and Repair Systems. By connecting relevant supply chain players to real-time operations data sharing, it facilitates proactive decision-making based on live information. This drives better execution at each node by ensuring all parties have access to and can act on the same data.

This integration provides stakeholders, including shippers, carriers, terminals, and asset owners, with real-time visibility into cargo status. This enables them to drive predictable, timely operations and take prompt action to reduce dwell times, demurrage, and impediments. Terminals can reduce rehandling moves, container dwell time, and truck and rail turnaround times to increase productivity. Carriers and asset owners can increase asset maintenance and performance, maximise revenue per trip, reduce operational costs, and deliver better service to shippers.

By connecting operational data to workflows within the execution ecosystem, the platform reduces non-productive moves, increases operating visibility to shipment status and operating events, and improves planning and scheduling to enhance efficiency and utilisation.

SLAS AND KPIS

Terminal operators can build trust with their customers by enhancing service levels through Service Level Agreements (SLAs). Customers prioritise fast turnaround times and minimal delays. Consistency is essential to establish trust between stakeholders.

SLAs and Key Performance Indicators (KPIs) enable terminal operators to measure, track, and communicate the quality and reliability of their services. This ensures that customers receive the standards of performance they expect. For example, an SLA might set a specific target for container processing times, while KPIs could track the frequency of on-time deliveries, allowing customers to see tangible evidence of the terminal's reliability and efficiency.

ARTIFICIAL INTELLIGENCE

A decade ago, AI's role in terminal operations was largely centred around basic automation for planning and monitoring. Applications focused on assisting crane scheduling to increase yard efficiency and predict equipment breakdowns. These tools were helpful but limited in scope.

Today, the AI landscape has evolved significantly. Driven by advances in machine learning, real-time data processing, and IoT integration, modern technologies can continuously analyse vast data sets from IoT-enabled devices, offering insights that help supply chain players quickly spot patterns in the logistics supply chain that a human might miss. This provides the opportunity for predictive analytics and better road maps to improve efficiency in the movement of goods.[48]

AI can be useful in a terminal's execution strategy as it can support the interoperability of systems. The technology can be used to integrate data from a TOS, YMS, and TMS, creating a unified view of operations.

In Kaleris' EVP, AI and machine learning are used in numerous ways, including the optimisation of berth plans and yard space, and to reduce travel distances based on vessel arrival schedules. In industries like food and perishables, where timing is critical, having AI-driven insight enables terminals to take proactive measures to prevent spoilage, ensuring that goods arrive fresh and intact.

In the future, AI has the potential to revolutionise process automation. It can support automatic data exchange at larger volumes, which is critical in operations visibility. Terminals can further enhance their notification engine of key events, using AI-powered notifications, such as container arrival times, delays, or customs clearance; AI can help further enhance customer trust. Shipping lines and downstream shippers that feel assured they will receive access to timely, relevant updates will likely be more satisfied with their terminal's services than those that have to keep chasing multiple parties for updates.

AI and ML are technologies that enable systems to analyse vast amounts of data, learn patterns, and make predictions and decisions with minimal human intervention. Kaleris have an AI engine that leverages advanced algorithms to solve problems, while ML, a subset of AI, focuses on enabling systems to learn and improve performance over time through data. Kaleris are looking at these technologies to drive efficiencies in our operational tools, improve decision-making in our execution software, and to potentially unlock new capabilities.

In the shipping and logistics software industry, particularly in the marine space, AI and ML are having a big marketing impact, these are the new "buzz words". Just as previous "buzzword" technologies, AI and ML are being utilised to optimise container terminal operations, predict cargo flows, enhance safety measures, and improve equipment utilisation.

48 FreightWaves (May, 2021) Viewpoint: The causes of port congestion — and tactics to improve efficiency

By using AI, terminals and software vendors are addressing key pain points such as congestion, resource allocation, and supply chain visibility. This wave of innovation is enabling marine operators to achieve greater operational precision and customer satisfaction.

The risk of AI is that it feels like a hammer looking for a nail. Kaleris' strategy for integrating AI and ML into their software solutions is to work closely with their lighthouse customers to identify the most pressing challenges that are well-suited for AI-driven solutions. This approach ensures that focus is on problems that are both impactful and solvable through AI. By collaborating with strategic partners and leveraging real-world use cases, Kaleris are aiming to validate their AI solutions, refine their models, and ensure practical, measurable benefits for their customers.

A WORLD WHERE MORE TRUCKERS USE DRAYAGE TMS

A world where more truckers used drayage TMS would make the great divide less painful. This is because a TMS serves as a digital link between the Marine Terminal TOS and the shipper world. The world of Logistics is complex, with dozens of transportation arrangements, from door to door, to port to door, from 3PLs to Freight Forwarders, to multiple freight providers based on region and redundancies. Because of that, in most cases Shippers are not looking to interact directly with marine terminals; they request visibility information from freight providers who in turn, request visibility information from truck and dray companies. A world where truckers had a digital asset such as a TMS, truckers could provide better visibility to freight providers, reducing the pain of the great divide.

The adoption of a TMS by trucking and dray transportation companies offers significant benefits, particularly in an era where the pain of the great divide is magnified from the effects of inflation. A TMS serves as the backbone of transportation operations,

The world of Logistics is complex, with dozens of transportation arrangements, from door to door, to port to door, from 3PLs to Freight Forwarders, to multiple freight providers based on region and redundancies.

providing truckers with tools to streamline processes, enhance visibility, and drive cost efficiencies. These benefits are evident for companies of varying sizes, although the specific advantages and implementation strategies differ between large and small truckers.

For large trucking companies, the value of implementing a robust TMS is clear and often justifiable from an ROI perspective. These organisations manage extensive fleets and high volumes of shipments and containers, requiring sophisticated systems to coordinate operations across multiple routes, drivers, and schedules and often geographies too. A TMS enables these companies to optimise route planning, reduce fuel consumption, and improve asset utilisation. Additionally, advanced features like real-time tracking, automated load matching, and integrated billing systems minimise manual effort and the risk of errors, and are the exact digital capabilities needed to reduce the pain of the great divide. The scalability of a comprehensive TMS also supports the growth of large enterprises, ensuring their operations remain agile and efficient as their customer base and geographic reach expand.

For smaller trucking and drayage companies, the case for a TMS may initially appear less compelling due to budget constraints and fewer operational complexities. However, there are light TMS products in the market place tailored to small-scale operations and they provide a cost effective solution.

These “light” systems offer essential features such as basic route optimisation, shipment tracking, and invoicing, enabling smaller companies to compete effectively in a highly competitive market.Again, reducing the pain of the great divide. By automating routine tasks, small businesses can save time, reduce administrative overhead, and focus on delivering superior service.

As mentioned before, for the great divide, one of the most critical advantages of a TMS for both large and small companies lies in its ability to integrate seamlessly with marine terminals’ TOS. This linkage can create a more unified environment that connects shippers to trucking companies, and use marine terminals’ data, ensuring smoother coordination of container movements. By establishing a digital bridge between the TOS and the transportation provider, downstream shippers can receive real-time updates on container availability, automate gate appointment scheduling, and reduce dwell times at terminals. This integration not only enhances operational efficiency but also improves customer satisfaction by providing greater transparency and reliability in container transport.

Ultimately, the implementation of a TMS is not merely a technological upgrade but a strategic enabler that aligns transportation companies with the demands of modern supply chain networks. Whether through a robust system for a large enterprise or a scaled-down version for a smaller operator, a TMS empowers companies to deliver efficient, transparent, and cost-effective transportation services. Most importantly, it ensures that critical supply chain links between marine terminals, drayage providers, and shippers are tightly connected, facilitating the seamless movement of goods and reducing the pain of the great divide.

CONCLUSION AND RECOMMENDATIONS

This research has highlighted the disparity in connectivity perceived between terminals and shippers. While terminals have advanced technology to provide sufficient operational transparency, shippers feels the visibility they receive falls short of their needs. 87% of terminals we surveyed think they provide adequate, good, or very good visibility. In contrast, approximately 25% of shippers think they receive good or very good visibility.

Terminals and shippers report that they only use 60-75% of the available functionality of their execution systems; 40% of those same terminals and shippers report that they have lost business because of this.

The capabilities of existing technologies are not always realised. In some cases, this is simply down to a lack of understanding of the system's full functionalities. In other cases, it's due to the interoperability that exists between systems. While advanced tools and platforms do well to enhance visibility in each node of the supply chain, these technologies rarely work well together. The lack of interoperability between systems triggers the silo of data, which leads to gaps in communication between today's key supply chain technology systems. This interoperability also means that data and information ultimately end up transferred manually, which stifles productivity.

Addressing these challenges requires an approach that focuses on both leveraging existing solutions and connecting platforms to drive a more integrated digital ecosystem. Trading partners and technology companies that use as close as possible to 100% of the capabilities of their existing technology and prioritise integrations will drive a connected digital infrastructure across systems and partners. Rather than focusing solely on acquiring new systems, organisations should prioritise investing in ways to fully leverage and optimise their existing technology. This requires investing in the people that are required to understand and operate these systems.

This requires investing in the people that are required to understand and operate these systems.

Visibility platforms alone are not sufficient to resolve the challenges facing today's supply chains. While they provide the foundation for understanding operations, a resilient and agile supply chain requires stakeholders to adopt an end-to-end visibility approach that enables actionable insights that are deeply integrated with execution. By using platforms designed to work together, supporting interoperability, and prioritising the full utilisation of existing technologies, the industry can move towards a more connected and resilient digital ecosystem.

The following recommendations have been made to help bridge the visibility gap between terminals and their customers and ultimately enable better execution.

01 ASSESS CURRENT TECHNOLOGY CAPABILITIES

As with any project, the first step is to assess the current situation. The well-known saying, 'what gets measured gets improved,' holds true for terminal operators and shippers seeking to improve operations. But you can't measure what you can't see, and therefore you can't make decisions on information you don't have.[49] Terminals and shippers need to first determine if their technological solutions are appropriate to enhance their operational execution. It may be that that there has been investments in visibility solutions for one particular, siloed benefit, but these solutions lack the connection to other systems to be a successful foundation for advanced analytics, AI and visibility.

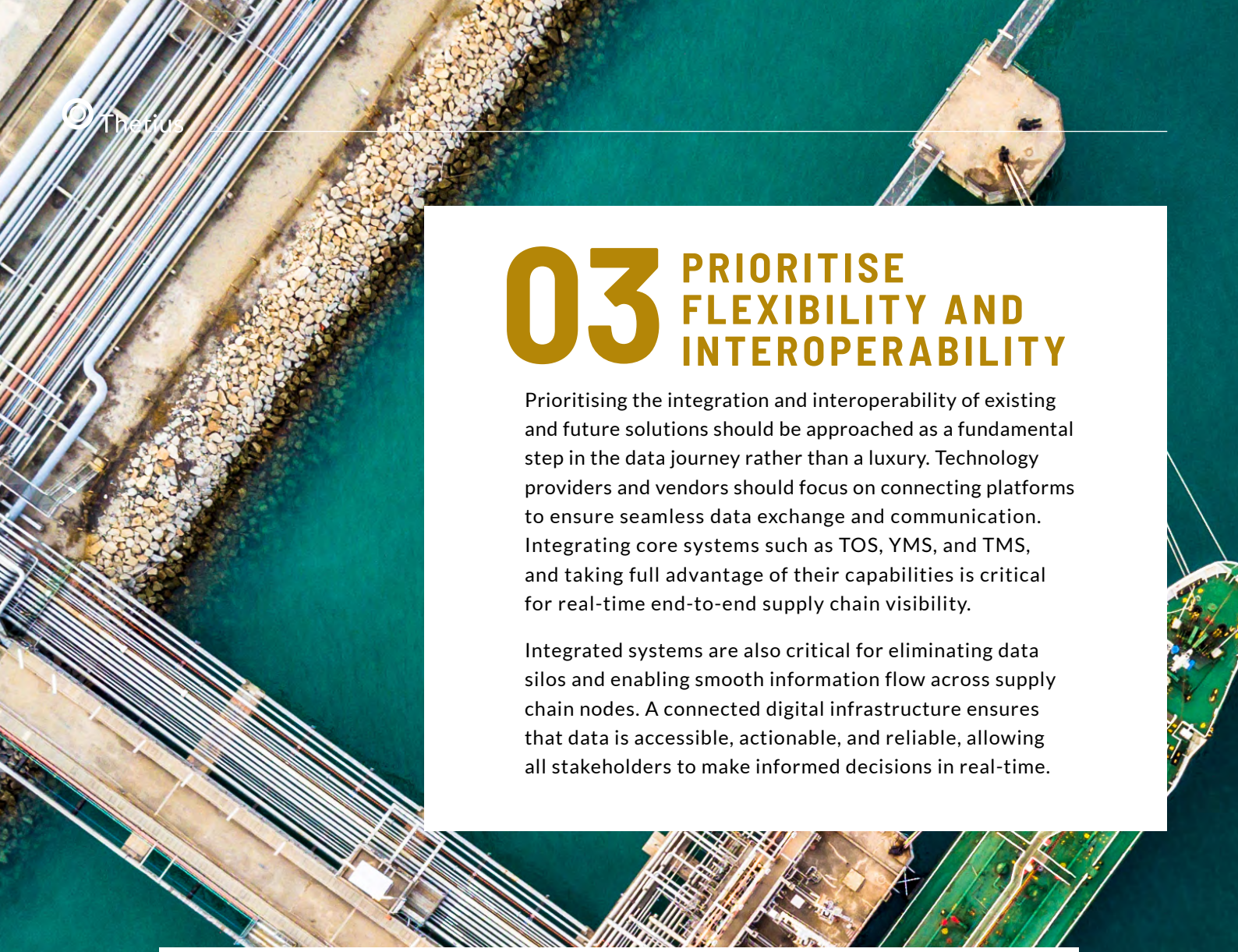
Terminal operators and shippers must therefore assess the technologies and critically analyse where the tangible benefits are being generated. Are these technologies a good foundation for an advanced data strategy?

02 DEPLOY PROVEN SOLUTIONS AND STRIVE TO USE 100% OF THEIR CAPABILITIES

Once you have mapped your organisation's critical needs and identified where the gaps lie, investing in simple but proven solutions to start addressing these should be the first port of call. There are a myriad of solutions that exist today that can improve terminal operations both within the terminal and up and down the supply chain. One of the most simple steps that can be taken is to deploy proven solutions that enable real-time tracking and alerts such as IoT sensors and advanced analytics. These technologies are widely available, do not require huge investment or overhaul, and provide good results.

The second part of this is to ensure that the capabilities of these proven solutions are maximised. Pick a vendor that will help you to fully understand the functionality of your technologies and be willing to adapt these as your needs expand. It is also important to invest in your people to fully execute your data strategy. Encourage people to actively engage with the technologies they use and explore their full capabilities, as they may discover untapped potential. This approach can also help reduce the likelihood of digital friction, or the unnecessary effort an employee needs to exert when using advanced technology.

49 Alvarenga, R (Oct, 2022) for Port Technology International. Connected, intelligent & resilient: a sustainable new supply chain landscape



03 PRIORITISE FLEXIBILITY AND INTEROPERABILITY

Prioritising the integration and interoperability of existing and future solutions should be approached as a fundamental step in the data journey rather than a luxury. Technology providers and vendors should focus on connecting platforms to ensure seamless data exchange and communication. Integrating core systems such as TOS, YMS, and TMS, and taking full advantage of their capabilities is critical for real-time end-to-end supply chain visibility.

Integrated systems are also critical for eliminating data silos and enabling smooth information flow across supply chain nodes. A connected digital infrastructure ensures that data is accessible, actionable, and reliable, allowing all stakeholders to make informed decisions in real-time.

04 BETTER EXECUTION LEADS TO BETTER VISIBILITY

This research has uncovered that much of the time, poor visibility is due to poor execution, rather than the absence of solutions. Visibility tools can provide great insight into the operations happening in different supply chain nodes, but this visibility often fails to be transmitted across various segments of the supply chain.

Implementing visibility systems without considering how they will communicate with systems in other nodes could limit the insight that is achieved. Visibility tools should prioritise collective transparency. To do this they must be integrated with execution platforms. This will help to drive meaningful outcomes that can be measured with advanced analytics tools.

05 PRIORITISE THE THREE CS: COLLABORATION, COORDINATION, AND CHANGE MANAGEMENT

Executing on a successful data strategy, to achieve outcomes like enhanced visibility, is about more than just enabling greater data flow between systems. It's about connecting people. The relationship within an organisation and how this extends to its customers is fundamental to a successful data strategy.

Coordination and collaboration are necessary to capitalise on the benefits of a successful data strategy. Focus on building trust with partners and fostering collaboration. This avoids zero sum game situations and creates business partnerships with win-win outcomes. At the end, better execution solutions will contribute to a better data strategy that can improve areas such as alert systems, ensure better communication, and strengthen the connection between terminal and shipper operations.

Top management is responsible for setting and communicating a clear vision throughout the organisation.

When implementing any new tool or system, it's important to prepare the people that will be using it. It might be a challenge to secure buy-in from all areas of an organisation, but taking the time to understand their concerns or reluctance will build trust and reduce the risk of digital friction.

Identify why people are reluctant to use a new or existing tool. Are they unsure how to use it? Do they worry it will replace their role and responsibilities? This is especially true with increasing digitalisation and automation; areas that must be carefully navigated to ensure acceptance and engagement.

Strong leadership and guidance around using current technologies or adopting new ones are essential to maximise their value. Top management is responsible for setting and communicating a clear vision throughout the organisation. Without a well-defined plan for how this vision will be realised, efforts may become redundant. Organisations need to be careful when increasing visibility as it can overload people with information. According to McKinsey, this can in some cases lead to an accountability gap where information is shared with people who do not use it as wisely as they could.[50] The success of technology adoption and effective use ultimately depends on individuals and their understanding of not just the solution itself, but its role in achieving the organisation's goals.

By implementing a structured change management process, the transition to new solutions or the better use of existing ones can be made more smooth. Placing a focus on clear communication, setting expectations, and addressing existing or anticipated resistance to change can also help to minimise digital friction.

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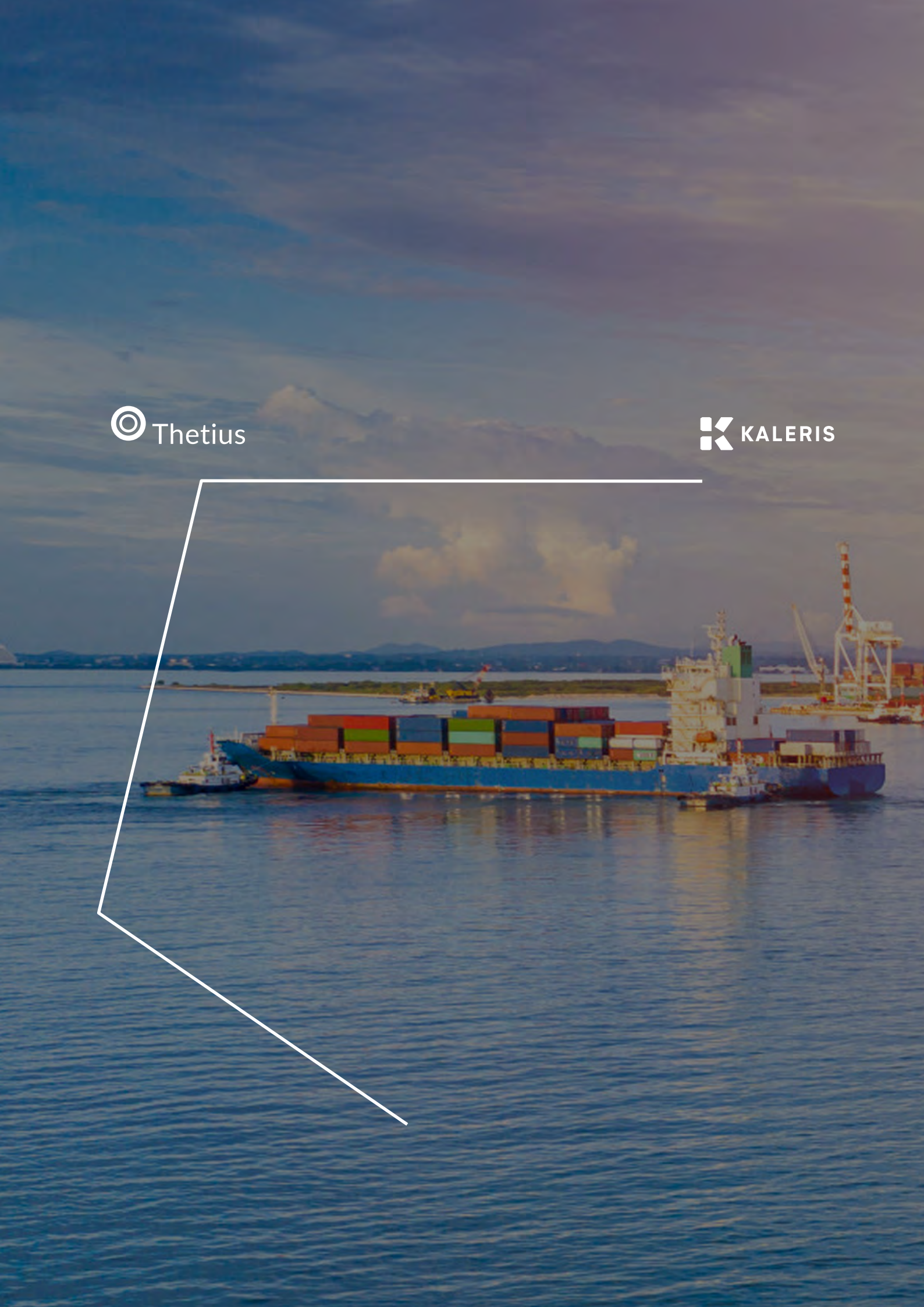
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