

Smarter ports for a safer future

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The TT Club's October 2025 very first **Port Authority Bulletin** highlights the need for seaports to leverage collaboration, digitalisation, and real-time data to strengthen safety, efficiency, and environmental performance to address growing challenges in the sector. Ports have been dealing with a mix of tough challenges, which have pushed them away from working in isolated, reactive ways toward more connected, data-driven approaches. These changes reduce risk, streamline vessel handling, support predictive planning, and cut emissions – demonstrating how innovation and shared responsibility make ports safer, more resilient, and more sustainable.

Port authorities are operating in a far more unpredictable environment than in previous decades. Geopolitical tensions, evolving fuel requirements, larger vessels, increasing digitalisation, and the effects of climate change have all been reshaping how modern ports must plan, invest, and run their operations.

Catching the wave of change

To stay ahead of the evolving circumstances, ports have to review supply chains more closely, ensure reliable access to needed products & services, and adjust commercial agreements to reflect changing market conditions. Shifting global circumstances and trade routes have pushed cargo onto alternative corridors, at times creating congestion and putting additional pressure on ageing infrastructure.

Rising tariffs have made hardware more expensive to service, while the worldwide, as well as the sector's, shift to low-carbon fuels has pushed ports to support clean power for neighbouring regions, visiting ships, and their own equipment. That means expanding shore-power capability, electrifying heavy-duty machinery, and developing facilities to serve offshore wind, carbon capture, ammonia, or hydrogen.

At the same time, vessel dimensions, particularly in the container and cruise markets, have increased so much that some older ports are struggling or are unable to accommodate them. This adds challenges for berth layout, channel depth, turning basins, and emergency planning.

On top of that, as technology keeps advancing, more ports are turning to smart tools like connected sensors, automation, and artificial intelligence (AI). These

systems help operations run more smoothly, cut emissions, and make day-to-day work more reliable. However, these tech upgrades require significant capital, new skills, and robust cybersecurity, where international cooperation becomes critical to harmonise standards and achieve efficiency.

Climate change adds yet another layer of risk with rising water levels, stronger storms, and more frequent heatwaves threatening infrastructure, equipment, and workforce safety. Ports are forced to rethink design for drainage, wind limits, and resilience of critical assets, plus use climate projections to better protect the ship-shore infrastructure.

Some ports also operate not-always-afloat-but-safely-aground berths, where vessels intentionally settle on the seabed at low tide. While these help ports with limited dredging capability or large tidal swings, they come with very specific hazards.



Photo: Canva

Uneven seabeds, shifting sediment, storm damage, and hidden debris (such as dropped cargo) can all harm a ship's hull. Therefore, regular, high-resolution surveys are essential, as is timely dredging and levelling based on accurate data. Clear procedures for investigating and clearing any dropped cargo are crucial to avoid hull claims, delays, and liability disputes. When these berths are managed carefully, they offer a practical and economical solution for some ports.

When the lights go off

Power outages are no longer rare events across the world. AI data centres, ageing electrical networks, a reliance on digital workflows, or the growing complexity of mixed-generation energy systems mean that outages have become more common and disruptive. For ports, where both safety and continuity are critical, the ability to handle a sudden loss of electricity has become an essential part of risk management. In some cases, the safest option might be a controlled shutdown, which also requires planning, practice, and clear procedures.

Power failures originate from minor to large-scale glitches. Maintaining stability has become more challenging as national

grids have to balance a blend of traditional and renewable power sources. Weather extremes further increase the risk – many substations were never designed for today's heatwaves, heavy rains, or more violent storms, leaving them exposed to failures when the grid is under stress.

Modern ports depend heavily on electrical systems, automation, and cloud-based tools. When power goes out, access to operational data, emergency protocols, and communication channels can disappear instantly, and even more concerning, sudden power shortages can damage equipment. Regional outages come with additional complications. When an entire area is without power, demand for generators, fuel, and specialised electricians skyrockets. Also, in an outage, emergency services come first, leaving ports at the back of the queue for essential support.

Strengthening resilience is dependent on understanding priorities. A thorough review of critical systems will highlight which functions cannot be offline for long and which can tolerate interruption. This assessment should be a guide in determining how quickly to respond when the grid fails and how much investment should be directed to backup solutions.

Digital redundancy is equally important. Key documents, operational checklists, and emergency contact information must be on platforms that are still reachable in the case of the failure of the primary networks. Parallel servers, alternative domains, or more common tools like QR codes (as long as mobile networks are still up and running) can keep essential information within reach. Also, uninterruptible power arrangements are a must, such as access to generators, batteries, and sufficient on-site fuel, in addition to manual pumps to transfer fuel if equipment is inoperable.

But resilience is not just about powering through, and sometimes halting operations is the safest choice. Therefore, staff need to be trained to recognise when continued work becomes unsafe, such as inside dark, unventilated areas without alarms or sprinklers. Lifting operations, which may stop mid-movement, require emergency lowering systems and well-practised fail-safes. Closing entry gates may also be necessary to prevent uncontrolled traffic jams from affecting nearby communities. Because telecom networks may fail during a widespread blackout, ports should have backup communication tools ready to use. VHF



Photo: Prima Shipping Group

radios, battery-powered sets, and printed emergency plans ensure teams can still coordinate even when screens and servers go offline.

Being prepared is one objective, but recovery is equally challenging and important. High-voltage systems must be brought back online carefully to avoid damaging older cables or equipment. Without regular drills, the restart phase can take far longer than is necessary. Managing the flow of vehicles is another concern, as when operations resume, ports may have long queues of trucks waiting to enter. Open communication with drivers, customers, and regulators will be essential to restoring operations and avoiding bottlenecks.

Equally, staff wellbeing is a central part of recovery planning because extended outages may affect access to water, food, or payroll systems. Keeping the workforce informed, supported, and safe during lengthy disruptions is key to maintaining morale and ensuring a smooth return to business as usual.

Pushing the limits

Ports worldwide are seeing rapid growth in project cargo, particularly components for off- & onshore wind developments.

Project cargo can be everything from wind turbine towers and blades to power-station generators, substation modules, bridge segments, and other heavy break-bulk. These shipments bring clear commercial opportunities, but they also introduce unusual stresses on port layouts, equipment, and personnel. Because these loads are often very heavy, oversized, and unfamiliar, they can cause damage, operational disruption, liability claims, and injury risks. Many of these pieces exceed the handling assumptions on which especially older ports were originally designed. As new technologies emerge, terminals may be asked to move equipment they have never encountered before, sometimes using vessels with deeper drafts or restricted manoeuvrability.

For ports, the greatest danger is unintended oversteering of infrastructure. Quays, pavements, culverts, utilities, and even bridge decks can be damaged if ground pressures from cranes or self-propelled modular transporters (SPMTs) exceed the limits of the structure, or if age has weakened it. Misjudging the effect of specialist lifting equipment can lead to failures, and unusually large ships can also pose hazards if they are unsuited to the port's navigational profile.

Project cargoes can also block normal traffic flows. SPMTs move slowly and require wide, carefully managed routes through the port and surrounding roads. Large laydown areas are needed for storage and assembly, and heavy-lift cranes often take up considerable space during build-up and dismantling. These activities can disrupt everyday port operations.

Safety is of great concern as well. Dockworkers may be unfamiliar with the load types or lifting methods, while specialist contractors might be familiar with the cargo but not the port, which is a hazard on its own. Therefore, coordinating all parties is essential to avoid errors.

Each operation demands a thorough technical assessment, detailed planning, and unambiguous contractual terms. Before agreeing to a project lift, ports need a solid understanding of the relevant national lifting regulations and accepted industry practices. Contractors must provide assessments of their crane loads and how these will affect the quay, but importantly, ports should not rely only on the contractor's view. Additional engineering checks, especially for bearing pressures and ground stability, are also necessary.

Method statements and risk assessments must address every step, including crane

