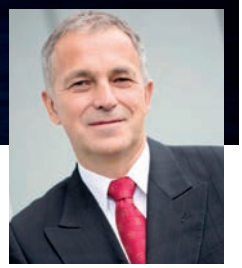

# INTELLIGENT BULK PORTS

## UNLEASHING THE DYNAMISM

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Why is it that progress in information technology generates so much excitement in the container shipping industry, yet hardly gets any press when it comes to bulk? If you attended any shipping conference dedicated to bulk, all you get are long discussions on rates, vessels, China commodity import trends of that particular moment, and more discussions on rates.

Any bystander at those conferences would think that bulk shipping is the most boring business in the world, yet bulk shipping is not immune to the onset of technologies that only a decade ago would be considered a flight of fancy. This tidal wave of technological innovation will be harnessed for the benefit of the ports, transporters, logistics companies, and the shippers.

The ports must use the technology to address a variety of competing objectives: efficient management of diverse cargo and the maximizing of land use while minimizing land use conflicts and environmental impacts, provision of efficient transportation systems for the movement of goods in/out of port's area, and improving existing processes to gain efficiency and reduce spending.

With so many objectives, artificial intelligence (AI), a term confusing many people in the industry, will play incredibly large role. Keep in mind that advanced software is known as "artificial intelligence" only until it becomes a casual part of everyday life. What was once imagined was the type of fancy only a human port planner could deduce. Yet notions such as determining the fastest way to unload a ship and move commodities off terminal lost its AI moniker once the TOS could do it as a matter of fact.

Nonetheless, AI is and will continue as a game changer in all logistical operations. It is already having some impact, but the commonly cited examples hardly show off the full application and potential of AI. The industry's attention is still focused on point solutions, often zeroing in on increasing equipment efficiency, rather than reimagining the problem and the optimal, holistic solutions to address it.

### MACHINE LEARNING

The point solution approach is partly driven by the machine learning (ML) technology underlying AI. ML is a process by which an advanced software system trains itself based on a set of historical examples, rather than being explicitly programmed with algorithms created by humans. ML-based applications get better as they acquire more data to train on and are programmed to modify their behaviour to meet specified objectives based on patterns discovered in the data set.

Modern ports and ship operators use ML applications to optimize equipment maintenance and for preventative repairs. Cost savings might not be stellar, but in operations, every dollar saved is a dollar that drops to the bottom line.

### HOLISTIC A.I.

However, looking holistically at terminal operations, a much better case for AI is not just finding potential faults in advance, but solving issues adversely affecting effective port calls and the transfer of commodities between the ship and land. Leaving AI to

figure out the best plan for port access optimizes equipment uptime, maximizes efficiency, reduces cost (for the port and their customers), and creates an excellent customer experience.

In this article, I use the example of coal supply chain, but similar solutions have been implemented in grain and chemicals bulk shipping.

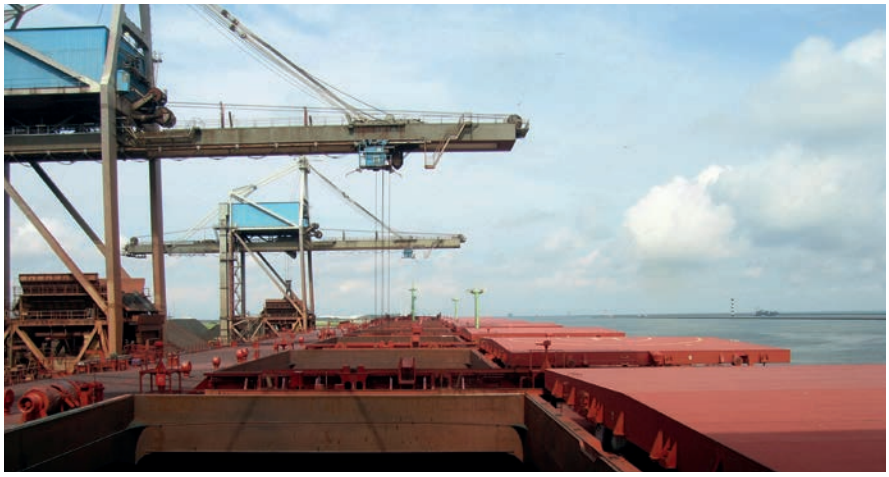
An outbound coal terminal moving 150 million metric tons of coal a year through their 10 double-sided berths provides a good model for understanding how AI works at the chain level, rather than in a functional silo. The port is connected to an extensive network of 2,500km of rail track linking the port to the coal mines in the hinterland. Inbound trains and outbound ships are coordinated from a single control room. Today, the operator is still more confident to keep the control room near the grounds of the terminal, a mile away, but the reality of automation is that a "control tower" could easily be in a bunker 1,000km from where the action takes place.

At any time a 60-car train is being unloaded, while 20 odd ships are concurrently loaded, we are easily exceeding human operator capacity for rapid decision making. Depending on the coal's chemical properties, an algorithm decides where the newly arriving coal will be stored and how big/high the pile can safely be to prevent self-ignition.

On the berth, the algorithm tries to meet the agreed berthing window, while deciding on the most efficient loading path between the ship and the coal piles spread around the port yard. Only exceptional events derived from calculating data reported by the machinery are conveyed to the human controllers for reaction.

Full automation of the whole process of coal transport from the mining pit to the port and from the port to the steel plant is only a short step away. Australian mining companies demonstrated that with removing drivers from their trucks and turning their attention to running driverless trains between the mines and the ports. No need for multiple control centers, as human decisions can be replaced in entirety by algorithms synchronizing customer mine production with yard capacity, ship arrival/departure schedule, railcar dumpers work rate, and vessel loading rates.

Over the water, an inbound mixed bulk terminal is receiving about 20 million metric tons of commodities. Constrained yard space demands absolute efficiency in allocating berths, use of temporary storage, and transshipping the commodities through a rail, road and short sea network. Optimization of each resource (berth, yard, rail ramp, etc.) on its own would be an exercise in futility. Instead, a machine uses



data provided by shipping companies, rail companies and shipper demands to shape the most efficient flow of commodities through the port. The algorithm solves a freight routing problem aimed at assigning optimal routes to move commodities through a multimodal transportation network accessible to the port. The algorithm considers multi-commodity flow routing, schedule-based rail services and time-flexible barge and road services, as well as strict carbon dioxide emissions regulations given its proximity to the densely populated areas.

## THE IMPACT OF A.I. IN BULK

The cost of integrating AI into a port's operation might not be low, but it offers long lasting efficiency gains. The same automation also has a profound impact on the efficiency of the workforce. Computer-driven automation removes the need for downtime due to shift changeovers, meal breaks, toilet breaks, or medical situations. With humans away from the direct controls, automated precision of equipment movements reduces wear and tear, as well as fuel consumption. The next time you see a human driver gunning their front-loader around the coal yard, you will know what I mean.

Shipping companies should not stand by and watch as things develop. One area they can involve themselves is while vessels are being loaded, the trim control is still in the hands of the vessel's crew and thus aided by a ship's computer, but why not have standard interface to the port control tower and let that synchronize the ship's trim controls with onshore loading equipment control? Also, on approach to unloading at a port, why not allow port control AI takeover control of the vessel speed and positioning for an efficient berth and yard/inland mode utilization?

How effective is the investment in AI-based automation, a reliable data communications network, and the implementation of advanced optimization applications? Results so far suggest the annual revenues from extra capacity and better port usage equal about 5 times that of the investment made. This is worth keeping in mind next time you analyze the ROI of your port technology investments.

## ABOUT THE AUTHOR

Kris Kosmala brings many years of extensive global experience as a business operations executive in the services and technology industries. He is a senior member of management team at Quintiq, a software company specializing in development and provision of advanced mathematical optimization software used in all aspects of planning and scheduling.

## ABOUT THE ORGANIZATION

Too often in large organizations, planners and managers are disconnected in their planning decisions. Many organizations are overwhelmed by the number of spreadsheets they're using to make sense of it all. Quintiq brings it all together. It's one planning system to cover every aspect of planning, from long-term strategic plans to short-term schedules and disruption management. Every department and every user can customize the interface and the information visible to suit preferences and requirements. Plans are updated in real-time for company-wide transparency and collaboration.

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