

**“WE NOW UNDERSTAND
ON A VERY PERSONAL LEVEL
HOW THE AVAILABILITY OF GOOD
DATA IS ESSENTIAL FOR
PLANNING FOR THE FUTURE.”**



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THE BEST INSIGHTS COME FROM COMBINING DATA WITH PERSONAL EXPERIENCE

EXAMPLES OF ARTIFICIAL INTELLIGENCE / MACHINE
LEARNING (AI/ML) AIDED DECISION MAKING IN
CONTAINER TERMINAL PLANNING PROCESSES

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Some people believe that planning for the future is a waste of time, as unforeseen events and dynamics at play will impact any attempt at accuracy. While this may feel like the case in our personal lives- think of the Covid-19 pandemic- this may not be entirely true for container terminals. In this paper, we will share examples of how predictive visibility can become a part of everyday planning processes and support expert users to make even better decisions.

Container terminals are dynamic environments and operators face a variety

of planning and optimization challenges. In our work with planning and execution teams, we have seen the importance of automation and use of advanced equipment optimization solutions to enable improved results, better safety, as well as improved user experience. And now, with the use of artificial intelligence and machine learning techniques (AI/ML), cloud technology and terminal operating system (TOS) data, we foresee a wave of innovation approaching with many different use cases that can be addressed. We

want to share our insights on two specific use cases we have been working on.

BERTH PLANNING

The first use case is berth planning. Determining where to berth a vessel along the quay can be a complex task due to multiple dynamic variables to consider. These variables span from physical berth and equipment availability, to crane operational ranges and heights, safety margins, the planned units current and future movements, all the way to port stay specific requirements like required

crane intensity. Factoring all of these for one or two vessel visits at a time may be feasible for a human brain to do, but once a person is managing ten or more upcoming vessels, the decision making gets complicated fast. Sub-optimal plans have a direct consequence on important operational KPIs. Berthing a vessel with a large call size on a poor, or less than optimal position can result in tremendous and often avoidable costs. Recent pilots we have conducted indicate the costs associated with the horizontal transport of containers could be reduced by up to 20%.

There is a lot that can be learned by collecting high quality Terminal Operating System (TOS) data for berth, vessel visits and yard operations and using AI/ML techniques to continuously seek insight and improvement. At Navis, like good meteorologists relentlessly using data to improve daily weather forecasts, we've been working with terminal teams to provide better predictive visibility as part of our solutions, resulting in a more empirical view of the future.

From our pilots, we learned connecting the berth with the yard, by developing a learning model that considers the impact of the yard allocation on the berth plans, can significantly decrease the operational costs of cargo handling by reducing horizontal transport travel distances from the yard to the quay and vice versa. This in turn contributes to numerous additional benefits such as improved asset utilization, lower equipment maintenance costs including less demand for replacement of worn parts, and lower fuel emissions.

Combining a reliable stream of data from the TOS with AI/ML techniques and the constraints that matter to the Berth Planners, the module provides predictive visibility to suggest more optimized plans, adjusting to the latest status of vessel schedules, load/discharge lists and unit yard positions, among other constantly changing factors. Additionally, this data informs the Berth Planner of the estimated horizontal transport travel distances and cost savings associated with different planning scenarios. Only by using advanced technologies can informed trade-offs be made on these complex decisions that effectively consider such a magnitude of variables. At Navis, we believe it is key to aid Berth Planners by suggesting the most promising plan which sup-

ports informed decision making that directly impacts the bottom line. These Berth Planners, empowered with the various trade-offs presented by each scenario, along with their own operational experience are able to then determine optimal berthing strategies for the overall benefit of the terminal.

VESSEL PLANNING

Our second use case involves vessel planning, another part of the daily planning activity, conducted by Vessel Planners and other planning functions. These teams spend from a couple of hours up to one or more shifts preparing the plan for an upcoming vessel call. Service level agreements, stowage instructions, load and discharge lists, along with the available labour and equipment resources are key inputs into this process, as well as targets themselves which may change over time as the planning progresses. As part of planning, best practices are applied that may involve manual fine tuning and tweaking of the stowage in order to arrive at, what the Vessel Planner may consider, a good plan. However, the question is, what is a good plan?

Experience and accumulated knowledge play a big role in the ability to assess a plan and conclude whether it will deliver satisfactory results or not. To this end, having a reliable and repeatable quality indication is important. The consequences of a low quality plan can be huge: when a vessel does not depart on time, this leads to a costly ripple effect on upcoming visits, impacting service levels. Recognizing the need for this repeatability, we developed a service that provides workflow visibility to teams across the terminal to manage their processes, service level agreements, and predictive visibility to measure how good a plan is.

Through the application of machine learning, stowage plans can be evaluated with critical KPIs predicted prior to vessel arrival. This enables planning teams to receive early feedback on what will most likely be the results allowing for timely corrective actions to be taken avoiding costly delays. With delays avoided, time is saved which allows for more flexibility and other value add activities. These predictions also ensure focus on targets and increase expert users'

confidence levels. Further, this predictive visibility enables planning iterations and provides visibility to how the KPIs change over time. While using these capabilities prior to vessel arrival provides great insights, they can also be consulted throughout the port stay. For instance, when post adjusting the crane split or replanning the remaining moves, terminal planning teams can better understand whether targets are still likely to be met or not and use this information to aid decision making.

The Covid-19 pandemic has taught us all the importance and value of data to help us manage tasks and make decisions in our daily lives in the face of a contagious, rapidly spreading virus. We now understand on a very personal level how the availability of good data is essential for planning for the future.

In the world of container terminal operations, predictive visibility combined with expert users' experience can provide the best insights for operational improvement and cost control. Adding to automation, here comes the next wave of innovation for smarter, safer and more sustainable supply chain operations.

ABOUT THE AUTHOR

Patrick Brehmer is the Senior Manager Applied Innovation at Navis. He has held a variety of positions within container terminals and has been part of the Navis Labs team in Rotterdam, the Netherlands for 5 years. He and the other experts on the Navis Labs team help to bring a customer-centric approach to early stage product development. The Navis Labs team collaborates with internal teams and customers to accelerate idea assessments, concept developments, prototype developments as well as customer pilots.

ABOUT THE ORGANIZATION

Navis provides operational technologies that unlock greater performance and efficiency for our customers, the world's leading terminal operators. The Navis N4 terminal operating system (TOS) represents more than 27 years of experience and innovation that enables terminals to optimize their operations and move cargo smarter, faster and more efficiently. As an industry leading technology, more than 270 container terminals worldwide, including some of the world's most advanced automated facilities, have partnered with Navis to improve performance, reduce costs and minimize risk.

