

# MODERNIZING PORT OPERATIONS FOR THE DIGITAL AGE

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Leading port operators are building a digital foundation that is providing dramatic improvements and meaningful business results, enabling the sector to handle a projected 400-million-ton annual increase in global port volumes (source: UNCTAD 2018 Review of Main Transport). They are moving past decades of manual process tradition to a more agile, data-driven approach, with a keen eye on risk and security issues. While many believe the best way to modernize is to automate, beginning this transition before you thoroughly understand your current operational process can lead to tragic- or at best very expensive- results. If your process is error-prone and inefficient, all you will do is automate these problems, leading to poorer performance.

In fact, McKinsey's "The Future of Automated Ports Study" - published in 2019 - seems to confirm this. Nearly 40

cargo ports around the world are using some form of process automation, with the total investment cost an estimated \$10 billion. McKinsey projects that ports and terminal operators will accelerate spending to \$15 billion in the next five years. Despite this extra funding, which has produced a 10-35% reduction in operating costs and improved consistency, a 7-15% decrease in productivity has been experienced. By McKinsey's estimates, most operators will fall short on the ROI needed to justify the automation investments without addressing some serious problems.

A common problem cited by the study is the lack of data standards, formats and data structures from the wide range of data sources needed, making it harder to drive consistent analytics and reports. They also cited insufficient data quality, analytics and reporting. Their proposed solution was a data-infrastructure to help address these

problems, orient the data together in one place and connect with personnel and applications such as maintenance, planning and staff to adjust in real-time and/or drive AI and machine learning applications. Regardless of your level of automation, it is the process, data, and people who are using data to better understand available business opportunities, who ultimately need to act. The solutions to these problems may be pulled from the best practices of other industries with more automation experience, many of which are now being applied to port operations.

## BASELINE YOUR OPERATIONS

The first step in any improvement process is benchmarking or baselining your processes and current performance levels. This will provide an honest assessment of your operations and indicate the areas most likely to drive valuable returns. You will also

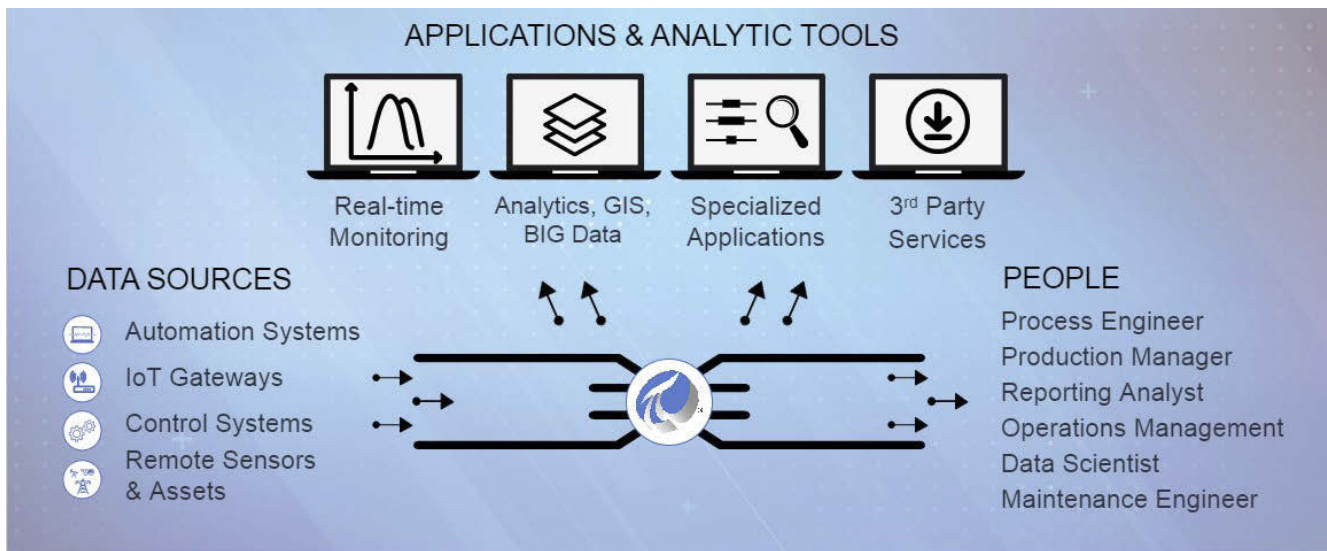


Figure 1: Real-time Operational Systems of Record (SoR) builds a foundation for digital transformation

be able to measure the result of changes you make along the way to ensure you are getting the expected results. For port operations, this means more than tracking your gross moves or tonnage: this is a detailed record of events across operations. Documenting what happened and when, along with any available data from sensors and systems oriented in time, like a digital event recorder, will make it easy to see what is happening and what to do about it. For example, a bulk material operator was constrained at their port. Once they baselined their operations, they were quickly able to see when they were losing valuable minutes and fix them before they impacted their throughput.

**BUILD A REAL-TIME OPERATIONAL SYSTEM OF RECORD (SOR)**

An Operational System of Record (SoR) captures data from the many data sources at their original fidelity and aligns them in time. Working much like other Business Systems of Record (e.g. Finance and ERP), the Operational System of Record provides an abstraction layer which is managed by operations and administered by IT. This provides “ah-ha” insights by seeing exactly what happened and when. In the Operational SoR you can also deal with other data issues such as data quality and operational context that often prevent information from being trusted and actionable across the organization. Another reason for a SoR is to protect control systems from cyber-security threats. Industry best practice for critical infrastructure protection is to build a SoR between your real-time control and Internet of Things (IoT) systems and the business systems that need that data. While it is not generally a good IT practice to copy systems data, this is a notable exception as it provides a data service for upstream data

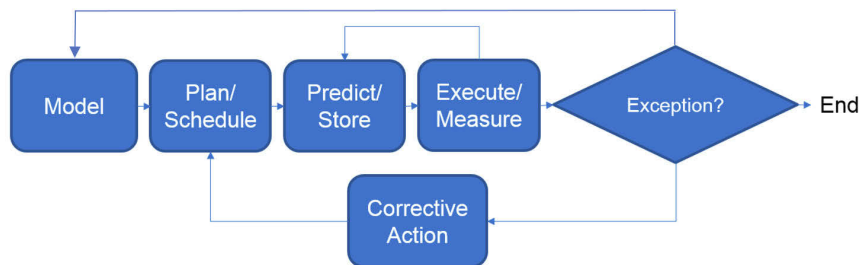


Figure 2: Dealing with exceptions takes integration and business logic

hungry applications without direct access or impact to critical system performance.

**OPTIMIZE THE PROCESS FOR THE PERFECT ORDER**

Many manufacturing companies use a concept of ‘the perfect order’ to identify potential process improvements. This concept follows each step in the value chain down to the second from order creation to customer delivery. A similar approach can be used in the value chain of ports. Once you know how to most efficiently move products (or people) and remove variability then you can automate and then increase the speed of the process. An amazing benefit of digitalization is a cultural shift to collaboration by democratizing data. The common practice of arguing over “who’s data is correct” gives way to “who’s approach will produce the best results”. This changes the focus to one of collaboration and unifies strategy, goals and tactics.

Part of the challenge is aligning all the operational interdependencies. Organizational groups with KPI’s and tactics that are not aligned with the current business strategy can result in performance gains in one area that are followed by losses or failures in another (such as maintenance or safety). This is avoided by ensuring that KPI’s are carefully selected, aligned with the overall business goals and shared with

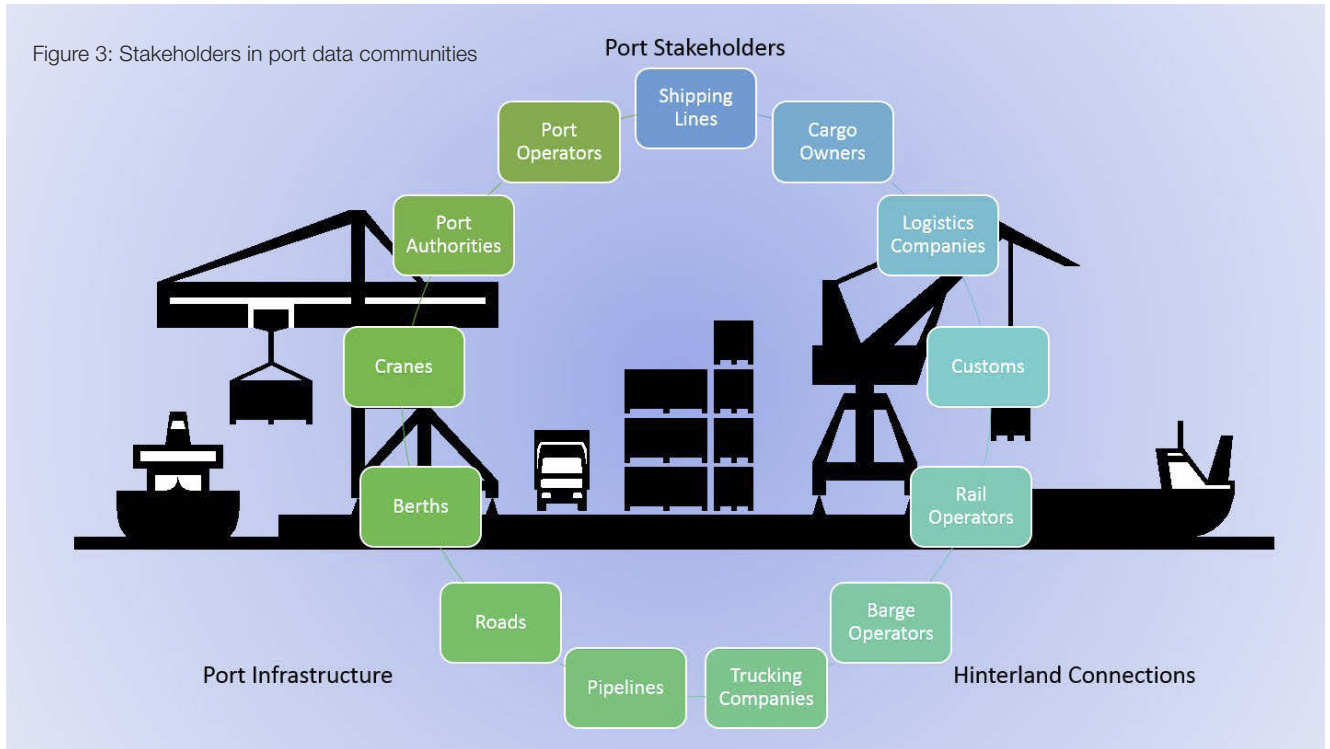
all stakeholders (even customer service and purchasing), not just the group driving them.

Another important area of continuous improvement is the environmental impact of operations. The marine industry is striving to be the most environmentally friendly mode of transport and global compliance will only increase over time. Having a SoR not only provides an auditable record of incidents, which can be reviewed to evaluate alternative responses, but also offers timely reporting with little extra effort. Once you can account for every moment in your process, you can start to focus on every exception: what can go wrong and how to deal with or eliminate it. The goal is to build a process improvement culture that adapts as your company and business climate changes, turning ‘the perfect movement’ into the perfect day, perfect month and perfect year.

**PLAN FOR EXCEPTIONS**

The McKinsey study cites exceptions to a plan and the inability for automation to deal with them as a key reason for productivity losses. This means that possibly the biggest opportunity to improve port operations is to take a more agile, exception-driven approach. By moving from a plan, operate, measure, react serial approach, to a plan, operate, measure, re-plan, operate,

Figure 3: Stakeholders in port data communities



measure by exception model, driving agility and innovation for both operations and business processes becomes easier. This model would require the integration of a System of Record (SoR) into the planning & scheduling systems, so that you can re-plan the entire system if you get off track and hopefully trigger workflows from other dependencies in purchasing, customer service and engineering/maintenance.

IoT provides the opportunity of having additional real-time data that could further change business processes by increasing visibility, with actionable data confirming we are on plan or measuring external factors that cause interruptions (like weather, tide levels etc.) into exception workflows. By combining information from traditional control and IoT systems into a common SoR and feeding other enterprise applications (ERP, Asset Management, Finance, EH&S etc.) many companies are delivering on the promise of supply chain optimization and setting the business process foundation for autonomous operations.

**NURTURE DATA ECOSYSTEMS**

The last and maybe most important concept is that although you can buy tools to help, you can't buy digital transformation, and few organizations achieve operational excellence without help. Surround your organization with trusted advisors and suppliers who are also data- and results-driven. Include them in your plans and processes and share the data that allows them to optimize and become more effective, so they can be a better supplier or partner. Many leading port authorities are nurturing data communities utilizing cloud

technologies to facilitate better overall performance, visibility and monetization. As shown in Figure 3, there are lots of stakeholders in the supply and value chain at ports. Connecting with them or collaborating in your own data ecosystem can expand data sources and lead to further performance gains.

**SUPPORTING PORT USE CASES**

As mentioned earlier, port operators are learning from other automated industries before applying and sharing what they have learned. OSISOFT is fortunate to have thousands of automation customers who openly share their learning with hundreds of port operation installations across the globe. Here are some recent editions that reflect the ideas in this paper:

- Adani- Adani Ports is the largest private port operator in India, handling the majority of the country's international trade. Economic growth is driving an expected increase in demand for port services. Adani Ports is planning for this growth by investing in both new port construction and port automation, to ensure that all facilities achieve peak performance levels. The PI System is the backbone of these initiatives, providing the data collection, analysis and reporting tools that have helped Adani Ports achieve ongoing performance improvements and wider profit margins.
- TraPac- For TraPac, automating its flagship operations at the Port of Los Angeles terminal enabled the company to cut costs, slash emissions, and move human operators out of harm's way. In order to fully realize the benefits of automation,

however, TraPac also needed to harness their data. In 2017, the company implemented OSISOFT's PI System to organize and analyze the information generated by their operations. The result was a 10+% decrease in cycle time, improved maintenance, and faster issue resolution.

**ABOUT THE AUTHOR**

OSISOFT's Transportation Industry Principal has a broad background in developing industrial electronics, automated control and information system software for OEM's and enterprises. Matt has been working with leading technology firms to bring real-time operational intelligence tools to the supply chain and smart city initiatives, resulting in dozens of innovative products being brought to market.

**ABOUT THE ORGANIZATION**

For over 39 years, OSISOFT has been dedicated to supporting critical operations and people behind them transform their world through data. Our software and cloud services turn operations data streams generated by utilities, manufacturers and other industrial customers into rich, real-time insights for saving money, making critical decisions or developing new products.

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