The Case for Digitalizing Ports

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Data is playing an increasingly critical role in seaport and maritime operations. By including technology — one key area being data management — in their master planning processes, port operators can find ways to address logistical bottlenecks and improve operational efficiencies, achieving competitive advantage and increasing value for the overall enterprise.

Every five years or so, port authorities across the U.S. undertake a process to update or completely rewrite their master plans, setting their strategic vision for the years and decades ahead. Although it requires substantial investment, this process also creates significant opportunities for port authorities to assess their infrastructure and operational capabilities and consider how a range of internal and external factors could affect their future operation and competitive status.

Historically, master planning considerations have included capital equipment and intermodal facility needs, cargo logistics, and international trade trends. Many master plans address ways to attract new tenants and minimize attrition. Others look at strategies for addressing resilience against climate change and related weather extremes, as well as decarbonization opportunities and contingencies for global supply chain issues.

Far less attention is typically focused on how technology and the use of data can impact a port's business and bolster its competitive position and long-term economic value.

To understand how to plan for technology investments, a port authority must first assess the enterprise's current capabilities and establish a data governance model to see that all future steps meet the organization's needs for information flow, data quality and security.

A data integration maturity model can aid this assessment. Maturity models are tools that enable an enterprise to determine its capabilities in a given area and, more importantly, help the enterprise understand the steps it might take to improve those capabilities.

Figure 1 illustrates a maturity model for data integration, one of the essential data management capabilities that allows a port or maritime enterprise to realize the
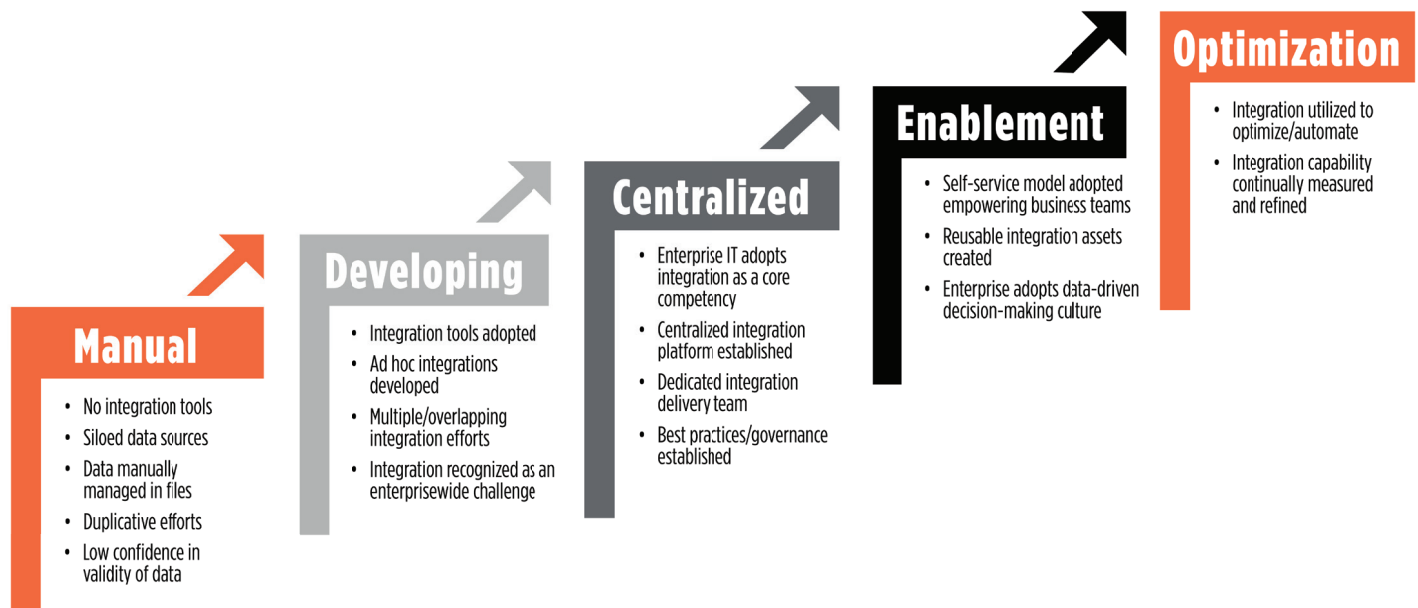
Figure 1: Maturity model for data integration.

Manual
- No integration tools
- Siloed data sources
- Data manually managed in files
- Duplicative efforts
- Low confidence in validity of data

Developing
- Integration tools adopted
- Ad hoc integrations developed
- Multiple/overlapping integration efforts
- Integration recognized as an enterprisewide challenge

Centralized
- Enterprise IT adopts integration as a core competency
- Centralized integration platform established
- Dedicated integration delivery team
- Best practices/governance established

Enablement
- Self-service model adopted empowering business teams
- Reusable integration assets created
- Enterprise adopts data-driven decision-making culture

Optimization
- Integration utilized to optimize/automate
- Integration capability continually measured and refined

benefits of digitalization. Data integration is the process of programmatically enabling unrelated applications and data sources to communicate, creating a common model of the enterprise's data. Integration makes it possible to leverage data as a key asset within the enterprise, reduce data silos, gain faster access to information, and establish common data views while enabling downstream capabilities such as business intelligence and analytics. Enterprises that invest in data integration have greater confidence in their data and more informed decision-making.

This data integration maturity model describes, at one end, an enterprise where integration is nonexistent and data is managed manually. At the other end of the spectrum is an integrated enterprise, where a comprehensive data infrastructure makes business process automation and optimization possible. However, not all enterprises need to strive for the highest level of maturity in the model. A moderate level of maturity might be wholly suitable, depending on the enterprise's business and operational needs.

As in any industry, data integration varies widely among and even within ports. For example, individual departments at some ports might be able to manipulate data they collect on spreadsheets but lack systems or processes for sharing it with other stakeholders or applications. Those further along in the maturity model may have integration strategies that allow different data systems to communicate among internal or, in some cases, external stakeholders.

The benefits these digitalization and automation strategies offer can be wide-ranging. With 80% of all the goods destined for warehouses and stores passing through them, ports are logistical hubs for international trade. By digitalizing their operations, authorities can integrate data from their own operations and with other links in the supply chain. The greater the integration, the better they can use market and logistics information and forecasts to optimize their operations and infrastructure, as well as to communicate plans and needs to their stakeholders.

For example, many ports already have timely access to shipping data, which enables them to predict and prepare for shipments before they arrive. Upon integrating this information with other port operations data, it is possible to share information with terminal operations, port engineering, intermodal operators and other stakeholders, allowing each to plan production and resources based on supply and demand. By automating manual processes and workflows, ports can also minimize use of paper spreadsheets and forms that currently must be entered into port data systems.

Roadblocks to Port Digitalization

There are many reasons a seaport's or inland port's progress on the digitalization journey may not have taken off or might have stalled:

Lack of data standardization: The supply chain is long, and different segments apply different data standards. Shippers,

terminal operators, intermodal transporters and other stakeholders all collect data they might be hesitant to share. To achieve standardization, parties would need to come to agreement not only on who will coordinate and fund data standardization efforts, but also regarding who will own or have access to the data. They will need to be convinced that the competitive advantages gained through data standardization are greater than those gained by maintaining data silos. Barring standardization, there are still methods for transforming data types to allow parties to work together in an integrated system.

Access to siloed data: Even if stakeholders agree to data standardization, technical challenges can follow. Data silos may be difficult to find and access. Once located, questions can arise over the validity of the information they contain. If these obstacles are overcome, the standardization process itself can be relatively straightforward.

First-mover reluctance: As with any new venture, many are reluctant to lead the way, especially when early-adapter investment costs are likely to be higher and payback longer. When the playing field is still relatively level, ports authorities may feel more comfortable sticking with the status quo. Why digitalize when a port's efficiency is comparable to others'?

Port operating model: Depending on the port's tenant structure, master planning for digitalization can create logistical challenges. A port authority that contracts tenants and maintains control over dock operations may be better positioned to lead on digitalization planning than one that functions as a landlord, leasing its land to independent terminal operators. However, even landlord port authorities have opportunities to improve efficiencies and create strategic advantages through digitalization efforts.

Achieving stakeholder buy-in: To ramp up digitalization planning, a port authority needs the consent of its stakeholders. In addition to port tenants, these can include municipal water treatment plants on port property, whose own master plans could be impacted by the process. Buy-in is also needed from local government representatives, off-site port officials and other affected stakeholders operating away from the port property.

Absence of a common Port Community Systems framework: Port Community Systems provide a framework and platform for sharing critical information among port stakeholders. Due to differing economic and competitive structures, U.S. ports often lack such a system, and no mechanism exists for data-sharing among ports. While some states have a central port authority that potentially could function as a clearinghouse for some of this data, others lack a single body to coordinate among multiple ports. Even in these cases, however, there might be a common agency that could facilitate some data-sharing among stakeholders in the supply chain.

Overcoming These Roadblocks

Perhaps the biggest roadblock to digital transformation is perceptions of the enormity of the task. The time and expense — not to mention disruption — associated with integrating smart technology into a port authority's enterprise could prevent some from harnessing the collective will to begin.

To overcome this mindset, a case must be built to demonstrate that ports can achieve significant returns from incremental efforts and investments. The data integration elephant does not need to be eaten whole. Tenants and other stakeholders often must be educated on how real-time data on ship location, labor forecasting, container availability and other key supply chain metrics can deliver clear competitive advantages for all involved. Fear of data-sharing must be overcome by demonstrating where value can be gained by sharing information and how to secure data that should remain private.

Those resistant to change or fearing job loss might also be reminded that new "smart ports" will not emerge overnight. By integrating digitalization and automation into the master planning process, port authorities can phase implementation over years, focusing first on the opportunities that deliver the greatest value.

Where to Begin: the Strategic Master Plan

The place to start is a port authority's master plan. Data is critical to all parts of port operations, from ship scheduling and real estate management to security. Understanding the role of data — and enabling technologies in each of those areas — can reveal both gaps and commonalities in needs. That is where digitalization and automation strategies can become part of the port's ongoing conversation. Along with projecting the overall internal and external demands on the port, planners can pinpoint gaps in data, identify opportunities to integrate technologies into a project or process, and articulate how these changes can make the port a more attractive partner in the supply chain.

Enterprise or solution architects are well-suited to lead this dialogue, as professionals with knowledge of holistic technology capabilities. They will ultimately be responsible for developing a data integration plan that supports a port's broader strategic goals.

Technology planning also requires the core engineering disciplines, material handling professionals, marine- and harbor-side operations personnel, financial and trade modeling specialists, and trend assessment professionals who can explore issues such as decarbonization. A systems integrator can then develop a phased plan that lays out when, where and how to integrate these technologies into port operations. A significant part of their work involves finding appropriate balance among business outcomes, cost, technological advances and future agility.

This component of the master planning process alone can take months or longer. Given long lead times for investment planning and project implementation, port authorities with a master plan update on the horizon would be well served to add digitalization and automation to their master planning agenda. The case for digitalizing U.S. ports has grown too strong to ignore.

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