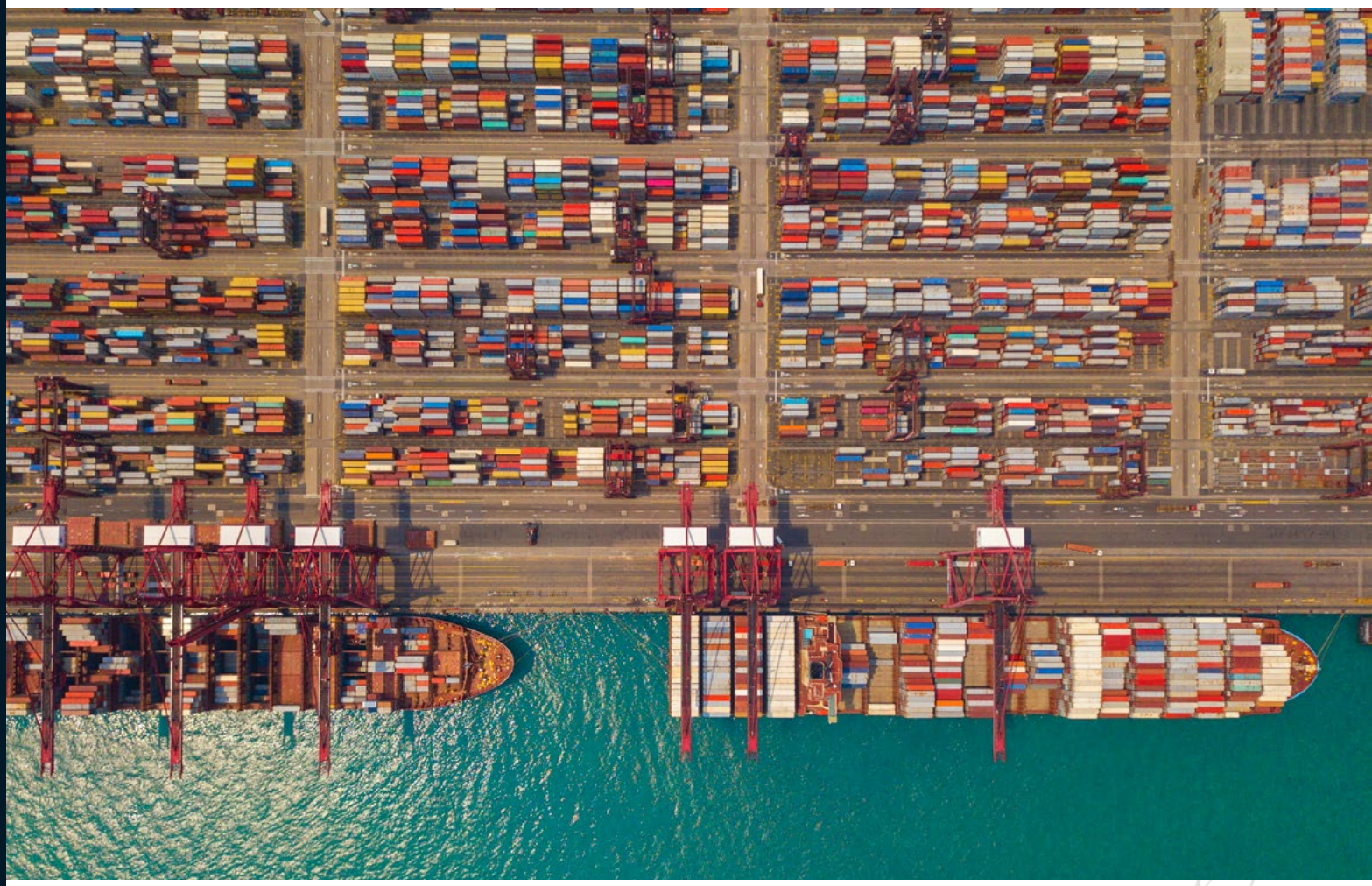
SSATP
Africa Transport Policy Program

SSATP Working Paper

March 2024



STATUS OF DIGITALIZATION AND POLICY IMPEDIMENTS IN AFRICAN PORTS

WORLD BANK GROUP

AFD
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international association of ports and harbors

African Union

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Sound policies lead to safe, reliable, and cost-effective transport, freeing people to lift themselves out of poverty and helping countries to compete internationally.

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ACRONYMS

AI	Artificial Intelligence
AUC	African Union Commission
CMS	Customs Management System
FAL Convention	Convention on Facilitation of International Maritime Traffic
ICT	Information and Communication Technology
MSW	Maritime Single Window
OECD	Organization for Economic Cooperation and Development
PCS	Port Community System
SSATP	Africa Transport Policy Program
TOS	Terminal Operating System
TFI	Trade Facilitation Indicator

ACKNOWLEDGEMENT

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FOREWORD

Leveraging digital solutions to enhance performance along regional transport corridors is a key focus of the Africa Transport Policy Program Fourth Development Plan (SSATP-DP4) strategy.

This report offers an overview of the current state of digitalization in African ports, examining factors that drive port digitalization, such as access to reliable internet and the availability and reliability of data centers. Additionally, it identifies significant barriers, including insufficient policies and regulations, which impede the digitalization process. The report also presents a set of recommendations aimed at supporting African ports in achieving a higher level of digitalization.

By providing insights into port digitalization and valuable analytics, this report informs our policy dialogue on enhancing transport and facilitating trade along economic corridors in Africa.

Mustapha BENMAAMAR
SSATP Program Manager

EXECUTIVE SUMMARY

African countries and ports have much to gain from the adoption of advanced digital solutions, which will facilitate the flow of cargo through their ports in a more transparent and efficient manner. At both a policy and strategy level, supported by appropriate legislation, the regulatory environment within a country can either drive or hinder this digitalization.

Leveraging logistics platforms and port digitalization and developing guidance and tools to assess and monitor regional transport corridors performance are among the priorities of the Africa Transport Policy Program (SSATP) Fourth Development Plan strategy. These activities aim to promote regional connectivity and economic integration by leveraging digital solutions and improving the monitoring and management of transport corridors in Africa. To this end, two activities were undertaken under the SSATP Regional Connectivity and Economic Integration pillar: (1) an assessment of the potential of the existing transport monitoring systems and the collection of data to support corridor management performance in Africa, and (2) a study on the Africa port digitalization assessment and policy recommendations.

2.76

Average score of the African Ports' **digital maturity**

The study reviews the digitalization status and policy environment in 31 countries and 39 ports across Africa and makes a set of recommendations to help most ports achieve a higher level of digitalization. Taking the overarching (and simplified) view of digital maturity score from 0 to 5, the African ports have a digital maturity average score of 2.76. There is a broad range of maturity (current and future capability and ambitions), ranging from the very low scoring Bissau Port (0.12), where digital topics were not as important as investment in main infrastructure, through to the very strong scoring Port of Tema (4.4), with significant current capability in digital tools and ambitious plans for the near future.

The impact of the digital maturity on port performance (CPPI) is not as clear cut. In general, the level of digital maturity and the level of (container) port performance align. However, notably, several container ports exhibit high digital maturity but are performing at low levels of productivity. This could be related to the types of digital solutions deployed and their maturity. It also clearly indicates that other factors need to be considered, such as equipment condition and availability and the general labor environment. In addition, some ports with low digital maturity nevertheless have a high container port performance. This may occur, for example, where private concessions exist, but the port authority is not invested in digital solutions.

The analysis of the various drivers contributing to port digitalization shows that there is a strong connection between trade facilitation policy, which is mostly sea based, and the digitalization of port processes. Government trade facilitation efforts are key drivers for supply chain and port digitalization. National ICT infrastructure and national connectivity development have a moderate impact. GDP per capita, port operating model, and volume handled have a low impact.

Infrastructure and system-related components (reliable internet, data center availability/reliability) are viewed as enablers because of the higher degree of control that the supply chain maintains over them. Regulations, public authorities' attitudes, and other components (aptitude for data sharing) are perceived as barriers. Overall, the study findings show a lack of policy direction or regulations to invest further in digitalization and there is still a large barrier to improving the level of digitalization within the ports and associated supply chains. The prevailing consensus is that governments (directly or through the port authorities) need to lead this digital transformation process.

It is worth noting that of all the ports in the study (of which the status is known), 28 percent already have a maritime single window (MSW), with another 15 percent actively implementing it. Twenty-six percent indicate that they have concrete plans to implement it within the next three years. The remaining 31 percent of ports have no concrete plans or are even not interested in implementing an MSW. This last group requires specific attention, to support and raise awareness for the need of a single window.

Based on the common observations from pan-African ports and maritime supply chains, a set of recommendations can be drawn out that would help most African ports achieve a higher level of digitalization:

i. Guide and support governmental bodies to increase their trade facilitation efforts (as a key driver for supply chain and port digitalization) by developing sound policies and digital platforms projects, such as Port Community Systems.
ii. Create forums and user groups on a national, regional, and continental level to discuss, develop, and deploy digital initiatives for the local needs of African ports.
iii. Showcase relevant examples from other regions of the world where innovative solutions and their financing models could be adapted to the local context of African ports.
iv. Explore and facilitate the deployment of "leapfrog" ICT infrastructure in African nations, such as cloud-hosting and data center availability.
v. Provide practical training and hardware/software toolkits to enable improved cybersecurity adoption at ports, especially for those growing into more digitalized supply chains.

31%

of ports have no concrete plans about implementing an MSW.

1.0 INTRODUCTION AND OBJECTIVES

Regional integration remains a key priority of the Africa Transport Policy Program Fourth Development Plan (SSATP-DP4) work program. To make economic corridors more competitive a special focus is placed on leveraging logistics platforms and port digitalization. Port digitalization involves integrating digital technologies to enhance efficiency, productivity, and management of port operations. It includes electronic information exchange between ships and ports to facilitate clearance processes. It utilizes tools like equipment automation, data analytics, and connectivity to streamline cargo handling, logistics, and security, aiming to improve transparency, reduce costs, and create a more agile maritime infrastructure and services. To ensure critical supply chains continue to function in the face of increased disruption from global events and pandemics, improvements in digitalization, and the underlying maritime and logistics supply chains are urgently needed.

With increased reliance on digitally enabled processes, supporting systems and infrastructure, the importance and focus on cybersecurity and resilience also grow in significance. African countries and ports have much to gain from the adoption of advanced digital solutions, which will facilitate the flow of cargo through their ports in a more transparent and efficient manner. At both a policy and strategy level, supported by appropriate legislation, the regulatory environment within a country can either drive or hinder these digitalization initiatives.

This study has the following objectives:

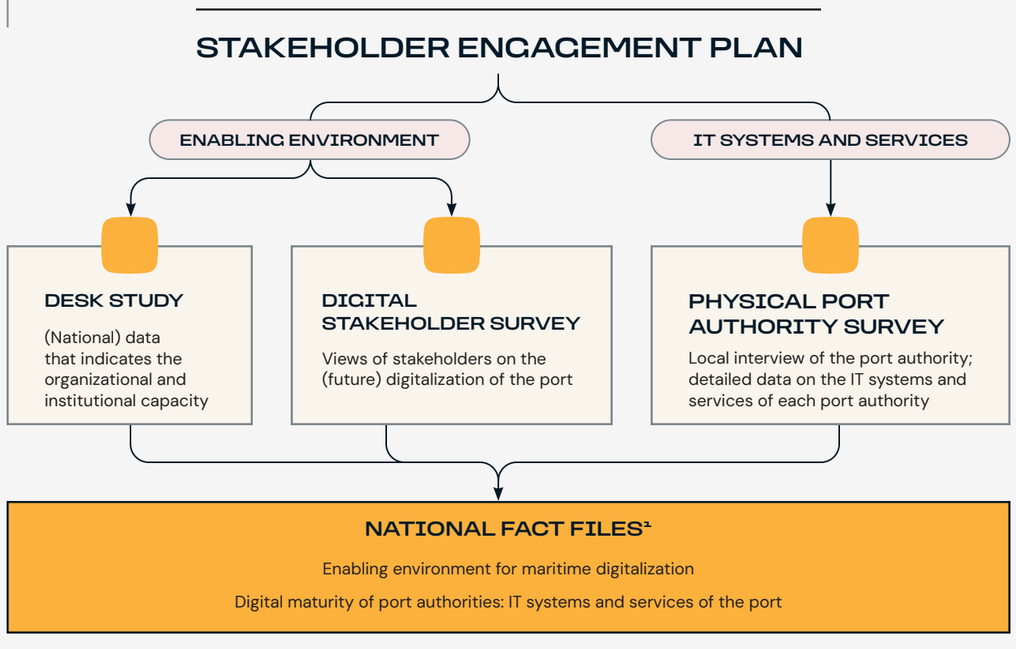
- Engage with national and port authority stakeholders on the topics of maritime supply chain digitalization.
- Capture the latest data points on policy, activity, and supporting conditions for digitalization within each coastal country.
- Carry out primary research with the maritime supply chain community to understand needs, challenges, constraints, and ambition for more digitalization within these countries.
- Assess the level of port digitalization in Africa
- Survey the capability, capacity, and readiness of port authorities in key ports around the coast for further digitalization, including the necessary infrastructure, security, staffing, and organizational capacity.
- Make a set of supportive recommendations to help most African ports achieve a higher level of digitalization.
- Analyze, present, and support dissemination of the project outcomes to the port and stakeholder community through presentation materials and a conference event.

2.

STUDY APPROACH AND METHODOLOGY

The methodology and approach followed for this study involved locally conducted face-to-face and online interviews with relevant port authorities, a general port stakeholder survey, and supporting desktop research (Figure 2.1).

Figure 2-1
Study Approach and Methodology



1. https://www.ssatp.org/publication/digitalization-african-ports-national-fact-files

The study encompassed a review of the digitalization status and policy environment in 31 countries and 39 ports across Africa. The specific solutions that will best fit and drive improvement in each port are expected to vary because of the differing degrees of digital maturity and underlying strategic drivers present in each country. Therefore, a one-size-fits-all solution is unlikely to apply, although similar solutions and gaps may be found across the study scope.

Figure 2-2
Map of African Nations and Ports Included in Study

3. RESULTS AND FINDINGS

3.1. NATIONAL MARITIME DIGITAL ENVIRONMENT (TASK 1 SURVEY)

The first survey was conducted with as broad a cross-section of port stakeholders as possible, including representatives from the port authorities, government agencies, terminal operators, and various supply chain partners and suppliers. The survey aimed to gauge the perception of the industry regarding the current status and value of digitalization, as well as who has responsibility for driving this agenda.

A total of 52 responses were received from approximately 300 invitations, covering most stakeholder groups and countries included in the study. The responses reveal a clear picture of how important digitalization is to the different stakeholder organizations and the critical role that enabling infrastructure, such as internet reliability and data center availability, have in supporting this objective. The survey results also show that there is in general a low aptitude for data sharing.

A lack of policy direction or obligatory regulations to invest further in digitalization indicate that there is still a large barrier to improving the level of digitalization within the ports and associated supply chains. The prevailing consensus is that governments (directly or through the port authorities) need to lead this digital transformation process.

100%
of respondents consider digitalization to be important to their organization.

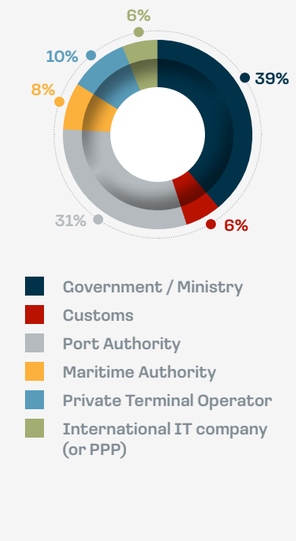
Importance of digitalization

All respondents consider digitalization important, with 67 percent considering it essential to their organization. This highlights that the port stakeholder network across Africa is highly conscious of the need for digitalization.

Leadership in the Supply Chain Digitalization

The respondents have differing opinions on which organization should take the lead in digitalization of the maritime supply chain, with most expecting government and port authorities to play a large role (Figure 3 1). There is a clear difference between what the maritime supply chain hopes the government will do and what's actually happening.

Figure 3-1
Leadership Expectation for Digitalization of the Supply Chain



Barriers and Enablers for Digitalization

Infrastructure and system-related components are viewed as enablers because of the higher degree of control that the supply chain maintains over them; regulations, public authorities' attitudes, and other components, on the other hand, are perceived as barriers. Stakeholders see the following as the main barriers and enablers:

Barriers:

- **Data sharing:** A negative attitude toward data sharing among private trade partners may result in reduced real-time visibility, collaboration, and predictive analytics within the supply chain.
- **Public authorities:** If public authorities view digitalization as a barrier, it can cause delays in the advancement of a nation's digital agenda.
- **Commercial incentives:** The perception of commercial incentives for improved digital efficiency as a barrier suggests that response of the market to investment in digital efficiency is weak.
- **Regulations:** The absence of regulations for the standardized use of digital trade platforms creates inconsistencies and operability problems, potentially erecting barriers.

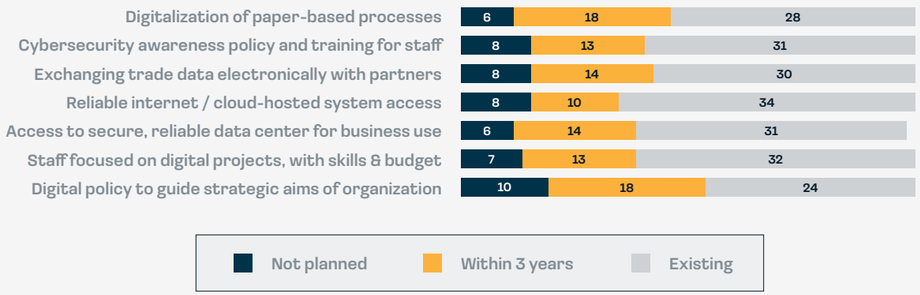
Enablers:

- **Data center availability/reliability:** The availability of data centers can be ensured by the supply chain through redundancy and backup systems. This can be achieved by investing in cloud services from providers with a strong availability track record.
- **Reliable Internet:** Most digital systems are reliant on a stable internet connection. Without it, investing in advanced digital systems does not make sense.
- **High-speed (broadband) internet**
- **Available online business software tools**

Digitalization of Supply Chain Actors

A correlation can be observed between the responses given on enablers and barriers to supply chain digitalization and the level of implementation. Specifically, infrastructure and system-related initiatives are more widely implemented, while governance-related initiatives (such as digital policy) exhibit lower rates of implementation.

Figure 3-2
Supply Chain Implementation Level of Digitalization Initiatives



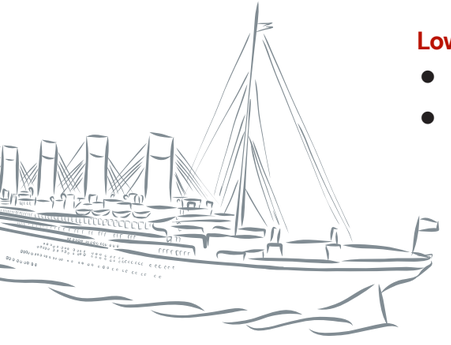
Impact of Enablers for Supply Chain Digitalization

High impact:

- Customs or other government agencies to adopt digital tools to improve service efficiency.
- Port or terminals to adopt digital tools to improve service efficiency.
- Digital platforms for trade transactions
- Training and skill-building for staff

Low impact:

- Commercial incentives for digital leaders in maritime trade
- Secure data center operated by public authority.



3.2. CURRENT STATE OF PORT DIGITAL MATURITY (TASK 2 SURVEY)

The second survey was conducted via either face-to-face interviews (wherever possible) or online meetings with the senior information technology (IT) representative at the port authority. The interviews were completed from the end of February 2023 through July 2023. Where interviews were not possible, the port digitalization data were collected from publicly available sources and knowledgeable consultants in the particular country and port.

The survey covered several categories, including the following:

- A checklist of IT technologies and systems in place or planned for implementation.
- Status of IT and cybersecurity at the port.
- Digitalization of port operations, including marine, rail, safety and security systems, and compliance procedures. Specific questions gauged compliance with the upcoming Convention on Facilitation of International Maritime Traffic (FAL) and the use of shared port-wide systems and platforms like single window and port community systems.
- Cargo and terminal operations.
- Organizational readiness for digitalization.

The survey was designed to give each question, category, and port a maturity score from 0 to 5.

Table 3-1
Digitalization Rating Description

Digital score range	Rating	Description
0–2	Low	Mostly manual, paper-based processes with little appetite or organizational readiness for digitalization
2–4	Medium / Average	Essential systems in place and processes digitalized, often on a stand-alone basis and not integrated or via any shared platform
4–5	Advanced	Strategic focus on digitalization, with supporting port platforms and systems well established

Taking the overarching (and simplified) view of digital maturity, there is a broad range of port maturity (being current capability, future plans and ambitions), ranging from the very low score of 0.12 at Bissau Port, where digital topics were not important or considered by the port authority as investment in main infrastructure had priority, to the very strong score of 4.4 for Port of Tema, which has significant current capability in digital tools and ambitious plans for the near future. The pan-African port authority average score is 2.76.

The results already demonstrate strong results for the larger and more developed economies, although it has been observed that countries with weaker economies can still host highly digitalized ports; in many cases, this is where private terminal operators under concession are able to push for a digitally managed (container or bulk) terminal in line with international standards. Also, strong results for some island nations (Cabo Verde, Mauritius) note the importance of their ports within their nations and therefore the strategic focus on port development and effectiveness.

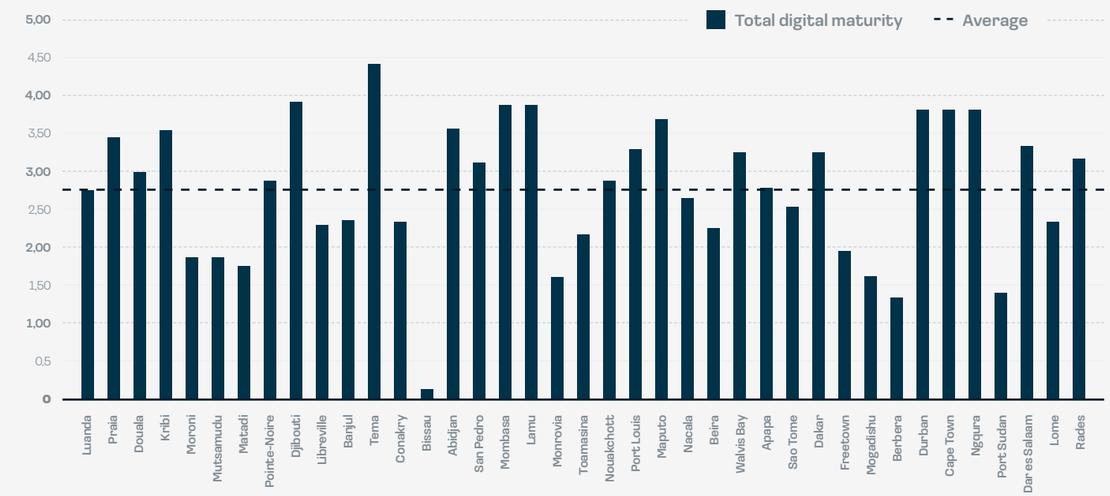
Currently, many new port developments are taking place within the African maritime sector, where newbuild facilities are often equipped with a stronger digital foundation, as seen at the Port of Kribi in Cameroon, for example. The digital maturity score is a metric for the general level of digitalization, blending the role of digitalization in current port operations and in the future ambitions for the organization and expectations of further developments.

Breaking down the overarching maturity score into its three components gives greater context to the readiness for digital transformation:

- **Technology and system development effort:** This metric is constructed from the results of section 1 of the survey and is an indicator for the digitalization developments that the port has gone through and/or is planning to go through.
- **Current operational maturity:** This metric is constructed from the results of sections 2, 3, and 4 of the survey and is an indicator for the level of digitalization of the present-day operations of the port.
- **Organizational ambitions for digitalization:** This metric is constructed from the results of section 5 of the survey and is an indicator for the role of digitalization within the ports organization and their ambitions as well as their opinion on the importance of digitalization.

Figure 3-3
Digital Maturity Scores for Ports in Study

Figure 3-4
Total Digital Maturity Score per Port



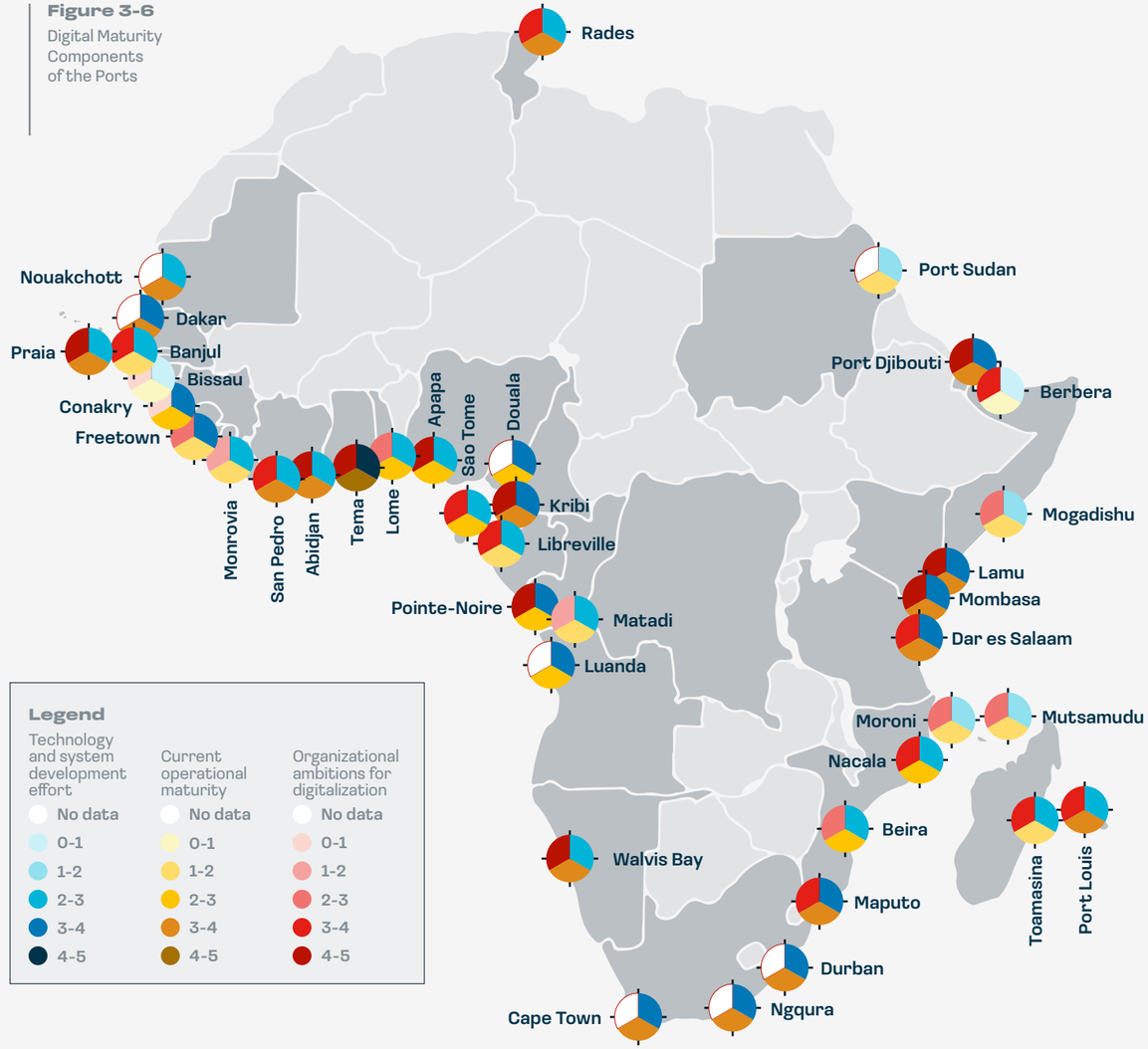
Generally, the current capability [current operational maturity] and the forward planning for technology [technology and system development effort] are closely correlated. This is logical, because once ports gain a decent level of technology (over level 2), then planning and adopting more technology becomes a priority.

For ports that are growing fast, forward planning scores more highly than the current maturity. This can implicate that ports with high ambitions have an equally high risk of those ambitions not fully materializing. Some mature ports with a higher level of current maturity may have lower scores on the future investment in technology, perhaps because they have reached a level of readiness that supports their business needs.

Both current maturity and near-term future planning for technology should be reflected in strong results for organization ambition and capability [organizational ambitions for digitalization], but this is not always the case.

Figure 3-5
Digital Maturity and Its Components per Port

Figure 3-6
Digital Maturity Components of the Ports

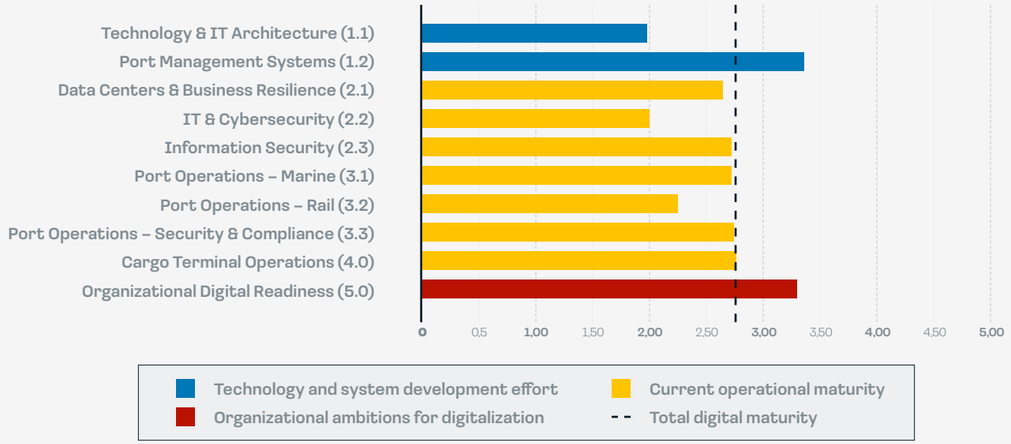


3.2.1. AFRICA AVERAGE RESULTS

In general, there are categories where ports score higher and categories where they score lower. Even for more advanced ports, the categories "Technology & IT Architecture" and "IT & Cybersecurity" score low. One possible explanation for this is that the surveyed ports are mainly focused on optimizing operations and therefore acquire systems that have a direct effect on operational efficiency. Technologies like cloud-based systems, artificial intelligence (AI), and virtual reality (VR) are not directly related to optimizing operational efficiency and therefore play a less pronounced role in African ports.

The category "Port Management Systems" scores generally high, indicating that the ports have implemented, or are planning to implement, systems like a terminal operating system (TOS), port community system (PCS), or maritime single window (MSW). This only partially reflects on "Port Operations" and "Cargo Terminal Operations" scoring, indicating that the implemented systems are not used to their full potential. Most systems can still be further developed to, for example, a port-wide system (instead of terminal based) or to better accommodate the sharing of information between stakeholders. "Organizational Digital Readiness" scores relatively high, indicating that many ports have high ambitions regarding digitalization.

Figure 3-7
African Average Scores per Category



3.2.2. CATEGORY RESULTS

This section presents the average response across all ports surveyed to the questions summarized per category. Individual port scores for each question and category can be seen in the fact files.[2] The surveyed ports exhibit a broad range of maturity. Almost every question has ports at the lowest and highest level of maturity, so a "mean" has some limitations.

Table 3.2 shows the spread of respondents as a percent of the total. This demonstrates the distribution of maturity levels, from 0 to 5 (or not applicable [N/A]), for each question and provides insight into where a strong variation between individual ports is detected.

Table 3-2
Distribution of Scores and Answers of the Port Authority Survey

Legend
Technology and system development effort: 0 – 50+
Current operational maturity: 0 – 50+
Organizational ambitions for digitalization: 0 – 50+

Questions		Distribution of scores (% of ports at each level):							
1. Port technology checklist		**0**	**1**	**2**	**3**	**4**	**5**	**N/A**	**Mean answer**
1.1. Technology & IT Architecture									
1.1.1	Cloud architecture or data-hosting	8%	15%	21%	13%	10%	23%	10%	In business plan
1.1.2	Disaster recovery as a service (DRAAS)	10%	15%	18%	15%	5%	21%	15%	In business plan
1.1.3	Digital twin for asset, operations or other needs	36%	31%	8%	10%	3%	5%	8%	Interested
1.1.4	Drones (UAV)	13%	18%	21%	18%	8%	23%	0%	In business plan
1.1.5	Virtual reality (VR) or Augmented reality (AR)	28%	41%	18%	8%	0%	5%	0%	Interested
1.1.6	IoT sensors, devices or other edge computing	8%	18%	31%	18%	5%	21%	0%	In business plan
1.1.7	Machine learning (AI) for any purposes	23%	28%	36%	8%	5%	0%	0%	Interested
1.1.8	Equipment automation for cargo handling	15%	41%	26%	15%	0%	3%	0%	Aspire to install
1.2. Management Systems									
1.2.1	Vessel traffic management and information system (VTMS/VTMIS)	5%	5%	15%	3%	18%	54%	0%	In implementation
1.2.2	Port management information system (PMIS)	10%	3%	5%	10%	5%	64%	3%	In implementation
1.2.3	Customs management systems (CMS)	8%	3%	5%	3%	13%	62%	8%	In implementation
1.2.4	Trade/National single window (TSW)	8%	8%	8%	15%	28%	33%	0%	In business plan
1.2.5	Maritime single window (MSW)	5%	10%	15%	26%	15%	28%	0%	In business plan
1.2.6	Port community system (PCS)	5%	15%	26%	10%	15%	21%	8%	No interest
1.2.7	Port call optimization tool (PCO)	13%	18%	23%	13%	5%	21%	8%	Aspire to install
1.2.8	Terminal operating system (TOS)	3%	3%	5%	5%	0%	85%	0%	In operation
1.2.9	Railway shunting system (RSS)	10%	8%	13%	0%	0%	15%	54%	Aspire to install
1.2.10	Gate operations system (GOS)	8%	15%	21%	18%	10%	28%	0%	In business plan
1.2.11	Truck appointment system (TAS/VBS)	8%	13%	18%	13%	8%	41%	0%	In business plan
1.2.12	Port security system	8%	10%	15%	13%	10%	44%	0%	In business plan
1.2.13	Crisis management system	5%	23%	21%	5%	3%	18%	26%	Aspire to install

2. https://www.ssatp.org/publication/digitalization-african-ports-national-fact-files

Questions		Distribution of scores (% of ports at each level):							
2. IT & security		**0**	**1**	**2**	**3**	**4**	**5**	**N/A**	**Mean answer**
2.1. Data center & business resilience									
2.1.1	Does the port operate its own data centre and at what resilience and security Tier?	13%	23%	15%	31%	18%	0%	0%	Tier 1
2.1.2	Does the port use cloud-hosted data centers and at what tier does this operate at?	51%	10%	3%	8%	8%	5%	15%	Yes, but tier level unknown
2.1.3	How does the port operate on-premise redundancy to provide high availability systems?	15%	18%	3%	18%	3%	44%	0%	Asynchronous mirror
2.1.4	What level of redundancy does the port operate within the network ?	23%	13%	3%	38%	0%	23%	0%	Wired network redudancy
2.1.5	Does the port have trained, dedicated and certified IT professionals?	5%	3%	5%	10%	33%	44%	0%	Full-time IT support team, trained
2.2. Cybersecurity									
2.2.1	Has the port implemented or outsourced any kind of cybersecurity operations center?	26%	23%	0%	23%	8%	13%	8%	Log management with ad-hoc alerting
2.2.2	Is there a process of capture and protection of forensic data in case of cybersecurity incident?	33%	23%	0%	21%	8%	8%	8%	Ad-hoc
2.2.3	Does the port have trained and dedicated ICT professionals?	21%	21%	0%	23%	5%	21%	10%	Professionals with part time dedication to cyber security operations
2.3. Information security									
2.3.1	Has the port implemented any kind of information security management system?	26%	3%	13%	26%	18%	15%	0%	Policies and processes
2.3.2	Does the port have an IT helpdesk (in or outsourced)?	10%	8%	0%	56%	8%	18%	0%	Dedicated personnel during working hours
2.3.3	Has the port established an information security incident process?	15%	23%	13%	8%	3%	31%	8%	Complete IS incident process without proven post-incident analysis
3. Port operations		**0**	**1**	**2**	**3**	**4**	**5**	**N/A**	**Mean answer**
3.1. Marine operations									
3.1.1	How does the port manage vessel visit scheduling?	3%	15%	31%	10%	21%	21%	0%	Shared file (eg sharepoint or webpage)
3.1.2	How does the port collect port call information, for ISPS and regulatory needs (eg FAL)	3%	23%	23%	13%	21%	18%	0%	Shared file
3.1.3	How does the port coordinate berth planning with terminal operators?	5%	13%	36%	8%	18%	13%	8%	Shared file
3.1.4	How does the port manage safe navigation within the harbor and control area?	5%	23%	0%	23%	18%	31%	0%	Navigational coordination: radio + AIS
3.1.5	How does the port coordinate marine resources (pilots, tug boats)?	8%	21%	23%	10%	31%	8%	0%	Planning tasks on excel
3.1.6	Does the port have IALA certified staff to manage marine operations or VTS ?	18%	10%	33%	21%	0%	8%	10%	Marine captain on duty for navigation advice
3.1.7	How does the port manage assets and equipment maintenance ?	5%	10%	26%	15%	10%	33%	0%	Asset register and repair records on a digital basis
3.1.8	How does the port monitor energy and fuel usage?	8%	23%	33%	15%	13%	8%	0%	Monitor fuel dispensed on a paper system
3.2. Rail operations									
3.2.1	How does the port manage train visit scheduling?	13%	5%	5%	5%	15%	0%	56%	Excel sheet
3.2.2	How does the port coordinate shunting operations with terminal operators?	8%	3%	5%	10%	15%	0%	59%	Shared file
3.2.3	How does the port coordinate shunting resources ?	10%	8%	5%	5%	15%	0%	56%	Radio instructions for tasks

Questions		Distribution of scores (% of ports at each level):							
3.3. Security and compliance									
3.3.1	How does the port manage entry and exit of people and vehicles at perimeter?	0%	3%	13%	36%	21%	28%	0%	Digital access card
3.3.2	How does the port manage entry and exit of trains at perimeter?	8%	26%	13%	3%	3%	0%	49%	Monitor by security guard
3.3.3	Does the port have different levels of access control or ISPS Restricted Areas inside the port?	8%	8%	10%	23%	18%	33%	0%	Locks on physical barriers to critical zones
3.3.4	How does the port monitor movement of people and vehicles inside the port estate?	0%	18%	5%	36%	26%	15%	0%	CCTV monitored by security staff
3.3.5	How does the port manage visitor and contractor access and security?	0%	18%	31%	33%	13%	5%	0%	Safety risk training and sign-off (on paper)
3.3.6	How does the port share vessel or cargo information with other regulatory authorities?	5%	36%	10%	8%	15%	21%	5%	In-house portal or governmental system
3.3.7	For sharing of port, vessel or cargo data, is there a standard data exchange structure?	23%	15%	3%	36%	13%	8%	3%	Bespoke fixed data formats to suit local systems
3.3.8	Does the port confirm verified gross mass (VGM) before export shipment?	10%	26%	21%	13%	21%	8%	3%	On-site weighbridge to capture container weight
4. Cargo and terminal operations		**0**	**1**	**2**	**3**	**4**	**5**	**N/A**	**Mean answer**
4.0.1	Is there a system to control stock inventory and work task planning?	0%	10%	10%	21%	44%	15%	0%	Basic TOS within the terminal
4.0.2	Does the port have a system for dangerous goods?	3%	5%	21%	26%	36%	10%	0%	DG consignments monitored within a cargo tracking system
4.0.3	How does the terminal manage cargo interchange with trucks?	8%	21%	38%	10%	13%	10%	0%	Use of cargo control system to record truck movements
4.0.4	How does the port record, monitor and visualize operational performance?	3%	21%	28%	13%	5%	31%	0%	Use of blended sources of data to create holistic performance views
4.0.5	How does customs (or other government agencies) inspect cargo arriving at the port?	5%	21%	10%	33%	13%	18%	0%	X-ray (non-invasive) inspection of cargo or containers
4.0.6	How do customs communicate inspection results or issues to cargo owners or other stakeholders?	3%	41%	13%	28%	5%	5%	5%	Email
4.0.7	How do importers arrange customs release ?	3%	33%	10%	28%	8%	13%	5%	Email or bank transfer
5. Organizational readiness for digitalization		**0**	**1**	**2**	**3**	**4**	**5**	**N/A**	**Mean answer**
5.0.1	Does the port have a digital policy, objectives or strategy?	5%	13%	15%	5%	10%	31%	21%	Actively owned by a senior staff member
5.0.2	Does the port have skills, staff and capability to adopt technology-driven change?	3%	8%	31%	15%	18%	5%	21%	Part of the recruitment and training for many departments
5.0.3	Does the port have management respresentation for IT & digital issues for the organization?	5%	10%	0%	18%	21%	26%	21%	IT manager leads the technical team, but reports up to another manager
5.0.4	Does the port have support from government bodies for maritime digitalization?	23%	15%	15%	5%	13%	8%	21%	Detailed maritime technology element in govt. strategy
5.0.5	Does the port consider that their tenants and users are motivated for digital change?	10%	5%	8%	28%	10%	15%	23%	Motivated to find holistic solutions for maritime activity
5.0.6	Does the port consider that digitalization will benefit the local economy, trade environment and port users?	5%	0%	0%	3%	13%	59%	21%	High value
5.0.7	Does the port consider that digitalization within port operations and the maritime supply chain will benefit the authority directly?	5%	0%	0%	3%	13%	59%	21%	High value

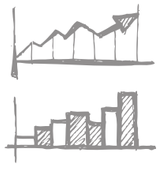
Note: CCTV = closed-circuit television; DG = dangerous cargo.

1.1 IT technology and architecture

On average, the range of more modern technology and IT tools are currently partially established across African ports, with several ports having some tools in operation, but most ports are only considering them as a possible aspirational option for the future. Interest in equipment automation was generally lower for port authorities than for private terminal operators.

1.2 Management systems

The most widely adopted technologies are a customs management system (CMS) and terminal operating system (TOS), which are the cornerstones for managing trade flow through regulatory border and managing the cargo-level transactions for terminal operations (principally in containers). Port community systems and single windows (trade or maritime) score a similar average across the port range, being in the "planning" stage. Several of these tools overlap strongly with national digital preparedness—in particular, CMSs and single windows—and a cohesive approach is noted in some ports.



2.1 Data center and business resilience

As a foundation for port digital maturity, understanding the infrastructure and capability of application infrastructure and data hosting in data centers is a critical starting point for the further adoption of digital tools. For data centers, 9 of the 39 ports interviewed had only informal, on-site server hosting. Cloud-hosting data centers are in place for port applications, but most ports do not use the cloud at all. The level of capability in existing IT teams is high, with 30 of the 39 ports having a full-time, trained IT team, with most of these being certified, too. This shows that human resource investment is being made in parallel and proportional to the technology deployed.

2.2 Cybersecurity

The data generally support a conclusion that cybersecurity remains an important risk as port digitalization expands and that a lack of awareness and preparedness, in current ports, should not implicate that no incidents or intrusions are taking place.

2.3 Information security

In line with the results from the cybersecurity and data center sections, a few ports have an information security management system (ISMS) in place to an international standard (13 ports).

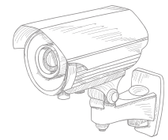
3.1 Port operations

Marine operations across African ports have a broad range of digitalization, with several ports operating full vessel traffic service (VTS) support with vessel traffic management system (VTMS) and port management information system (PMIS) solutions. This may reflect the scale of marine traffic busy ports and the

prevalence of major container shipping lines calling, with expectations of safe and efficient engagement with port marine services. Large/busy ports are likely to comply with the FAL reporting guidelines in early 2024, but from a pan-African viewpoint, this is much less likely, with often insufficient foundations to meet the obligations.

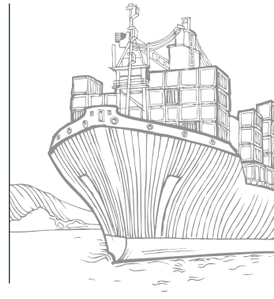
3.2 Rail operations

Only 17 of the ports surveyed are connected by regular rail freight services and therefore may need some digital technology to support this service. Logically, on a continental level, rail operations are not considered a priority for digitalization by port authorities.



3.3 Security and compliance

Most ports surveyed control the movement of people and vehicles at the gates and perimeters with identification or swipe cards checked by security guards and supported via closed-circuit television (CCTV) and via access control systems. Working together with other regulatory authorities (customs and other bodies) by sharing data produces a range of results, roughly in line with observed technology maturity. However, there is a noted disconnect here for several ports, where the regulators' own systems may not be capable of interacting with the port and manual workarounds appear.



4.0 Cargo and terminal operations

As identified in the earlier technology section, most ports surveyed have some form of TOS for their cargo operations; therefore, relatively high scores on dangerous good segregation, truck interchange and performance monitoring are seen in correlation, since most TOS products can manage these operational elements. The necessity for digital tools is dependent on the volume and type of cargo handled in the port, and several smaller ports demonstrate low digital maturity, but this may be suitable within their operational (and commercial) context. Cargo terminal operations often fall under the responsibility of private terminal operators, which can partly explain the relatively high scores compared to other categories within the component "current operational maturity."

5.0 Readiness for digitalization

Reflecting on the findings from the wider stakeholder survey, there is a recognition of the importance of digitalization for the port and how this will benefit operations of the port and for the supply chain interacting with the port. Without exception, all the ports surveyed identified these topics as important. This importance of digitalization is translated into policy and management ownership of these objectives by port authorities in many of the nations surveyed, but with a similar correlation to those ports that have a higher deployment of technology.

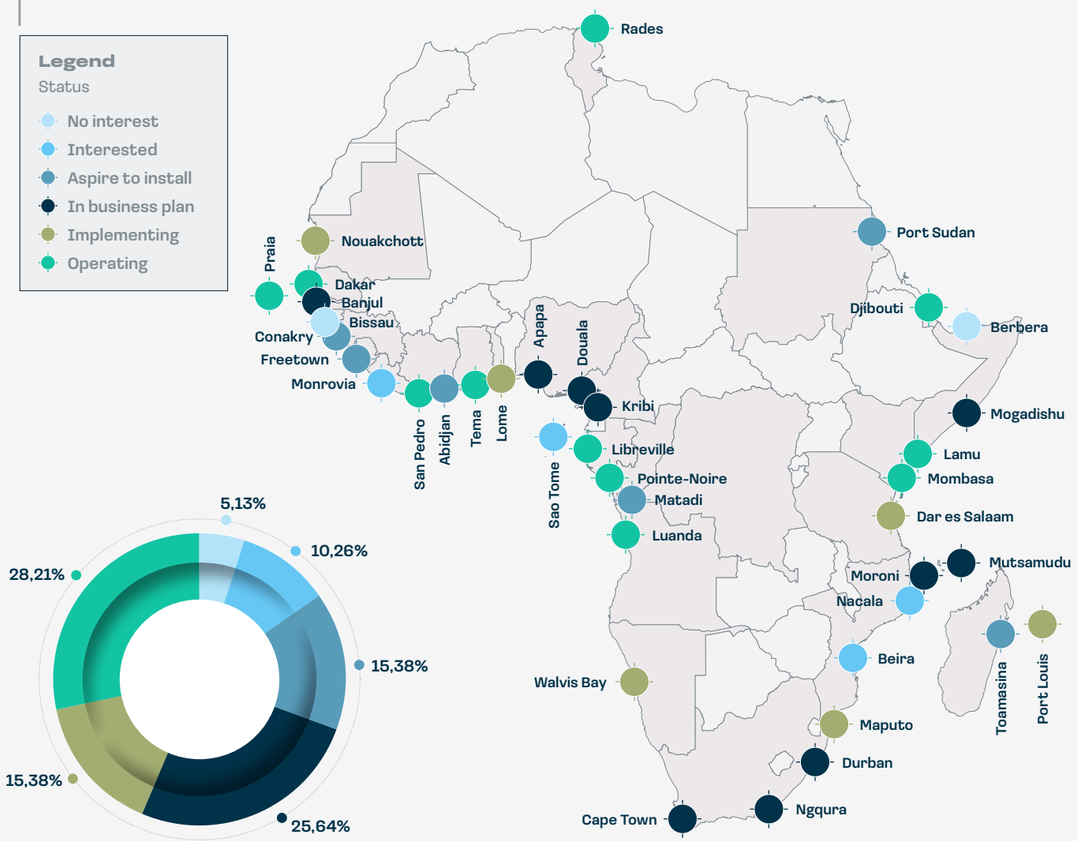
On average, port authorities surveyed reported a limited level of active support from their governmental partners or regulators in the field of digitalization, with supportive policy and objectives, but less substance in active participation or investment in port-level projects.

3.3. OBSERVATIONS ON MARITIME SINGLE WINDOWS

Twenty-eight percent of all ports in the study (of which the status is known) already have a maritime single window, with another 15 percent actively implementing an MSW. Twenty-six percent of the ports indicate that they have concrete plans to implement one within the next three years.

The remaining 31 percent of ports have no concrete plans or are not even interested in implementing an MSW. It is this last group that requires specific attention, to assist and raise awareness for the need of a single window.

Figure 3-8
Status on the Implementation of Maritime Single Windows across Africa



4.

MARITIME DIGITAL POLICY

The focus of the policy review was to study the current policy and regulatory environment within each country as it applies to digitalization in general and to the maritime and port sector specifically. The intention was to look at the degree to which the policy and regulatory framework supports or acts as a barrier to the improvement of (port) digitalization.

It is worth noting that the presence of policy statements alone is often noted to have no correlation to execution or implementation, and this was seen in certain cases, particularly with regard to maritime and trade single windows.

In assessing the overall policy and regulatory environment within the study countries, the OECD Trade Facilitation Indicator (TFI) rating was identified as a representative indicator for enabling maritime digital policy. The TFIs were used as a proxy to gauge the policy and regulatory (supporting) environment, to compare with the overall digital score of each country and to ascertain the level of correlation between these two measures.

Port authorities surveyed report a limited level of active support from their governmental partners or regulators in the field of digitalization, with supportive policy and objectives, but less substance in active participation or investment in port-level projects.

Table 4.1 shows a summary of the policy review, presenting important country digital policies and strategies as well as the presence of different types of laws important for digitalization.

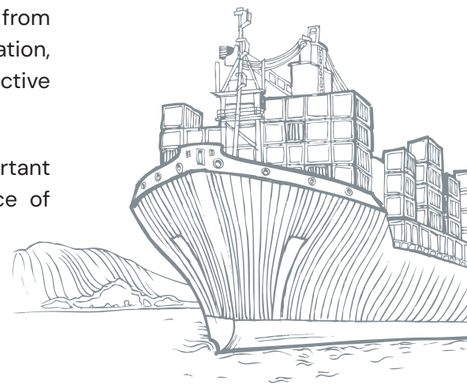


Table 4-1
Policy Review Summary

Country		Policies and digital strategies	ICT authority	Data protection	Cybercrimes	Single window act	Other ICT legislation
Angola	1.	National Development Plan on Information and Communication Technology		☑	☑		
Cabo Verde	1. 2. 3.	Strategy for the Digital Governance of Cabo Verde Strategic Programme for the Information Society National Cybersecurity Strategy	☑	☑	☑		
Cameroon	1.	Cameroon Digital 2020	☑		☑		
Comoros	1. 2.	Comoros Emerging Plan Comoros Digital Strategy 2028	☑	☑	☑		☑
Congo, Dem. Rep.	1. 2.	National Digital Plan National Strategic Development Plan (PNSD)	☑		☑		☑
Congo, Rep.	1. 2.	Congo Digital 2025 National Development Plan	☑	☑	☑	☑	☑
Côte d'Ivoire	1.	National Development Plan	☑	☑	☑		☑
Djibouti	1. 2. 3.	National Development Plan Djibouti ICI Roadmap for the Digital Economy and Innovation Vision 2035	☑	☑	☑		☑
Gabon	1.	Gabon Digital 2025 Strategy	☑	☑	☑		☑
Gambia, The	1. 2. 3.	Gambia National Development Plan Gambia National Cyber Security Policy, Strategies and Action Plan Data Protection and Privacy Policy and Strategy	☑		☑		☑
Ghana	1. 2. 3.	Digital Ghana Agenda Ghana ICT for Digital Development (ICT4AD) Policy National Science, Technology, and Innovation Policy	☑	☑	☑	☑	☑
Guinea	1.	Guinea Digital Roadmap	☑	☑	☑		☑
Guinea-Bissau	1.	Global Rationalization Plan	☑				
Kenya	1. 2. 3.	Kenya National Digital Master Plan Kenya National ICT Policy Kenya Ports Authority Strategic Plan	☑	☑	☑	☑	☑
Liberia	1.	Liberia ICT Policy	☑				☑
Madagascar	1.	New National e-Government Strategy		☑	☑		☑
Mauritania	1. 2. 3.	National Agenda on Digital Transformation National Strategy for Modernization of Administration and ICTs Promotion Strategy Universal High Speed and Access	☑	☑	☑	☑	
Mauritius	1.	Digital Mauritius 2030	☑	☑	☑		
Mozambique	1. 2. 3.	National ICT Policy e-Government Strategy National Cybersecurity Strategy		☑	☑	☑	☑
Namibia	1. 2. 3.	ICT Policy for Education in Namibia Vision 2030 Namibia Broadband Policy	☑	☑	☑		☑
Nigeria	1. 2. 3.	National Digital Economy Policy and Strategy A Strategic Roadmap for Developing Digital Identification in Nigeria Nigeria e-Government Master Plan	☑	☑	☑	☑	☑
São Tomé and Príncipe	1.	Contribution to a National Strategy for Digital Governance	☑	☑	☑		
Senegal	1. 2.	Senegal Digital Strategy 2025 (SN2025) Emerging Senegal Plan	☑	☑	☑		☑
Sierra Leone	1. 2. 3.	National Cyber Security and Data Protection Strategy National Innovation and Digital Strategy Digital Development Policy	☑		☑		☑
Somalia	1.	National ICT Policy & Strategy	☑				
Somaliland	1. 2.	ICT Management Policy Somaliland e-Government Strategy	☑				
South Africa	1. 2. 3.	Strategic Plan for the Department of Communications and Digital Technologies National Digital and Future Skills Strategy National e-Government Strategy and Roadmap	☑	☑	☑	☑	☑
Sudan	1.	Sudan National Strategy of ICT Industry	☑				☑
Tanzania	1. 2. 3.	National ICT Policy e-Government Agency (eGA) Strategic Plan TPA Digital Transformation Strategy	☑	☑	☑		☑
Togo	1. 2.	National Digital Planning Strategy e-ID Togo	☑	☑			☑
Tunisia	1. 2. 3.	National Digital Transformation Strategy National Strategic Plan Digital Tunisia 2020 Smart Tunisia Programme	☑	☑	☑	☑	☑

5. ENABLERS AND BARRIERS FOR DIGITALIZATION

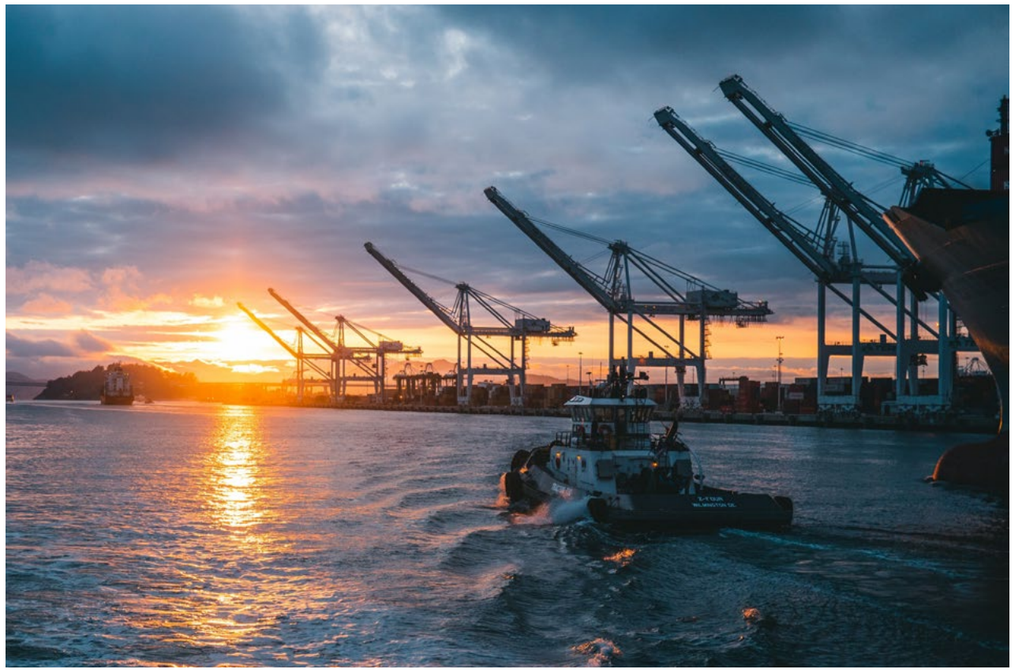
This section summarizes the insights gathered throughout the study—which includes direct feedback from surveyed parties, blended with the institutional policy reviews—and gathers viewpoints that are common to many of the countries around Africa.

Each country has a different size, structure, geography, management, and supervision model for their maritime supply chain and the systems and processes contained within, and it is important not to overly generalize on the positive and negative aspects, as each nation (and each port) is a specific case.

However, within the larger, smaller, continental, or island nations broad correlations can be seen in both the data and the captured feedback, which support a short summary of where common initiatives, policies, skills, and systems development could be most beneficial.

This section, in a series of figures, compares a blend of data from the benchmarks gathered from previously existing public data, at a country or port level, with the results from the surveys carried out under this study to assess digital maturity at a port level. This comparison highlights where broader external forces, policies, or stakeholder actions work together with port digitalization initiatives to boost both metrics for trade and port transformation.

Each figure uses the digital maturity score set for each port in the study; this is the overall average score acquired for each section within the survey, including both current maturity and the planning and aspirational elements.



This score is compared with different barriers/enablers, which can be represented by indicators from the desk study/fact files:[3]

1. National economic output density – GDP per capita (US$)
2. Governmental trade facilitation – OECD Trade Facilitation Index
3. National ICT infrastructure – AIDI ICT Index
4. Port cargo throughput – 000s metric tons
5. National connectivity progress – internet penetration growth %/year
6. Port management model – assessment of landlord, public, or private port operation

Of course, in reality, the digital maturity is a factor of multiple enablers, many times more than are listed here. Enablers by themselves have relatively bad correlations with digital maturity. However, when the enablers are combined, the correlation with digital maturity becomes clear. The goal of this analysis is to find the most important enablers for digital maturity, and therefore the smallest combination of enablers that approximates trends in digital maturity.

3. https://www.ssatp.org/publication/digitalization-african-ports-national-fact-files

Figure 5-1
Digital Maturity versus National Economic Output Density

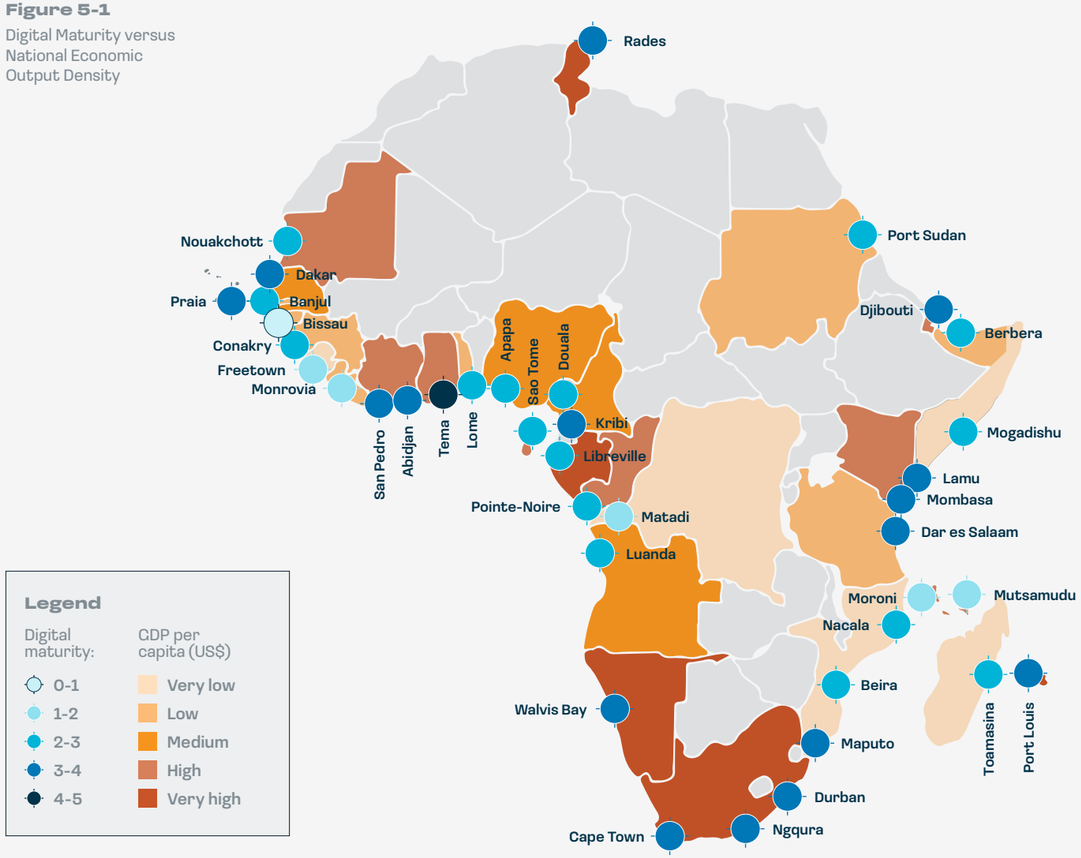


Figure 5-2
Digital Maturity versus Fluctuations in Economic Output Density

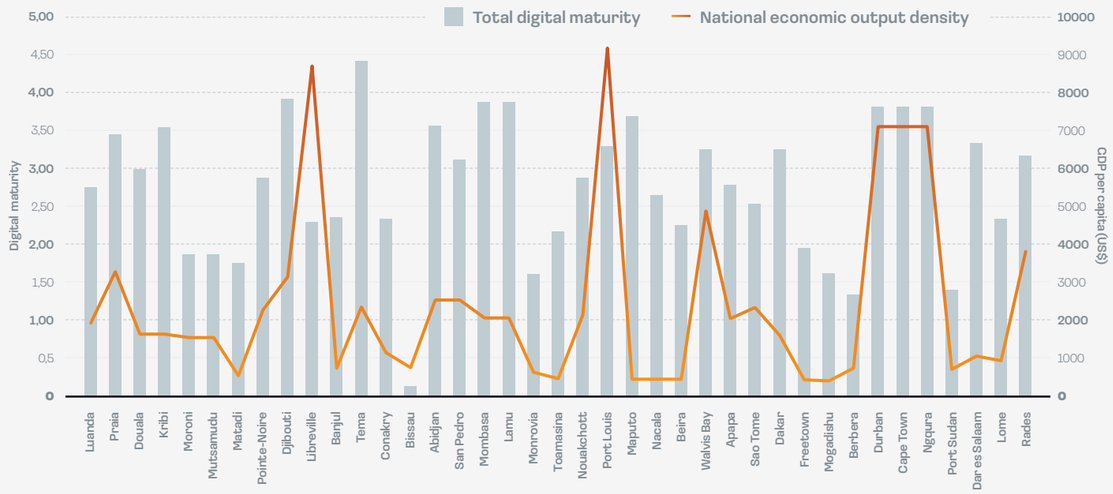


Figure 5-3
Digital Maturity versus Governmental Trade Facilitation

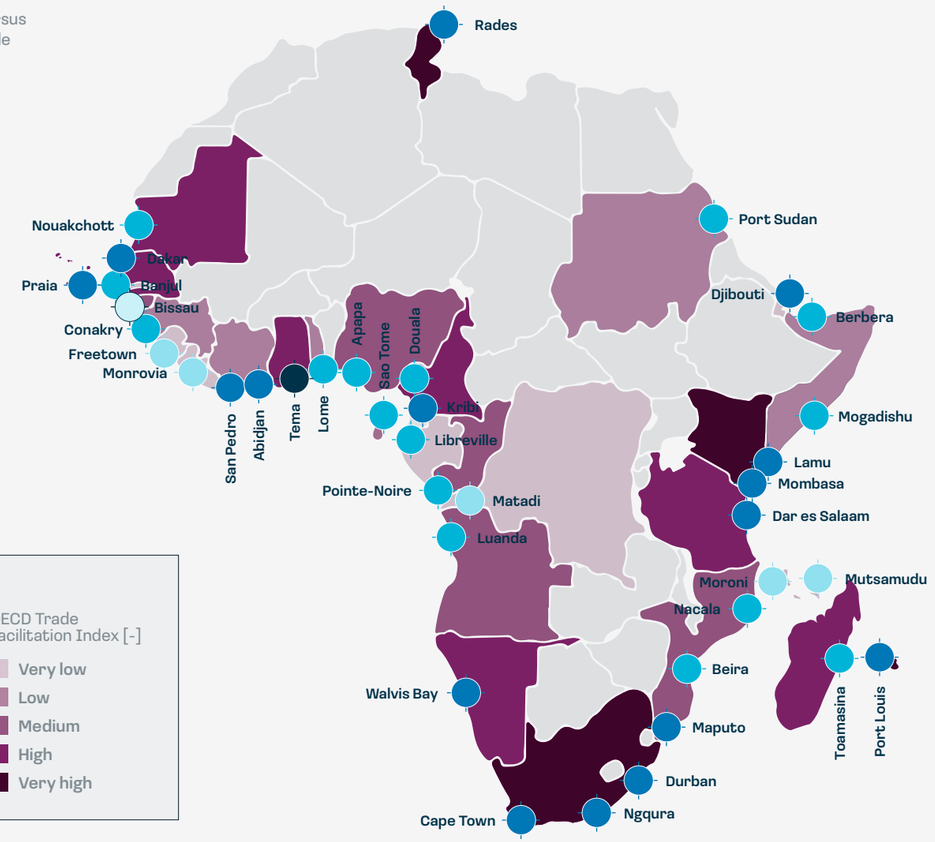


Figure 5-4
Digital Maturity versus Fluctuations in Governmental Trade Facilitation

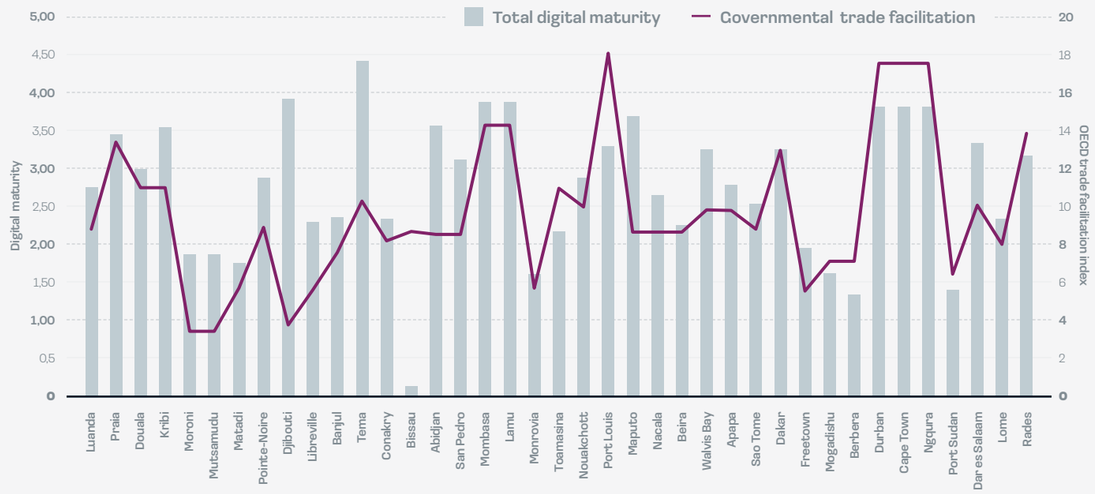


Figure 5-5
Digital Maturity versus National ICT Infrastructure

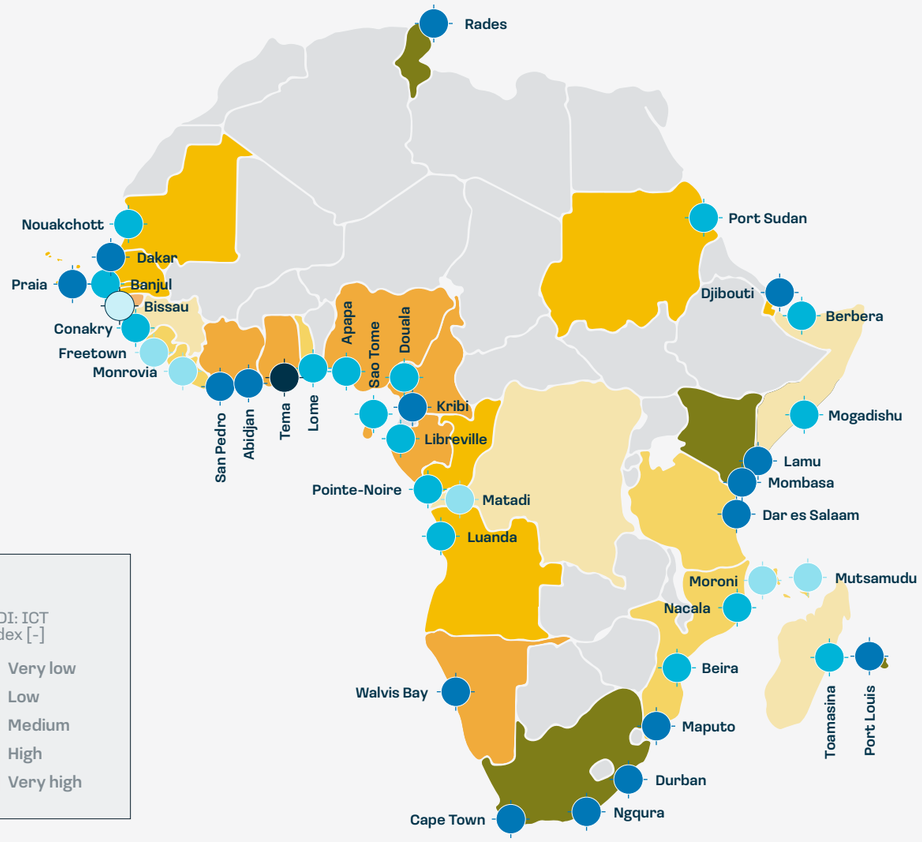


Figure 5-6
Digital Maturity versus Fluctuations in National ICT Infrastructure

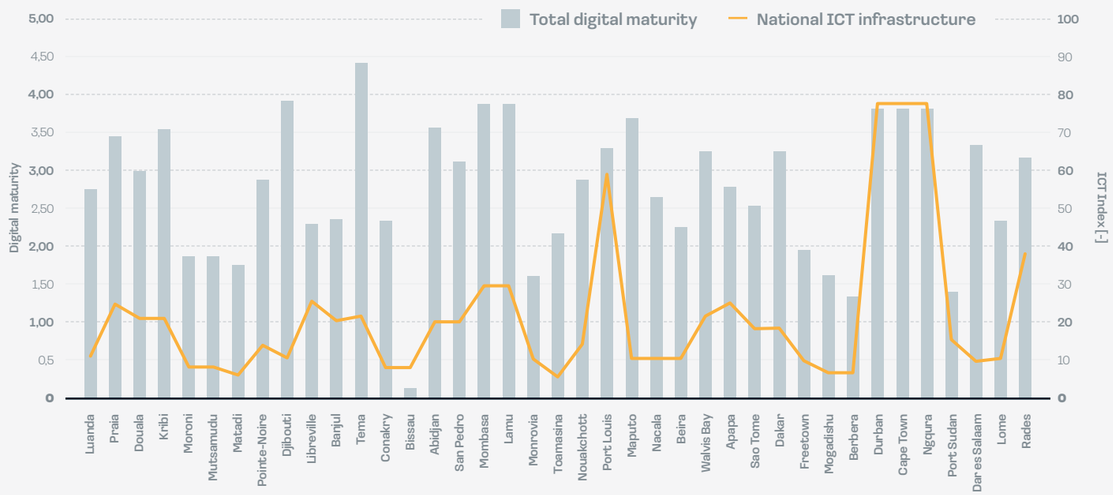


Figure 5-7
Digital Maturity versus Annual Port Cargo Throughput

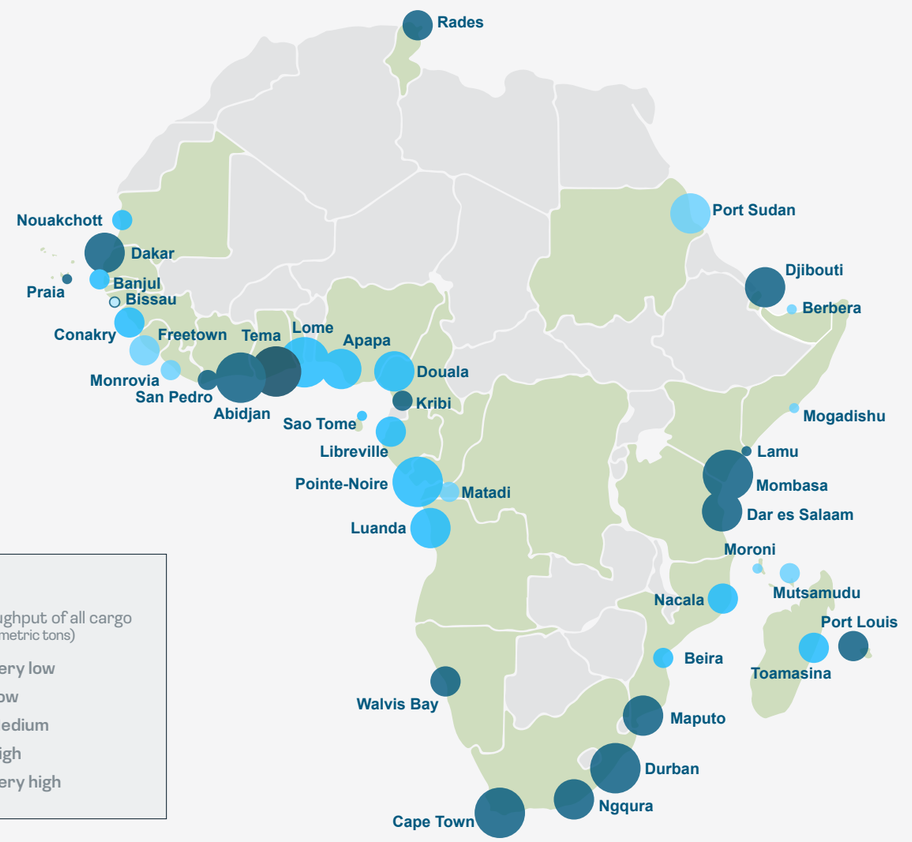


Figure 5-8
Digital Maturity versus Fluctuations in Port Cargo Throughputs

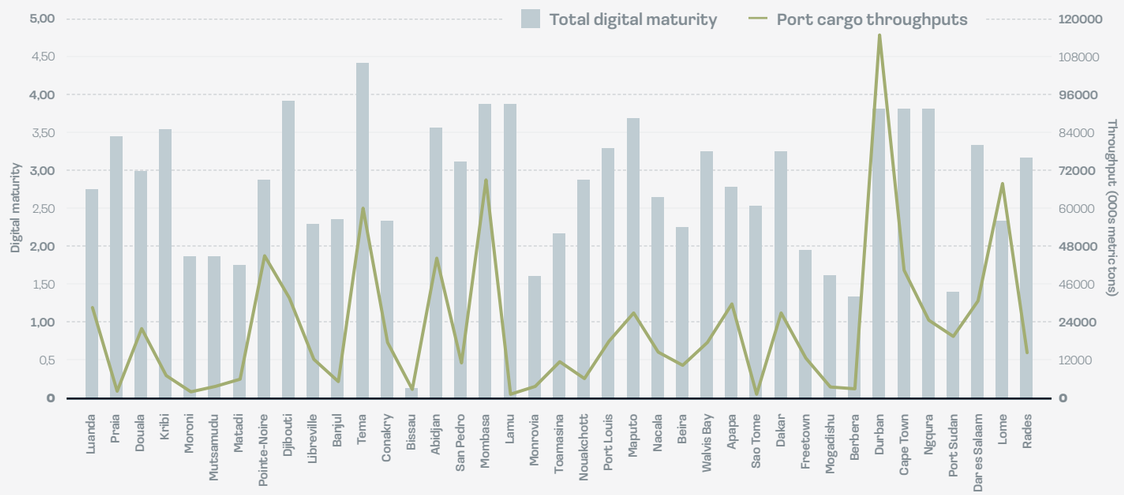


Figure 5-9
Digital Maturity versus Data Communications Network Growth Progress

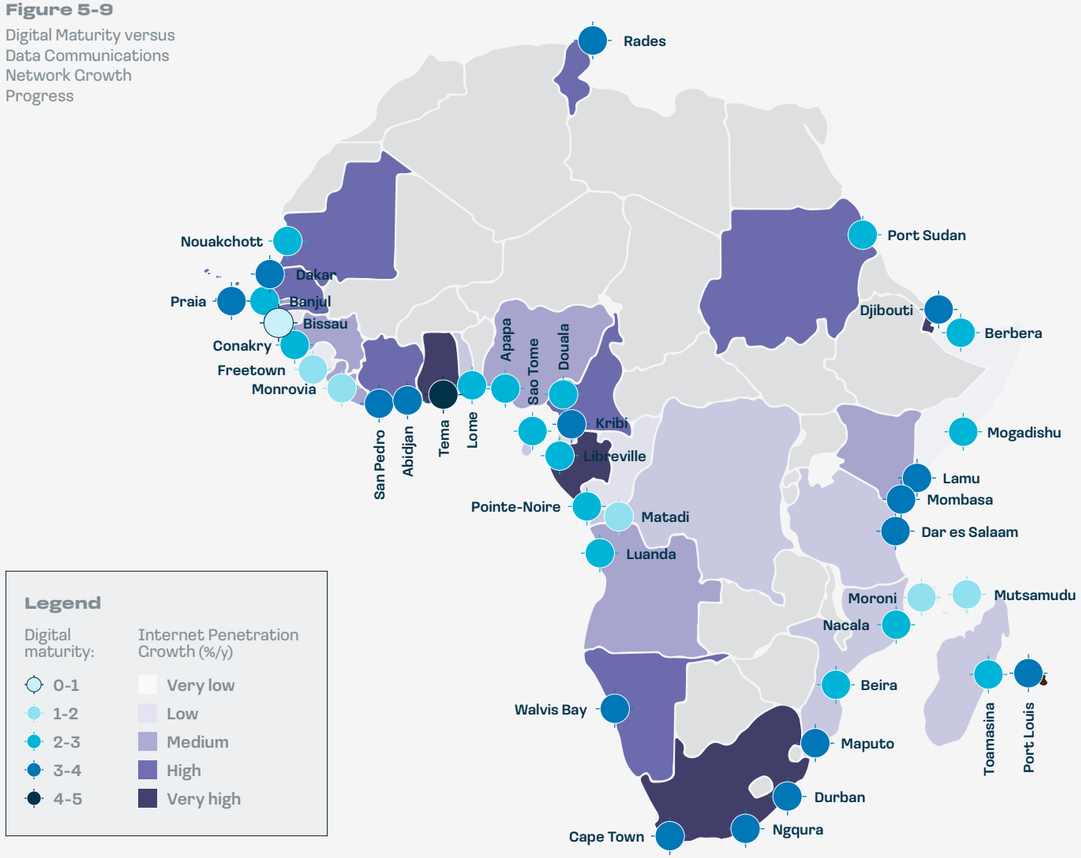


Figure 5-10
Digital Maturity versus Fluctuations in National Connectivity Progress

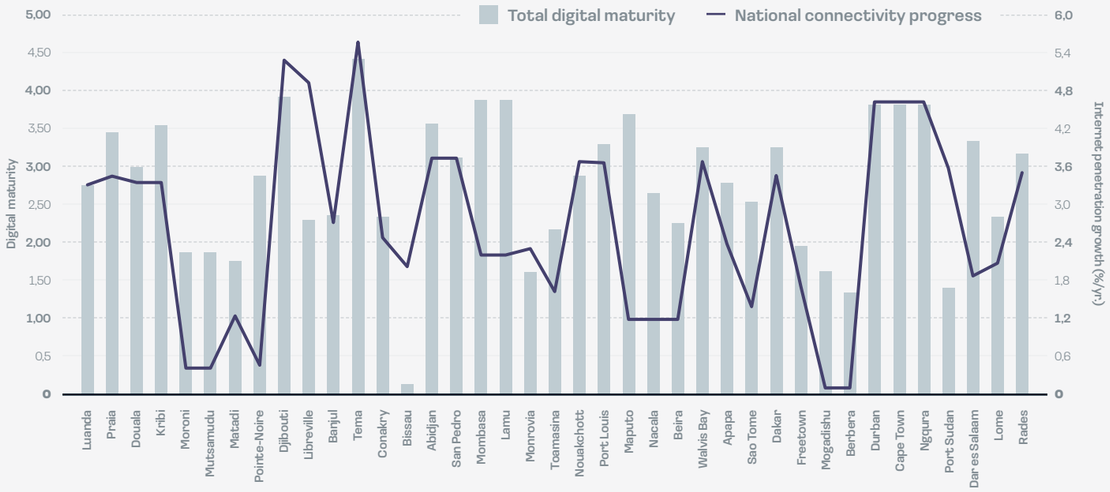


Figure 5-11
Digital Maturity versus Port Management Model

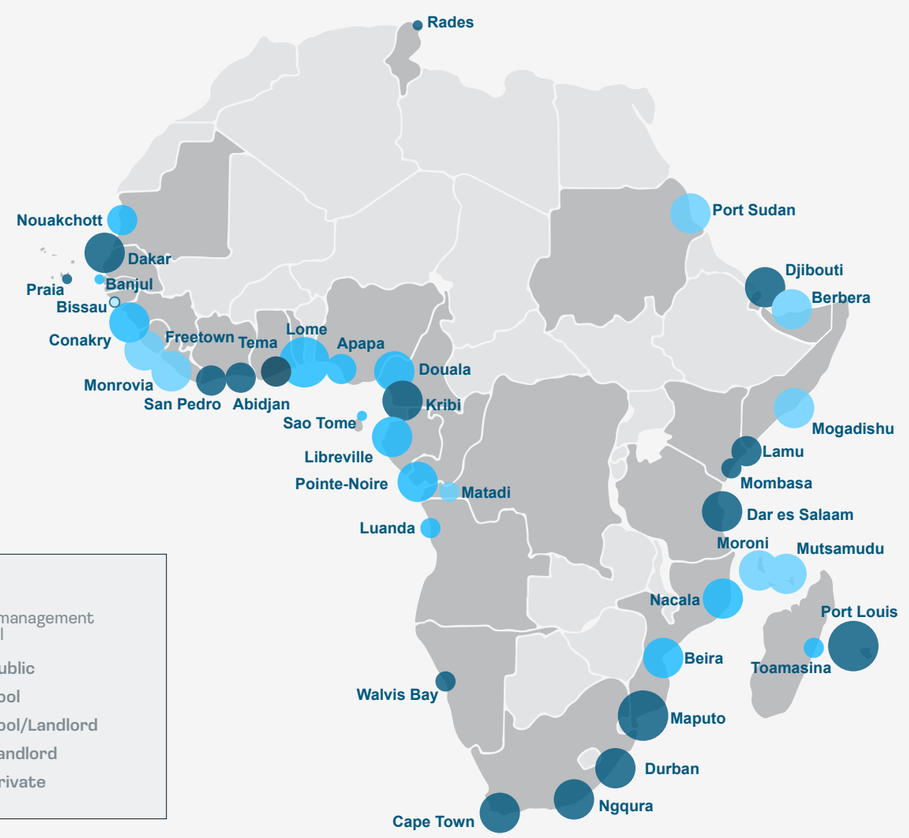
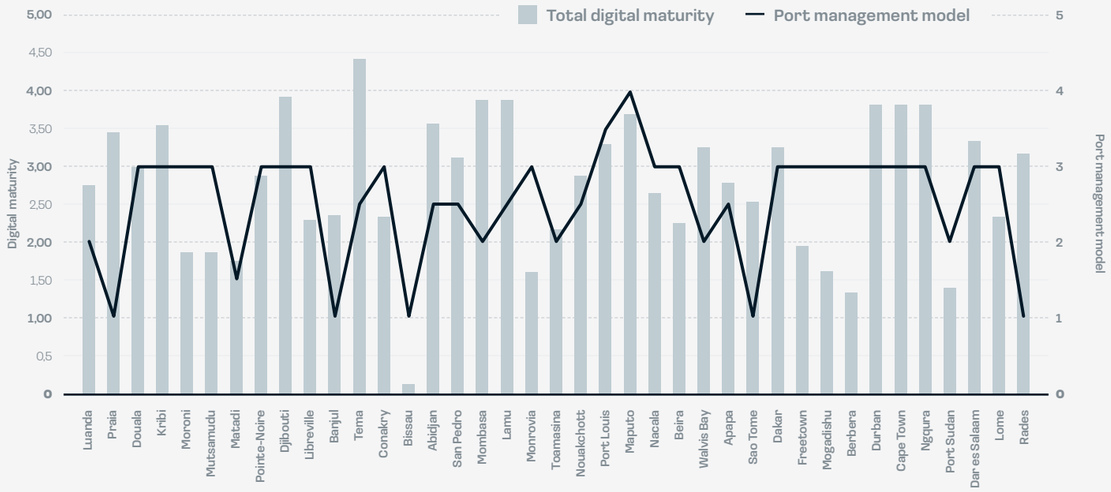


Figure 5-12
Digital Maturity versus Fluctuations in Port Privatization



5.1. FACTORS DRIVING PORT DIGITALIZATION

Various drivers contribute to port digitalization. Table 5.1 summarizes the factors that strongly, moderately, or weakly correlate (or impact) with the port digitalization scores.

The broad nature of governmental trade facilitation and the underlying indicators support a number of foundational elements of port digitalization, including information availability, procedures for and automation of trade (formalities), and involvement of the trading community, or supply chain stakeholders. The key role of other government agencies, such as border security and customs, is also emphasized as part of these measures. While some anomalies exist, the overall correlation between the TFIs and the digital maturity level of the studied ports is very strong.

Table 5-1
Impact of Key Drivers on Port Digitalization

Driver	Impact	Comments
National economic output	Low	Population size and national GDP may not influence the digital maturity of ports, particularly for larger nations where the maritime supply chain is less important, proportional to the population size and distribution.
Port operating model	Low	Both publicly and privately operated ports can exhibit strong digital maturity, suggesting that the ownership model does not seem to influence this.
Volume handled	Low	Some level of correlation in ports with high tonnage throughput, but wide variation among smaller ports, where other factors are more important influencers. In general terms, the total tonnage does not correlate to digital maturity.
National ICT infrastructure	Moderate	National-level ICT infrastructure aligns with port-level digital maturity, but not in all cases, especially in countries with low levels of national digital infrastructure and more sophisticated ports.
National connectivity development	Moderate	Wider supply chain users adopting digital tools are dependent on internet availability, making this driver a potential supporter of future port-centric digitalization.
Governmental trade facilitation	High	There is a strong connection between trade facilitation, which is mostly sea based, and the digitalization of port processes.

The impact of the digital maturity on port performance (CPPI) is not as clear cut. In general, the level of digital maturity and the level of (container) port performance is aligned. However, several container ports exhibit high digital maturity but perform at low levels of productivity. This could be related to the types of digital solutions deployed and their maturity. It also clearly indicates that other factors need to be considered, such as equipment condition and availability and the general labor environment.

Conversely, some ports have low digital maturity yet have a high container port performance. This may occur, for example, where private concessions exist, but the port authority is not invested in digital solutions.

5.2. SUMMARY OF COMMON OBSERVATIONS

To conclude, there are some common trends and overarching observations from the data study:

- African port-level digitalization is not uniform. On all markers, both nil and maximum scores were captured.
- National-level economic markers, such as GDP, do not necessarily indicate where digitalization is strong, or important.
- Digitalization in ports feeds advancement; high scoring ports on one marker often scored well on others and have staff, organizational capacity, and plans to continue to grow. The reverse is also seen to be true, but very few ports have no digital awareness or ambitions.
- Most ports have some foundation systems, such as a customs management system or terminal operating system.
- Appetite for equipment automation is very limited, but digitalization feeds trade and port efficiency without impacting on labor demands (as "automation" is perceived to do).
- Ambition and awareness of importance for digital tools is strong.

- Government policy and investment support for ports is not strong and can be improved.
- Cybersecurity awareness, preparedness, and managing data safely are generally very weak.
- IT infrastructure and resilience are varied but generally weak.
- Having a policy or law on single windows does not necessarily mean that the policy or law gets implemented in reality. Closer involvement and active support from governmental agencies during the implementation are required.
- Enhanced teamwork between supply chain stakeholders is important.
- The diversity of digital maturity in African nations and ports is very broad and overgeneralization is important to avoid.
- There is a strong connection between trade facilitation, which is mostly sea based, and the digitalization of port processes. Government trade facilitation efforts are key drivers for supply chain and port digitalization.

6.

RECOMMENDATIONS

Based on the common observations from pan-African ports and maritime supply chains, a set of supportive recommendations can be drawn out that would help most African ports achieve a higher level of digitalization.

While there is a noted diversity in digital maturity, it is possible to identify some common improvement initiatives:

- Create forums and user groups on a national, regional, and continental level to discuss, develop, and deploy digital initiatives for the local needs of African ports, gathering port communities with similar gaps in maturity to work together and share expertise (and potentially investment) to move forward. This will break down perceived barriers and enable collective teamworking, as aligned with the approach for multitier collaboration of the previous World Bank report, *Accelerating Digitalization: Critical Actions to Strengthen the Resilience of the Maritime Supply Chain*. Survey feedback often stressed the need for teamwork, particularly to be led at the governmental level.
- Guide and support governmental bodies to increase their trade facilitation efforts (as a key driver for supply chain and port digitalization) by policy focus and funding for cornerstone projects for digital platforms, such as a port community system (PCS). The complexity of scale, but commonality of functionality, in such trade platforms do support some cross-national teamwork. All

PCS platforms need to be locally bespoke, but the architecture and implementation techniques are standard. Execution of PCS and single window platforms is lagging, and support with skill-building and ready-made software tools to implement these would benefit African ports.

- Explore and facilitate the deployment of "leapfrog" ICT infrastructure, such as cloud-hosting, data center availability, and business resilience tools, enabled by stronger internet penetration (perhaps over cellular networks), to break out from the investment intensive on-premises traditional deployments currently favored. This report highlights a low-level of data center and cloud platform availability.
- Provide practical training and hardware/software toolkits to enable improved cybersecurity adoption at ports, especially for those growing into more digitalized supply chains. While promoting guidelines is essential, it is equally important to provide the knowledge and skills required to implement these changes on the ground.
- Develop regional-level training courses to enhance skills in port community staff in areas such as business process modeling, requirements analysis, procurement, project management, and business case development. This training will empower staff to contribute effectively to project design and delivery by port authorities and others in the maritime supply chain.
- Provide guidance toward best-value investments, potentially using the maturity index presented in this report. This guidance should be aimed at governments or authorities to deliver positive change in their supply chains and maximize value from their limited budgets. Sharing knowledge and expertise among regional port actors will enable lessons learned and best practices, with a relevance to African ports.
- Showcase relevant examples from other regions of the world where innovative solutions and their financing models could be adapted to the local context of African ports. This can serve as inspiration for efforts to reshape long-standing business practices and to address policy, organizational, commercial, and operational changes on which port authorities and governments may require external support.

6.1. SUGGESTED NEXT STEPS

Here, we present a multi-pronged approach for improving the digitalization of ports in Africa. It is expected that this approach will be further refined and aligned with the priorities of the African Continental Free Trade Area (AfCFTA) and the Programme for Infrastructure Development in Africa (PIDA). Furthermore, provision should be made for future updates to the digital maturity scores of the surveyed ports, as these scores are expected to change over time. This could take a form of a ports digitalization policy matrix[4] to inform decision-makers at the continental level. The update of the ports digitalization matrix could be part of the mandate of the recently established Africa Green Ports Forum.

1 – Focus on ports with low digital maturity

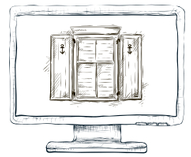
Matadi, Bissau, Monrovia, Freetown, Mogadishu, Berbera, Port Sudan, and the ports in the Comoros all have digital maturity scores below 2, indicating minimal use of digital tools or systems in their operations—despite their high ambitions regarding digitalization. Prioritizing the advancement of these ports to achieve an acceptable level of digitalization is imperative. This can be accomplished through training, awareness campaigns, government support, and potentially additional funding.

9 study ports minimally use digital systems and/or platforms to support their port operations.

Each port has its own specific challenges, so it is crucial to carefully study and analyze them to make sustainable improvements in digitalization.

2 – Raise awareness on MSW requirements

Many of the surveyed ports were unaware of the FAL requirements to take effect on January 1, 2024. It is therefore essential not only to communicate this deadline but to explain what is expected from the ports and why a FAL-compliant maritime single window (MSW) is important. In addition to the International Maritime Organization (IMO) guidelines on MSWs, several ports require additional support and guidance in implementing an MSW.



31%

of ports have no plans to implement a maritime single window.

Currently, there is limited awareness of the requirements for an MSW; therefore, some ports place it low on their agenda.

4. https://www.ssatp.org/documents/policy-matrix-diagnostic-status-current-it-systems-and-policy-impediments-african-ports

42%

of ports have no or untrained ICT personnel.

Reliable, fast internet and data centers are the most important enablers for digitalization according to stakeholders.

72%

of ports consider digitalization very important for the port and the economy.

3 – Build digital skills

IT skills—in particular, those related to cybersecurity—are often inadequate.

Several ports indicated that dedicated trained personnel is difficult to find, especially related to cybersecurity. More digital training of port staff is required and can therefore be facilitated. This will also increase support within the port for digitalization. Training on topics related to operating systems, network and data center security and management, software development, collaboration tools, and information security practices would be valuable.

4 – Increase investment in ICT infrastructure

Availability of reliable ICT infrastructure is a crucial barrier/enabler, according to both the pan-African analysis and the stakeholder survey. Important systems in the port, like a port community system, terminal operating system, and cloud-based systems, require a reliable and fast internet connection to function optimally. At a lot of ports, internet penetration is insufficient.

Investment in advanced data centers is increasingly required for developing ports and their supply chains.

Investment in foundational digital infrastructure is required to drive further digitalization of ports and their supply chains.

5 – Facilitate regional port cooperation

Digital maturity varies greatly between African ports. The experience and lessons learned from digitally mature ports can benefit ports further behind on their digitalization journey.

Ports that lag behind on certain topics can be coupled with ports that have already advanced in these fields.

By facilitating this pan-African cooperation, specific experiences and skills can be shared and more customized guidance can be provided. Ambitions on digitalization are in general very high at digitally immature ports.

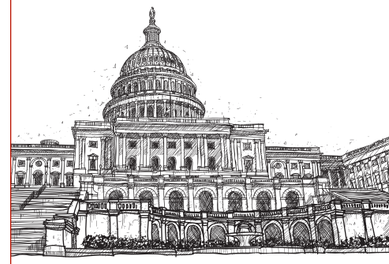
African ports with high digital maturity often have more realistic ambitions and therefore are in the ideal position to help low-scoring ports make their ambitions concrete.

6 – Align ports with their government

Governmental trade facilitation is the most important barrier/enabler for port digitalization. Thus, the stance of the government toward digitalization in general and specifically within their ports is crucial, not only in writing policies and regulations but also in their practical implementation.

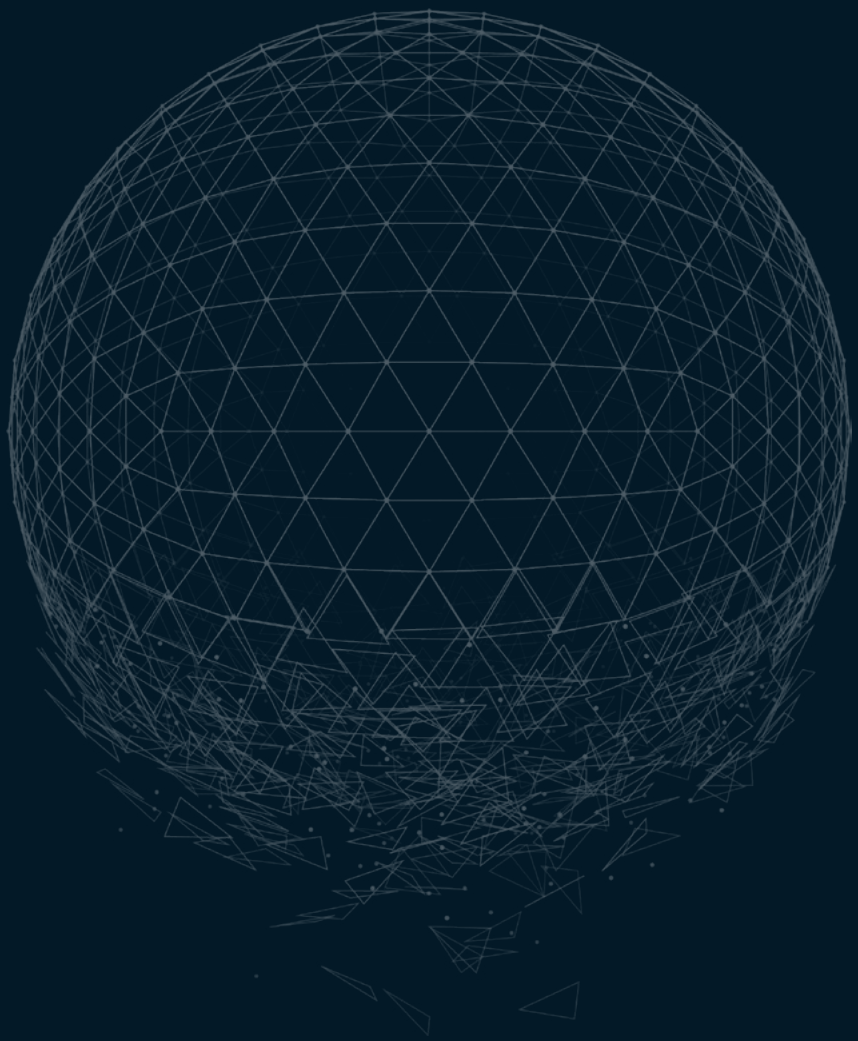
It is critical to raise awareness at a governmental level for the importance of maritime digitalization.

By aligning the views and ambitions of the government and the port authority, more effective policies and financing plans can be created.



39%

of port stakeholders think the government should play a leading role in digitalization.



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