Status of digitalization and regulatory frameworks in African ports

Final Report Summary

October 2023

Project Information

Client: World Bank Group (WB)

Involved stakeholders and sponsors:

The International Association of Ports and Harbors (IAPH),

The Africa Transport Policy Program (SSATP)

The African Union Commission (AUC)

Funding and Partnership

This assignment is undertaken as part of the support to the implementation of the Programme for Infrastructure Development in Africa (PIDA), managed by the Department for Infrastructure and Energy, Africa Union Commission (AUC). The assignment is co-financed by the World Bank and by funding granted by the French Development Agency (AFD) to AUC through SSATP to support the AUC in line with the priorities set by the 2063 agenda for the transformation of Africa into a world power.

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Introduction and background

Scope

- 31 countries / 39 ports

Country	Port
Angola	Luanda
Cabo Verde	Praia
Cameroon	Douala
	Kribi
Comoros	Moroni
	Mutsamudu
Congo, DR	Matadi
Congo, Republic	Pointe-Noire
Djibouti	Djibouti
Gabon	Libreville
Gambia	Banjul
Ghana	Tema
Guinea	Conakry
Guinea-Bissau	Bissau
Ivory Coast	Abidjan
	San Pedro
Kenya	Mombasa
	Lamu
Liberia	Monrovia
Madagascar	Toamasina

| Country	Port
Mauritania	Nouakchott
Mauritius	Port Louis
Mozambique	Maputo
	Nacala
	Beira
Namibia	Walvis Bay
Nigeria	Apapa
Sao Tome et Principe	Sao Tome
Senegal	Dakar
Sierra Leone	Freetown
Somalia	Mogadishu
Somaliland	Berbera
South Africa	Durban
	Cape Town
	Ngqura
Sudan	Port Sudan
Tanzania	Dar es Salaam
Togo	Lome
Tunisia	Rades

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Scope

1. Desktop review of the legal, policy and regulatory framework of the countries and ports in relation to digitalization.

2. A high-level review of the current IT systems and services provided at these ports (via survey and interview), specifically to identify:-

   i. Does the port meet the mandatory FAL convention requirements (current and new);

   ii. Systems used for digital health security;

   iii. Systems used for port call management and port management;

   iv. Systems used for terminal operations;

   v. Systems used to engage with the port community, and any plans/proposals to develop/introduce a Port Community System;

   vi. Systems used by Customs;

   vii. Systems used by OGAs related to international trade and other type of traffic such as cruises; and

   viii. Review of existing cyber-security measures, policies, and systems.

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Study approach and methodology

- The methodology and approach followed for this study involved a combination of locally conducted face-to-face and online interviews with relevant port authorities, as well as a general port stakeholder survey and supporting desktop research, as shown below.
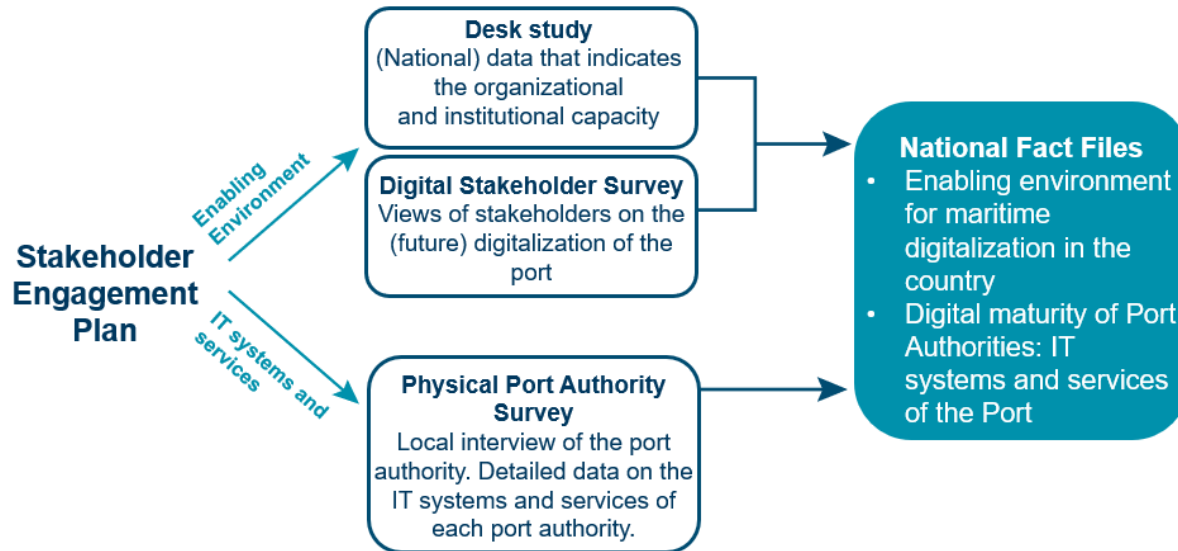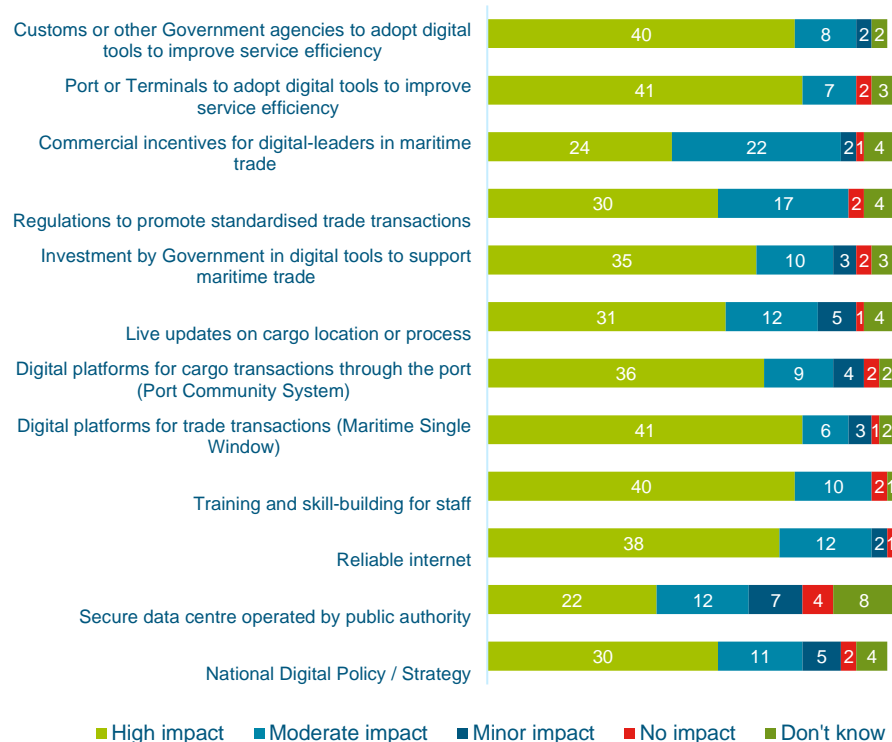
National maritime digital environment

Task 1 survey

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National maritime digital environment (task 1 survey)

- The survey covered a broad cross-section of port stakeholders including port authorities, government agencies, terminal operators, supply chain partners and suppliers.

- The objective was to gauge the perception of the respondents regarding the current status and value of digitalization, as well as the responsibility for driving this.

- A total of 52 responses were received from approximately 300 invitations.

- Key take-aways from this survey include:-
  - ❖ The importance of digitalization to lead supply chain performance improvement and transparency.
  - ❖ A dependency on enabling infrastructure.
  - ❖ A low aptitude for data sharing.
  - ❖ A lack of policy direction or obligatory regulations to invest further in digitalization.
  - ❖ Governments need to lead this digital transformation process.

	High impact	Moderate impact	Minor impact	No impact	Don't know
Customs or other Government agencies to adopt digital tools to improve service efficiency	40	8	2		2
Port or Terminals to adopt digital tools to improve service efficiency	41	7		2	3
Commercial incentives for digital-leaders in maritime trade	24	22	2	1	4
Regulations to promote standardised trade transactions	30	17		2	4
Investment by Government in digital tools to support maritime trade	35	10	3	2	3
Live updates on cargo location or process	31	12	5	1	4
Digital platforms for cargo transactions through the port (Port Community System)	36	9	4	2	2
Digital platforms for trade transactions (Maritime Single Window)	41	6	3	1	2
Training and skill-building for staff	40	10		2	1
Reliable internet	38	12		2	1
Secure data centre operated by public authority	22	12	7	4	8
National Digital Policy / Strategy	30	11	5	2	4

Impact level of supply chain digitalization initiatives

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National maritime digital environment

Capacity building of personnel involvement at training centres in port trades is required
– Terminal Operator, Ivory Coast

The importance of cybersecurity. As more digital systems are used in the maritime supply chain, it is important to ensure that these systems are secure. Cybersecurity threats are a growing concern in the maritime industry, and Namibian businesses need to take steps to protect their data and systems.
– Port Authority, Namibia

The RCG(Reporting of Goods) prior to loading that was recently introduced by Customs to prevent unwanted cargo, substances entering or leaving the country. It is still in its infancy stage but improving.
- Trade, South Africa

The policy of online data availability for the users concerned has a great positive impact on the use of digital systems in the supply chain
- Port Authority, Madagascar

Port and maritime authority digital readiness (task 2 survey)

- The overall average for all countries surveyed was 2.76.

- Individual country scores can be seen in the graph on the following page.

- High digital maturity scores were not limited to particular regions, size of port, or economic development in a country.

- Generally, high scores were seen for digital maturity in cargo operations and low levels of maturity or scoring for the digitalization of customs processes and systems.
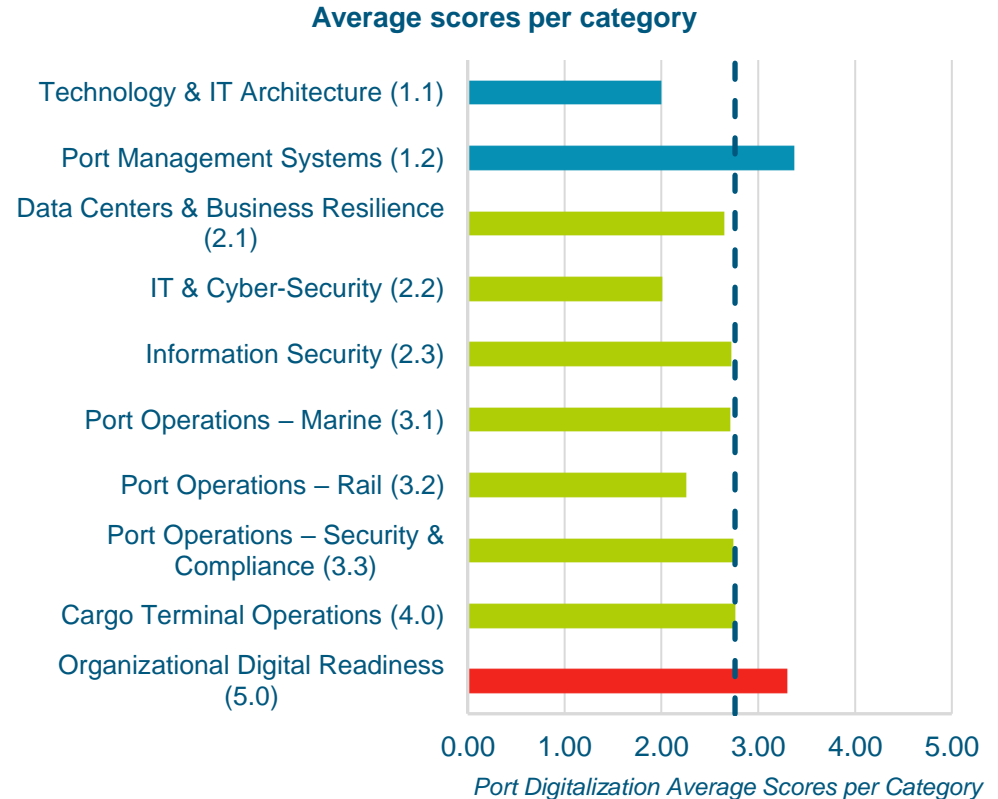
Digital Maturity

Rades
Nouakchott
Dakar
Banjul
Praia
Bissau
Conakry
Freetown
Lome
Apapa
Tema
Monrovia
Douala
San Pedro
Abidjan
Kribi
Sao Tome
Libreville
Pointe-Noire
Matadi
Luanda
Port Sudan
Djibouti
Berbera
Mogadishu
Lamu
Mombasa
Dar es Salaam
Moroni
Nacala
Mutsamudu
Port Louis
Beira
Toamasina
Walvis Bay
Maputo
Durban
Ngqura
Cape Town

Legend

Digital maturity:

- 0-1
- 1-2
- 2-3
- 3-4
- 4-5

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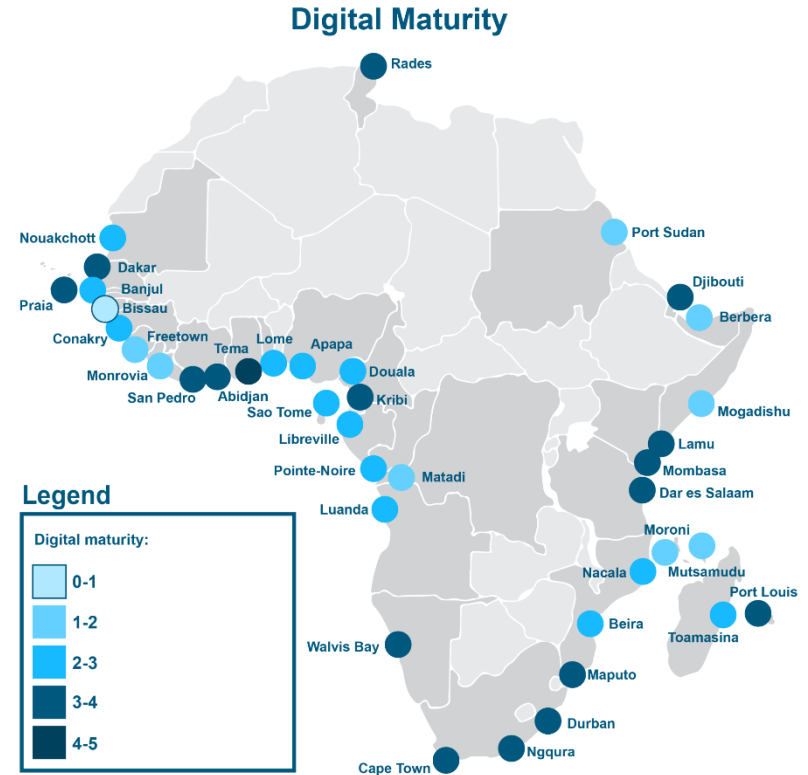
Port and maritime authority digital readiness (task 2 survey)

Digital maturity scores for all ports within the study

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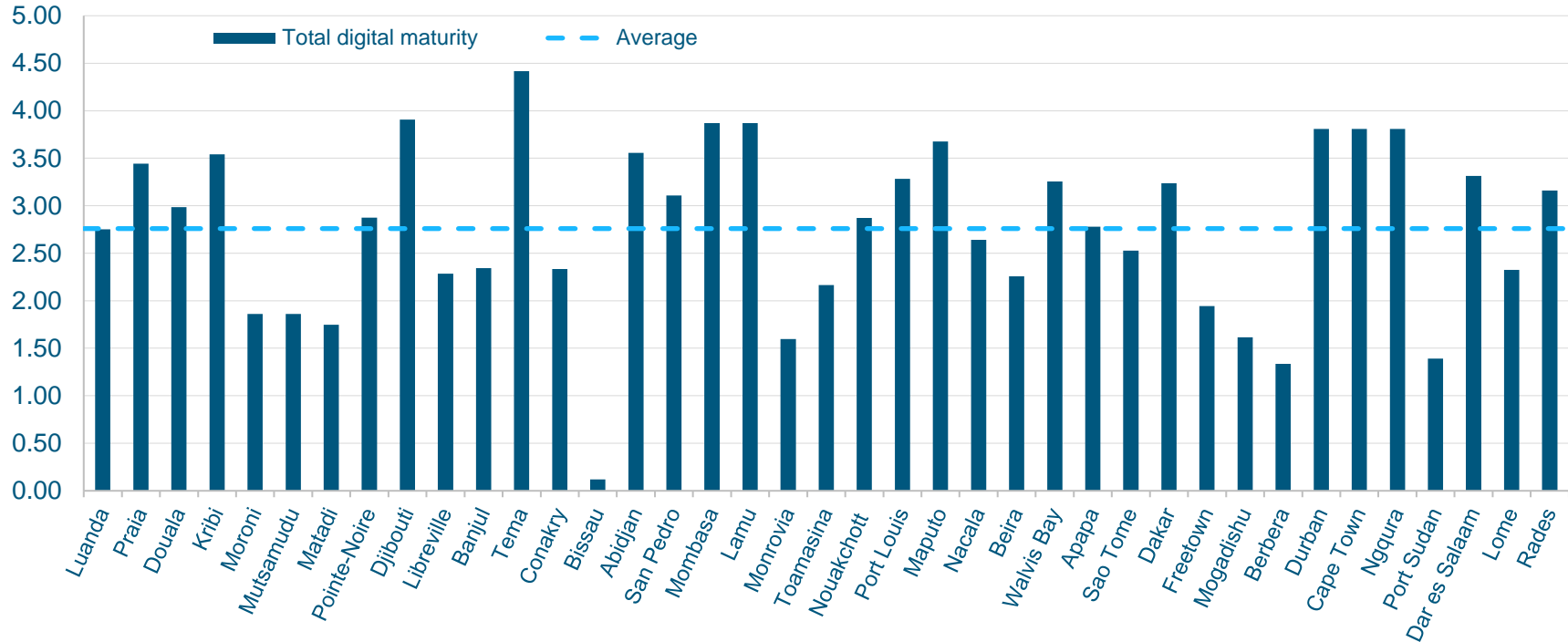
Port and maritime authority digital readiness (task 2 survey)

- The survey covered :
  - A checklist of IT technologies and systems in place or planned for implementation.
  - The status of IT and cybersecurity at the port.
  - The digitalization of port operations (marine, rail, safety and security).
  - Compliance with the upcoming FAL convention.
  - The use of shared port-wide platforms like Single Window and Port Community Systems.
  - Cargo and terminal operations.
  - Organisational readiness for digitalization.

Average scores per category

Category	Score
Technology & IT Architecture (1.1)	~2.0
Port Management Systems (1.2)	~3.4
Data Centers & Business Resilience (2.1)	~2.7
IT & Cyber-Security (2.2)	~2.0
Information Security (2.3)	~2.7
Port Operations – Marine (3.1)	~2.7
Port Operations – Rail (3.2)	~2.3
Port Operations – Security & Compliance (3.3)	~2.7
Cargo Terminal Operations (4.0)	~2.7
Organizational Digital Readiness (5.0)	~3.3

0.00   1.00   2.00   3.00   4.00   5.00

Port Digitalization Average Scores per Category

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Port and maritime authority digital readiness (task 2 survey)

Management systems

- Most ports have customs systems and TOS

navisn4

operator has own

tos

in-house build   catos

navis   mxsuite

logistar-envecon   navis master terminal

Customs cargo processes

- Cargo processes by customs are often lagging in digitally immature ports

Digitalization of cargo processes by the operator vs. the digitalization of cargo processes of the customs in a port

	High digital mature ports	Average ports	Low digital mature ports
Cargo processess of the PA/operator	4.07	2.96	2.38
Cargo processes of customs	4.14	2.45	1.63

■ Cargo processess of the PA/operator   ■ Cargo processes of customs
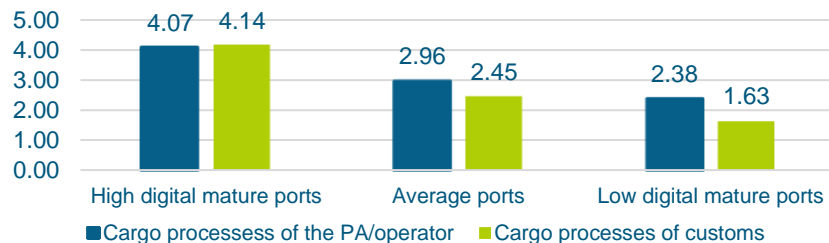
Cybersecurity

- Cybersecurity is generally low, most ports are unaware of the current state of their cybersecurity

data-stolen

designed

interested in knowing more   difficult   email   implementation

threats   dedicated staff   attacks monitored

ddos

aspire to implement   100000   in progress

not aware of guidelines

no intrusions aware of

phishing   iso-27001   firewall   cyber attack   roadmap

no penetration

all implemented
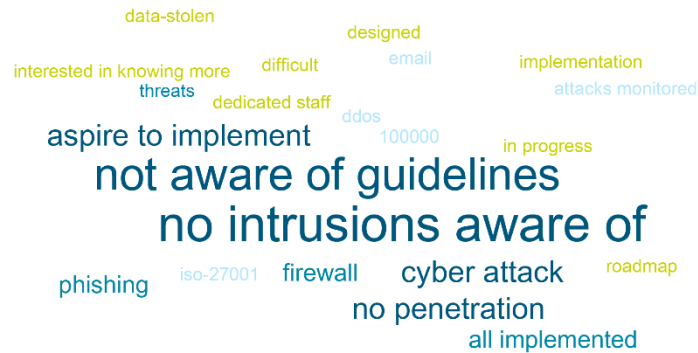
Implementation of IMO/IAPH Cybersecurity guidelines

■ Yes
■ In Progress
■ No
■ Other

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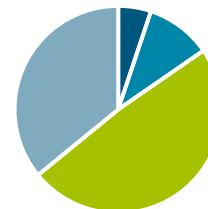
Port and maritime authority digital readiness (task 2 survey)

- Commentary on the task 2 survey results
  - Organisational ambitions for further digitalization and improvements are not translated into the implementation of the necessary systems and platforms to enable this.
  - Generally low scoring for the questions related to cybersecurity.
  - Most ports (approx. 70%) are not expected to be ready and compliant with the new FAL regulations in 2024.
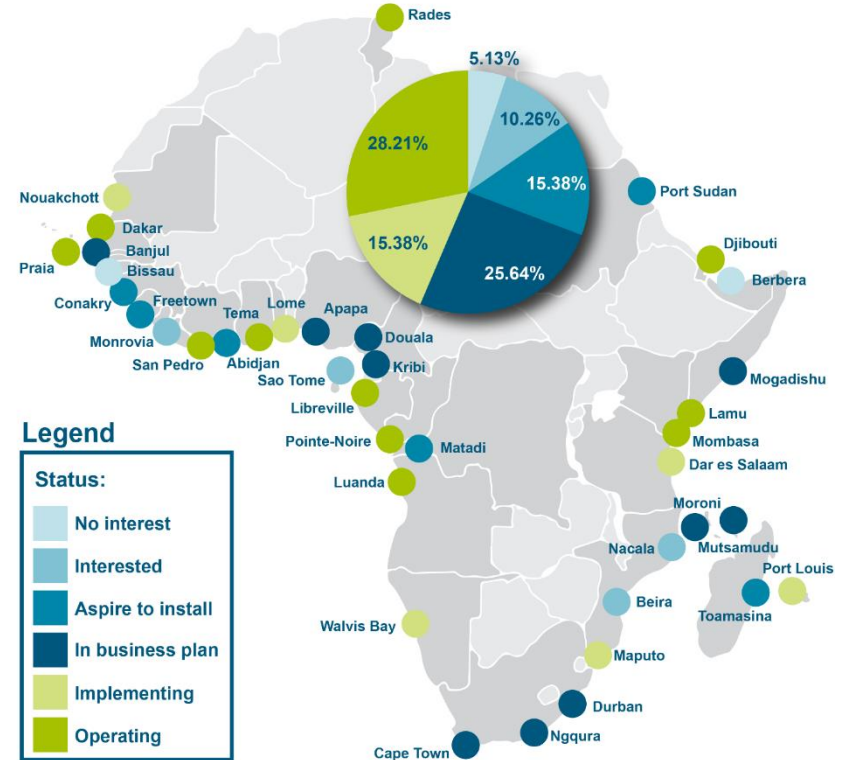
Status on the implementation of Maritime Single Windows across African Ports

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Policy review

Desktop study

Policy review – desktop study

- A study of the current policy and regulatory environment within each country as it applies to digitalization in general and specifically to the maritime and port sector.

- To assess the degree to which the policy and regulatory framework supports or acts as a barrier to the improvement of (port) digitalization.

- Policy statements alone do not necessarily translate to implementation, particularly with regards to maritime and trade single windows.

- The OECD Trade Facilitation Indicator (TFI) rating was identified as a representative indicator for enabling maritime digital policy.

- Port authorities reported limited active support from their governments, specifically regarding active participation and investment in port digitalization projects.

Policy and Digital Strategy Framework				
(Maritime relevance:)	**Policy**		**Timeframe**	
	Goal(s):		Responsible Institution	Status
Legislation				
	ICT Authority establishment	Ref #	**Law/Act**	
	Goal(s):		Responsible Institution	Date
	Data Protection	Ref #	**Law/Act**	
	Goal(s):		Responsible Institution	Date
	Cybercrimes	Ref #	**Law/Act**	
	Goal(s):		Responsible Institution	Date
	Single Window Legislation	Ref #	**Law/Act**	
	Goal(s):		Responsible Institution	Date
	Other ICT legislation	Ref #	**Law/Act**	
	Goal(s):		Responsible Institution	Date
Digital Regulations for the Maritime sector specific				
Ref #	**Regulation**		**Act**	
	Goal(s):		Responsible Institution	

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National fact files

National Fact Files

- Designed to be easily comprehensible as a standalone report, providing the status of digitalization in each of the surveyed countries.

- The fact files bring together several elements of the digitalization study in a standardized and easily sharable format.
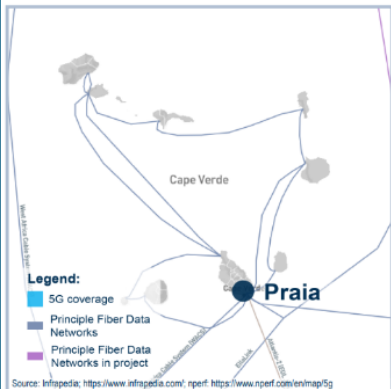

OCTOBER **2023**

DIGITALIZATION IN AFRICAN PORTS
NATIONAL FACT FILES
Diagnostic of Status of Current IT systems and Policy Impediments in African Ports

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Results and conclusions

Factors driving port digitalization

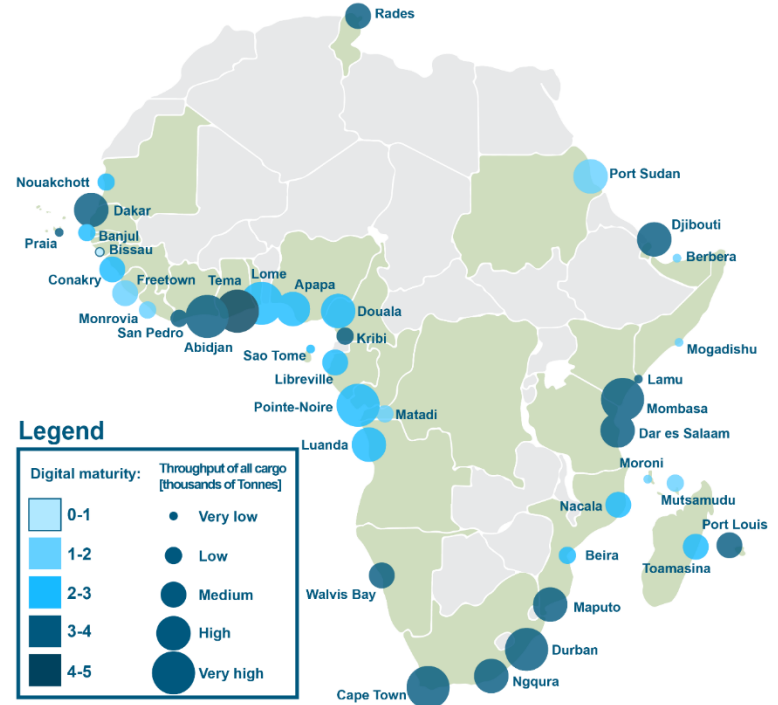| Driver	Impact	Comments
National Economic Output	Low	Population size and national GDP may not influence the digital maturity of ports, particularly for larger nations where the maritime supply chain is less important, proportional to the population size and distribution.
Port Operating Model	Low	Both 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 amongst 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.

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Factors driving port digitalization

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A predictive model for port digital maturity

■ Using the strongest correlations between national, external factors and the assessed level of port digital maturity, a model of alignment can be obtained to create a formula for the expected level of digital maturity at a port, on the basis of the surrounding external factors.
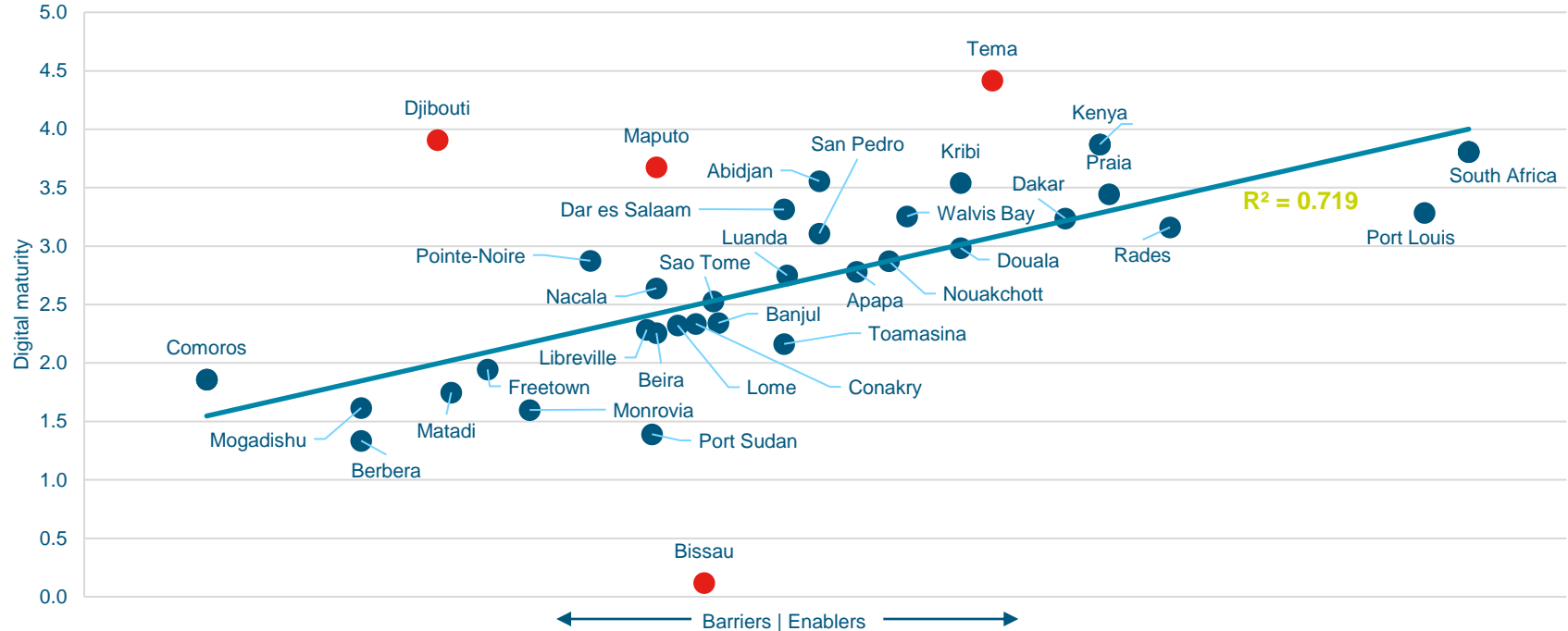
$$Digital\ maturity = 0.72 * (Governmental\ trade\ facilitation^{0.45} * National\ connectivity\ progress^{0.10} * ICT\ infrastructure^{0.05}) + 0.24$$

■ The predictive model was made by iteratively varying the weights in the exponent of these enabling factors within the variable of a linear model until the best linear fit was achieved.

■ The model explains approximately 72% of the variance in the digital maturity based on trade facilitation, national connectivity progress and ICT infrastructure.

■ The strongest enabling factors have been used to construct this predictive model:

  ❖ Governmental Trade Facilitation [OECD Trade Facilitation Index]

  ❖ National Connectivity Progress [Internet penetration growth]

  ❖ National ICT Infrastructure [AIDI ICT Index]

■ Because the governmental trade facilitation has been found to have a significantly higher weight than the other enabling factors it becomes clear that governmental involvement in trade has a large influence on port's digitalization trajectory.

■ This formula may be used as for predicting expected levels of port digital maturity, using the national context (and data that is pre-existing), within other African countries that were not included in this study.

■ As national initiatives and investments expand over time, changing index scores from individual nations can be used to predict changes to port-level digital maturity.

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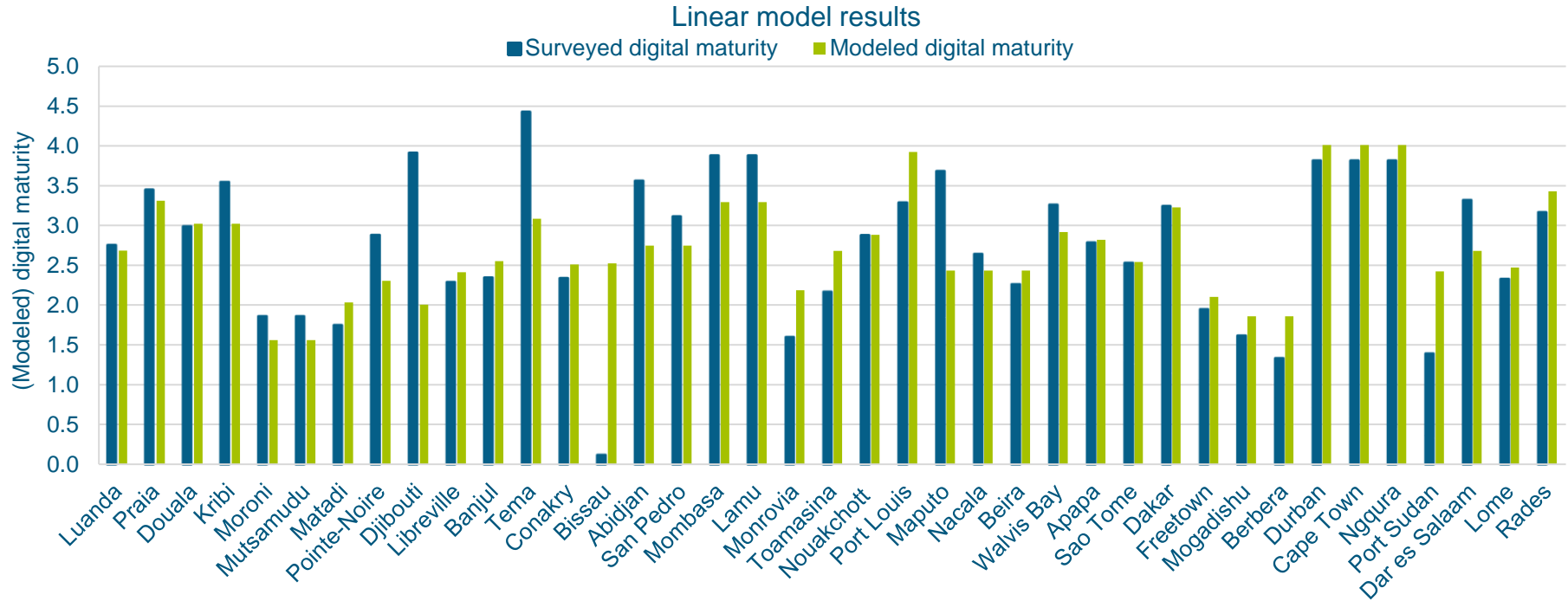# A predictive model for port digital maturity

$$Digital\ maturity = 0.72 * (Governmental\ trade\ facilitation^{0.45} * National\ connectivity\ progress^{0.10} * ICT\ infrastructure^{0.05}) + 0.24$$
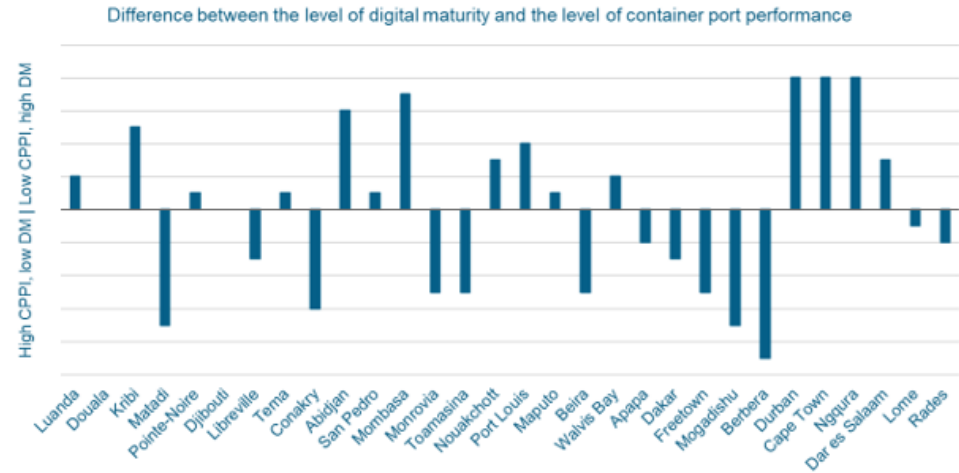

Linear model results

R² = 0.719

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A predictive model for port digital maturity

Linear model results

Surveyed digital maturity ■ Modeled digital maturity

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Impact of digitalization on port performance

- The impact of digital maturity on port performance, was not clear cut.

- In general, the level of digital maturity and the level of (container) port performance is aligned.

- Exceptions exist where 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 indicates that other factors need to be considered, e.g. equipment condition and availability and the general labour environment.

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

Difference between the level of digital maturity and the level of container port performance

High CPPI, low DM | Low CPPI, high DM

Luanda, Douala, Kribi, Matadi, Pointe-Noire, Djibouti, Libreville, Tema, Conakry, Abidjan, San Pedro, Mombasa, Monrovia, Toamasina, Nouakchott, Port Louis, Maputo, Beira, Walvis Bay, Apapa, Dakar, Freetown, Mogadishu, Berbera, Durban, Cape Town, Ngqura, Dar es Salaam, Lome, Rades

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General Observations

Ambition and awareness of the importance of digital tools is strong.

Government policy and investment support for ports is weak and can be improved.

Most ports have essential foundational systems in place, such as a Customs System and TOS.

There is limited appetite for automation, but digitalization is perceived as a means to improve trade and port efficiency.

IT infrastructure and resilience is varied but generally weak.

Cyber-security awareness, preparedness and safe data management is generally very weak.

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Recommendations

Recommendations

Raise awareness on MSW (and FAL) requirements - awareness is currently low.

31% of the ports have no plans to implement a Maritime Single Window

Increased investment in ICT infrastructure - to drive further digitalization of ports and their supply chains.

Reliable, fast internet and available data centers are the most important enabler

Align ports with their government – to create more effective digitalization policies and financing plans.

39% of port stakeholders think the government should play a leading role in digitalization

Focus on ports with low digital maturity - each port has its own specific challenges in order to make sustainable improvements in digitalization.

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

Build digital skills - IT skills, and in particular those related to Cybersecurity, are often inadequate.

42% of the ports have no or untrained ICT personnel.

Facilitate regional port cooperation - ports that are lagging behind on certain topics can be coupled with other ports that have already advanced in these fields.

72% of the ports consider digitalization very important for the port and the economy

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