

From Smart Ports to Intelligent Trade Corridors

A Proposed Fifth-Generation Port Model
for Value Creation Across Africa's Corridors
and Blue Economy



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Authorship and attribution

The economic and institutional architecture presented in this volume is authored by Rhavy Nursimulu and developed within Africa Intelligent Corridors 2030. Original models, instruments and strategic configurations are attributed at their respective points of use. External sources retain their attribution.

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Authorship and the AIC2030 contribution

This monograph presents the African Fifth-Generation Port architecture developed by Rhavy Nursimulu within Africa Intelligent Corridors 2030 (AIC2030). It forms part of his wider programme of economic and institutional architecture, connecting maritime gateways, productive territories, enterprise capability, capital and governance.

The author's contribution comprises the particular five-capability port architecture, its connected decision logic and the associated concepts, instruments and strategic configurations attributed throughout this volume. These contributions have been developed across the AIC2030 framework and the Mombasa, Durban, Port Louis and Abidjan–Lagos strategic blueprints. Their source works and development relationships are recorded in the references.

The work combines doctrine, architectural design, strategic application and an implementation method, supported by research and operating evidence. Established concepts and external findings retain their respective attribution. Original authorship, practical application and empirical validation are identified separately so that readers can recognise both the author's contribution and the evidence supporting each claim.

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Professional disclosure. The author has undertaken strategic and advisory work related to selected geographies discussed in the companion publication, including Mombasa, Durban and Cotonou. This volume also develops the author's own strategic blueprints. These relationships are disclosed so readers can distinguish authored propositions from external observations; they do not imply endorsement, an official mandate or independent validation of the proposed model. (Nursimulu 2026f, 6)

Institutional note

LOGI-CONSULT's facilitated diagnostics, programme tools and advisory services support practical implementation of the architecture. The analytical argument and published examples stand independently of an engagement.

The monograph within the AIC2030 body of work

Re-Architecting African Freight develops the companion argument about movement and productive transformation. This volume develops the maritime gateway, the ocean economy and the institutions connecting them to productive corridors. Its definitions, explanatory mechanisms, differentiated applications and assessment logic set out an economic and institutional architecture for the future African port.

The Mombasa and Northern Corridor, Durban OceanGate and Port Louis Indian Ocean Blue Corridor blueprints supply differentiated strategic applications. The gateway, industrialist and SEZ frameworks supply related assessment disciplines. Their definitions are retained where shared; a framework's publication or working status is recorded in the references. The Abidjan–Lagos blueprint adds the distributed maritime-productive configuration and its cross-border operating, supplier and liquidity relationships. (Nursimulu 2026c)

Series definitions and reading conventions

The companion reference is *Re-Architecting African Freight*, publication edition revised 6 October 2026, 120 pages. Its definitions and evidence conventions provide the shared language. This volume applies that language to ports and the ocean economy without reproducing the freight decision model in full. Later working frameworks are identified separately by title, edition and status; their extensions are attributed to those sources. (Nursimulu 2026f, 6, 9–16, 63)

The five canonical flows are Goods, People, Capital, Knowledge and Data. Energy enables production and movement; services support transactions and transformation. Neither replaces a flow. The six operating layers, Physical, Industrial, Trade, Digital, Capital and Governance, describe how the corridor system is organised, not six additional flows. The value cycle is Create, Transform, Retain, Circulate, Reinvest and Compound. These distinctions apply consistently to port, corridor and territorial discussions.

Productive Yield retains the companion's definition and eight dimensions, reproduced in this volume's glossary and Chapter 4. It is a family of outcome assessments, not a universal monetised score. Productive Density concerns what the movement contains; Gateway Value Density is a port-specific proposition requiring its own declared units and boundary. The Port Value Account distinguishes value added and income distribution. OPI measures operating pressure. None substitutes for another, and the proposed port capabilities do not become Productive Yield dimensions. (Nursimulu 2026f, 13, 63)

The intervention sequence Avoid, Optimise, Shift and Clean retains its meaning: remove unnecessary movement, improve necessary movement, allocate suitable freight to the appropriate mode and clean the remaining energy and assets. It does not imply that every service should change mode or that cleaner technology can await all other reforms. The five port capabilities, five corridor development levels, gateway maturity stages and F01 assessment pillars concern different objects and remain explicitly named rather than merged into one ladder.

Evidence markers follow the companion: [E] established evidence at its traceable scope; [SR] source-reported evidence not independently validated here; [P] an authored analytical or design proposition; [S] a scenario assumption; [R] a research requirement. Input maturity remains separate: Measured, Reconciled, Estimated, Scenario or Unknown. A label does not replace a source, and a reported operating observation cannot validate a whole model. (Nursimulu 2026f, 9)

The proposed architecture and its prescriptive applications are [P]; constructed numerical demonstrations and their inputs are [S]. The narrative identifies changes of evidence status within a demonstration. Published port and operator results are [SR] unless independently reconciled, and quantitative claims retain their sources and periods. A research requirement identifies evidence to obtain, not an adverse finding. An Unknown input prevents a point conclusion where it could reverse the decision. These conventions govern the prose whether or not a passage carries an inline marker.

The freight volume's Part III addresses metropolitan circulation, complemented here by Chapter 5's port-city interface. Its Part V addresses market power and regulation; Chapter 7 here develops gateway access, pricing and investment rights. Its Part IX and Annexes A-B contain the freight decision architecture and reproducible example; this volume supplies the gateway investment comparison, Port Value Account and proposed OPI application. These are complementary treatments, not claims that one application certifies another. (Nursimulu 2026f, contents and relevant parts)

Executive summary

The central thesis is that African ports can convert operating gains into retained productive value by connecting dependable maritime services, gateway interfaces, authorised decisions, enterprise capability and sustained stewardship around a defined economic purpose. The proposed African Fifth-Generation Port model specifies these relationships across Africa's corridors and Blue Economy, including how reinvestment renews the capability and value retained by connected territories.

Smart-port technologies can improve individual operations while clearance, inland transport, energy or payment remains unreliable. The proposed model connects these functions, while retaining safe marine access, nautical competence, terminal performance and maintenance as its operational foundations.

The model comprises five capabilities: Maritime and Operational Excellence; Gateway Integration; Gateway Decision Intelligence; Productive Value Creation; and Custodial and Compounding Leadership. Together they describe the port's maritime responsibilities and its authorised, collaborative anchoring role across inland and ocean relationships.

The model specifies how maritime functions, corridor services, productive enterprises, capital and institutions can connect around an intended economic purpose. Evaluation examines operational dependability, commercial usability, retained value and subsequent reinvestment and capability renewal. Value creation concerns what enterprises produce; retention concerns where income and capability accrue. Measurement informs design, implementation and adaptation; productive transformation is assessed through enterprise capability, retained value and subsequent productive use.

The Blue Economy connects the port to seafood, vessel services, marine research and coastal networks. BlueTech contributes ocean knowledge and applied capability. Energy links operating reliability to enterprise demand and investment. Beyond green-port objectives, the model asks which sustainable productive activities these relationships can support.

The intelligent corridor connects maritime services, inland enterprises, productive platforms and ocean partners. The Living Corridor brings workers, communities and everyday services into productive geography. Passerelle and pre-trade finance describe routes through which enterprises can acquire market access and capability.

Governance connects accepted information to authorised decisions, funded services and continuity. Public, tool, landlord and private port models distribute responsibilities differently; concessions, joint ventures and capital participation create further choices. Orchestration depends on accepted responsibilities, workable commitments and accountable decisions. Investment must connect viable demand, complementary capability and the responsibilities needed to sustain productive use.

The architecture is continental, with different configurations for transit gateways, industrial ports, island economies and distributed maritime systems. Mombasa develops the gateway-transit relationship; Durban connects operating recovery to an industrial spine; Port Louis develops ocean services and productive intermediation; Abidjan–Lagos illustrates a distributed multi-port productive coast. These applications inform adaptation rather than prescribe one institution, route or investment ratio for Africa.

Implementation begins with a reachable economic role. A consequential service provides an activation unit; transformation of the connected productive system remains the objective. Baselines and operating tests distinguish maintenance, institutional, financial and capacity requirements. Observations and design propositions remain distinct; the application protocols contain detailed assessment rules.

The purpose and contribution of this monograph

This monograph's central thesis is that African ports can convert operating gains into retained productive value by connecting dependable maritime services, gateway interfaces, authorised decisions, enterprise capability and sustained stewardship around a defined economic purpose. The proposed African Fifth-Generation Port model develops this economic and institutional architecture for the future African port. It specifies which service must work, which dependencies must be resolved, which institutions must act, how investment and operating responsibilities should be organised, and what productive value, retained capability and continuing renewal should result.

The work should be assessed through complementary tests. Intellectual assessment examines the clarity, provenance and coherence of its concepts. Architectural assessment examines the completeness of dependencies, allocation of responsibilities, feasibility of service relationships and proportionality of interventions. Empirical assessment examines observed performance and productive consequences. Research informs each test; implementation provides the conditions through which the architecture can be examined, challenged and improved.

The architecture allows different configurations for transit gateways, industrial ports, island economies, secondary coastal ports and gateways serving landlocked countries. Their shared purpose is to convert connectivity into enduring productive capability and value that can be retained and reinvested.

The port is central to this proposition. Safe marine access, competent nautical services, reliable terminal operations and sustained maintenance provide its foundations. Its wider contribution emerges through relationships with maritime industries, productive platforms, inland enterprises, ocean partners and reachable markets. The future African port is developed here as a productive gateway with an authorised role in coordinating these relationships.

The Mombasa and Durban Strategic Blueprints supply applied foundations for the architecture. Mombasa develops layered partnerships, inbound value-added services, maritime innovation, corridor orchestration and economic diplomacy. Durban develops the maritime economic domain, land-sea productive continuum, distributed industrial system, energy transition and Living Corridor. Their mechanisms are developed here as adaptable components of a continental model. Place-based proposals remain illustrations of configuration rather than limits to the model's geographical relevance. (Nursimulu 2025b; Nursimulu 2025a)

The intended readers are policymakers, port and corridor institutions, municipalities, developers, industrialists, investors, researchers and professional bodies. The architecture helps them establish productive purpose, determine a reachable gateway role, organise interdependent capabilities, allocate responsibilities and sequence investment. Its contribution is a proposed economic and institutional model whose applications can be examined through operating evidence and productive outcomes.

Within the AIC2030 monograph family, Re-Architecting African Freight examines movement's productive purpose; this volume develops the maritime gateway and its ocean and inland relationships. The preceding series guide establishes their shared definitions and evidence conventions. (Nursimulu 2026f)

The eight chapters move from the future African port to the AIC2030 Fifth-Generation Port model, the Blue Economy and the intelligent corridor; then to productive territory, operations, investment and implementation. The glossary and application protocols support practical use without replacing the controlled gateway methodology or specialist project work.

The four blueprints supply complementary configurations. Mombasa contributes regional gateway and corridor integration; Durban contributes the industrial gateway, operating recovery and productive spine; Port Louis contributes the ocean hinterland, productive intermediation, capital and custodial functions;

and Abidjan–Lagos contributes a multi-port productive coast with inland and overseas connections. They inform design across Africa without prescribing a single jurisdiction, institution or route. (Nursimulu 2025b; Nursimulu 2025a; Nursimulu 2026e; Nursimulu 2026c)

How to read the architecture

Read the architecture through three primary elements. The five port capabilities constitute the operating model: the contribution the productive gateway is designed to make. OPI supports diagnosis of operating pressure. The Port Value Account organises the creation and distribution of value within a declared boundary. Productive purpose connects these elements to operating decisions and outcomes across maritime services, inland enterprises, productive territories and the ocean economy. The supporting lenses answer distinct questions, as the reader guide explains.

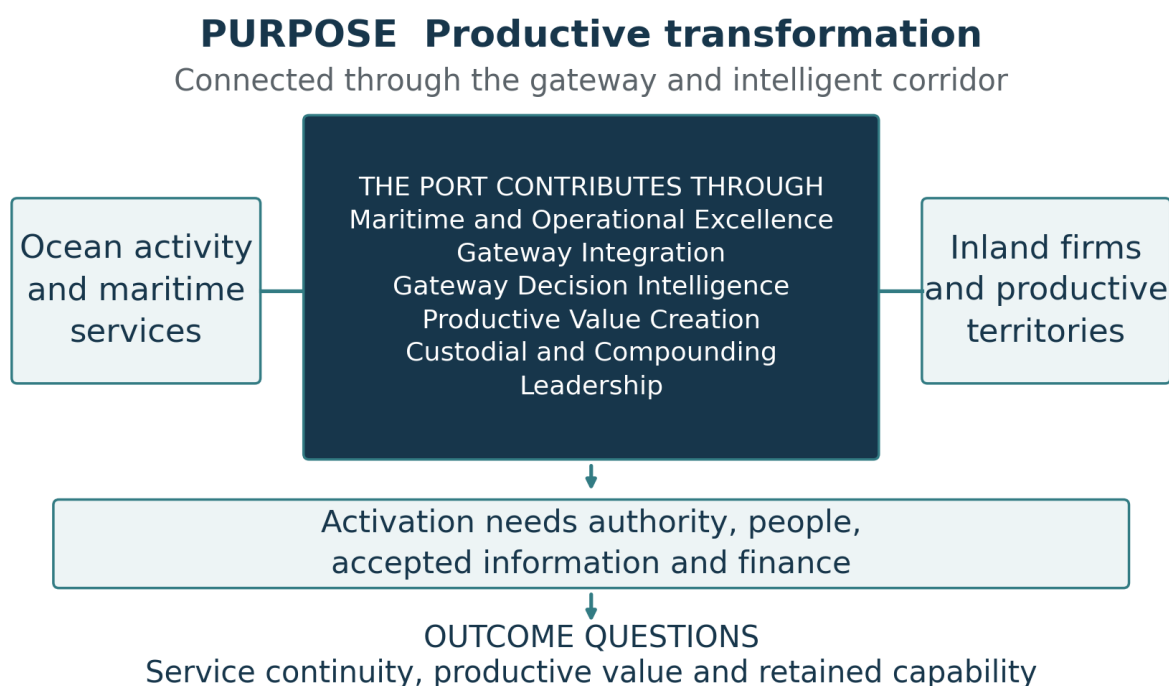
Supporting concepts explain particular relationships within the architecture. Decision intelligence links information to action. Sovereign APIs address authorised information exchange; Architectural Finance concerns shared foundations; the Living Corridor brings everyday participation into productive geography. Productive Yield assesses the wider productive contribution, while Gateway Value Density relates productive or retained value to a declared gateway resource denominator, such as land, energy or infrastructure capacity. These concepts enter where the argument needs them; their controlled meanings remain in the glossary.

F01 Version 1.3.3, internally identified as the August 2026 edition, is the companion gateway assessment method. Its eight pillars and 89 dimensions organise diagnosis. They are not the five capabilities of the proposed port operating model. The protocol section records methodological boundaries and source reconciliations. (LOGI-CONSULT 2026a)

Table 1 Reader guide to the architectural lenses

Element	Question it answers
Productive transformation	Why organise the system? Strengthen productive capability and the capacity to retain and reinvest value.
Gateway and Intelligent Corridor	Which ocean, maritime, territorial and market relationships form the selected economic service?
Five port capabilities	What contribution must the proposed port operating model make?
Five corridor development levels	What kind of corridor development is being described? These are not the port capabilities.
Five economic flows	What circulates? Goods, People, Capital, Knowledge and Data.
Six Economic Operating System layers	What enables circulation to become productive? Physical, Industrial, Trade, Digital, Capital and Governance.
Productive Yield	What productive consequences, distribution and retained capabilities should be examined?

The lenses are complementary, not successive steps or interchangeable scores. The overview shows the port's contribution within the connected economy; Chapters 2 and 4 explain the capabilities and corridor levels respectively.

Figure 1 The port capabilities within the productive architecture

Source: Rhavy Nursimulu, AIC2030; author synthesis of the proposed operating model. Arrows represent designed relationships, not demonstrated causal effects. The five capabilities remain distinct from assessment pillars, corridor development levels and Economic Operating System layers.

The architectural orientation

Architecture Over Assets. Begin with the economic service, then connect infrastructure, enterprise, people, information, capital and institutions so that capacity can be used and sustained.

Authority Is Not Ownership. Assign the decisions required to make the service work, respecting the powers of each institution. The port's anchoring role is exercised through its mandate and agreed relationships.

Value Created and Retained. Measure the economic contribution alongside movement. Identify productive activity, the distribution of income and capability, and the conditions for reinvestment across the connected territories.

Continuity and Learning. Test critical functions under disruption, fund their upkeep and use evidence to revise the design. Confidence in the architecture rests on observed performance and the ability to correct failure.

Economic Analysis and Architectural Design

Economic analysis establishes how a gateway functions, which constraints matter and what consequences may follow from change. Economic and institutional architecture uses that understanding to design the relationships through which an intended economic function can operate. It specifies the necessary capabilities, institutional responsibilities, service commitments, information, capital and continuity arrangements. This monograph contributes to both activities, with its principal authored contribution residing in the design and application of the connected architecture.

For an African maritime gateway, dependable maritime operations are foundational. Their wider economic contribution depends on how they connect enterprises and productive territories with inputs, services, finance and markets. An assessment may identify vessel delays, fragmented inland services or weak enterprise access to customers. Architectural design uses that evidence to establish which productive activities the gateway can support, which capabilities must operate together, who is authorised to act, and how implementation and investment should be sequenced.

The model's five capabilities organise this integrated configuration. Its contribution lies in connecting these capabilities so that dependable gateway services can support productive activity, value retention and the renewal and expansion of productive capability.

Responsibilities remain distributed. The port acts within its mandate and works through commercial agreements and inter-institutional arrangements where services and outcomes depend on other parties.

Analysis informs and tests the architecture throughout implementation. Operating evidence establishes whether services perform dependably. Enterprise and corridor evidence examines whether those services are commercially usable. Economic assessment investigates additional productive activity, retained value and subsequent capability formation, distinguishing observed changes from effects reasonably attributable to the intervention.

The architecture remains a proposed configuration to be implemented, tested and adapted. Its credibility rests on explicit responsibilities, workable service relationships and evidence of results under stated conditions.

From strategic blueprint to continental reference architecture

This monograph belongs to a progressive research and architecture programme. The Africa I See establishes the wider vision; the New African Economic Architecture supplies the proposed organising system; African Economic Sovereignty describes the strategic outcome; and AIC2030 develops a principal operating architecture. Strategic blueprints, city monographs, thematic monographs and controlled frameworks perform complementary tasks within that programme.

The programme connects the value cycle, Create, Transform, Retain, Circulate, Reinvest and Compound, to the five flows and six operating layers introduced in the series guide. Flows identify what circulates; layers identify the capabilities and arrangements that make circulation productive. The classifications guide the blueprint applications that follow.

The blueprint mechanisms in this volume are interpreted within that shared architecture. Earlier lists of pillars, nodes and institutions retain their specific analytical purposes. They do not add competing layers to the Economic Operating System. The seven AIC2030 framework families and the parallel human architecture of African builders also remain distinct. This discipline allows the monograph to develop a connected argument without turning every useful mechanism into another overarching classification. (LOGI-CONSULT 2026b Master Roadmap V2.0 sections 2–6)

1 The future African port

Chapter objectives: Distinguish Current, Declared and Reachable Roles; assess a gateway's network position and service evidence; separate throughput from productive contribution.

The future African port proposed here combines maritime dependability with an active role in the productive economy. Ships gain safe access and reliable services; connected enterprises gain usable routes to inputs, customers and specialised capability. According to its economic role, the port can help organise maritime engineering, processing, supplier development, energy services and ocean knowledge. Its strategic purpose is to make these relationships work together so that trade supports production and the capability to undertake more demanding activities.

This productive role extends inland and seaward. An intelligent corridor connects the gateway to farms, factories, cities and landlocked markets; ocean services connect it to maritime partners and Blue Economy activities. BlueTech, skilled people and investment help develop these relationships. The port exercises its anchoring role through its own competence and agreed responsibilities with others. Value creation, the retention of income and capability, and reinvestment give the architecture its economic direction.

Begin with the economy the port must serve

The future African port must be designed around the economy it can help make viable. That economy includes households requiring food and essential supplies, enterprises importing machinery and intermediate goods, producers seeking dependable export services, and coastal communities whose livelihoods depend on access to the sea. It also includes industrial activities that could become competitive if logistics, energy, skills, finance and market access work together.

The economic purpose comes before the infrastructure proposal. What economic functions should this gateway make possible? A grain import gateway, a container transshipment port, a regional manufacturing gateway and an island maritime services centre do not require identical development programmes. Each needs an operating proposition grounded in cargo, users, shipping networks, productive geography and service economics. A general ambition to become a hub provides little guidance until the intended customers, connections and functions are specified.

A port's national contribution extends beyond waterfront revenue: dependable fertiliser access supports inland agriculture; replacement components sustain factory operation; and usable export services can enable processor investment and wider markets. Its contribution includes activities made possible elsewhere by reliable service.

This does not make the port responsible for every economic outcome. Production also depends on enterprise capability, input costs, demand, regulation and investment. It does make the relationship between port decisions and productive possibilities a legitimate subject of strategy. A port master plan should explain which economic requirements its proposed capacity and services address, which complementary conditions are necessary and who will deliver them.

The AIC2030 gateway framework gives this relationship an explicit analytical boundary. The port is a defined institution and operating area. The gateway is the wider functional system linking maritime access to corridors, productive locations and markets. Its geography follows material dependencies rather than an administrative fence. This distinction allows the port to be assessed rigorously without asking it to govern every organisation on which trade depends. (LOGI-CONSULT 2026a, sections 1.4 and 1.8)

The African port landscape

Africa's port transformation begins from different economic and operating positions. A continental assessment must encompass Mediterranean and Red Sea gateways, Atlantic and Indian Ocean systems, island networks and secondary coastal ports. Central African and Horn gateways belong within that assessment alongside the eastern, western and southern configurations developed in the blueprints. Landlocked economies enter through the complete service they receive, including the inland and border interfaces that determine whether maritime access is usable. The relevant starting point is the gateway's role in these relationships.

The selected observations combine dated activity, digitalisation and vessel-performance evidence. The discussion retains the earlier 2024 activity observations and the September 2025 CPPI publication covering 2020–2024, alongside Mombasa's reported 2025 cargo volume and the subsequent CPPI 2025 publication released in 2026. Publication dates and observation periods are distinguished below. These sources establish a dated starting picture, not a current census; applications should refresh them while preserving their units, geographical boundaries and scope.

Scale and operating performance

Tanger Med Port Authority reported 10,241,392 TEU handled in 2024, an increase of 18.8% over 2023. Kenya Ports Authority's earlier release reported 41.1 million tonnes at Mombasa in 2024 and 36.0 million in 2023. Its 2025 release reports 45.45 million metric tonnes against a 40.99 million 2024 baseline. Those latter volumes imply approximately 10.9% growth; the release's reported 10.0% does not reproduce. The two 2024 baselines are not reconciled here. TEU and cargo tonnage measure different quantities; neither establishes comparative performance, retained income or industrial capability. (Tanger Med Port Authority 2025; Kenya Ports Authority n.d.; Kenya Ports Authority 2026)

For a gateway seeking additional capacity, growth creates a question about the receiving system. More maritime activity can require inland evacuation, utilities, storage, working capital and enterprise readiness. A transshipment service raises another question: whether connection reliability and the shipping network can sustain the proposed role. Bulk and specialised cargo require their own handling and service measures. The investment response follows the particular demand and constraint rather than the largest available throughput figure.

The World Bank and S&P Global Market Intelligence's CPPI publication released in September 2025 benchmarks 403 container ports using more than 175,000 vessel calls and 247 million container moves. It emphasises total vessel time in port. Its release identifies Dakar and Port Said among ports whose scores and rankings improved between 2020 and 2024. This is evidence of differentiated operating trajectories, rather than one uniformly deficient African port system. (World Bank 2025a)

CPPI provides a useful maritime operating lens. The gateway assessment must add the evidence appropriate to its economic role: bulk and specialised services, inland delivery, enterprise access and productive outcomes. A stronger container-vessel result is one part of that account. It cannot, by itself, establish an improvement in a factory's access to inputs or in the capability retained by suppliers. Chapter 2's operability diagnostic and Chapter 7's value account address different parts of this wider assessment.

The subsequent CPPI 2025 publication, released in June 2026, reports a slight global deterioration in vessel turnaround during 2025. The result reinforces the need to date every observation and to distinguish network shocks from terminal capability. CPPI remains a container-vessel-time diagnostic; it does not measure complete corridor service or productive value. (World Bank and S&P Global Market Intelligence 2026)

Connectivity and digital readiness

UNCTAD's Liner Shipping Connectivity Index measures a country's integration into liner shipping networks. Country-level connectivity and port-level connectivity answer related but different geographical questions. For a gateway decision, the assessment must also examine the actual service available to the user: frequency, reachable destinations, transshipment requirements, usable capacity and continuity. Connectivity measures should therefore be read alongside shipping-service and enterprise evidence, with the index version, period and geographical unit stated. (UNCTAD n.d.)

SSATP's March 2024 study examined digitalisation and policy conditions across 39 ports in 31 African countries. Its executive summary reported that, among ports whose Maritime Single Window status was known, 28% already had one and 15% were implementing one. These are findings for the study's observation scope, not a census of every African port or a statement of implementation status in October

2026. (SSATP 2024, executive summary, 12–13)

The study connects digital progress with policy, trade facilitation, infrastructure and capability, and notes that digital maturity and container-port performance do not align uniformly. Our architectural reading is that equipment and software must be examined within the service relationship they support. A working information system can strengthen clearance or planning while a shortage of receiving capacity, competent staff, energy or accepted decision rights remains decisive. (SSATP 2024, executive summary and sections 3–5)

A selected continental gateway baseline

The baseline below makes the continental reach of the model explicit while preserving unlike-for-like boundaries. It combines dated operating observations with clearly labelled evidence gaps. Throughput, vessel time, connectivity and productive contribution remain separate measures. A listed gateway is therefore an application context, not a ranking or a Fifth-Generation Port designation. Gateway configurations are the author's functional interpretation of the cited records, not classifications awarded by the reporting institutions.

Gateway or system	Configuration represented	Dated observation or evidence status	Architectural question
Tanger Med, Morocco	Mediterranean port-industrial and transshipment gateway	10,241,392 TEU in 2024, authority-reported ¹	How are maritime scale, industrial activity and retained capability connected?
Port Said, Egypt	Canal-linked and transshipment gateway; boundaries must be specified	Port Said CPPI trend over 2020–2024 ⁶ ; SCCT is an East Port Said terminal ² . Do not merge West/East Port Said or terminal records.	How does operational performance support a wider canal and industrial system?
Dakar and Ndayane, Senegal	Established gateway and new-capacity transition	Dakar CPPI trend over 2020 -2024 ³ . DP World reported Ndayane major dredging complete, 27 July 2026; construction continued, not operational clearance ⁴ .	How should existing service, new capacity and operator obligations be sequenced?
Abidjan–Lagos system	Distributed multi-gateway productive corridor	Blueprint-based design; harmonised operating baseline still required ⁵	How can several sovereign gateways cooperate without common ownership?

Sources for the preceding table panel: 1. Tanger Med Port Authority 2025. 2. APM Terminals n.d.. 3. World Bank 2025a. 4. DP World 2026. 5. Nursimulu 2026c. 6. World Bank 2025a.

Gateway or system	Configuration represented	Dated observation or evidence status	Architectural question
Lomé, Togo	West African transshipment and inland-serving gateway	Transshipment and inland access documented in government and port accounts ¹ ; matched service and enterprise baseline still required.	Which inland and coastal services create a reachable role?
Kribi, Cameroon	Central African deep-sea and industrial gateway	UNECA reported port-linked industrial activity in April 2024 and distinguished future zone development ² ; current matched service records still required.	How should maritime capacity connect to Central African productive geography?
Lekki and Lagos, Nigeria	Lekki concession/PPP within the Lagos metropolitan gateway configuration	NPA describes Lekki's concession and public- private participation ³ . Lekki and Lagos facilities need separate operating and market-access records.	How do concession obligations, urban circulation and industrial demand form one usable service?
Mombasa, Kenya	Eastern transit and productive gateway	45.45 million metric tonnes in 2025, authority-reported ⁴	Does maritime growth translate into reliable inland and enterprise service?
Djibouti gateway system	Horn transit, rail and maritime-services gateway	DPFZA documents rail links to SGTG and DMP ⁵ ; current multi-terminal reliability and enterprise baseline still required.	How are sovereign access, rail continuity and maritime services coordinated?
Berbera, Somaliland	Horn maritime gateway with inland-market ambitions	Operator reports terminal inauguration in 2021 and economic-zone opening in 2023 ⁶ ; current service use, permissions and legal baseline still required.	What reachable role follows from access, demand, authority and corridor alternatives?
Port Louis, Mauritius	Island and ocean-economy gateway	FY2024–2025 vessel-time observations available ⁷	How can maritime reliability support ocean services and productive intermediation?
Durban, South Africa	Southern industrial and energy gateway	Terminal-specific ship-working-hour observations available for FY2024–2025 ¹⁰	Which constraint governs the port-to-factory service?
Walvis Bay, Namibia	Atlantic corridor and energy- services gateway	Namport documents corridor connections and a mixed cargo/service role ⁸ ; current service-specific cargo and energy-demand baseline still required.	Which inland and ocean services justify investment and recurring capability?
Nacala and Maputo, Mozambique	Distinct southeastern resource, industrial and transit configurations	CFM and MPDC document Nacala and Maputo functions separately ⁹ ; comparable service-specific baseline still required.	How should role, cargo, corridor demand and local value retention be distinguished?

Sources for the preceding table panel: 1. Government of Togo 2025; InterCom Togo n.d.. 2. United Nations Economic Commission for Africa 2024. 3. Nigerian Ports Authority n.d.. 4. Kenya Ports Authority 2026. 5. Djibouti Ports and Free Zones Authority n.d.. 6. DP World 2023. 7. Mauritius Ports Authority 2026. 8. Namibian Ports Authority n.d.. 9. Caminhos de Ferro de Moçambique 2025; Maputo Port Development Company 2026. 10. Transnet 2025.

The table is deliberately asymmetric: an operating observation, a reported facility or institutional arrangement, a construction milestone and an authored design proposition have different evidential status. A research requirement means that the baseline needed for this architecture remains to be established, not that no public information exists. Refresh each assessment by service, period and source before use. Grouped rows identify related configurations, not one operating or statistical unit. Sources were checked for this edition on 25 October 2026.

Institutions and the investment starting point

The starting landscape includes different allocations of public responsibility, terminal operation and capital. A public port can contain privately operated services; an operating company can combine equity partners and concession obligations. The dated investment examples in Chapter 7 illustrate development commitments, institutional investment and ownership-transfer proposals with different implications for the productive service. A gateway assessment should record the actual rights, access conditions, renewal duties and fiscal exposure rather than infer them from an operator's name or a management-model label. (World Bank 2025c; DP World 2020b; DP World 2020a; IFM Investors, CPP Investments, and OMERS 2026)

Project pipelines require the same differentiation. An announcement, an agreement, financed construction, commissioned capacity and a commercially usable service are separate conditions. Their economic contribution depends on demand and on the complementary connections, workforce and recurring resources available when operation begins. The proposed model therefore links infrastructure preparation to the readiness of the productive economy it is intended to serve.

Each gateway therefore needs a role-specific record separating activity, maritime performance, connectivity, digital capability and institutional responsibilities. The shared architecture asks how those conditions support a complete productive service and which intervention would strengthen it. The configurations below apply that question to different African economies.

A continental architecture with differentiated gateway configurations

The configurations test different dependencies within the same architecture. Transshipment and network gateways need dependable connections between shipping services; regional transit gateways need usable border and inland delivery commitments. Port-industrial gateways must connect cargo access to factory inputs, utilities and supplier capability. Energy and resource gateways require specialised safety, handling and lifecycle decisions tied to the commodity and productive demand. These functions can coexist, but throughput in one does not demonstrate competence in another.

Metropolitan gateways must reconcile cargo access with urban freight, land use and receiving capacity. Island and Blue Economy gateways depend on ocean connections, essential supply and commercially viable marine service chains within ecological limits. Distributed multi-port coastal systems require compatible interfaces across separate gateways and jurisdictions while preserving competition. The distributed system describes a relationship among gateways, not an eighth gateway role or a new corridor development level. These distinctions explain why adaptation changes the service, participants and investment sequence without changing the five port capabilities.

The functional boundary follows the productive relationship being designed. It can cross a national frontier, connect an island to several maritime partners or join coastal activities to an inland industrial region. Jurisdiction remains with the competent authorities. Architecture connects their responsibilities through agreements, service arrangements and investment sequences appropriate to the economic geography.

Application should state whose productive opportunities are being strengthened and where benefits are expected to remain. A gateway serving landlocked economies must include their enterprises, service requirements and institutional participation. A port-led programme must also consider smaller coastal and rural participants whose economic access can be weakened by concentration at a few large nodes.

(Nursimulu 2025b, 30–37, 68–74; Nursimulu 2025a, 80–96, 149–161)

Choose the gateway role through economic function

Africa's gateways require a division of functions that reflects the markets and productive systems they can serve. A port may principally provide national access, concentrate transshipment, connect a regional production system, or host specialist services that help several gateways operate together. These functions can coexist, but their infrastructure, commercial exposure and institutional requirements differ. A transshipment ambition cannot substitute for dependable domestic access; a specialist financial or knowledge service cannot substitute for the physical reliability of the gateways it supports.

The Port Louis blueprint's gateway, mega hub, system port and elevated port propositions express this differentiation. In the continental architecture they are functional configurations, rather than a universal hierarchy or additional historical port generations. A gateway should declare its intended role, identify the enterprises and territories that benefit, and test whether shipping services, land, skills, ecological capacity and counterpart institutions support that role. Specialisation should create useful complementarity between African gateways, with the capacity to revise the role when demand or conditions change. (Nursimulu 2026e, 170–171)

Gateway roles and the capability they require

The gateway framework distinguishes seven functional roles: National Trade Gateway; Regional Transit Gateway; Port-Industrial Gateway; Transshipment and Feeder Gateway; Resource and Energy Gateway; Metropolitan Gateway; and Blue Economy and Island Gateway. These are functional archetypes. They identify different service requirements rather than a ranking of importance. A port may combine roles, but each additional role creates claims on land, berths, energy, workforce, capital and institutional attention. The assessment should identify a primary role and a limited set of material secondary roles, with emerging ambitions recorded separately.

A national gateway must protect essential supply and domestic export access. A regional transit gateway must provide commercially usable cross-border services, including transit procedures, border interfaces and participation by inland users. A port-industrial gateway needs dependable factory access, utilities, bonded interfaces and supplier capability. Transshipment depends on shipping-network demand and connection reliability. Resource and energy gateways need specialised handling, safety and lifecycle planning. Metropolitan gateways require urban freight and land-use coordination. Blue Economy and Island Gateways require evidence of maritime dependence, essential supply, ocean services and the marine value chains they can sustain.

Current Role must be demonstrated through cargo, services, users and operating capability. Declared Role records an attributed strategic ambition. Reachable Role is the credible future function supported by demand, geography, competitive position, capability, institutions, investment, continuity and economic additionality within a stated horizon. A declaration may be conditionally reachable, a longer-horizon possibility or unsupported aspiration. Present capability should be assessed against the current role; the additional requirements of a future role define a transformation gap.

(LOGI-CONSULT 2026a sections 3.1–3.2, 3.7 and 4.4)

The port beyond its physical boundary

The facility has a physical boundary; its economic role follows the productive relationships it can credibly support. A port can help organise maritime engineering, food production, regional distribution, energy services or other productive functions while connecting their enterprises to markets. The relevant question is what the gateway can become within the economy it serves, given demand, capabilities, ecological conditions and the institutions able to participate.

This wider role makes environmental performance integral to economic strategy. A green port objective addresses important emissions, resource and ecological requirements. The future port proposition also asks which productive activities become possible, who can participate and what capability remains. A cleaner handling operation is an important achievement; the broader productive contribution requires its own evidence. Maritime excellence, environmental responsibility and productive development should inform the same strategy.

A wider economic role does not require every function to occupy the port estate. A workshop inland, a research institution, an industrial platform, an offshore activity and a regional customer may be connected through dependable services. The port's anchoring contribution is to help make critical relationships usable within its mandate and agreements. Different gateways can perform that role at different scales.

The port within a distributed maritime economy

The proposed Fifth-Generation Port can anchor a productive relationship while also participating in a wider network of gateways. Along a productive coast, several ports may connect metropolitan markets, inland branches and overseas services. Their contribution depends on relationships among these functions as well as on performance within each port boundary. The Abidjan–Lagos blueprint develops this distributed configuration alongside the transit, industrial and island configurations examined elsewhere in this volume.

The economic geography has four connected parts: the maritime gateway, its coastal productive basin, the inland relationships it serves and the overseas network through which it trades. A port may perform strongly in one relationship and weakly in another. Assessment should specify the selected service and identify which connections are usable, which are proposed and which remain constrained.

Complementarity does not require every port to surrender overlapping markets or accept a permanent specialisation. A gateway may combine industrial supply, domestic distribution, transshipment or maritime services in different proportions. Demand, competence and commercial access determine the reachable combination. Cooperation on safety, accepted information and continuity must preserve lawful competition and user choice. (Nursimulu 2026c, 137–162)

The maritime foundations of the future port

The future port remains a maritime place. Its wider economic role begins with ships being able to approach, enter, berth, exchange cargo or receive services, and depart safely. Navigable access, hydrographic knowledge, aids to navigation, appropriate manoeuvring space, pilotage, towage, mooring and competent traffic management form an operating sequence. Its weakest material link can limit the usefulness of the others. A berth window must also be feasible for the vessel, environmental limits and available marine-service resources. Pilots, tugs and mooring teams require suitable capability and agreed procedures. Commercial or corridor priority cannot override competent navigational decisions. (Maritime and Coastguard Agency and Department for Transport n.d.)

Depth is a service requirement to be established against the intended fleet, cargo and operating conditions. A deeper channel can create opportunities where shipping demand supports it, but also creates capital, maintenance and environmental obligations. The strategic case should compare vessel requirements, tidal restrictions, call patterns, dredging needs and alternative service configurations. Accommodating the largest conceivable vessel is not a sufficient development objective.

Berth productivity likewise depends on more than the crane or cargo-handling equipment visible at the quay. A vessel requires an available berth, a safe working area, competent labour, functioning equipment, receiving space and a plan for moving cargo away. A terminal can possess substantial nominal capacity while its effective capacity is constrained by equipment downtime, poor yard configuration, unavailable transport or slow cargo release. Future capacity should therefore be described as a functioning service under stated conditions.

Cargo differences matter. Containers require suitable stacking, lifting, information and interchange arrangements. Dry bulk can require specialised unloading, dust control, conveyance and storage. Liquid bulk requires appropriate transfer systems, safety controls and compatible storage. Vehicles and rolling cargo require circulation and marshalling space. Project cargo may need exceptional load capacity, handling expertise and a permitted inland route. A strategy that speaks only in aggregate tonnes can conceal these distinct requirements.

The port must also sustain the less conspicuous activities that keep the maritime system usable: engineering workshops, maintenance planning, spares, emergency response, pollution reception, ship agency, vessel supplies and access for service personnel. Service availability during nights, weekends and disruption can be economically consequential. A single unavailable specialist or replacement component may interrupt an otherwise well-equipped operation.

Maritime excellence is thus a continuing capability. It rests on people, procedures, assets and maintenance funding working together. New investment should strengthen that capability, with explicit provision for inspection, renewal, training and operational learning. A port's future cannot be secured by acquiring equipment that its operating system cannot maintain.

Shipping connectivity as a usable service

A shipping connection becomes economically meaningful through frequency, reliability, route coverage, capacity availability and the commercial terms offered to users. A line on a network map does not establish that a producer can obtain an appropriate booking, meet the cut-off or reach a buyer at a competitive delivered cost.

An exporter moving modest volumes may depend more on a dependable weekly connection and reliable consolidation than on an occasional direct mainline call. A manufacturer importing components may value schedule predictability because uncertain arrival forces it to hold more inventory. A seafood processor needs reefer availability and handling arrangements compatible with its product and destination requirements. These users can require different improvements within the same gateway.

The port's shipping proposition should consequently be examined alongside cargo aggregation, feeder connections, empty-equipment supply and inland collection. Mainline and feeder operators make commercial choices within wider networks. Port planners can improve the conditions for service, engage carriers and identify anchor demand, but a capacity expansion does not itself secure a lasting service commitment.

Transshipment deserves its own commercial account. It may support terminal activity, network connectivity and maritime services. Its contribution to the productive economy depends on the extent to which local firms supply those activities or use the resulting connectivity. A container transferred between vessels does not automatically create processing, supplier development or inland market access. Those links must be deliberately built and subsequently evidenced. The same discipline applies to regional shipping. A coastal or interisland service needs cargo in compatible directions, suitable vessels, dependable berthing windows, workable documentation and receivers able to handle the cargo. Where volumes are initially thin, service design and demand aggregation may matter more than terminal scale. The relevant unit is the commercially usable journey, including the connections at both ends.

From a handling facility to a service ecosystem

The port of the future should be understood through the services that allow trade and production to function. Maritime and nautical services provide access and vessel support. Terminal and logistics services handle, store, consolidate and distribute cargo. Productive services support processing, packaging, assembly, testing and repair. Commercial services enable transactions, working capital, insurance and dispute resolution. Knowledge services develop the technical and professional capability on which the others depend.

These activities do not need a single owner. A port authority may provide common infrastructure, manage land and concessions, coordinate access and convene institutions. Private operators may provide terminal, storage, trucking, engineering or processing services. Banks and insurers supply financial products within their own rules and risk decisions. Customs, fisheries, health and other competent authorities retain their respective public functions. We architect the relationships that make these contributions work together around an actual service requirement.

Consider an illustrative machinery import. Discharge is followed by clearance, exceptional handling where needed, insurance, suitable transport and delivery to a prepared site. Installation may require technicians, lifting equipment, power and commissioning support. The port's economic contribution is weakened if the machinery remains in storage because the importer cannot secure finance or the inland route cannot accommodate it. The useful service extends to the point at which the productive investment can enter operation.

Similarly, an export service may require quality testing, packaging, consolidation, inspection, booking and access to trade finance before cargo reaches the terminal. Enterprise participation depends on those services being available at a usable scale and price. A gateway can exclude smaller firms through minimum shipment requirements or service fragmentation even while its principal infrastructure performs well.

Identify missing, unreliable or commercially inaccessible services. Responses may include investment, changed operating hours, transparent service information, shared facilities, procurement access or agreements between existing providers. Users should obtain a complete, credible service through routine arrangements rather than exceptional personal intervention.

Current role, declared role and reachable role

Apply the gateway framework's Current, Declared and Reachable Role distinctions to each proposed change, comparing additional service requirements with demonstrated capability and a feasible horizon. The following examples show their use. (LOGI-CONSULT 2026a, sections 2.2 and 3.2)

An assessment begins with the present customer base and operating record. It then examines the proposed change: different cargo, a larger market, additional maritime services, a new processing activity or a stronger regional connection. Each change introduces requirements. A repair cluster needs suitable demand and technical capability. A cold-chain gateway needs dependable utilities and market acceptance. An industrial gateway needs viable productive sites and enterprise demand as well as transport access.

Reachability also depends on alternatives. Nearby gateways may compete for some of the same cargo while serving different economic functions. A project can be commercially attractive to one operator yet add little regional capability if it mainly redistributes existing activity. Regional assessment should distinguish additional service, useful redundancy, competition that improves user choice and duplication that creates unsustainable obligations.

A smaller gateway can pursue a demanding, strategically valuable role in domestic supply continuity, short-sea connectivity, fisheries, repair, selected industrial cargo or a particular transit market. Ambition follows the role's quality and economic usefulness, translated into appropriate capability.

Long-horizon options should remain visible without being treated as immediate projects. Land reservations, adaptable layouts and staged utility provision can preserve possibilities. Full-scale construction should follow stronger evidence of demand and the readiness of complementary services. This sequencing protects scarce land and capital while allowing the port to evolve.

The port city and productive territory

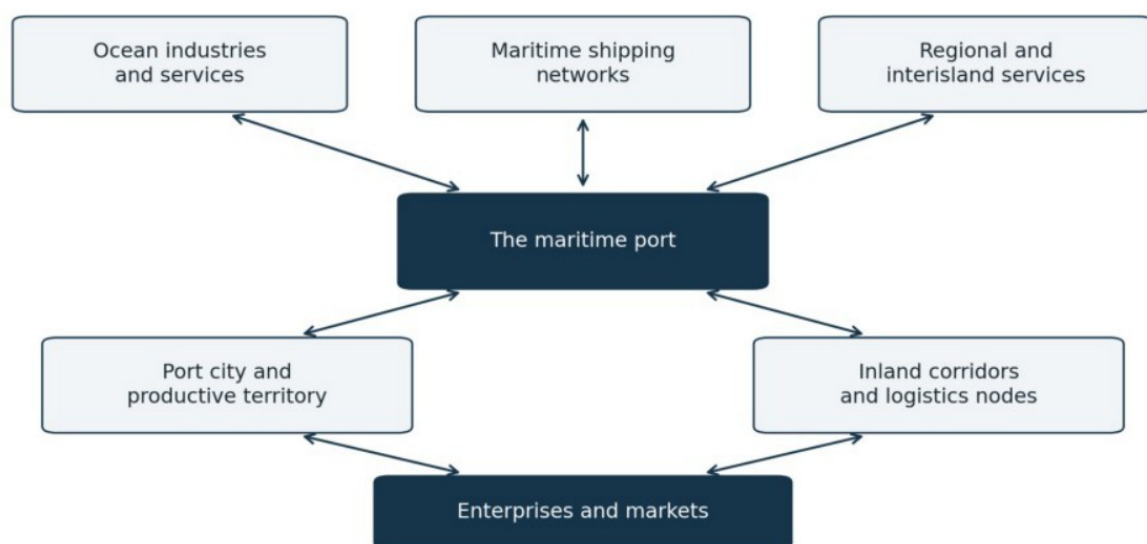
The port's landward relationship starts immediately outside its boundary. Truck queues, freight routes, worker access, utility networks, housing and industrial land connect port operations to the city. A faster terminal can transfer pressure to urban roads if dispatch is not coordinated with receiving capacity. Conversely, congestion or unreliable worker transport can reduce the usefulness of waterfront investment.

The port city should therefore appear in gateway strategy as a productive and social system. It supplies labour, firms, engineering, professional services, accommodation and everyday services. Its residents also bear traffic, noise, safety and environmental effects. Port development should explain how these relationships will be managed with the relevant municipal, transport, utility and community institutions.

Productive territory extends farther inland. Farms, factories, inland terminals and distribution centres need appropriate connections to the gateway. Their proximity in kilometres is less informative than the service actually available: travel time and variability, transport cost, handling requirements, operating hours, shipment size, border procedures and access to buyers. This is the basis for examining the Effective Reachable Market.

The same geographical discipline applies seaward. An island gateway reaches productive partners through ocean services rather than a continuous land corridor. A coastal gateway may connect sea routes to a mainland hinterland and also support domestic coastal trade. The port's functional geography can therefore include both ocean and inland networks, with different commercial and institutional relationships in each.

Figure 2 Maritime and productive gateway relationships



Source: Author conceptual synthesis. Relationships indicate functions rather than jurisdiction.

Energy, ecology and continuity as design conditions

Energy reliability belongs inside port strategy because cargo handling, lighting, security, refrigeration, workshops and digital systems depend on it. An electrification programme changes the gateway's demand profile and the consequences of interruption. Equipment selection should be linked to grid capability, charging or connection arrangements, maintenance skills, tariffs and backup provision.

Decarbonisation requires an account of the service being changed. Electrified handling, shore power, cleaner fuels and modal change each have distinct dependencies. Their effect should be assessed over the relevant lifecycle and operating boundary. A fuel label or equipment purchase does not by itself establish the emissions outcome, affordability or continuity of the resulting service.

Ecological conditions also affect the port's future role. Dredging, coastal development, waste, water quality and marine habitats require appropriate assessment and competent oversight. The Blue Economy cannot be advanced by disregarding the ecosystems and livelihoods on which marine activity depends. Economic purpose must be pursued within these conditions, with evidence about distribution as well as aggregate benefit.

Continuity brings these dependencies together. A gateway needs to know which functions must remain available during a channel interruption, storm, power failure, equipment outage or information-system disruption. It needs a realistic account of alternative capacity, the time required to activate it and the resources required to sustain it. A second route or backup asset becomes useful only when it can actually provide the necessary service.

The future African port is consequently an operating institution with a productive purpose. Maritime competence and dependable services provide the foundation for enterprise development across its connected inland and ocean economy. Governance and investment sustain those relationships; learning and reinvestment can deepen the capability they create. The contribution section that follows explains the decisions this architecture changes. Chapter 2 sets out the five capabilities of the proposed port model.

The decisions this architecture changes

This monograph's connected decision architecture asks which gateway role is credible, which services and interfaces it requires, which intervention improves the complete journey, and what productive capability remains. It follows the relationship from vessel to enterprise and, where relevant, from ocean activity into a productive maritime economy.

The architecture connects specialist findings: engineering establishes physical requirements; maritime and logistics practice, service conditions; trade facilitation, procedures; and economic and financial appraisal, value and viability. Each discipline retains its authority while decisions are tested against their dependencies across domains.

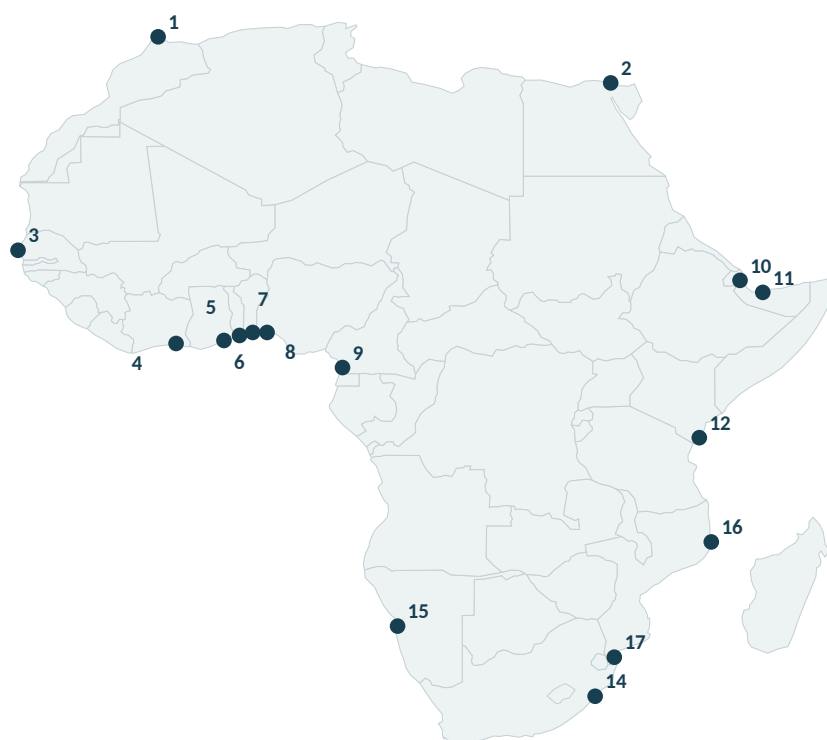
Table 2 Gateway contribution to specialist decisions

Decision field	Established specialist question	Additional gateway decision in this monograph
Port capacity	What can the facility handle?	Which reachable role needs the capacity and can the connected services use it
Smart operations	How can information and technology improve a task?	Can trusted information become accountable action across the critical hand-offs
Corridor performance	How do time, cost and reliability change?	Which enterprises gain usable access and what still constrains their journey
Blue Economy	Which ocean activities have development potential?	Which complete service chains can the port and connected territory credibly support
Investment	Is a project feasible and financeable?	Does its sequence create usable capability with funded lifecycle obligations
Economic contribution	What benefits does an intervention generate?	What productive capability and retained value persist and support reinvestment

The table describes this synthesis rather than exclusive ownership of its questions. Existing literature and practice already connect ports, corridors, productive activity and institutions. AIC2030 specifies a particular relationship among gateway role, critical interfaces, authorised decisions, continuity and Productive Yield. Its practical additionality must be demonstrated against a feasible alternative, through decisions improved and productive outcomes observed; novelty of terminology is not sufficient. (Nursimulu 2026f; LOGI-CONSULT 2026a; Lee and Lam 2016; Lee et al. 2025; Kunaka and Carruthers 2014)

The architectural contribution specifies relationships before the investment programme is settled and helps select the appropriate intervention. Maintenance, a service agreement or targeted capacity improvement may resolve the material constraint. See Economic Analysis and Architectural Design in the opening orientation.

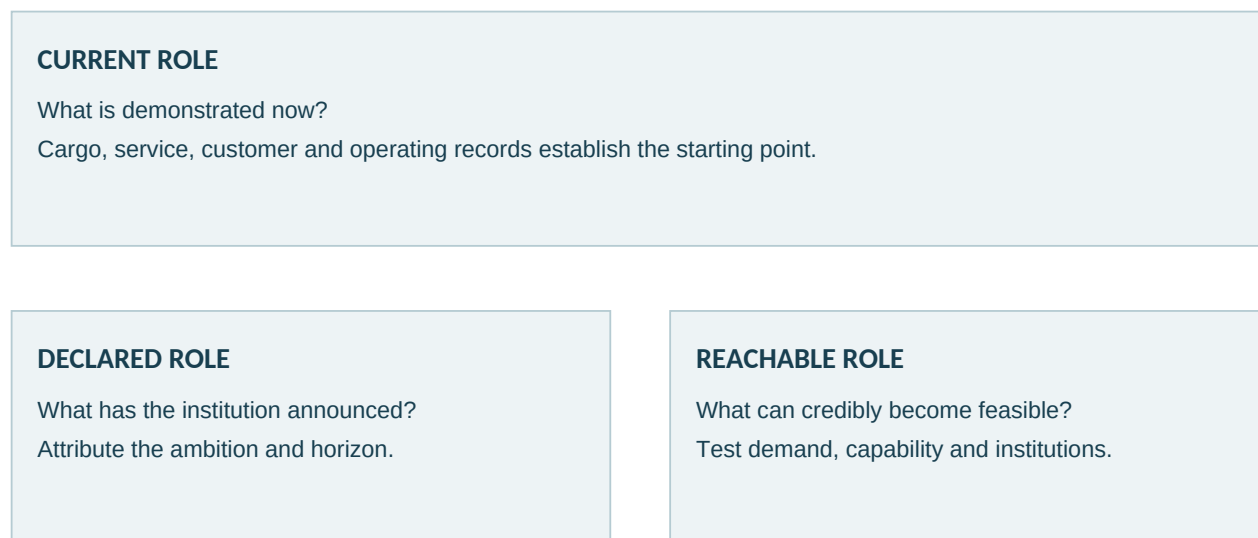
The gateway role establishes the economic purpose. We can now specify the capabilities through which the port contributes to that purpose and distinguish the proposed model from its supporting assessment method.

Figure 3 Gateway contexts across Africa

Locator	Locator
1. Tanger Med	2. Port Said
3. Dakar / Ndayane	4. Abidjan
5. Tema	6. Lomé
7. Cotonou	8. Lagos / Lekki
9. Kribi	10. Djibouti
11. Berbera	12. Mombasa
13. Port Louis	14. Durban
15. Walvis Bay	16. Nacala
17. Maputo	

Location numbers identify places, not performance ranks. The chapter baseline includes individual gateways and grouped systems; this locator unpacks their principal coastal locations. The Abidjan–Lagos configuration spans several marked gateways. Coordinates are approximate.

Source: Rhavy Nursimulu, AIC2030; gateway selection from Chapter 1. Basemap: Natural Earth, 1:110 million admin-0 countries, public domain. Geographic presentation does not adjudicate sovereignty or recognition.

Figure 4 Distinguish demonstrated function, announced ambition and feasible reach

Transformation gap: additional requirements between current capability
and a supported reachable role, within a stated horizon.

These are distinct judgments. An announced ambition may be unreachable.

Assess current function from evidence. Test the future role against its additional service requirements and feasible alternatives. A declaration supplies a proposition to examine; it does not establish the reachable role.

Source: Rhavy Nursimulu, AIC2030; Chapter 1 and the gateway framework (LOGI-CONSULT 2026a).

Key takeaways: Choose a credible role before selecting investment. Compare like-for-like measures. Test benefits at enterprise level. For reflection, use the Chapter decision guide; controlled terms are defined in the glossary.

2 The African Fifth-Generation Port

Chapter objectives: Explain the five capabilities and their relationship; distinguish maritime single windows, port community systems and decision intelligence; use OPI to direct diagnosis.

The proposed model and its intellectual contribution

The African Fifth-Generation Port is the AIC2030 operating architecture for connecting maritime dependability with productive economic capability across inland and ocean relationships. Its five capabilities are Maritime and Operational Excellence; Gateway Integration; Gateway Decision Intelligence; Productive Value Creation; and Custodial and Compounding Leadership.

The contribution lies in their specified relationship. A gateway's economic role determines its service requirements; those requirements reveal critical dependencies; institutional authority and commercial commitments make coordinated action possible; investment sustains the required capability; and the productive account examines what enterprises and territories create, retain and renew.

Port-generation scholarship, port regionalisation, smart-port development and established governance practice provide important intellectual foundations. AIC2030's contribution is the particular architecture developed here and its application to African gateway conditions. The generation designation identifies this authored model. Its practical effectiveness remains subject to operating tests, comparative application and independent evaluation. (Lee and Lam 2016; Lee et al. 2025; World Bank 2025b; Notteboom and Rodrigue 2005)

Fifth-generation port concepts predate this monograph. Lee and Lam's 2016 discussion addresses fifth-generation development and earlier customer-and community-oriented propositions. The sixth-generation framework proposed by Lee and colleagues in 2025 addresses digitalisation, decarbonisation, sustainability and post-pandemic port-logistics transformation. Port regionalisation recognises relationships extending beyond the terminal and traditional port perimeter. These precedents locate the AIC2030 contribution within an existing field of scholarship and practice. (Lee and Lam 2016; Lee et al. 2025; Notteboom and Rodrigue 2005)

A gateway may improve vessel turnaround while cargo remains constrained by inland transport. A digital platform may provide visibility while the competent institutions lack an agreed response to interruption. Additional terminal capacity may increase throughput while productive participation remains limited. The architecture connects these service dependencies to proportionate intervention choices. Targeted maintenance, a service agreement or an existing coordination mechanism may provide the appropriate answer. Its usefulness should be assessed through the decisions it improves and the productive consequences that can be demonstrated.

The smart port as the starting point

In this monograph, smart-port development means the deliberate use of connected information, digital services and operational intelligence to improve the port's work. It can support safe navigation, vessel planning, terminal performance, clearance, equipment reliability, energy management and environmental monitoring. This is a working definition for the argument, not a claim that one universally accepted smart-port specification exists. A digitally capable port is a substantive achievement on which the proposed model builds. (World Bank 2025b, Module 9)

Three arrangements should be distinguished. A Maritime Single Window addresses public reporting formalities associated with a ship's arrival, stay and departure. A Port Community System supports information exchange and coordination among the public and private organisations involved in port logistics. Operational intelligence uses relevant information to improve a particular operating decision.

They can reinforce one another, but installing one does not establish that the others are functioning.

Under the IMO Facilitation Convention’s 2022 amendments, effective from 1 January 2024, public authorities are required to establish, maintain and use single-window systems for the electronic exchange of the information required on arrival, stay and departure of ships. The arrangements are intended to coordinate transmission so that information is provided once and reused as far as possible. This convention requirement should not be confused with verified implementation at every African port, or with a complete end-to-end cargo service. (International Maritime Organization n.d.)

The World Bank and IAPH describe Port Community Systems as collaborative digital platforms connecting public and private port stakeholders. Their implementation concerns governance, financing, legal arrangements and functional design as well as technology. For a gateway application, the questions include who provides and accepts each record, who can access it, how participation is funded and how errors are resolved. A shared platform must be supported by workable institutional commitments. (World Bank and IAPH 2023)

Operational systems perform different tasks. A terminal operating system organises terminal activity; equipment monitoring informs maintenance; a port-call service supports arrival planning. Digital twins and predictive tools can examine choices where their data and models are fit for purpose. Assess each capability against its intended use. The Singapore example later in this chapter distinguishes an announced implementation from measured system-wide benefits. (World Bank 2025b, Module 9; Maritime and Port Authority of Singapore 2023)

Consider an illustrative import-release decision. Customs clearance may be visible electronically while the terminal has not confirmed availability, the haulier has no usable collection slot or the inland receiver cannot accept delivery. Better information can expose the mismatch. A usable service additionally requires the responsible parties to reconcile those conditions, act within their authority and provide an agreed recovery route when the plan fails. This is an illustration of the proposed architecture, not a measured finding from a named port.

The African starting point is differentiated, as Chapter 1’s dated landscape establishes. SSATP’s assessment associates digitalisation with policy, trade facilitation, infrastructure and capability; it does not establish that every digitally advanced port has the same operating performance. The practical response is to identify the actual constraint on the service. A missing clearance interface, unreliable power supply, equipment shortage and absence of an authorised decision owner require different interventions. The proposed model does not presume that a more elaborate platform is always the appropriate first investment. (SSATP 2024)

Port Louis provides a bounded example of the existing agenda’s breadth. UNCTAD convened a workshop on 27 May 2025 to present its Sustainable Smart Port assessment. The subsequent official United Nations account discusses renewable energy, equipment electrification and shore power alongside funding, land and regulatory constraints, and connects the transition to the blue economy.

These are reported assessment findings and proposed directions, not evidence that all recommendations have been implemented. They show why smart and sustainable port work should not be reduced to software installation. (United Nations Mauritius 2025; UNCTAD 2025b)

The comparison concerns how these relationships are specified and tested together. Port regionalisation already places ports within wider logistics networks and calls for governance beyond the traditional perimeter. (Notteboom and Rodrigue 2005) Industrial and sustainable-port approaches likewise provide established reference points, as Tables 3 and 4 show. AIC2030 brings maritime dependability, authorised decisions, enterprise participation, ecological conditions and capability renewal into one proposed gateway decision logic. Its distinctiveness lies in that specified synthesis and application, not in originating port-hinterland integration, industrial development, digitalisation or sustainability.

Table 3 Existing approaches and the proposed AIC2030 contribution

Established approach Recognised contribution Specific AIC2030 adaptation

Smart-port transformation ¹	Digital services, governance, skills, cybersecurity and operational visibility	Tests whether accepted information changes a consequential, authorised service decision
Environmental sustainability ²	Environmental management, resilient infrastructure and cleaner operations	Connects ecological limits and energy choices to defined inland and ocean productive activities
Port governance and port-city relationships ³	Institutional accountability, port authority roles and urban coordination	Specifies service obligations across institutional boundaries and examines participation and retained capability
Port regionalisation ⁴	Integration with inland logistics networks and relationships beyond the terminal	Connects integration to economic role, service constraints, decision authority and productive outcomes
Fifth-and sixth-generation proposals ⁵	Customer and community concerns, digitalisation, sustainability and evolving port functions	Proposes a contextual five-capability operating architecture rather than another universal progression
AIC2030 architecture ⁶	Authored synthesis of maritime, institutional and productive capabilities	Tests service continuity, productive additionality, value distribution and capability renewal

Sources for the preceding table panel: 1. World Bank 2025b. 2. World Bank 2025b. 3. World Bank 2025b. 4. Notteboom and Rodrigue 2005. 5. Lee and Lam 2016; Lee et al. 2025. 6. Nursimulu 2026f; LOGI-CONSULT 2026a; Nursimulu 2026b.

These approaches provide the context for gateway design and investment. The next comparison locates the proposed operating model within the port-generation literature.

Port-generation models and the AIC2030 contribution

Generation terminology is a way of organising changing port functions and relationships, not an internationally accredited ranking through which every port must progress. Published schemes use different criteria, and a port may combine characteristics associated with several generations. Russo and Musolino's review explicitly cautions against treating the classifications as a simple ranking of ports.

Accordingly, fourth-generation port and smart port are not used here as universally interchangeable terms. (Russo and Musolino 2020)

The comparison below separates the organising emphasis of selected published approaches from this monograph's proposed operating model. The early UNCTAD lineage is treated together because this is a conceptual comparison rather than a retrospective reclassification of individual African ports. For G1 and G2, the comparison is limited to the scope stated in the available publisher and institutional-repository abstracts; it does not claim a full-text evaluation or demonstrate superiority.

Table 4 Port-generation lineage and the proposed operating model

Published lineage Organising emphasis Relationship to AIC2030

Early UNCTAD lineage: first to third generations ¹	Port functions expand to logistics, industrial and commercial relationships; port community and marketing already matter.	Productive integration has an established lineage; no claim of originating the wider economic role.
Fourth-generation discussion ²	Horizontal and vertical integration; network relationships beyond a single terminal.	Network integration is a precedent; AIC2030 specifies five connected capabilities for contextual gateway decisions.
Fifth-generation discussion ³	Lee and Lam address fifth-generation ideas and earlier customer-and community-centred approaches.	The fifth-generation label is not new; the proposal must be judged by its defined architecture and usefulness.
Sixth-generation proposal ⁴	Post-pandemic digitalisation, decarbonisation, sustainability and smart transformation.	Digital and environmental aims overlap; compare proposals on stated mechanisms and purposes, not numerical superiority.
AIC2030 proposed African Fifth-Generation Port ⁵	Five capabilities link maritime competence, gateway integration, decisions, productive value and custodial renewal.	Contextual operating proposition for inland and ocean economies; requires independent application and validation.

Sources for the preceding table panel: 1. UNCTAD 1992; Lee and Lam 2016. 2. UNCTAD 1999; Lee and Lam 2016. 3. Lee and Lam 2016. 4. Lee et al. 2025. 5. Nursimulu 2026f; LOGI-CONSULT 2026a; Nursimulu 2026b.

The historical evolution of port functions establishes important precedents for the architecture developed here. Logistics integration, customer orientation, port-community relationships, environmental responsibility and digital transformation are not exclusive features of the AIC2030 proposal.

The distinction advanced by this monograph concerns the organisation of these capabilities around a defined productive service, with explicit attention to institutional authority, economic additionality, retained capability and continuity. This distinction must be tested rather than presumed. A proposed intervention should be compared with credible alternatives, including targeted maintenance, contractual coordination, operational reform and investment in existing capacity. The preferred intervention is the one that most effectively resolves the material constraint under the gateway's economic, institutional and ecological conditions.

The Fifth-Generation Port designation therefore identifies the proposed AIC2030 operating architecture. It does not establish a universally applicable historical stage, a ranking of port sophistication or empirical superiority over existing approaches.

Define the operating model

The African Fifth-Generation Port is a port that performs its maritime responsibilities dependably and exercises an authorised, evidence-led and collaborative anchoring role across the inland and ocean relationships on which its connected productive economy depends. Its five capabilities are Maritime and Operational Excellence, Gateway Integration, Gateway Decision Intelligence, Productive Value Creation, and Custodial and Compounding Leadership. The fourth capability includes creation, retention and the reproduction of productive capability; it develops the productive and market orientation stated in the gateway framework. (LOGI-CONSULT 2026a, section 4.10; Nursimulu 2026b, section 6) These capabilities describe how the port contributes to a wider system. They do not replace the framework's eight assessment pillars or its controlled dimension register. The pillars organise diagnosis; the five capabilities express the port's proposed operating role. Gateway maturity describes the condition of the connected system. Each classification should be used for its stated analytical function. The five capabilities connect strategic purpose to practical decisions. They help identify the productive relationship to be developed, the interfaces it requires, the port's own responsibilities and the complementary action needed from other institutions. Investment can then be organised around a complete service and its economic purpose, rather than an unchanged list of separate projects.

Orchestration within an authorised gateway architecture

The operating boundary is collaborative. A harbour master's safety decision, a customs release, terminal dispatch and a carrier's routing remain distinct. The port can act as operator, landlord, convenor, strategic partner, data contributor, interface custodian or investment catalyst within its mandate and agreements. Its coordination may connect port access, productive platforms, port-city relationships, energy, information and reinvestment. Agreed processes make dependencies visible; they do not transfer a partner's statutory powers or create authority over private investment.

Maritime and operational excellence

The first capability protects the port's core competence. It requires safe access, appropriate berth and terminal capability, dependable services and equipment that can be maintained. An orchestration role is credible when the port can deliver its own responsibilities and understand the consequences of failure across the service chain.

Operational excellence should be examined by cargo and service. Vessel turnaround, berth occupancy, equipment availability, yard condition and cargo dwell explain different parts of performance. They should be interpreted together with arrival patterns, cargo composition and downstream readiness. A rise in crane productivity may be valuable, but it can also expose an evacuation constraint that was previously less visible.

Consider an illustrative delayed vessel carrying production inputs. The port first needs a safe and feasible berth plan. The terminal needs a workable sequence and receiving space. Marine services need confirmed requirements and sufficient notice. Cargo owners and inland operators need revised availability information. The first capability secures competent maritime execution; the second ensures that execution connects to the next part of the journey.

Maintenance is a strategic component of this competence. Availability depends on inspection, qualified technicians, procurement lead times, spares and lifecycle funding. A gateway that repeatedly finances new equipment while deferring renewal of essential systems can increase its obligations without increasing dependable service. The operating model should expose this difference before capital is committed.

Gateway integration

Gateway integration concerns the physical, operational, commercial and institutional connections that allow separate services to form a usable journey. A road connection is physical. A confirmed collection window is operational. A transport booking and liability arrangement are commercial. Clearance and authorised interchange involve institutional requirements. All may be necessary for one cargo movement.

At the vessel-terminal interface, integration connects arrival information to berth readiness and cargo plans. At the terminal-inland interface, it connects cargo availability to transport, release status and receiving space. At the productive interface, it connects shipment plans to the timing and condition required by the enterprise. Integration becomes real when these relationships can be used routinely by participants.

Information quality must support that routine. The participants need shared meanings for events such as arrival, discharge, availability, release and gate-out. They also need to know whether a time is planned, estimated or confirmed. A schedule that has not been accepted by the receiving operator should not be presented as a committed connection. The distinction affects bookings, labour, equipment and customer promises.

Integration also requires commercial alignment. A terminal may prefer rapid evacuation while an importer uses its storage allowance because inland warehousing is expensive or finance is unavailable. A transport operator may resist appointments that create unpaid waiting or unreliable return work. These behaviours should be examined through actual incentives and constraints. A digital booking tool cannot by itself resolve an economically unattractive service arrangement.

The port's leadership contribution is to identify the interface, bring the competent parties together, define the service requirement and sustain evidence about performance. Some tasks can be resolved by a service agreement. Others require a change in infrastructure, regulation, procurement or commercial practice. Institutional form should follow the problem.

Gateway Decision Intelligence

Gateway Decision Intelligence is the capability to convert trusted data, visibility and analysis into timely, coordinated and accountable decisions. It is a controlled concept in the gateway framework. Its test is an operating consequence: the right actors recognise a material condition, make an authorised decision and carry it through to action. (LOGI-CONSULT 2026a, section 2.2)

An illustrative reefer disruption shows the sequence. A delayed arrival changes discharge timing. The terminal forecasts demand for reefer positions, a cold store confirms available receiving capacity, and the processor identifies the latest acceptable delivery. Customs and food-safety authorities indicate the applicable status within their own responsibilities. The participants can then choose among feasible actions rather than dispatching cargo using an obsolete plan.

The information required is specific: cargo identity, condition where relevant, expected availability, release status, receiving capacity and service commitments. Access should follow the task and the parties' rights. A common operating picture does not require publication of every firm's customer list, margins or confidential contracts. The design should make necessary coordination possible while protecting legitimate commercial and public interests.

A decision record should identify what was known, its reliability, the alternatives considered, the person or institution authorised to decide and the resulting action. Where information is uncertain, the system should preserve that uncertainty. A forecast based on incomplete data may justify preparation or further checking; it should not silently become a confirmed operational instruction.

Human judgement remains central. A harbour master may reject a proposed movement for safety reasons. A regulator may require inspection despite a logistics priority. An operator may lack the capacity assumed by the model. Decision intelligence improves the evidence and coordination surrounding those decisions. It should preserve the ability to question data, refuse unsafe action and correct the operating model.

Artificial intelligence and digital twins can support prediction, comparison and scenario analysis. Their value depends on the quality of the underlying representation and the ability to act on outputs. A twin that omits a border restriction or overstates rail capacity can recommend an infeasible journey. Model validation should therefore include operational users and observed execution, with clear arrangements for correction and fallback.

Productive Value Creation

The fourth capability directs port strategy towards enterprises and the markets they can actually serve. It asks what dependable gateway service changes for a producer, processor, distributor or maritime service firm. This moves economic evaluation beyond proximity to the port and beyond aggregate throughput.

For a processor, reliable imported inputs can reduce interruption, while suitable export services can extend customer reach. For a repair enterprise, vessel calls can support skilled work if the yard, technicians, suppliers and approvals are available. For a small exporter, shared consolidation and testing may provide access that individual shipments could not sustain. Each pathway needs its own commercial and operational evidence.

The distinction between potential and realised effect matters. An industrial site connected to a port may still lack power, water, tenants or viable products. A new berth can facilitate investment without causing it alone. The port strategy should specify the pathway, the complementary conditions and the observable change expected. Enterprise output, service use, supplier participation and investment entering operation provide stronger evidence than announcements alone.

Productive orientation also changes procurement and service development. Gateway institutions can examine whether local enterprises have a fair opportunity to supply maintenance, packaging, engineering, logistics and professional services. Participation requires competent delivery, workable contract sizes, payment arrangements and access to training or equipment. Local value retention should develop productive capability rather than become an assumption attached to ownership labels.

Custodial and compounding leadership

Custodial leadership means continuing responsibility for the gateway's coherence, performance and development direction. It asks who preserves knowledge of critical interfaces, reviews unresolved constraints, sustains continuity arrangements and follows through on agreed improvements when individual projects or officeholders change. The responsibility must be assigned and resourced if it is to endure. (LOGI-CONSULT 2026a, sections 2.2 and 4.10)

The function can be distributed among existing institutions. A port may maintain an interface register and convene service reviews. A corridor body may monitor cross-border performance. Operators retain responsibility for their services, while competent public authorities retain regulatory decisions. A shared arrangement should make these responsibilities clearer and provide an effective route for unresolved issues.

Custodianship also requires restraint. A convening port has commercial and institutional interests. Shared performance information, access rules and escalation arrangements should enable smaller operators and competing users to rely on fair treatment. Formal dispute resolution requires an appropriate legal or contractual basis and a competent decision-making body. The custodian's coordinating role must therefore have explicit boundaries, transparent conflicts management and an accessible route for review.

The interdependence of the five capabilities

The five capabilities should not be interpreted as independent achievements whose presence automatically produces a Fifth-Generation Port.

Their significance lies in the relationships through which they affect a defined economic service.

Maritime excellence may improve vessel handling without resolving inland delivery. Gateway integration may establish a functioning connection without securing the institutional decisions needed when that connection fails. Decision intelligence may improve operational coordination without demonstrating additional productive activity. Productive value may emerge without sufficient arrangements to preserve and renew the capabilities on which it depends.

The proposed architecture therefore requires a service-level examination of dependencies, authority, economic purpose and continuity.

Its five capabilities are neither a substitute for operational diagnosis nor a claim that every gateway requires an equally extensive programme in each domain. Their application should be proportionate to the gateway's role, the material constraints identified and the productive opportunities that can credibly be supported.

The model's explanatory value lies in showing why an intervention is necessary, how it connects with complementary capabilities, which institutions must act and what evidence would demonstrate that the intended economic contribution has occurred.

Custodianship and the allocation of authority

The proposed Fifth-Generation Port requires continuity of institutional responsibility without assuming concentration of institutional power.

Custodianship concerns the sustained protection, performance and development of the gateway relationships necessary to support its economic role. It does not confer ownership of participating enterprises, regulatory jurisdiction over independent authorities or discretionary control over private investment.

Four responsibilities must therefore remain distinguishable.

Strategic custodianship concerns the preservation of critical assets, institutional commitments, continuity arrangements, long-term development direction and the capacity to renew productive capability.

Statutory authority concerns decisions lawfully reserved to competent public institutions, including maritime safety, customs, environmental regulation, competition and other regulatory functions.

Commercial and operating responsibility concerns the delivery of services, investment commitments, contractual performance and the management of risks allocated to operators and investors.

Collaborative gateway coordination concerns the agreed arrangements through which these separate responsibilities are connected around a defined service requirement.

These responsibilities may be exercised by different institutions or combined within lawful institutional arrangements. Their allocation must nevertheless remain explicit, accountable and subject to appropriate safeguards.

A port authority may act as an anchor, convenor or interface custodian where its mandate and agreements permit. Its effectiveness should be assessed through the reliability of the relationships it helps sustain, not through an assumed right to direct every participant in the connected economy.

The credibility of custodianship consequently depends on institutional restraint as well as leadership. Transparent access, proportionate information sharing, competition safeguards, conflict management and lawful review mechanisms are conditions of legitimate coordination.

The strategic objective is not to centralise control of the gateway economy. It is to ensure that the responsibilities on which productive services depend remain coherent, funded, enforceable and capable of improvement over time.

Asset ownership carries responsibility for condition, maintenance, replacement and development commitments. Regulation oversees matters such as access, competition and service obligations within its lawful remit. Development and investment prepare and deliver usable capability. Operations provide dependable services and maintain the assets entrusted to them. Enterprise participation brings productive use, innovation, suppliers and market activity into the ecosystem. These responsibilities require explicit allocation even where one institution performs more than one function.

Where ownership, regulation and commercial participation intersect, safeguards should address conflicts of interest, information access, related-party transactions and transparent treatment of competing operators. A public shareholder's development interest does not eliminate the need for credible oversight. A private operator's service contract does not transfer statutory powers beyond those lawfully granted.

Public enterprises, concessions, joint ventures, management contracts and other lawful arrangements can fulfil different parts of the architecture. The Mombasa and Durban blueprints propose hybrid ownership and operating arrangements, including national-municipal participation. Their continental contribution is the explicit relationship between custodianship, partnership and performance. The 90/10 equity configuration is a contextual proposal rather than a requirement for every African gateway. (Nursimulu 2025b, 30–37; Nursimulu 2025a, 70–79, 122–123) The custodian's remit must be specified.

Convening does not confer regulatory authority, ownership of participating enterprises, a right to allocate private capital or jurisdiction to decide disputes. Regulators exercise statutory powers; operators deliver contracted services; investors and lenders make investment and credit decisions; competent courts and properly constituted tribunals decide legal disputes. A coordinating institution may help parties locate the appropriate process without claiming those powers itself.

Nonconversion means that information access, convening influence and stewardship functions are not quietly converted into exclusive commercial advantage or discretionary control over entry. Participation should have clear terms, proportionate disclosure, accountable conflicts management and lawful avenues for review and exit. A custodian that also sells commercial services must separate decisions, information access and accounts sufficiently to make neutrality credible. Durability should rest on useful service and trusted conduct, with portability and nonexclusive participation where feasible. (Nursimulu 2026e, 45–62)

The port capability model describes the economic and institutional role to be demonstrated. Public service, tool, landlord and private port models describe arrangements for ownership and service provision. A concession, joint venture or fund investment describes another aspect of the structure. None of these labels establishes Fifth-Generation Port capability on its own. Chapter 7 examines how their combination can support or obstruct the productive corridor role.

Layered partnerships and enforceable operating commitments

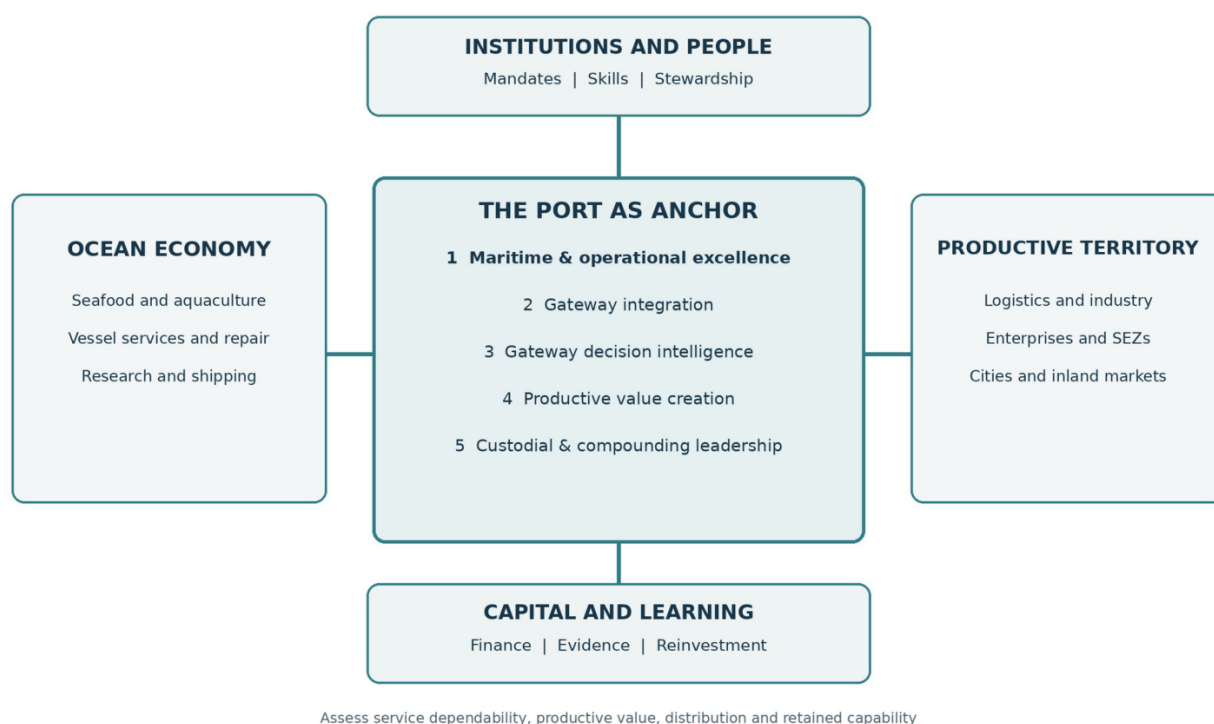
Layered partnership architecture distinguishes the custody of strategic assets from project development, operating delivery and commercial participation. A gateway can maintain public custody of critical land and marine infrastructure while using different contractual arrangements for terminals, logistics parks, repair facilities, cold chains, energy services and productive platforms. Each project should identify its own demand, financing, revenue, performance and risk allocation.

A joint venture should specify the capabilities each party contributes: capital, operating expertise, technology, customers, land access, local supply networks or specialist knowledge. Technology transfer and workforce development need milestones, budgets and acceptance tests. Equity participation alone does not demonstrate that these capabilities will become embedded in the connected economy.

Contracts should establish maintenance and renewal duties, service standards, access conditions, environmental obligations, data provision and reporting. They also need remedies, escalation, handback conditions and continuity arrangements. Step-in rights and asset reversion should be designed where lawful and appropriate, with clear triggers and a realistic ability to sustain service.

Institutional integrity becomes operational through procurement transparency, conflict declarations, protected reporting channels, contract monitoring and independent challenge. The custodial task is continuous: changes in investors, operators or political leadership should preserve critical services, asset records, workforce knowledge and the capacity to enforce obligations. (Nursimulu 2025b, 33–37; Nursimulu 2025a, 106–111, 122–123)

Figure 5 The African Fifth-Generation Port architecture



Source: Rhavy Nursimulu, AIC2030. Arrows indicate functional relationships, not common ownership or jurisdiction.

Applying the capabilities to a gateway role

The capabilities connect maritime dependability, integrated services, coordinated decisions, productive purpose and continuing relationships and learning. The gateway's role determines their practical combination of services, partners and investment.

A consequential service offers a practical starting point: it brings users, institutions and a productive requirement into one operating relationship. The minimum architecture must make that relationship usable, with safe operations, functioning connections, accepted information, competent people, accountable decisions, lifecycle funding and continuity. These requirements describe a coherent service system rather than a standard construction programme. Transformation of the wider productive system remains the strategic objective.

Assessment supports this design work. The five operating capabilities describe the port's contribution; readiness concerns the suitability and development position of its role; gateway maturity concerns the condition of the connected system. The application protocols retain the capability evidence requirements, readiness categories, maturity stages and limits on assessment conclusions. They enable specific claims to be examined without turning the proposed model itself into a certification scheme.

What a bounded application can demonstrate

Singapore's September 2023 marine circular announced implementation of a just-in-time planning and coordination platform for vessels berthing at PSA Terminal and Jurong Port from 1 October 2023. It identified participating shipping and marine-service actors, described schedule information for resource planning, and recorded preparatory training. Its efficiency and emissions benefits were presented prospectively. The circular is evidence of a defined implementation arrangement, not an independent evaluation of achieved effects. (Maritime and Port Authority of Singapore 2023, paragraphs 1–4) The relevant lesson for this architecture is specificity. A named operating task connects schedule information, participants, resource planning and preparation for use. An African gateway can begin with a similarly bounded interface where a practical improvement is needed. A universal institutional reconstruction is not a prerequisite for every useful change.

SSATP's 2024 African port digitalisation study likewise provides a reason for careful diagnosis. Its reported relationship between digital maturity and performance includes alignment and exceptions. The findings should not be reduced to a claim that digitalisation never improves performance, nor treated as proof that technology alone determines it. (SSATP 2024, executive summary, 12–13)

These examples show how a defined operating scope connects information, participants and a service decision. The OPI diagnostic below examines pressure within that service context; Chapter 3 develops the port's seaward productive relationships.

Operating pressure and the AIC2030 Port Congestion Model

The Operability Pressure Index (OPI) gives this operating architecture a diagnostic instrument. It examines vessel-flow, terminal and landside pressures through a ten-indicator dashboard. Five normalised pressure scores form the proposed headline index: vessel waiting time, berth occupancy, yard occupancy, container dwell time and crane productivity.

Waiting and berth occupancy describe different observations: delay experienced by vessels and the proportion of available berth time in use. They may respond to the same congestion episode, so their combined contribution can give that episode additional influence in OPI. This is a potential overlap to examine, rather than proof that either component is redundant. Read the component profile alongside the headline score and identify whether the two measures support the same diagnosis or reveal different operating conditions. The five components and their weights remain unchanged.

The authored weighting is $OPI = 0.30 s(VWT) + 0.20 s(BOR) + 0.20 s(YOR) + 0.20 s(CDT) + 0.10 s(CRP)$, where s denotes a score on the proposed 0–10 pressure scale. Better crane productivity must reduce its pressure score. The fuller dashboard also records vessel time in port, equipment availability, truck turnaround, rail evacuation share and congestion surcharge activation. These indicators support diagnosis even though they are outside the five-component aggregation.

OPI is useful when it directs investigation and coordinated action. A rising waiting score may require berth, equipment, yard, evacuation or scheduling interventions. It does not establish which cause dominates. The Durban blueprint's decongestion architecture supplies an associated menu of operating responses; the application protocols retain the authored calculation and specify the evidence required before publishing a measured baseline. (Nursimulu 2026a; Nursimulu 2025a, 105–113, 224–225)

Table 5 OPI dashboard and headline components

Layer Dashboard indicators Headline OPI components

Vessel flow	VWT; VTP; BOR	VWT 30%; BOR 20%
Terminal operations	CRP; YOR; CDT; EAR	YOR 20%; CDT 20%; CRP 10%
Landside and systemic	TTT; RES; CSA	Diagnostic dashboard only

The application protocols specify proposed measurement conventions, interpolation, calibration governance and a complete constructed five-component example. Their illustrative anchors are not operational thresholds. Use the component profile to investigate the constraint before choosing an intervention.

Operating pressure and the limits of aggregate diagnosis

The Operability Pressure Index (OPI) is a proposed diagnostic instrument for examining selected sources of operating pressure within a defined port service. It combines five normalised headline components while retaining a broader ten-indicator dashboard for operational investigation.

The index is intended to support diagnosis, prioritisation and coordinated action. It does not establish the cause of congestion by itself.

A deterioration in vessel waiting time, for example, may arise from berth availability, terminal productivity, yard congestion, landside evacuation, vessel-arrival patterns or external disruption. The relevant intervention depends on identifying the material constraint through operating evidence.

The five-component aggregation must therefore be interpreted alongside its individual component scores, raw observations, defined measurement periods and relevant service conditions.

Consequential operating comparisons require locally calibrated and validated weights and normalisation. Illustrative scores remain unverified as port-performance benchmarks.

OPI must also remain separate from gateway maturity and productive economic outcomes.

A reduction in operating pressure may improve service dependability. Whether that improvement produces additional enterprise activity, income retention or renewed productive capability requires separate evidence, appropriate comparison and attention to other contributing factors.

The diagnostic succeeds when it improves the quality of an operating decision. It does not certify a Fifth-Generation Port or establish the economic success of the proposed architecture.

Five decisions for port and corridor leaders

Declare the reachable role and identify whose productive requirements it serves. Select one consequential service whose failure is costly enough to justify coordinated action. Establish the operating baseline, the binding constraint and the institutions authorised to act. Commit investment and service obligations against that diagnosis. Review value creation, retention and continuity before expanding the intervention.

For a transit gateway, include the inland partner in that decision process. Define service commitments for transit cargo, accepted information, border interfaces, transit guarantee arrangements where applicable and a route for users to challenge failures. Landlocked states and their enterprises need an effective voice in the relevant corridor arrangements, with their delivery reliability, costs and productive capability included in the results account. The coastal authority's statutory powers remain distinct from those of its partners.

The scope of the operability pressure diagnostic

OPI remains a bounded operating-pressure diagnostic. It does not measure the maturity of the gateway, certify a Fifth-Generation Port or establish productive value. F01 prohibits a single aggregate gateway score and requires critical deficiencies, thresholds and evidence confidence to remain visible. A component pressure index can inform that wider diagnosis only when its defined scope, raw observations, normalisation and uncertainty are disclosed. A favourable OPI cannot offset unsafe operations, missing authority, an unreliable border or an unsupported productive claim. (LOGI-CONSULT 2026a sections 4.3 -4.5; Nursimulu 2026a)

The future port as a connected productive institution

The African Fifth-Generation Port proposed in this monograph is not defined by the scale of its infrastructure, the sophistication of its digital systems or the extent of its institutional influence.

Its defining proposition is the capacity to connect dependable maritime services with the productive requirements of the economy it serves, through lawful coordination, accountable decisions and sustained institutional capability.

The five capabilities provide the organising architecture for that contribution. They establish the operational foundation, connect the critical interfaces, enable coordinated action, direct attention towards productive outcomes and sustain the learning and reinvestment necessary for continued development.

Their practical expression will differ across gateways.

A transit port may prioritise reliable cross-border delivery and the productive requirements of landlocked economies. An industrial gateway may concentrate on the dependable movement of inputs, the development of suppliers and the commercial viability of manufacturing activity. An island gateway may place greater emphasis on ocean services, essential supply, maritime enterprise and the economic relationships connecting it to regional and international markets.

The architecture does not prescribe identical institutions, infrastructure or investment programmes for these different conditions.

It requires a credible economic role, an identifiable service constraint, competent decision-makers, proportionate interventions and evidence capable of distinguishing operating improvements from wider productive effects.

The model must also remain open to contradiction. If a simpler intervention resolves the material constraint more effectively, that is the appropriate conclusion. If improved port performance does not translate into additional productive activity, the assumed economic pathway must be reconsidered. If custodial arrangements undermine competition, accountability or lawful authority, their institutional design must be revised.

The proposed Fifth-Generation Port should therefore be judged through demonstrated service improvement, economic additionality, institutional integrity and the capability retained and renewed over time.

The port's productive relationships extend in two directions: inland, towards enterprises, cities and regional markets; and seaward, towards marine industries, ocean resources, maritime services and knowledge networks.

The next chapter develops the second of these relationships. It examines how the Blue Economy can become part of a productive gateway architecture while respecting the ecological systems, institutional responsibilities and economic conditions on which sustainable ocean activity depends.

Figure 6 Ten indicators support diagnosis; five form the headline OPI**VESSEL FLOW**

VWT: vessel waiting time, 30% of headline OPI

VTP: vessel time in port, dashboard only; BOR: berth occupancy, 20%

TERMINAL OPERATIONS

CRP: crane productivity, 10%; YOR: yard occupancy, 20%

CDT: container dwell, 20%; EAR: equipment availability, dashboard only

LANDSIDE AND SYSTEMIC

TTT: truck turnaround; RES: rail evacuation share

CSA: congestion surcharge activation; dashboard measures, no headline weights

$OPI = 0.30 s(VWT) + 0.20 s(BOR) + 0.20 s(YOR) + 0.20 s(CDT) + 0.10 s(CRP)$. Each component is normalised to pressure on the proposed 0–10 scale; better crane productivity reduces its pressure score.

Source: Rhavy Nursimulu, AIC2030; Port Congestion Model (Nursimulu 2026a), Table 5 and application protocols.

Decision use

Read raw observations, component scores, uncertainty and critical failures together. Withhold the headline when a required component or approved calibration is absent. The index does not determine the cause of congestion or select an investment by itself.

Key takeaways: The contribution is the specified relationship between capabilities. Digital systems require accepted decisions and dependable services. OPI locates pressure; field evidence establishes causes. For reflection, use the Chapter decision guide; controlled terms are defined in the glossary.

3 The port and the Blue Economy

Chapter objectives: Trace an ocean activity into a productive service; assess seafood and BlueTech opportunities; identify ecological, regulatory and continuity conditions.

Make the ocean economy an operating relationship

The port's productive role extends into the ocean economy. Fishing, seafood processing, marine engineering, coastal shipping, ocean research and selected offshore activities create different requirements for waterfront space, utilities, specialist labour, transport and market access. This chapter explains those operating relationships and the ecological and social conditions within which they can develop.

The African perspective extends beyond the shoreline. UNECA's Blue Economy policy handbook includes lakes and rivers within the continent's aquatic resource base and places sustainable use, management and conservation at the centre of the approach. This provides an important boundary for economic ambition: activity associated with water is not automatically sustainable or socially beneficial. (United Nations Economic Commission for Africa 2016)

The port's role is to connect relevant activities to the services and markets they require. Fisheries management remains with the competent institutions. Environmental approvals, marine planning and maritime safety retain their respective mandates. Gateway analysis identifies the dependencies among these responsibilities and productive activity, then asks how authorised actors can make the interfaces work.

Begin with a service chain rather than a sector list. Identify its user, product or service, customer and revenue basis; then specify marine and land facilities, operating inputs, skills, assurance, finance and ecological conditions. Energy investment must follow the loads, reliability and backup that the selected activity requires. Separate enterprise assets and working capital from shared services and public functions, with an identified payer and maintenance responsibility for each. These dependencies determine whether the proposition can operate commercially and within its permissions.

Water systems and the productive coast

The Blue Economy begins upstream of the quay. Catchments, rivers, wetlands, groundwater, estuaries and coastal waters carry sediment, nutrients and pollution into the maritime economy. Industrial water demand and urban wastewater affect ecosystem condition, while flooding and coastal change can interrupt the same roads, substations and settlements on which port continuity depends. The relevant boundary is the dependency that can be demonstrated, rather than an assumption that every water body belongs within the port's mandate.

A source-to-sea assessment should identify the water systems material to a proposed service, the responsible authorities and communities, and the routes through which damage or restoration changes economic performance. Measures can include water quality, sediment management, freshwater reliability, habitat condition and exposure of critical infrastructure. Baselines and monitoring must support the particular ecological claim; conservation, carbon storage, flood protection and fisheries productivity are distinct benefits with different evidence requirements.

Natural systems can provide resilience services alongside engineered protection. A coastal wetland may reduce particular flood exposures, but its performance depends on local condition, the hazard and the infrastructure being protected. Investment appraisal should compare maintenance, restoration and engineered options, allocate long-term stewardship costs and include residual risk. Ecological value should remain visible even where it cannot responsibly be converted into a tradable credit. (Nursimulu 2026e, 45–46, 63–64, 121–122, 228)

The maritime economic domain and land-sea productive continuum

The productive geography of an African gateway extends inland and seaward. Inland, it connects to logistics platforms, industrial districts, agricultural regions, resource-transformation centres, cities and markets. Seaward, it connects to shipping services, marine engineering, fisheries, aquaculture, offshore activities, ocean research and environmental systems. The port forms an interface between these productive geographies.

The Durban blueprint develops this relationship as a maritime economic domain. It brings maritime logistics, blue industry, blue food, marine energy, digital services, coastal activity and knowledge institutions into an economic design. The Mombasa blueprint adds maritime innovation, ocean intelligence and cross-ocean cooperation. Their shared contribution is an account of how maritime capabilities can reinforce the productive system connected through the gateway.

The land-sea productive continuum has four useful functional spaces: the maritime gateway, the logistics interface, the productive territory and the ocean economy. Their relationship need not follow a single continuous estate. A repair facility may sit at the waterfront, a component supplier inland, an ocean research team in a university and a customer in another country. The architecture specifies the services, knowledge, investment and agreements connecting them.

A maritime economic domain is an economic planning boundary. It does not give a port authority ownership of ocean resources, control over scientific institutions or powers beyond its mandate. Its value lies in identifying complementary functions and making their dependencies visible before land, infrastructure and capital decisions become difficult to change. (Nursimulu 2025b, 70–74; Nursimulu 2025a, 80–96)

The Blue Economy within the corridor

The shoreline is an interface within the corridor's productive geography. A seafood relationship may connect ocean harvesting or aquaculture with landing, processing, cold storage, inland suppliers and a destination buyer. A maritime engineering relationship may connect a vessel with waterfront work, component production, technical skills and customers elsewhere. Shipping connects those productive systems with further gateways and markets. The Blue Economy is therefore a constituent part of the connected economy wherever these relationships are material.

An ocean extension should specify the activity, service, counterpart, market and institutional dependency that make it relevant. The corridor can include regional maritime links and ocean productive activities without claiming every sea route or resource as part of its system. This functional boundary makes the relationship assessable while preserving the responsibilities of the competent institutions. (Nursimulu 2026b, sections 6–7)

Fisheries and seafood from landing to market

A seafood gateway begins before the vessel reaches the quay and continues after the product leaves the port. Arrival planning must connect vessel access, landing requirements, handling capacity, receiving facilities and the authorities responsible for the relevant checks. A processor needs confidence about product identity, condition, timing and lawful supply. A buyer needs a product that meets the agreed commercial and applicable market requirements.

The chain may include landing or discharge, weighing and identification, inspection, sorting, grading, chilling or freezing, storage, processing, packaging, certification and distribution. The precise sequence depends on the product and regulatory context. Frozen raw material for industrial processing differs from fresh fish for local markets or a chilled export product with a short commercial life. Facility design should follow those differences.

Temperature control is a service requirement across the chain. A cold store does not protect product during an uncontrolled transfer, and a refrigerated container cannot compensate for inappropriate handling before loading. Operators need suitable equipment, trained staff, monitoring, maintenance and procedures for deviations. Power reliability, water quality, cleaning and waste arrangements belong within the operating proposition rather than in a distant infrastructure annex.

For a delayed lot, the processor assesses rescheduling, the cold store confirms space, the carrier confirms onward options and competent authorities determine status. Disposition follows product condition and applicable rules as well as space constraints. Reliable communication preserves options that unresolved decisions can consume.

Market access is equally important. Processing equipment creates little value if the product lacks buyer acceptance, compliant documentation, reliable distribution or sufficient demand. The gateway should examine access to testing, packaging suppliers, commercial intermediation and working capital. Smaller enterprises may require shared services at an appropriate scale, while larger processors may need dedicated arrangements. These are distinct service models to be assessed rather than assumed.

The productive pathway reaches beyond the processor. Refrigeration maintenance, packaging, transport, laboratories, engineering, vessel supplies and professional services can deepen supplier capability. The relevant economic question is which activities become viable, which firms can participate and what skills and assets remain locally. Gross export value alone cannot answer how much productive value has been retained.

Port Louis as an ocean to enterprise interface

Mauritius provides a useful documented starting point. A ministry background paper on its Seafood Hub describes a chain including trading, warehousing, processing, distribution, re-export and vessel-related services. The paper contains historical 2011 data and 2012 policy context; it is used here to establish the breadth of the documented service concept, not the present operating capacity or current legal arrangements. (Government of Mauritius n.d., 1–3)

The author's later Port Louis blueprint develops a wider proposition linking port infrastructure, Freeport activity, short-sea services, ocean food systems, marine services, knowledge and capital. Its chapters on ocean infrastructure and industries provide the internal source for this architectural extension. The proposed future facilities, service loops, institutions and time horizons remain propositions requiring separate verification and adoption. (Nursimulu 2026e, 136–147)

The architectural opportunity is to connect these layers around specific transactions. For an illustrative seafood export, the waterfront receives the raw material, a processor transforms it, packaging and testing prepare it for sale, and a cold-chain service connects it to the buyer. Vessel maintenance and supplies can support the fleet generating the flow. Finance and insurance can support transactions through competent providers. Each additional relationship should have an identifiable user and commercial function.

An island gateway also needs an ocean hinterland: dependable maritime connections through which it can source, combine, process and distribute goods. That expression describes a functional market network. It does not imply jurisdiction over neighbouring ports or countries. A proposed regional loop must be tested against demand in both directions, vessel economics, port interfaces, cargo compatibility and accepted trading arrangements.

For Port Louis, the important strategic choice is therefore the combination of functions that can support one another at a credible scale. More transshipment may improve connectivity under certain service configurations; processing can create cargo demand; engineering can retain service expenditure;

knowledge services can deepen local competence. These reinforcing relationships are the proposition to test. None follows automatically from a throughput target or the designation of a hub.

Ecological limits and coastal participation

A stronger seafood gateway must operate within the biological and institutional conditions governing its supply. Processing capacity should not create an assumption that more catch is available or desirable. Supply assessment, lawful sourcing, traceability and ecosystem conditions require competent evidence and oversight. Productive development should pursue value and capability within those limits.

Coastal livelihoods require their own service design. Industrial waterfront activity can compete with smaller operators for landing space, access routes, cold storage and market facilities. A strategy should identify those effects early, consult affected users and examine practical arrangements for access and participation. Shared facilities, appropriate landing areas and workable service charges may be more relevant than an invitation to join an industrial platform that does not fit their needs.

Participation also depends on conditions within the chain. Small producers and traders need understandable quality requirements, usable payment arrangements and access to customers. Women and informal enterprises may perform important handling, processing or trading functions that are missed by an assessment focused only on registered exporters. Local research must identify the actual participants rather than presume a single enterprise model.

Waste and by-products deserve a material account. Processing can create opportunities for additional products, but those uses need customers, appropriate technology and assurance. Wastewater, rejected material and other residues require safe management even where a commercial recovery pathway has not been established. A circular-economy label should follow a functioning material chain, with evidence about both value and environmental effect.

Lawful seafood supply and port state measures

The blue productive gateway depends on lawful supply as well as reliable handling. FAO's Agreement on Port State Measures targets illegal, unreported and unregulated fishing by restricting access to ports and use of services by relevant vessels. Its scope, exceptions and duties must be read with the treaty and national implementation; it is not interchangeable with the general port-state-control regime for merchant-ship safety. (FAO n.d.)

For a seafood service, identify the responsible fisheries, maritime, customs and food-safety authorities. Verify the applicable designated-port, prior-information, inspection, denial-of-entry or use, notification and review procedures. Commercial operators may supply records and facilities but cannot replace the competent authority's decision. A corridor service window must accommodate lawful inspection rather than treat every enforcement hold as avoidable inefficiency.

Traceability should connect vessel identity and permissions, catch and transshipment records, landing, processing and onward consignment where required. Keep legal provenance, sanitary acceptance and product-condition evidence distinguishable: a temperature sensor cannot establish lawful catch, and a catch record cannot establish food safety. BlueTech and TradeTech contribute accepted observations and records only when measurement, identity and institutional recognition are dependable.

The Port Louis demonstration should therefore admit only supply that can meet applicable legal and buyer requirements. An uncertain provenance finding can require rejection, further verification or suspension, even where faster movement would improve a cost comparison. This makes ecological custodianship operational: safeguarding lawful access and the resource base becomes part of the service's productive integrity, not a decorative environmental commitment.

Ship repair and maritime engineering

Ship repair offers a different productive pathway. The customer purchases technical competence, dependable scheduling, appropriate facilities and confidence in the completed work. The service may range from afloat maintenance and equipment support to major repair requiring a dock, slipway or specialised yard. These activities have different capital requirements and address different vessel markets.

A credible repair proposition begins with the fleet that might use it. Vessel types, operating routes, repair needs, competing yards, travel time and acceptable interruption help define demand. A new facility should have an explicit customer and service strategy. General growth in shipping does not establish that a particular repair investment will secure sufficient work.

Delivery depends on technicians, supervisors, engineering drawings where required, welding and fabrication capability, electrical and mechanical services, testing, spares and appropriate quality assurance. Certain work will require approvals or acceptance from the relevant vessel interests and competent bodies. The applicable requirements should be established for the service offered rather than asserted through a generic claim of international certification.

The yard is also a logistics system. Imported parts must arrive in time; heavy equipment needs an accessible route; contractors need safe access; and completed work must be coordinated with the vessel's return to service. A missed component can hold a vessel and occupy scarce repair space. Connecting procurement, clearance and transport to the repair schedule is therefore a direct productive application of corridor intelligence.

Supplier development can make the activity more valuable locally. Apprenticeships, technical training, qualified subcontractors, workshops and recurring maintenance contracts can build competence that serves both marine and other industries. The pathway requires consistent work, supervision and a commercial reason to retain skills. Training numbers alone do not demonstrate an engineering cluster.

Environmental and land requirements are material. Repair activity needs safe working space, suitable access and systems for managing coatings, residues, contaminated water and other wastes appropriate to the work. The port city must accommodate the traffic and industrial effects. An attractive service opportunity still requires an acceptable site and operating envelope.

Vessel services as a productive economy

A vessel call can support ship agency, towage, pilotage, mooring, supplies, bunkering, waste reception, crew services and technical attendance. The economic significance depends on the services actually procured and the capacity of local enterprises to deliver them. A short call can contain several distinct commercial transactions and skill requirements.

Service coordination matters because the vessel's time is shared among cargo operations, inspections, maintenance, supplies and departure requirements. Providers need realistic windows, safe access and clarity about any simultaneous operations. A change to berth timing can affect multiple suppliers. A useful gateway information service gives each authorised participant the information needed to prepare and revise its work.

These activities create different opportunities for enterprise. Some require specialised capital or public authorisation; others rely more on logistics, quality, responsiveness and customer relationships. Gateway policy should identify the relevant entry conditions and avoid treating all maritime services as interchangeable. Transparent procurement and dependable payment can matter as much as physical premises for smaller suppliers.

Bunkering and future fuels require particular care in strategic planning. Storage, transfer, safety, environmental management, supply contracts and vessel demand must fit together. A future-fuel ambition should distinguish readiness options from committed demand and operating infrastructure. Flexible planning may preserve future choices while avoiding premature investment in a service whose market is not yet secure.

Offshore energy and specialist ocean services

An offshore energy project can create demand for port staging, heavy handling, storage, assembly, crew transfer, specialist vessels and continuing maintenance. The port's role changes over the project lifecycle. Construction can require an intense but temporary service, while operation and maintenance may require smaller, recurring flows and specialised competence.

The gateway strategy should identify which phase it intends to serve and the evidence supporting that role. Confirmed projects, procurement requirements and credible developer engagement differ from a general assessment of offshore potential. Dedicated facilities should be appraised against the timing and durability of demand, with a realistic account of alternative uses if the project is delayed or cancelled.

Physical suitability must be demonstrated. Quay strength, laydown area, navigational access, lifting arrangements and routes for large components require project-specific engineering. Staff competence, vessel availability and emergency arrangements are equally relevant. A nearby port is not necessarily a suitable project base.

The productive opportunity lies in repeatable capability: marine operations, electrical and mechanical maintenance, component repair, logistics and technical assurance. Local firms need a pathway into actual procurement, with requirements they can meet and a schedule that justifies investment. A local-content aspiration without contracts, skills and qualified supply is an incomplete industrial strategy.

Ocean research, monitoring, subsea cable support and marine biotechnology have different demand structures again. The port may support research vessels, samples, laboratories, equipment maintenance or specialist logistics. Biotechnology additionally depends on scientific capability, legitimate access to resources, product development and customers. These opportunities should remain visible in the strategy while being developed through separate evidence and feasibility pathways.

Coastal shipping, tourism and the distribution of benefit

Coastal and interisland shipping can connect food systems, smaller markets and productive nodes that do not generate mainline volumes. A dependable service can help firms aggregate cargo, receive inputs and serve neighbouring territories. Its commercial model must account for port costs, vessel utilisation, cargo balance, shipment frequency and the onward connection to users.

The receiving end is often decisive. A service that lands cargo where unloading, storage or local distribution is unreliable offers limited market access. Connecting both port interfaces to enterprise requirements is therefore part of the shipping proposition. Regional coordination can standardise useful information and improve hand-offs while preserving the competent authorities' responsibilities.

Passenger and cruise activity can support visitor expenditure and services, but those effects need a separate account from freight. The gateway should examine terminal access, local transport, provisioning, enterprise participation and pressure on urban and environmental systems. Arrivals alone do not measure locally retained benefit. A port with limited waterfront space must compare these uses with its other functions and public obligations.

The sector chains establish what a usable ocean service requires and who may supply it. Their shared needs now inform the platform, technical and energy choices below. Chapter 4 follows those services through maritime and inland connections to accepted delivery; Chapter 5 examines the locations, suppliers and people needed to sustain them. These are successive parts of one economic relationship, not separate claims that port activity automatically creates development.

Blue productive platforms and the Blue SEZ proposition

A blue productive platform assembles the shared conditions needed for a selected group of maritime enterprises to operate. Depending on viable demand and ecological conditions, it can combine marine fabrication, repair, seafood processing, aquaculture services, vessel supply, cold-chain facilities, research or specialist ocean logistics. Shared access, utilities, waste treatment, technical services and training can reduce the burden on individual firms.

The Blue SEZ proposition is one possible institutional configuration for that platform. The legal designation must serve a credible productive purpose, with clarity on land and marine permissions, environmental responsibilities, developer obligations and tenant services. Fiscal advantages cannot compensate for absent customers, unsuitable waterfront space, unreliable energy or weak technical capability.

Platform development should distinguish common infrastructure, commercially operated facilities, enterprise investment and public services. The occupier strategy identifies anchor demand, supplier requirements, operating scale and the sequencing of facilities. Smaller firms may need shared workshops, testing access, affordable premises and procurement pathways before they can participate in larger maritime contracts.

The Mombasa Dongo Kundu and Durban Blue SEZ proposals illustrate possible configurations. The continental model accommodates other forms, including an existing port estate, a municipal maritime district, connected industrial sites or cooperation between several gateways. Benefits depend on the productive relationships established, not the name assigned to the development. (Nursimulu 2025b, 71–73; Nursimulu 2025a, 88–95)

Blue SEZ configurations and operating integrity

A Blue SEZ is proposed here as a governed productive platform connecting maritime resources, services, enterprises and markets within ecological and legal limits. The Port Louis blueprint distinguishes port-anchored, coastal or nearshore, and offshore or floating configurations. These describe location and operating dependencies. Logistics, industrial and digital functions describe a separate axis of specialisation. Neither classification requires every gateway to host every type, and neither replaces the AIC2030 Economic Operating System or the wider SEZ assessment framework.

The design should establish five linked conditions: ecological integrity; a credible economic activity; usable trade and connectivity arrangements; appropriate information and evidence; and accountable governance. These are the author's platform design tests, not an externally accredited certification. Spatial planning must identify permitted uses, competing interests, access and servicing requirements, emergency arrangements and responsible authorities. Maritime jurisdiction, tenure and resource rights require local legal analysis; an offshore area cannot simply be treated as a terrestrial industrial estate.

Integrity is an operating requirement. The platform needs an accountable operator, competent regulators, environmental baselines, enforceable service obligations and a route for affected communities to obtain information and remedy. Where the public sponsor, commercial developer and custodian share an institutional umbrella, their separate duties and conflicts require explicit treatment. Pausing an activity, changing a configuration, restoring a site and decommissioning assets must be feasible under the relevant permits and contracts, with provision for the cost.

For uncertain ocean opportunities, the Explore-Learn-Option approach begins with bounded investigation, evidence and an explicit next decision. A marine biotechnology prospect, for example, may first require scientific assessment, access and benefit sharing arrangements, biosafety review and a credible route to product validation. Research access does not establish extraction rights, intellectual property ownership or commercial feasibility. Spending should purchase defined learning, with stop conditions and an option to proceed only when the evidence and permissions support it. (Nursimulu 2026e, 118–135, 293–294)

BlueTech ocean intelligence and maritime innovation ecosystems

In this monograph, BlueTech refers to technologies and applied knowledge that enable the responsible use, understanding, protection and productive development of marine and aquatic systems, together with their connected economic activities. This is the working scope adopted for the AIC2030 argument. It includes physical and biological technologies, engineering, observation and analytical capabilities as well as digital applications. The term is used here without a claim of original invention or a universally settled classification.

Ocean intelligence connects relevant marine information to decisions about safety, production, ecosystems and investment. Vessel movements, weather, ocean conditions, fishery observations, environmental quality and trade records have different owners, methods, sensitivities and users. Their combination should begin with a defined decision and scientifically credible information requirements.

For example, an aquaculture service may need environmental monitoring, disease surveillance, cold-chain planning and buyer specifications. A repair cluster may need fleet demand, equipment condition, technical certification and supplier intelligence. These are different knowledge requirements. A single dashboard should not conceal differences in measurement quality, access rights or institutional responsibility.

A maritime innovation ecosystem connects research institutions, training providers, operators, enterprises and finance around such practical requirements. The BlueTech Coast proposition in the Mombasa blueprint supplies an adaptable mechanism: test facilities, marine data capability, industry research partnerships and enterprise incubation linked to actual maritime customers. Durban adds marine engineering, ocean-science and industrial training relationships.

Development should fund the capabilities between invention and commercial use: field trials, safety assessment, technical support, procurement access, intellectual-property agreements and maintenance skills. Public research and small enterprises need fair terms when sharing information or developing technology with larger operators. Capability retained includes people able to improve and maintain the service after the original project ends. (Nursimulu 2025b, 71–74, 94–95; Nursimulu 2025a, 93–95)

Within the working BlueTech scope defined above, applications include environmental observation, fisheries and aquaculture systems, marine engineering, robotics, biotechnology and appropriately assessed energy or water technologies. Each has distinct scientific, technical and economic requirements. OECD's ocean-innovation work examines a similarly diverse set of enabling technologies and their relationship with development and ecosystem condition. (OECD 2019, chapter 2, section 2.1.2 and Table 2.1)

Application begins with a defined problem and user. An aquaculture enterprise may need reliable information about water conditions and a response that protects production. A vessel service firm may need inspection capability that supports a safe maintenance decision. A processor may need evidence about product condition that a buyer or competent authority can accept. The technology is useful when it changes a decision or service within a credible operating relationship; collecting data or acquiring equipment is an intermediate output.

The Blue Economy establishes the economic and ecological domain. BlueTech supplies relevant technical and knowledge capabilities within it. TradeTech supports transactions, assurance, finance and information connecting services to markets. The Intelligent Corridor organises these functions with productive territories, infrastructure, institutions, capital and customers. Their overlap need not create separate platforms: a seafood assurance service can combine BlueTech measurements with TradeTech records, provided competent users accept the evidence and the resulting decisions.

The Mombasa BlueTech Coast is a proposed regional innovation mechanism rather than a template every African gateway must copy. A continental application should identify which research, training, testing and enterprise capabilities already exist and connect them to the gateway's reachable role. A specialist coastal or inland water gateway may use a focused technical partnership rather than establish a new technology park. Institutions in different African locations can perform complementary functions.

(Nursimulu 2025b, section 2.4.2, 71–72)

The relationship between knowledge and productive use requires deliberate support. A research result may need field validation, product development, a competent operator, a first customer, service support and a feasible funding arrangement before adoption. Environmental monitoring and other shared evidence services may require continuing public or collective finance because their benefits are not confined to one purchaser. The gateway should assign responsibility for these functions while preserving the independence of scientific findings.

BlueTech's development contribution should be assessed through capability as well as adoption. Ask who can interpret the evidence, calibrate and repair instruments, improve the application and serve additional users. A technology service can generate local employment while leaving critical maintenance, data access or decision capability dependent on an external provider. Partnerships should therefore make the intended knowledge, service and enterprise outcomes explicit. Protection of ecosystems and productive benefits both require evidence; a BlueTech label establishes neither.

Waterborne services as commercially usable connections

Short-sea shipping can connect secondary coastal ports, provide regional distribution and feeder services, or support continuity when a land route is disrupted. Its case depends on cargo volume and direction, shipper commitment, vessel availability, service frequency and compatible port operations. The comparison must include both transfers, port dwell, handling and documentation charges, inventory exposure and first- and last-mile service. Coastal proximity alone does not establish a viable route.

River and lake services require the same end-to-end discipline with additional attention to navigability, seasonal depth, hydrology, navigation aids, suitable vessels, maintenance, safety and ecological and community effects. A route's value depends on usable connections to production, markets, rail, roads and border processes. Legal and commercial requirements must be examined by competent specialists for the relevant jurisdictions. These tests allow island, coastal and inland-waterway applications to share a decision method while retaining their geographic differences. (LOGI-CONSULT 2026a sections 9.10–9.12)

Cooperative maritime networks and blue diplomacy

African maritime development can combine gateway specialisation with selective cooperation. Several ports may share an interest in ship-repair skills, fisheries quality services, coastal shipping, marine research, emergency response or environmental information while continuing to compete commercially. Cooperation should identify the specific service and the reciprocal commitments that make it useful.

For a cooperative coastal or interisland network, apply the full service test above to both ends of each connection. Compatible facilities, cargo balance, vessel economics, market access, documentation, workable schedules and receiving capacity must support reciprocal commitments. Connecting blue production nodes on a map establishes a geographical possibility; the service design must establish how enterprises can use it repeatedly.

Blue diplomacy negotiates these relationships across public mandates and national boundaries. It can support research partnerships, recognised qualifications, appropriate standards cooperation, marine environmental stewardship and investment in shared services. The proposed Indian Ocean Compact and Southern Blue Corridor are source applications of this function. Neither establishes that a formal agreement or operating network is already in place.

The continental architecture should remain open to Africa's different maritime basins and island economies. The blueprints' eastern and southern applications establish research foundations; the model's relevance extends to other African gateways where the corresponding economic, ecological and institutional conditions can be demonstrated. (Nursimulu 2025b, 72–73, 127–132; Nursimulu 2025a, 83–84, 132–136)

Engineering capability and the adoption of maritime technology

Procurement should translate the BlueTech capability objective into obligations after installation: calibration, spare parts, technical documentation, training and a funded maintenance owner. Enterprises need to maintain instruments, interpret observations, repair equipment and adapt solutions to local conditions. Access to a proprietary platform is distinct from the ability to sustain its service.

The Abidjan–Lagos Atlantic Corridor blueprint identifies connectivity, compute, context and competence as requirements for useful technological adoption. Applied here, context means a defined maritime or enterprise problem and an authorised decision that the technology can improve. Competence includes technicians, engineers and users able to recognise failure and challenge an unsuitable output. These requirements support the existing architecture; they do not create an additional corridor maturity ladder.

Universities, technical institutes, laboratories and maritime enterprises can connect research to operating demand through supervised repair, testing and adaptation work. Supplier agreements should distinguish legitimate intellectual property protection from restrictions that prevent routine maintenance or capability development. The result to examine is a service that remains usable and a workforce able to reproduce the relevant competence. (Nursimulu 2026c, 227–235)

Energy transition circularity and coastal resilience

A maritime transition programme must connect energy security, affordability, emissions and long-term adaptability. Shore power, electrified handling, renewable generation, storage and alternative bunkering each require appropriate customers, technical systems, safety capability and financing. A fuel's lifecycle performance depends on its production pathway and use; a technology label alone does not establish a low-emissions service.

The Durban blueprint's Fossil-Smart, Future-Ready proposition is interpreted here as a requirement to preserve essential productive services while reducing lifecycle emissions and avoiding unnecessary dependence on unsuitable assets. Transition choices should compare credible alternatives, infrastructure lifetime, conversion costs and the consequences of changing fuel demand. The blueprint's dated fuel sequence is a scenario for assessment rather than a continental timetable.

Circular productive platforms can share water treatment, cooling, materials recovery, repair facilities and selected utility services. Industrial symbiosis becomes practical when one enterprise can reliably use another's by-product under suitable specifications, contracts and environmental controls. The design must establish volume, quality, liability and continuity rather than assuming that every waste stream has a buyer.

Coastal resilience should be treated as a service requirement and a territorial obligation. Drainage, flood protection, critical power backup, ecosystem protection and emergency access must be assessed together. Adaptation measures should consider effects on neighbouring communities and habitats. Ecological restoration can have public value without being assumed to generate saleable credits or an automatic financing return. (Nursimulu 2025b, 75–84; Nursimulu 2025a, 122–125, 162–167)

Maritime decarbonisation requirements and gateway choices

Keep legal scope and policy ambition distinct. FuelEU Maritime is an adopted EU regime applying from 1 January 2025, with earlier monitoring-plan provisions. It concerns the greenhouse-gas intensity of energy used by ships within its scope, rather than imposing a blanket requirement on every African terminal. The Commission also identifies special treatment of listed neighbouring container-transshipment stops. A project must examine the relevant ships, voyages, energy and applicable exceptions. (European Commission n.d.-a)

EU ETS maritime coverage began in 2024. Its geographical coverage generally includes all emissions on covered intra-EU voyages and at EU ports and half on voyages between EU and non-EU ports, subject to the legislation's scope and exceptions. The phase-in reaches 100% of covered emissions for the 2026 reporting year, surrendered in 2027; this does not mean 100% of every international voyage. Methane and nitrous oxide enter ETS coverage from 2026. African gateways can therefore face commercial consequences through serving ships and routes without being transformed into EU-regulated ports. (European Commission n.d.-b)

The IMO Net-Zero Framework requires separate treatment. The official MEPC 84 account, covering 27 April–1 May 2026, records continuing work on draft amendments and a planned resumed extraordinary session in December 2026, subject to confirmation. That dated account is not evidence of adoption or entry into force. Do not price a proposed global levy as an existing legal obligation. Preserve a regulatory register separating adopted requirements, implementation dates, proposals and contractual customer expectations; refresh it before an investment commitment. (International Maritime Organization 2026)

For an African gateway, the architectural decision is which energy and assurance capabilities support a credible service under these different conditions. Compare efficiency, shore electricity and fuel options using actual vessel demand, electricity supply, lifecycle emissions, safety and workforce readiness. Allocate monitoring, verification and any contractual cost pass-through explicitly. Test changes in routes and demand rather than assume that a green designation guarantees additional cargo or access to capital.

Port Louis from operating evidence to architectural choice

Port Louis allows us to follow the argument through a named African island gateway. We begin with reported operating evidence, then examine the decisions that evidence can inform. The exercise does not claim that the proposed AIC2030 arrangement has been implemented or that its productive effects have been measured. It demonstrates the use of the architecture in selecting and sequencing work.

The Mauritius Ports Authority's 2024–2025 annual report gives the following comparison. These are the report's measures and financial years, rather than an independently reconstructed dataset. (Mauritius Ports Authority 2026, 81–83)

Table 6 Port Louis reported operating measures

Reported measure		
Average vessel time in port	45.9 hours	39.4 hours
Average time at berth	32.2 hours	31.9 hours
Average pre berthing delay	13.7 hours	7.5 hours
Average moves per gross crane hour	22.8	22.9

The first architectural decision is to preserve the distinction between these measures. The overall time change is 6.5 hours; the reported components change by 6.2 hours before berthing and 0.3 hours at berth. That subtraction locates the change within the reported averages. It does not identify its causes or establish benefits for cargo owners.

This distinction changes the investment discussion. A proposal to improve the next unit of service cannot rely on the aggregate vessel-time result alone. It needs to establish whether the relevant constraint concerns arrival and berth coordination, handling productivity, equipment availability, cargo exchange patterns or another operating condition. A programme that treats all delay as the same problem risks selecting an intervention with little influence on the remaining constraint.

The maritime service decision

The proposed application first selects a vessel and cargo population relevant to the role being examined. Mainline, feeder and other calls can have different requirements. The diagnostic team needs arrival, readiness, berthing, work and departure events with consistent definitions. It then examines variation across calls and operating periods rather than assuming that the annual average describes every user.

The port's competent maritime actors establish safe access and movement requirements. Terminal management establishes berth, equipment and yard readiness. Agents and carriers provide the information and commitments relevant to their services. Marine-service providers establish resource availability. Together, these records identify where a feasible plan fails or where the service is being used differently from its stated design.

One possible finding would justify improved schedule exchange or resource coordination. Another could justify maintenance or additional equipment. A third could show that changing call patterns explain part of the result. These are competing diagnoses. The application must retain them until the call-level evidence supports a conclusion. The published averages alone cannot settle the choice.

Once a response is selected, the operating test has a clear boundary. Measure whether the selected service becomes more reliable, whether pressure shifts elsewhere and whether the change can be sustained with the available staff and resources. This provides a stronger basis for investment than an unqualified promise that a digital platform or a larger terminal will improve the whole gateway.

The ocean food service decision

The second workstream follows a seafood transaction through the port and productive territory. The historical ministry description establishes a documented service-chain concept; the author's Port Louis blueprint supplies a wider proposed ocean and productive architecture. Neither source substitutes for current enterprise records. The application therefore begins by selecting an actual product, processor, source and buyer relationship. (Government of Mauritius n.d.; Nursimulu 2026e)

For that transaction, map arrival or landing, product identification, handling, applicable inspection, cold transfer, processing, packaging, dispatch and market receipt. Record who supplies each service, which conditions must be met and what happens when timing changes. The map should include energy, water, maintenance and the assurance services necessary for the product. These dependencies determine whether a seemingly minor delay has a material consequence.

The first intervention follows the binding condition. If the product repeatedly waits for a receiving facility, additional vessel-handling speed may have little influence on the productive result. If transfers interrupt temperature control, the relevant response could concern equipment, procedures and competence. If a buyer requires a service that local enterprises cannot obtain, market assurance or commercial support may matter more than another storage building.

These examples are diagnostic alternatives, not findings about present Port Louis enterprises. Their purpose is to show how the gateway architecture makes a productive investment question concrete. A cold-chain proposal must establish the product, customer, operating chain and constraint it will address. Its success can then be examined through product condition, accepted deliveries, enterprise use and the resulting productive capability.

Engineering regional connection and the shared service base

The third workstream examines whether vessel-service demand can support stronger local engineering. Begin with actual repair and maintenance requirements, the work being purchased, the competence already available and the reasons work is undertaken elsewhere. The answer can distinguish a suitable supplier-development programme from a capital-intensive facility whose demand has not been established.

An engineering service shares dependencies with the corridor. Parts need procurement, finance, clearance and delivery. Technicians need access, tools and accepted procedures. A yard needs reliable utilities and an appropriate environmental operating envelope. The gateway can improve these interfaces while firms develop the technical service. A new dock or workshop is justified only within the resulting commercial proposition.

The fourth workstream tests a proposed regional maritime connection. Select a product and pair of markets, then examine available cargo, vessel requirements, handling at both ends, frequency, operating cost and distribution to users. Ocean hinterland becomes an actionable concept when the connection supports repeatable transactions. A proposed route without suitable receiving capability remains an incomplete service.

These workstreams may share facilities and competence. Refrigeration technicians can support several cold-chain users. Engineering firms can serve vessels and productive enterprises. A reliable feeder connection can support both inputs and exports. Shared demand may improve utilisation, but it must be established from compatible requirements rather than assumed through co-location.

A sequenced gateway proposition

The Port Louis application produces a proposed portfolio with separate decision owners and tests. It does not begin by committing to every facility mentioned in a long-term vision. It establishes the next service requirement and the evidence needed to move from possibility to commitment.

Table 7 Proposed Port Louis workstreams

Proposed workstream	Accountable participants to confirm	First decision and observable test
Maritime reliability	Competent port maritime actors, terminal management, carriers and service providers	Diagnose the call level constraint and test the selected response
Seafood service chain	Participating processor, logistics providers and competent authorities	Select a transaction and verify the complete handling and market service
Maritime engineering	Repair firms, vessel customers, training providers and relevant port actors	Establish repeat demand and the competence or facility gap
Regional connection	Carriers, traders and operators at both gateways	Test a complete service with credible cargo and receiving arrangements
Shared enabling services	Utilities, site operators, employers and service institutions	Fund and test the dependencies required by the selected workstreams

The sequence protects the distinction between the operating result and the productive proposition. Maritime improvement is valuable on its own terms. The broader economic case depends on firms using the service, undertaking viable productive activity and retaining capability. The investment account in Chapter 7 and the implementation gates in Chapter 8 carry this application forward.

The port remains the maritime anchor of this proposed portfolio. Ocean activities supply or demand services; dependable gateway interfaces connect them to productive territory and customers. Each workstream therefore needs a purpose, decision owner and operating test. The following seafood journey brings these dependencies together before Chapter 4 examines the wider corridor relationship.

Following one seafood service through the whole gateway

Consider an illustrative processor receiving frozen fish by sea through Port Louis, processing and packaging it in Mauritius and supplying a regional buyer. This authored design scenario is not a verified enterprise, contract or route. The historical seafood-chain source and blueprint supply conceptual foundations; annual port indicators provide context, not transaction-level evidence. (Government of Mauritius n.d.; Nursimulu 2026e; Mauritius Ports Authority 2026)

The buyer's product specification, delivery commitment and payment terms govern the journey. Before arrival, the processor confirms receiving space and production time; the carrier and agent supply accepted arrival information; terminal planners establish handling readiness. Competent authorities determine documentary, inspection and release requirements. Transport and cold-store operators confirm usable capacity. An estimated arrival remains distinct from a guaranteed delivery.

If an arrival change conflicts with cold-transfer capacity, the first decision concerns reception rather than discharge speed. Participants compare a later window, another suitable facility, a revised production sequence or a changed dispatch promise. Each alternative requires product suitability, capacity, authorisation, cost and an accountable decision. If none is feasible, the commercial commitment must change.

Cargo identity, handling and condition records follow discharge and transfer. A disputed record goes to its designated decision owner; collection follows actual release and receiving acceptance. At the processor, water, energy, trained staff, equipment and packaging determine whether production can proceed. A maintenance response and tested alternative protect refrigeration only within their funded operating limits.

The processor must fund inputs and wages before buyer payment. A finance provider makes its own credit decision using information it may lawfully receive. Outbound production readiness, assurance, equipment, booking, terminal cutoffs and destination reception must align. Goods, People, Capital, Knowledge and Data therefore meet within one transaction, enabled by energy and institutions.

The economic account separates processor revenue, intermediate purchases, labour income and value added. Local transport, engineering, packaging and assurance create wider relationships where they actually supply the service; imported inputs and external services must also be recorded. Export receipts, supplier turnover and wages cannot simply be added. Chapter 7 examines the funding and retention decisions; the worked demonstration after Chapter 8 traces responsibilities, a numerical illustration and disruption recovery.

For this seafood journey, test whether a service agreement, maintenance response or assisted information exchange resolves the constraint before financing additional capacity. Record the improvement and remaining gaps. Chapter 4 extends the same transaction across receiving gateways and inland connections, preserving each participant's authority rather than treating the port exit as the end of the economic service.

Key takeaways: Begin with the complete service chain. Match capability and investment to verified demand. Keep environmental obligations and evidence boundaries explicit. For reflection, use the Chapter decision guide; controlled terms are defined in the glossary.

4 From port to intelligent corridor

Chapter objectives: Map the vessel-to-enterprise journey; identify interface commitments; distinguish corridor development levels and nearshoring activity shares.

Carry the economic purpose through the whole journey

The port's maritime capability becomes economically useful through dependable access to productive activities and markets. An Intelligent Corridor includes the point at which cargo becomes usable by a factory, saleable to a buyer or available to a household. Its operating boundary therefore extends beyond the port exit and a line-haul route. This chapter follows that connection through the complete enterprise journey.

The canonical definition shared with Re-Architecting African Freight is reproduced below. Typography is normalised without changing its substantive wording. (Nursimulu 2026f, 15)

An Intelligent Corridor is an end-to-end economic system that connects infrastructure and economic flows to productive capabilities, markets and economic opportunities so that movement generates progressively greater productive value across the geographies it connects. It extends the corridor from movement to productive value, from gateway to end user and, where applicable, from land through the port into the ocean economy, while using data and digital intelligence to make the system more visible, connected, coordinated and adaptive, and progressively reducing its carbon and resource intensity. Its intelligence is ultimately demonstrated not by technology or movement alone, but by its capacity to convert economic flows into enduring and reproducible productive capability, creating, transforming, retaining, circulating, reinvesting and compounding value.

An Intelligent Corridor converts movement into productive value and connects that value end-to-end across the economic system.

The later working paper From Transport Corridor to Intelligent Corridor provides the following extended articulation. It elaborates the same economic purpose; it is retained as an attributed development, not a competing series definition:

“AIC2030 defines the Intelligent Corridor as an end-to-end economic system that connects infrastructure and economic flows to productive capabilities, territories, cities, markets, end users and economic opportunities, so that movement generates progressively greater productive value across the geographies it connects. It extends beyond the conventional port-to-hinterland and transport-corridor paradigm: inward through productive territories, industrial platforms and urban economies to enterprises, markets and end users; and, where applicable, outward through ports and maritime gateways into the ocean economy and onward to regional and global markets. It thereby connects continental and ocean productive systems within a continuous economic geography. Through the integration of physical infrastructure, industrial capacity, trade systems, digital intelligence, capital and governance, an Intelligent Corridor enables economic flows to create, transform, retain, circulate, reinvest and compound value. Its intelligence lies in the capacity of the system to see, connect, coordinate, learn, anticipate and adapt - continuously improving how productive resources, economic actors and opportunities interact across the corridor. An Intelligent Corridor also progressively decarbonises the infrastructure, transport, logistics, industrial and trade activities it enables, while reducing their wider energy, material and resource intensity and strengthening resilience. Its objective is therefore not movement or technology for their own sake, but greater Productive Yield: more enduring productive capability and economic value generated, retained and compounded from the flows passing through the system. Ultimately, the intelligence of a corridor is demonstrated by its capacity to convert economic flows into enduring and reproducible productive capability - building enterprises, industries, skills, technologies, institutions, markets and capital that allow territories to participate more productively in regional and global economic systems while progressively strengthening their economic sovereignty.”

(Nursimulu 2026b, section 6, 11–12)

The Value-Chain Integrated Trade Corridor, or VCITC, is an integration mechanism within this Intelligent Corridor architecture. It connects production platforms, logistics nodes, ports, special economic zones and markets around a defined value-chain service without requiring common ownership. Its task is to reconcile the service dependencies and participant commitments needed by that chain. It neither supplies a competing corridor definition nor adds a development level, Economic Operating System layer or authority over the participating institutions.

Both formulations give corridor intelligence an economic direction. Visibility, forecasting and coordinated action support the wider productive system. A digitally connected route can possess useful operational intelligence while its productive outcomes remain to be demonstrated.

Earlier corridor literature already treats corridors as systems requiring management and coordination. The World Bank's Trade and Transport Corridor Management Toolkit is a relevant foundation. AIC2030's proposition should be assessed as a particular synthesis of gateway role, economic flows, productive geography, continuity and retained capability within this established field. (Kunaka and Carruthers 2014, introduction and Module 3)

How the port anchors an intelligent corridor

Anchoring connects the maritime service with the economic purpose of the complete journey. A port that improves vessel handling while cargo becomes unusable at the next interface has improved one operation without completing the productive service. The anchor role is exercised through accepted handoffs, credible commitments and an ability to bring the relevant parties into a decision when the relationship fails.

Trade gives that relationship a commercial form. Buyer specifications, order quantities, delivery windows, product assurance, payment and financing influence which physical service is useful. Demand then informs investment in processing, energy, transport, storage and technical capabilities. The corridor connects these choices across inland and ocean locations so that productive opportunity influences the design from the beginning.

Intelligence is demonstrated when the system can see a relevant change, interpret its consequence, connect the responsible actors, coordinate authorised action, learn from the result and adapt subsequent decisions. Digital visibility supports those functions. Productive Yield, retained and reproduced capability, resilience and progressively lower carbon and resource intensity determine whether the wider economic proposition is being realised. (Nursimulu 2026b, section 6)

Five flows and the layers that enable them

The architecture follows five economic flows: Goods, People, Capital, Knowledge and Data. Goods include inputs, intermediates, equipment, products and return materials. People supply labour, enterprise, technical competence and commercial relationships. Capital finances transactions and productive assets. Knowledge enables design, maintenance, assurance and improvement. Data makes relevant conditions and transactions visible to those entitled to use it. (Nursimulu 2026f)

Energy, infrastructure, institutions, markets, services and custodianship are enabling conditions and functions. They shape how the flows operate, but are neither additional canonical flows nor an alternative set of Economic Operating System layers. The six layers remain Physical, Industrial, Trade, Digital, Capital and Governance. This distinction identifies what circulates and the capabilities and arrangements that make circulation productive.

An illustrative repair service uses all five flows. A replacement component travels from a supplier to the vessel. Technicians perform the work. Working capital finances procurement and wages. Engineering knowledge supports a safe repair. Data communicates specifications, arrival, clearance and completion. An efficient component shipment is valuable because these relationships allow the vessel to return to service.

The interactions also reveal constraints that a transport-only view can miss. The component may arrive while the technician is unavailable. The technician may be available while procurement is held by a payment problem. Reliable data may reveal the issue without providing authority or finance to resolve it. The architecture should diagnose the binding dependency in the actual service, then identify the appropriate response.

Five levels of corridor development

The five-level corridor model expresses a progression in the economic system being organised. Level 1, the Movement Corridor, provides physical connectivity. Level 2, the Integrated Trade Corridor, coordinates multimodal logistics, borders and trade facilitation. Level 3, the Economic or Development Corridor, combines connectivity with investment, industry and territorial development. Level 4, the Productive Corridor, deliberately strengthens transformation, enterprise capability, retention and reinvestment. Level 5, the Intelligent Corridor, operates as an adaptive end-to-end productive system that learns and progressively improves Productive Yield and resource performance.

These levels are proposed dominant conditions rather than inevitable historical steps. A corridor may combine strong manufacturing with weak border coordination, or advanced digital clearance with little supplier development. Assessment must reveal that unevenness. A digital maturity score cannot substitute for an account of the productive and institutional system.

Corridor intelligence combines three tests: productive value and capability creation and reproduction; system visibility, coordination, anticipation, adaptation and learning; and productive value relative to carbon, energy, material and ecological burdens. Their interaction defines the fifth level. (Nursimulu 2026b Intelligent Corridor Working Research Edition 1.0 section 10)

Table 8 Five levels of corridor development

Level	Dominant capability	Economic test
1 Movement	Physical connectivity	Can flows move?
2 Integrated Trade	Coordinated logistics and trade facilitation	Can users exchange and reach markets?
3 Economic or Development	Investment and territorial development	Does connectivity support wider development?
4 Productive	Transformation retention and reinvestment	Does capability deepen?
5 Intelligent	Adaptive end-to-end productive system	Does Productive Yield improve with resilience and lower resource intensity?

The vessel to enterprise chain

The maritime journey first meets the gateway through expected arrival, access and berth planning. The terminal needs cargo and vessel information adequate for planning. Marine-service providers need feasible work windows. Inland operators and cargo owners need timely changes to the expected availability of goods. These are connected plans with different degrees of certainty.

After discharge, cargo may require storage, inspection, release and an inland booking. Physical availability, customs release and commercial delivery authorisation are separate conditions. A container can be present in the yard while one or more conditions prevent collection. The gateway information design should represent the relevant states accurately rather than compress them into a misleading single status.

Dispatch then requires a receiving movement and destination. A truck needs a suitable appointment and route. Rail requires an available service, loading arrangements and delivery at the inland terminal. A barge or coastal feeder needs compatible handling and onward distribution. The selection should consider the full journey, including transfers and waiting, rather than line-haul price alone.

The receiving enterprise needs space, staff, equipment and a reason to accept delivery at the proposed time. For production inputs, delivery timing may be linked to stock levels and manufacturing schedules. For retail distribution, it may depend on warehouse capacity and onward orders. A terminal's desire to evacuate cargo cannot substitute for a feasible receiving plan.

The export chain works in the other direction. A producer must prepare the product, secure the required assurance, obtain a booking, deliver within the accepted window and connect to the intended sailing. A missed connection can affect quality, inventory, payment and customer confidence. Gateway design should trace those effects back to production decisions rather than stopping at terminal receipt.

The corridor is thus bidirectional and cyclical. Imported machinery creates productive capacity. Inputs support manufacture. Exports generate revenue. Containers, reusable packaging, repairable equipment and other materials return through further movements. A corridor strategy should examine these interactions where they materially affect service economics and productive value.

The critical hand-offs

Each hand-off should be described as a service relationship. The sending party must know what the receiving party can accept, under which conditions and at what time. The receiving party needs the information and resources required to honour that commitment. Where a public decision is necessary, its status and responsible institution must be identifiable.

The following matrix illustrates the questions to resolve in an application. It is a design instrument, not a description of operating arrangements already adopted at a named gateway.

Table 9 Critical service hand-offs

Interface	Commitment to establish	Evidence and decision	Consequence to test
Vessel and berth	Safe access and feasible work window	Arrival update and readiness confirmed by competent maritime and terminal actors	Waiting and missed connection risk
Terminal and clearance	Cargo availability and applicable release status	Event records and decisions from the responsible authorities and commercial parties	Collectable cargo and unresolved holds
Terminal and inland service	Accepted pickup or loading slot	Cargo readiness matched to transport and receiving capacity	Queue relocation and equipment utilisation
Inland node and enterprise	Suitable delivery in an agreed window	Destination readiness and exception response	Production continuity and cargo integrity
Producer and export service	Shipment accepted for an achievable connection	Booking and applicable assurance completed in time	Market reliability and working capital

The purpose is to identify dependencies before an improvement displaces a problem. Faster discharge can create yard pressure. Faster gate-out can create an off-port queue. Faster line-haul movement can leave cargo waiting at an inland terminal. A genuine gateway improvement changes the complete service in a useful way or clearly identifies the remaining constraint.

Commercial responsibility should be equally explicit. Who pays for waiting, storage or a missed collection? Who can revise a booking? Who informs the cargo owner? The answers shape behaviour. Where contracts reward local performance while imposing costs elsewhere, the gateway may need a revised service arrangement rather than another layer of reporting.

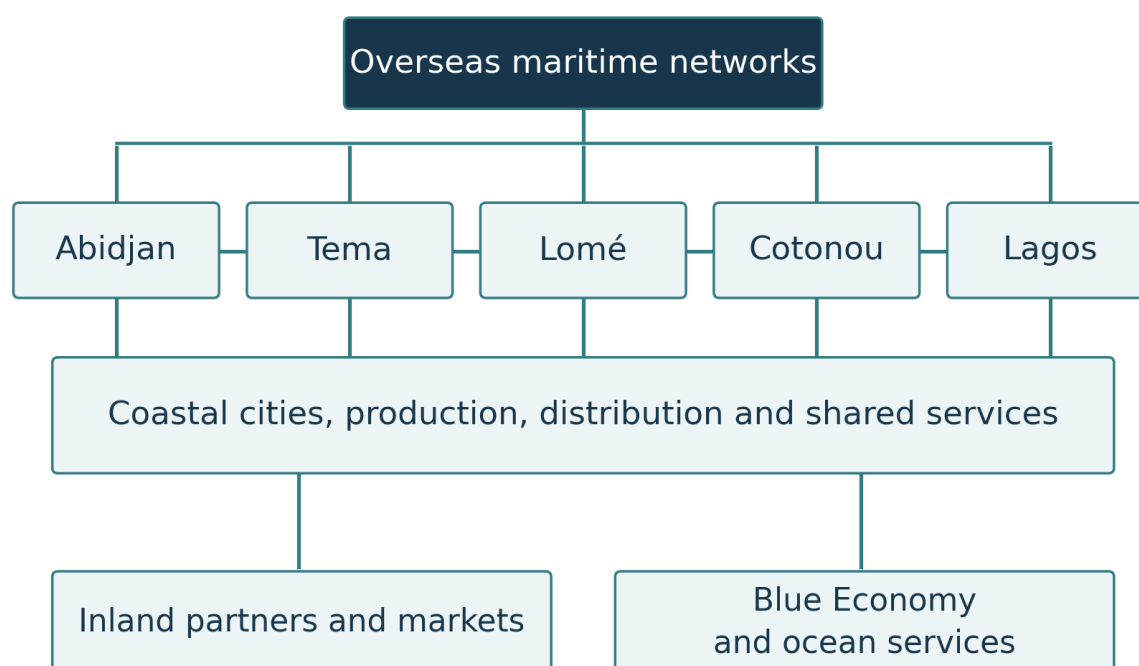
Distributed productive nodes and complementary specialisation

A productive corridor distributes functions across connected territories. The Durban blueprint's seven corridor organs identify maritime engines, urban industrial districts, inland platforms, resource-transformation hubs, agro-industrial parks, digital innovation locations and urban-industrial settlements. These are useful functional roles; they can overlap within a location and need not be reproduced as seven separate projects.

The Mombasa blueprint's coastal, inland and lake-linked proposals illustrate another configuration. Their continental lesson is complementary specialisation. Each node needs a productive purpose, viable demand, suitable capabilities and dependable relationships with other nodes. An inland location may add testing, consolidation, assembly, distribution or transformation rather than acting solely as storage displaced from the waterfront.

Productive choices should follow customer requirements, input availability, utilities, workforce capability, environmental conditions and delivered economics. A resource-transformation hub needs more than proximity to minerals; an agro-industrial park needs sustained supply, quality control and buyers; a digital innovation district needs users able to adopt its services. Industrial depth is earned through operating capability.

The model includes inland and landlocked territories as participants in design. Their governments, producers and enterprises help determine service requirements, investment priorities and benefits. A gateway's regional importance does not confer a right to direct their industrial policy. Cooperation should strengthen reciprocal productive opportunity and preserve strategic options. (Nursimulu 2025b, 68–70; Nursimulu 2025a, 149–156)

Figure 7 A distributed maritime productive system

Source: Rhavy Nursimulu, AIC2030; adapted from the Abidjan–Lagos blueprint (Nursimulu 2026c). Links show proposed service relationships, not a map, verified schedules or exclusive assignments of economic functions. Gateways retain separate mandates and lawful commercial competition.

The ocean hinterland and dependable regional shipping

An ocean hinterland is the network of island, coastal and mainland production and consumption relationships that a gateway can serve repeatedly through maritime connections. Its economic reach depends on dependable services, commercial demand and usable interfaces. Distance on a map is insufficient. The network becomes productive when enterprises can plan procurement, delivery, working capital and upgrading around a service that operates often enough and with sufficient reliability for their products.

The operating design should connect mainline calls, feeder or short-sea services and local distribution. It must account for sailing frequency, berth windows, cargo reception, transshipment cutoffs, empty equipment, refrigerated capacity, inland collection and customs procedures. Two-way cargo opportunities and seasonal imbalances affect cost and continuity. A proposed vessel size or weekly schedule is therefore a service design choice supported by cargo evidence, rather than a continental standard.

Dedicated terminal capacity and a shipping line anchor are options to assess against shared facilities, common user access and alternative service agreements. The decision should test credible contracted demand, utilisation under weaker scenarios, concentration risk and the effect on competing users. An expression of interest does not guarantee volumes. A gateway should not acquire infrastructure obligations that depend on commercial commitments the counterpart is free to withdraw without consequence.

Where a socially or strategically important route cannot initially support a commercial service, public participation may test demand through transparent capacity procurement, co-loading, charter arrangements or time-limited support. The mandate, beneficiary, procurement method, budget, service obligations and review date should be explicit. Private entry and withdrawal of support require workable terms. Mauritius-based proposals for connectivity anchoring illustrate one institutional possibility; African networks should use the institution and routing that best serve their own productive relationships. (Nursimulu 2026e, 138, 174–190, 202–205)

Elastic hinterlands and buffer functions

A hinterland is economically reachable only while the complete service remains usable. Its effective boundary changes with delivered cost, reliability, border conditions, commercial access and alternative gateways. A shorter route may lose practical reach when its service becomes unpredictable. The assessment should therefore map reachable customers and production relationships under normal and disrupted conditions rather than designate a captive geographic territory.

Buffer and redistribution nodes perform a distinct function within that geography. Consolidation, seasonal stockholding, container repositioning, customs activity where authorised and onward distribution can absorb differences between arrival patterns and inland demand. A smaller gateway or inland platform can create value through these functions without replicating the industrial scale of a larger neighbour. The Cotonou-related propositions in the Abidjan–Lagos Atlantic Corridor blueprint illustrate this design possibility, rather than establish a verified operating baseline.

Buffer design must state the cargo, usable capacity, ownership, maximum acceptable holding period and release arrangements. Storage brings financing, handling and land costs; it can also protect production against interruption. The relevant test is whether the buffer improves total service continuity at an acceptable cost. A queue displaced from the waterfront to an inaccessible depot does not meet that test.

(Nursimulu 2026c, 122–130, 384–404)

Road, rail, water and inland nodes

Mode selection should follow the shipment and the geography. Road can provide flexible collection and delivery. Rail can serve suitable consolidated flows where terminal access, service frequency, reliability and last-mile arrangements support the journey. Inland waterways and coastal shipping can perform important functions where navigability, vessel suitability, ports and transfer costs permit. These are service choices to compare under actual conditions.

An inland terminal becomes productive when it performs a useful function in the chain. It may consolidate cargo, connect modes, provide storage, support clearance where authorised or reduce pressure at a congested gateway. Its location should reflect users, routes and service economics. Moving a storage problem inland without improving the journey can add handling and cost.

A dry port or logistics platform also needs recurring services and a receiving market. Warehouses, rail sidings and digital connections do not establish utilisation. Cargo owners need a commercially attractive reason to route through the node. Public and private sponsors should test that reason against alternatives and identify the volume, frequency and service commitments on which the node depends.

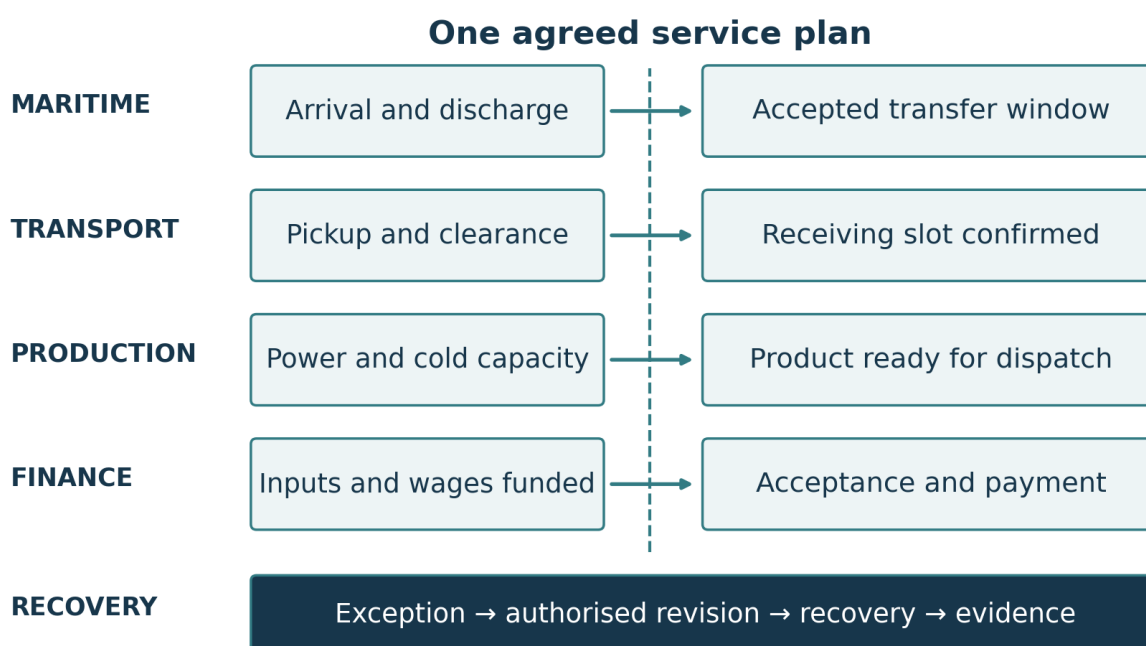
SEZs and industrial platforms require a two-way interface with the gateway. Their firms generate demand for inputs, equipment and export services. The gateway can strengthen the location's viability through reliable access and logistics capability. Internal zone governance, tenant economics and incentives remain separate matters. The AIC2030 gateway framework explicitly assigns complete internal SEZ architecture to the separate SEZ framework. (LOGI-CONSULT 2026a, section 1.10)

Urban distribution completes many journeys. Wholesale markets, factories, shops, hospitals and households depend on the final transfer through a metropolitan circulation system. Delivery restrictions, unloading space, informal trading patterns and local transport capability can affect service. The corridor should represent these conditions where they materially determine access, rather than treating the city as an undifferentiated destination.

Synchronising the operating clocks

Synchronisation joins maritime arrivals to transport, clearance, receiving capacity, production and payment readiness. Its purpose is a service that each participant can honour. Chapter 6 develops the operating plan, decision ownership and recovery arrangements; the worked seafood demonstration follows their consequences for one enterprise.

Figure 8 Synchronising the enterprise journey



Source: Author operating logic. Maritime, transport, production and finance commitments interact through one agreed plan. The dashed line joins exception decisions across the service; it is not a single legal command structure or a fixed timeline.

Connecting transport energy and information services

The connectivity doctrine joins maritime, rail, road, air and pipeline services with the information needed to coordinate them. Energy networks supply the productive and transport activities embedded in the corridor. These components have different physical and economic functions. The source expression Data as the Sixth Mode emphasises information's strategic role. Data is one of the five economic flows; digital capability belongs to the Digital operating layer. Neither substitutes for physical transport.

Modal design follows the shipment and productive requirement. Heavy, regular flows can support rail where reliable train paths, terminals, equipment and reception exist. Road provides flexible collection and distribution. Air serves selected urgent, high-value or perishable movements. Coastal or inland water services require suitable geography, vessels and receiving facilities. Pipelines and power connections have specific commodity and industrial uses.

The corridor plan should examine the complete service and the interfaces between modes. A rail allocation without dependable wagons, traction, terminal windows and final delivery does not create usable modal capacity. A universal rail-share target or distance-based truck restriction can transfer delay and cost if alternatives are unready. Targets therefore follow the service economics and operating test.

Redundancy also needs functional equivalence. A second route should be assessed for cargo compatibility, permissions, spare capacity, switching time and commercial access. A road, pipeline and data link are complementary systems, but they cannot necessarily substitute for one another during disruption. (Nursimulu 2025b, 85–89; Nursimulu 2025a, 157–161)

Borders and cross-jurisdiction connections

For a transit gateway, the service crosses institutions and jurisdictions with different responsibilities. Customs transit, security, health or product controls, road rules, commercial authorisations and transport arrangements can affect the same shipment. A usable corridor needs an account of these requirements and their interfaces, including what can be prepared before arrival and what must occur at a particular location.

Interoperability has a practical purpose: information provided or generated at one point should be usable at the next where the rules and rights permit. Technical exchange requires compatible definitions, secure access and reliable records. Institutional acceptance requires agreement about the status of the information and the decisions it can support. An application programming interface cannot grant a public power or create legal recognition on its own.

The port can contribute to these relationships without claiming authority over a foreign border. A corridor body, competent agencies and operators may agree procedures, operating information, performance review and escalation. The necessary authority should be established for the task. Where an existing arrangement can deliver it, a new organisation may add little value.

The service also needs a process for exceptional cases. Incomplete documentation, suspected non-compliance, equipment failure or a closed crossing can require a different path from routine traffic. Clear status information and a responsible contact can reduce uncertainty while the substantive issue is addressed. Operational escalation should preserve the competent authority's decision and the affected party's available remedies.

Mombasa and the Northern Corridor

The Northern Corridor's July–September 2025 dashboard reports average containerised import dwell at Mombasa of 83 hours, compared with 99 hours in the same quarter of 2024. Its definition runs from discharge to port exit and excludes containers held beyond 21 days for specified compliance or legal reasons. The dated result shows an improvement in the reported port measure; it does not establish the complete delivery time or productive effect for an inland enterprise. (Northern Corridor Transport Observatory 2025, 8)

The architectural task is to follow the reported improvement: identify the cargo benefiting, inland readiness, changes in total variability and the commercially useful effect for users. Examine excluded long-stay consignments separately where they are material. Targeted operational gains can be meaningful without establishing the wider productive outcome.

An application should therefore connect the port event record to an appropriate inland sample. The sample needs cargo and destination categories, milestone definitions, costs where obtainable, and a record of exceptions. Enterprise interviews or operating records can then examine whether delivery performance affected inventory, interruption or market commitments. This is a proposed research pathway, not a claim that such linked evidence has already validated the AIC2030 model.

The case also demonstrates why averages should be interpreted carefully. Different users can face different service conditions within the same gateway. A predictable improvement for one cargo group may coexist with persistent difficulty for another. The purpose of a corridor assessment is to identify the service that works, the users it reaches and the remaining constraints.

Effective Reachable Market

Effective Reachable Market is the market a gateway's users can serve under commercially usable conditions. Assessment is specific to a product, enterprise, service and horizon. It examines delivered cost, reliability, shipment scale, integrity and frequency alongside border procedures, tariffs, origin requirements, recognised standards, distribution, payments, foreign exchange and buyer demand.

Population and GDP indicate potential demand but do not establish that a firm can serve it. (LOGI-CONSULT 2026a, sections 2.2 and 3.4)

A nearby market can remain inaccessible when consolidation or cold-chain services fail. A more distant customer may be reachable through dependable component and technician services. Start with the customer requirement, trace the transaction and compare alternatives. The binding remedy may be infrastructure, documentation, skills, working capital, service aggregation or market development.

Market access also has a competitive dimension. Lower logistics cost can improve a firm's position without making its product competitive if production or quality constraints remain decisive. Conversely, a modest service improvement can matter greatly where delivery reliability is the last obstacle to a viable order. Gateway strategy should explain the mechanism rather than assign the same economic effect to every hour saved.

Port-anchored nearshoring and productive localisation

Inbound flows can supply productive capabilities as well as finished consumption. Machinery can be assembled, calibrated, installed and maintained. Components can be configured for regional customers. Food and pharmaceutical inputs can require controlled storage, testing, packaging and distribution. Repair, refurbishment and recycling can extend asset use and support technical enterprise. These activities are central to the Mombasa blueprint's inbound Logistics Value-Added Services proposition.

A productive gateway should identify where additional service creates competitive value. Some functions benefit from waterfront proximity; others belong near labour, customers or inland production. Requiring every consignment to undergo local transformation would add cost where no viable activity exists. Location follows productive purpose, customs conditions, logistics and enterprise economics.

Nearshoring connects regional production to reachable demand through complementary capabilities across countries. It includes productive localisation and regional value-chain development without presuming relocation of a foreign operation. Its economic purpose is to strengthen enterprise capabilities, supplier development and productive upgrading in response to market demand. Repair or packaging can create durable value without becoming manufacturing. The 40% ambition below specifies its selected-product scope and conditions; Chapter 7 examines value added, attribution and retained capability.

AIC2030 proposes a strategic ambition for selected goods imported from outside Africa: to undertake 40% of their value-chain activity within African port-linked productive ecosystems and connected corridors. Inbound Logistics Value-Added Services, including finishing, assembly, testing, calibration, packaging, customisation and after-sales support, provide pathways towards this ambition. Activities should be located within the port, adjacent productive zones or connected inland centres according to operational suitability, commercial viability and applicable regulation.

The 40% figure is retained as an authored planning ambition from the cited Mombasa blueprint. This volume establishes its proposed scope and measurement requirements; an empirical rationale establishing 40% as the appropriate activity share has not been demonstrated. Product-family calibration must precede operational use. (Nursimulu 2025b, 50, 58–61)

This is an authored strategic ambition, not an observed achievement, a universal processing requirement or a regional rules-of-origin threshold. For each selected product family, an implementation protocol must define the relevant value-chain stages, the African geographical boundary, the baseline, the assessment period and the denominator and weighting used to calculate the activity share. Counting unequal stages as equivalent would not establish a defensible 40% measure. Until that protocol is specified, the ambition should not be reported as a measured performance indicator.

The productive purpose is to connect imported inputs and components with African enterprise capability and regional demand, rather than merely redistribute finished imports. Local participation must be tested against service reliability, skills, energy, market access, environmental conditions and the costs of production and delivery. A port anchors these relationships through its lawful responsibilities and commercial arrangements; it does not acquire authority over the entire value chain.

Enterprise development is therefore part of gateway architecture. Supplier qualification, technical assistance, shared testing, finance and access to anchor customers should be organised around explicit capability gaps. A platform's contribution is demonstrated when firms can repeatedly meet customer requirements and retain the skills, systems and margins needed for their next productive cycle. (Nursimulu 2025b, 50, 58–61; Nursimulu 2026d Industrialist Framework parts III-IV)

Productive additionality, depth and diffusion

A gateway platform should compare what its intervention makes possible with credible alternatives. Productive Additionality asks which activity is newly enabled, accelerated, retained or materially strengthened. Productive Depth asks which transformation stages, supplier functions, skills and knowledge become embedded. Diffusion asks how those gains reach enterprises and territories beyond the platform itself.

These tests connect the port model to the AIC2030 enterprise and SEZ frameworks. The gateway framework's eight pillars and 89 dimensions remain distinct from the SEZ framework's eight pillars and 40 indicators. Enterprise capability and progression also require their own assessment. The monograph supplies the relationships between these instruments rather than substituting one score for another. (Nursimulu 2026d Industrialist Framework; AIC2030 Institute 2026 SEZ Framework sections on ERM and diffusion)

From logistics performance to Productive Yield

The common Productive Yield definition is “the additional productive capability and retained value that exist because a freight, corridor, urban, energy or infrastructure system is built or improved.” Its eight canonical dimensions are Transformation, Enterprise, Capability Development, Retention, Market Access, Spatial Diffusion, Resilience and Compounding. (Nursimulu 2026f, 13 and 69)

Each dimension asks a distinct question. Transformation concerns what is processed or made possible. Enterprise concerns the firms that emerge, grow or participate. Capability Development examines competence and productive capacity. Retention examines where value and enduring assets remain.

Market Access concerns commercially usable reach. Spatial Diffusion examines how capability and benefit extend across connected territories. Resilience concerns the ability to sustain productive function. Compounding concerns learning, reinvestment and successive capability formation.

These outcomes should be connected to a causal pathway. For an illustrative seafood chain, reliable cold transfer may reduce loss and support a more demanding product market. That can strengthen processing and create demand for packaging, maintenance and testing. Retained earnings and supplier learning may support further investment. Each step requires evidence; a plausible sequence is a hypothesis until the relevant change is observed and alternative explanations considered.

The operational and economic accounts should remain connected without being merged. Berth time, cargo dwell and route reliability describe services. Processing output, enterprise participation, skill formation and reinvestment describe productive consequences. An improvement in the first account can contribute to the second, but the strength and timing of that contribution depend on the wider economy.

Distribution also needs attention. A gateway can create aggregate value while concentrating gains or imposing costs on particular communities and firms. Productive Yield should be examined alongside who participates, who pays and who retains the resulting capability. The architecture is more useful when it exposes those differences than when it compresses them into a single unqualified benefit figure.

From a visible bottleneck to a binding constraint

A weak indicator identifies a problem requiring investigation. A Binding Constraint is the condition whose relief would materially improve the gateway's defined role. Diagnosis should establish role materiality, causal effect, system impact, the expected result of relief and the reason the weakness persists. Long dwell may arise from equipment, documentation, Customs, cargo-owner finance, storage incentives or unreliable evacuation. Each cause implies a different response.

Constraints can reinforce or conceal one another. Removing a berth constraint can displace congestion into the yard and city; improved rail capacity can remain unused without commercially accepted schedules and inland receiving capability. The assessment should distinguish primary, secondary, emerging and latent constraints, and identify the dependencies that determine intervention sequence. A statement that rail or coordination is weak is insufficient without a causal pathway and an observable improvement expected from the remedy. (LOGI-CONSULT 2026a sections 4.5–4.5.3)

Keep the corridor usable under stress

Continuity is an operating requirement because enterprises make commitments against expected service. A gateway should identify its critical functions, the interruptions that could affect them and the minimum service that must be restored. The priority may differ for essential imports, time-sensitive exports, industrial inputs and other cargo. The choices require competent agreement and an account of trade-offs.

Fallback should be designed around the service. If the normal information system is unavailable, participants may need an authorised procedure for identifying cargo, checking status, recording decisions and reconciling transactions afterwards. If power fails, critical cold-chain loads need an adequate energy arrangement. If a route closes, an alternative must be suitable, available, authorised and commercially usable for the cargo concerned.

The cost and duration of fallback matter. An emergency arrangement that works for several hours may be unsustainable for several days. A diversion can preserve delivery while increasing cost, border work or handling risk. Continuity planning should establish those limits, the decision to activate the alternative and the resources needed to recover the backlog.

Learning completes the operating loop. Disruption records should identify failed assumptions, interfaces that held and needs for repair, retraining or investment. Chapter 6 develops Architectural Debt as the burden of poorly integrated past choices, including the diagnosis and remedies. Those remedies can involve maintenance, integration, revised agreements, repurposing or retirement as well as construction.

(LOGI-CONSULT 2026a, sections 4.7–4.8)

The productive relationship

The connection is reciprocal. Productive enterprises generate cargo and demand for maritime services. Better gateway service can strengthen those enterprises and extend their market reach. Ocean industries can develop technical capability that serves other activities. Retained value and learning can support the next round of improvement. These relationships connect the port to the Intelligent Corridor and establish the basis for the following chapters on territory, operations, capital and implementation.

Corridor economic diplomacy and distributed leadership

Corridor economic diplomacy organises cooperation around productive requirements that cross institutional and national boundaries. Relevant tasks include compatible transit arrangements, accepted information, trade facilitation, standards cooperation, skills recognition, investment coordination, market development and financing relationships. Agreements should state the commercial or public service they are intended to improve and the institutions able to deliver it.

Leadership can be distributed across the economic geography. A port city may concentrate maritime operations, an inland metropolis policy and commercial services, a university network knowledge, and a financial centre capital structuring. The Mombasa-Nairobi proposition illustrates complementary leadership functions. Their allocation should follow actual mandates and capability rather than prescribing a single command location for all African corridors.

Transoceanic cooperation extends this relationship to overseas technology, capital, shipping and customer networks. The proposed Kenya-Gulf-India Economic Sea Bridge provides one source configuration. Other gateways can design different partnerships around verified productive demand. Agreements should specify technology access, capability development, market commitments, risk allocation and the value expected to remain in African enterprises and institutions.

Diplomatic architecture becomes useful through delivery. A partnership compact needs responsible parties, funded work, review dates and dispute pathways. A roundtable can convene, prepare and monitor cooperation; it acquires binding authority only through the mandates or agreements of the participating institutions. (Nursimulu 2025b, 116–120, 127–132; Nursimulu 2025a, 206–210)

The Passerelle Doctrine and reciprocal market access

The Passerelle Doctrine provides a structured bridge between African production and markets that firms cannot yet serve independently. The bridge combines product adaptation, standards and certification services, finance, commercial intelligence and buyer access. Nearshoring or finishing services address product fit; trading hubs connect compliant supply with buyers, liquidity and distribution. Their value lies in enabling repeat transactions and capability development in the originating productive economy.

This arrangement should be reciprocal. An origin gateway and its enterprises must retain meaningful participation in decisions about product development, commercial relationships and upgrading. A partner that provides finishing, finance or distribution should identify what it contributes and how firms can acquire or access those capabilities over time. Permanent dependency on an intermediary is a warning sign when the declared purpose is productive transformation.

The allocation of activities should follow capability, commercial and development evidence. The continental model does not prescribe a fixed percentage of processing or value retention in each jurisdiction, nor a mandatory route through a particular international hub. The product-specific 40% nearshoring ambition concerns selected imported product families under a declared activity-share protocol; it is distinct from a jurisdiction-wide processing or retention requirement. Commercial provenance and legal origin also require separate treatment. Packaging or finishing does not automatically confer origin; eligibility for preferences and cumulation must be verified under the applicable rules. The doctrine is a proposition for organising market access, with each application subject to its trade and legal requirements. (Nursimulu 2026e, 191–200, 261–269)

Trade authorship and regional economic co-development

Trade Authorship describes the demonstrated ability of African states, institutions and enterprises to shape market access, commercial relationships, standards, information, services and value-chain participation. It is exercised through usable choices and capabilities within interconnected trade.

Relevant evidence includes alternative routes and customers, standards competence, supplier participation, retained service margins, authorised data access and the ability to sustain essential trade under disruption.

Corridor economic co-development asks whether participating territories acquire complementary productive functions. A coastal service provider, inland processor and regional supplier may each strengthen the same value chain, while receiving different benefits and bearing different costs. Those relationships need evidence, negotiated responsibilities and a visible distribution of gains. Transit cargo alone does not demonstrate co-development; a shared industrial label does not establish productive linkages. (LOGI-CONSULT 2026a section 4.14)

The enterprise journey defines the corridor boundary

The seafood scenario in Chapter 3 has an inbound maritime leg, a productive stage and an outbound regional leg. Its corridor includes the hand-offs that make the buyer's order executable. The national boundary, port exit and factory gate each mark a change in responsibilities, while the service must remain coherent across them.

An institutional map for that journey would identify the owner of each consequential decision and the commitments on which the next participant relies. The receiving gateway is part of the design. Its handling arrangements, applicable release and onward distribution may determine the service available to the buyer even when the originating port performs well. An agreement at one end cannot impose obligations on an operator or authority at the other.

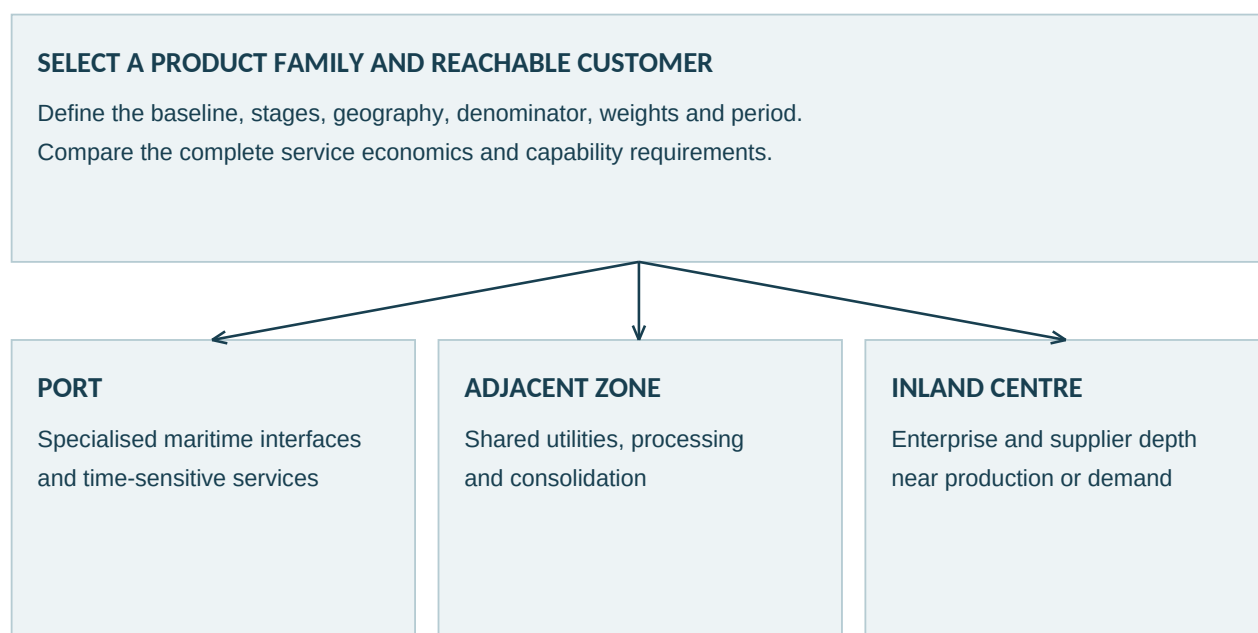
This boundary also gives measurement a purpose. Port time describes one operating segment. Time to accepted input receipt describes another. Production readiness, successful dispatch and accepted delivery describe further stages. The relationship among them explains whether a gateway improvement changes the enterprise's usable market access. The result must preserve the units and responsibilities at each stage, so that a delay removed from one ledger is not simply transferred to another.

The complete journey depends on places able to receive, transform and distribute what moves. Chapter 5 therefore turns from the interfaces between services to the territorial conditions that make their commitments feasible: land, utilities, supplier capability, worker access and community participation. The ocean and inland relationships remain connected; their benefits and costs must be traced to the enterprises and places concerned.

Figure 9 A productive service depends on accepted commitments across interfaces

The diagram synthesises a vessel-to-enterprise journey and its market connection. Each interface needs a responsible executor, a competent decision owner, accepted information and a recovery arrangement. Specific events and interfaces follow the selected service.

Source: Rhavy Nursimulu, AIC2030; Chapter 4, Table 9 and the service compact protocol. Arrows show service dependencies, not common ownership or automatic causal effects.

Figure 10 Locate value-chain activities where the complete service can work

Allocate activity through evidence. No universal location or processing share is implied.

Finishing, assembly, testing, calibration, packaging, customisation and after-sales support can strengthen market access. Their location follows product requirements, commercial viability, skills, energy, permissions and receiving capability.

Source: Rhavy Nursimulu, AIC2030; Chapter 4 nearshoring architecture and (Nursimulu 2025b).

Decision use

The 40% selected-import activity ambition and the 60% export activity ambition use different scopes. Neither is a domestic-value-added percentage, an origin rule or a universal jurisdictional requirement.

Key takeaways: Dependability requires accepted commitments across interfaces. Place activity where the complete service can work. Keep activity shares, value added and ownership ratios distinct. For reflection, use the Chapter decision guide; controlled terms are defined in the glossary.

5 The port city and the productive territory

Chapter objectives: Assess port-city and territorial relationships; examine enterprise capability and supplier diffusion; identify reciprocal benefits for inland users.

The territory that makes the gateway work

The corridor journey established in Chapter 4 requires productive places. The waterfront provides maritime access; the city supplies workers, suppliers, professional services, utilities and customers. Inland production generates demand for inputs and exports, while ocean partners supply and receive through maritime networks. This chapter examines where those functions can operate, how their enabling services are sustained and how enterprises and communities participate in the resulting economy.

This geography is neither a uniform industrial belt nor an administrative enlargement of the port. A cold store needs proximity to particular handling and distribution services. A fabrication workshop needs access to skilled labour, appropriate land and customers. A regional distribution centre needs a position that works for its receiving markets. These functions may occupy different locations while depending on a common gateway service.

The task is to establish which relationships require proximity and which require reliable connection. Sensitive products may need very short transfers. Heavy components may require a suitable route more than a short one. Knowledge and financial services may operate from another urban centre while depending on accurate operational information. A spatial strategy becomes useful when it explains these dependencies and the cost of organising them in a different way.

For an island gateway such as Port Louis, productive geography includes the connections between maritime operations, port-adjacent activity, national distribution and ocean markets. For a mainland transit gateway, it includes inland cities, borders and landlocked economies. These configurations share an architectural method; their physical and commercial solutions differ. The same investment template cannot answer both.

Freight access and the metropolitan circulation system

The port gate is a critical metropolitan interface. Trucks approaching a terminal share roads with workers, passengers, businesses and emergency services. Dispatch decisions can concentrate demand in a narrow period. A queue that disappears from the terminal can reappear on a public road, an access junction or an unprepared receiving site. The gateway account must follow that consequence.

An effective response connects terminal readiness, cargo release, transport bookings, staging and destination capacity. A truck appointment is useful when a vehicle can arrive within the accepted window and receive the promised service. Holding space is useful when drivers can use it safely and the calling arrangement is dependable. Pricing and operating rules must give participants a reason to comply. Physical provision and commercial design belong to the same decision.

Municipal and road institutions enter the architecture through their actual responsibilities. Freight routes, junction management, loading space, land use, public transport and local safety can affect port service. Those institutions are Metropolitan Gate Institutions where their decisions materially influence access and continuity. Their participation should establish a workable interface with port and logistics actors while preserving their broader public obligations.

Passenger mobility is part of the operating geography. A terminal shift requires workers to arrive at the right time, including periods when ordinary transport may be limited. A repair cluster needs technicians able to reach dispersed work sites. We must examine the workforce journey as carefully as the cargo journey where it constrains service. Transport, shift planning and safe access may produce a more immediate operating benefit than additional handling capacity.

Productive locations shared utilities and the industrial connection

Port proximity does not create an industrial cluster. Firms need customers, premises, equipment, competent people and usable services. Gateway access can improve their proposition, but each site must be assessed against its production process. Food processing requires water, power, hygiene, waste management, cold transfer and distribution. Engineering requires workshops, spares, specialised labour and access for heavy loads; assembly adds component supply, inventory and quality-control requirements.

The Abidjan–Lagos Atlantic Corridor blueprint’s multi-utility node describes the convergence of enabling services at a viable productive location. Electricity, water, wastewater treatment, logistics, customs interfaces, communications and worker access need capacities, delivery dates and maintenance arrangements reconciled with tenant commitments. Compare shared and distributed provision using demand, environmental limits, charges and access for smaller firms. Neither one ownership model nor a full set of facilities is required at every node.

Industrial and logistics land should be compared through total operating conditions. Cheap land can become expensive if utility connections are uncertain or transport is unreliable. Expensive waterfront land can be wasted on uses that could perform as well inland. Conversely, moving an activity inland can destroy its economics if it requires repeated specialised transfers. The relevant choice is the productive use of the whole location system over time.

Metropolitan and rural relationships should remain explicit. Food and material supply, worker mobility, housing and municipal services influence operating viability and the distribution of benefits. Spatial concentration can support capability and service provision, but the programme should examine land access, displacement risks and access for surrounding communities rather than count serviced hectares as transformation. (Nursimulu 2026c, 176–181, 452–457)

For an SEZ location, the territorial decision complements the gateway interface examined in Chapter 4. Test whether land, utilities, workforce access and neighbouring uses support the proposed tenant activity. Freight, documentation and market access must work with those conditions. Developer economics, tenant strategy and internal governance remain subject to the separate AIC2030 SEZ framework; this monograph does not replace that fuller analysis. (LOGI-CONSULT 2026a, section 1.10)

The Living Corridor and port city compacts

The Living Corridor brings the conditions of everyday participation into economic design. Freight and maritime services depend on workers and communities with safe employment access, affordable housing, reliable utilities, health services, skills development and social stability. Enterprises depend on functioning settlements, public services and community relationships. These conditions affect operating costs and the ability to sustain service, making them an operating concern as well as a public-policy concern.

Establish these relationships through local evidence. Staff absence may reflect transport, working conditions, health or management. Turnover may reflect remuneration, housing costs, limited progression or competition for skills. Trained people may be unable to access recruitment or reach the workplace even where employers report shortages. Identifying the constraint makes a practical response possible.

Development also affects people who do not directly use the gateway. Freight traffic can change neighbourhood access, noise exposure and road safety; waterfront redevelopment can displace small enterprises and coastal users. Design, mitigation, consultation and benefit distribution should address these consequences. Compensation and access arrangements require the appropriate legal and institutional processes.

The Durban blueprint develops a territorial expression using Gateway, Production, Heartland, Regeneration and Capital Nodes. This five-node configuration is a contextual planning proposition.

(Nursimulu 2025a, 203–204) The transferable principle is to assign functions to places and connect them coherently, with evidence for each relationship.

The C'Urban proposition aligns corridor, port, city and productive-platform planning. A port-city compact should establish shared commitments on freight access, worker mobility, land use, utilities, waterfront activities, environmental quality and community participation. It should identify which institution finances, delivers and maintains each element, with review and grievance arrangements.

Urban development must also protect productive space. Workshop clusters, small warehouses, fishing access and affordable commercial premises can be displaced by higher-value real estate uses.

Decisions should compare their economic and social functions, consultation requirements and realistic alternatives. Regeneration should be examined through who gains access and who bears relocation or service costs.

Municipal equity is one possible means of participating in gateway value; planning agreements, service contracts, benefit-sharing arrangements and joint programmes can perform other functions. Effective participation depends on enforceable responsibilities and capacity rather than a universal shareholding rule. (Nursimulu 2025b, 98–100, 119–120; Nursimulu 2025a, 95–96, 190–194)

Supplier depth and safeguards against enclave development

Productive depth can be examined through the relationships around recurrent gateway and industrial demand. Identify final producers and their component, material, engineering, maintenance and other specialised suppliers. This functional map is more useful than assuming one universal supplier-tier numbering. It reveals which capabilities are available, which are imported and where a credible upgrading opportunity exists.

A supplier-development commitment should connect a defined demand opportunity to qualification requirements, testing, appropriate finance and repeat procurement. Training without an accessible commercial opportunity may leave capability unused. Conversely, a local purchasing quota can increase reported expenditure without improving quality or competence. Record acceptance performance, repeat orders, payment delays, supplier progression and the ability to serve additional customers.

A terminal or zone can be commercially successful while operating as an enclave with few wider linkages. The test is whether firms outside its boundary can access useful contracts, standards services, logistics, knowledge and finance on workable terms. Procurement and investment incentives should be transparent and reviewed for additionality, including the costs borne by public institutions and users. Foreign expertise and investment can contribute to these relationships; their presence alone does not establish either productive diffusion or leakage.

The full sector codex in the Abidjan–Lagos Atlantic Corridor blueprint belongs to a broader industrial programme. Gateway implementation should select value chains with demonstrable demand and feasible capability progression. Packaging, equipment repair or cold-chain services may be appropriate entry points in a particular service. No universal number of suppliers or domestic-input percentage establishes sufficient depth across all sectors. (Nursimulu 2026c, 204–212, 338–344)

Human capability, skills and institutional learning

The workforce architecture distinguishes operational execution, system integration and architectural stewardship. Operational roles perform the service safely and reliably. Integrators maintain the interfaces among organisations, processes and information. Stewards preserve the purpose, coherence, continuity and learning of the wider arrangement. These roles can sit within existing institutions; the distinction clarifies responsibilities rather than prescribing new job titles everywhere.

Competence must be demonstrated in the work. A terminal planner needs to manage changing arrivals and yard conditions. A cold-chain operator needs to recognise and respond to a temperature deviation. An interface manager needs to resolve conflicting records and identify the competent decision owner. A continuity steward needs to understand which services can be sustained, for how long and at what cost. Course attendance alone answers none of these questions.

Human Capital Compacts are proposed agreements among employers, institutions, training providers and professional bodies to sustain this competence. They can specify practical assessment, training capacity, supervision, succession, knowledge transfer and recurrent funding. Equivalent arrangements may already exist and should be recognised. The compact is useful when it closes a material gap in the service, rather than adding another ceremonial agreement.

Professional Guilds are a related AIC2030 proposal for peer learning and professional development across institutional boundaries. Their recognition, governance and relationship with established professional bodies require agreement. They carry no automatic accreditation or public authority. Their value would lie in improving competence, practice and institutional memory, with performance assessed on that basis.

Port labour and the automation decision

Port reform changes work as well as assets. The ILO places social dialogue, safety, training and working conditions within its port-sector agenda; the World Bank's toolkit also treats workforce adjustment as part of reform. These references support treating labour as an operating and institutional relationship. The applicability of individual conventions and national employment obligations requires jurisdiction-specific examination. (World Bank 2025b; International Labour Organization n.d.)

An automation proposal begins with the service constraint. Compare changes to tasks, maintenance, shifts, training and procedures with automated alternatives. Assess the resulting demands on equipment maintenance, data quality, security and exception handling. Include safe separation of people and machines, remote-control competence, cybersecurity, recovery after failure and access to parts and support. Lower headcount alone does not demonstrate improved complete-service reliability or productive value.

Engage workers and their representatives early enough to influence the design. Establish changes to jobs, competence, working hours and safety responsibilities, together with practical training, redeployment where feasible and treatment of displacement through the applicable arrangements. Include transition measures in both implementation and recurring operating costs. Verify competent performance, maintenance readiness and the ability to operate under degraded conditions; a training announcement does not establish retained capability.

The gateway capability account should examine workforce outcomes alongside service outcomes. Record injuries and near misses, critical vacancies, competence acceptance, employment quality and the distribution of opportunities. For the proposed Fifth-Generation Port, technology adoption strengthens the productive economy when people and institutions can maintain, adapt and renew the service, rather than becoming permanently dependent on an externally controlled technical function.

Knowledge progression and purposeful skills mobility

An intelligent gateway needs operational expertise, asset stewardship, interpretation of risk, translation between productive requirements and capital, and the ability to integrate decisions during a disruption. These functions are performed by people working across institutions. A capability plan should therefore connect maritime and terminal occupations with engineering, product standards, trade finance, environmental science, data analysis and public administration.

Progression can include movement from an operational role into technical, analytical or managerial responsibility, supported by practical education and credible assessment. It should also recognise specialist careers that deepen without following a single managerial ladder. Training has value when skills can be exercised in real services, with equipment, decision authority and adequate remuneration. Knowledge requires renewal; staff turnover and obsolete systems can erode it.

Purposeful mobility can connect African production locations, gateways, research centres and market partners through placements, professional exchanges and joint service delivery. Arrangements should define learning objectives, recognition of qualifications, worker rights, immigration requirements and opportunities to apply skills on return or through continuing collaboration. A corridor benefits from knowledge circulation when origin institutions and firms can use what is learned, rather than merely supplying personnel to better resourced hubs. (Nursimulu 2026e, 146–147, 270–274, 309–318)

Within a Human Capital Compact, the skills programme specifies occupations and tasks, employer demand, curriculum responsibilities, practical placements, qualified instructors, funding and routes into work. Authorities and workers join employers and training institutions in defining these requirements. Marine operations, maintenance, refrigeration, engineering, customs, industrial quality, ocean data and coordination need different competence. Investments should fund the people able to operate and improve the service, with recognised qualifications and supervised assessment of safe performance.

Institutional learning extends beyond individual courses. Maintenance histories, incident reviews, operating procedures, decision records and succession arrangements preserve knowledge across staff changes. Universities and research organisations can help examine repeated failures and test improvements. Enterprise participation should include suppliers capable of absorbing technical knowledge and applying it to further contracts.

The source Blue Skills Academy and Corridor Skills Academy proposals illustrate possible delivery arrangements. Their continental function can be fulfilled through existing institutions, employer networks or new capacity where justified. Announced training volumes are planning ambitions until delivery, competence and employment outcomes are evidenced. (Nursimulu 2025b, 42–43, 73, 119; Nursimulu 2025a, 95, 126, 147–148)

Enterprise progression and configuration capability

The Passerelle firm transition ladder makes the beneficiary's progression explicit. Entry establishes a first compliant route to market. Stabilisation develops repeat business, dependable delivery, buyer relationships and suitable finance. Upgrading increases the firm's processing, technical, certification or commercial capability, including capabilities developed within its African production base. Graduation reduces avoidable dependence on the original support arrangement through more direct or more capable market participation.

These four stages describe the market access relationship. They complement the Industrialist Framework's wider enterprise development pathway and do not replace it. Graduation need not mean owning every service internally: a firm may rationally continue buying specialist logistics, testing or distribution. The test is whether it has greater choice, capability and bargaining power, with support justified by continuing need rather than institutional convenience.

Configuration capability is the ability to make a product usable for a specific buyer or market through assembly, finishing, packaging, labelling, testing, compliance and order preparation. Shared facilities and smaller production units can make these services accessible where individual firms lack sufficient volume. Their scale should follow the activity, safety requirements, economics and demand. Final stage processing is valuable where it solves a real market problem; its position late in the chain does not by itself prove that it captures the greatest value.

An enterprise progression agreement should state the initial constraint, service provided, cost and subsidy, required evidence and next capability milestone. Track repeat orders, delivery performance, compliance failures, financing terms, domestic supplier development and the share of functions that firms can perform or procure competitively. An exit review should ask whether support can be reduced, redesigned or concluded without destroying a viable commercial relationship. (Nursimulu 2026e, 191–195, 264–267)

Enterprises, small traders and participation

An intelligent gateway must be usable by the enterprises it intends to serve. Smaller firms can face shipment thresholds, opaque charges, fragmented documentation and limited access to finance or assurance services. A technically advanced process may increase these barriers if participation requires equipment, subscriptions or specialist staff that small users cannot afford.

The response starts with the transaction. Consolidation can make modest shipment volumes viable. Shared testing or packaging can support market entry. Assisted digital access can make a lawful workflow usable without forcing every trader to become a systems specialist. Transparent information about charges, requirements and service windows helps users plan and compare providers. Each arrangement needs an identified operator, payer and service standard.

Informal activity can reveal how the formal gateway actually works. Traders may use alternative routes or intermediaries because the official process is expensive, unpredictable or poorly matched to transaction scale. Other activity may involve material non-compliance or harm. Diagnosis must distinguish these circumstances and work with competent authorities and affected users. A blanket assumption that informality is either failure or virtue prevents useful design.

Apply the supplier-depth tests above to the enterprises whose participation is constrained. Qualification and training must connect to credible purchasing requirements and payment practices that allow suppliers to survive. Without accessible contracts, new capability can become an unfunded cost. Design the progression path around actual demand while retaining quality, competition and public accountability.

Rural urban reciprocity and territorial participation

The productive territory includes rural origins of food, materials and knowledge as well as urban processing and services. A corridor should examine where producers can aggregate, store, process, obtain technical support and reach customers. Feeder access and rural service capability can be decisive even when the main trade spine performs well.

Value retention near the origin can arise through processing, supplier contracts, producer services, ownership, employment, applied knowledge and reinvestment. These channels should be investigated separately. A resource shipment passing through a rural area does not itself demonstrate productive participation or fair distribution.

The living-corridor node configuration introduced above is a territorial planning lens, distinct from digital maturity and corridor development levels. Several functions may coexist in one place. Its purpose is to reveal relationships that a transport map can omit.

Practical commitments can include aggregation services, shared quality facilities, accessible procurement, suitable payment terms, rural worker mobility and producer representation. Participation measures should follow actual suppliers, workers and users, including women, younger enterprises and informal traders whose access may be constrained by finance, shipment size, documentation or digital systems. (Nursimulu 2025a, 192–194, 203–204; AIC2030 Institute 2026 SEZ Framework diffusion tests)

Culture, hospitality and the economy of participation

Cultural enterprise, hospitality, business travel and recreation can contribute to a gateway territory's economic life. The Durban blueprint calls their intersection the Bleisure Economy. Its relevant contribution is the relationship between commercial participation, attractive places, cultural identity and services that allow people to visit, work, learn and sustain partnerships.

Applications might include maritime heritage, conferences linked to actual industry networks, cultural businesses, hospitality serving technical visitors or safe public waterfront access compatible with port operations. Their commercial case requires customers, suitable locations, infrastructure and credible operators. Benefits to local enterprises and communities should be designed and measured.

This is a supporting component of territorial development. It should receive space proportionate to its role in the gateway's productive purpose. Resort proposals, branded festivals or dedicated funds should be advanced only through their own feasibility and environmental assessment. The blueprint's employment and GDP projections are not adopted as established effects. (Nursimulu 2025b, 130–131; Nursimulu 2025a, 194 -204)

Reproducing the human capability of the gateway

Human capability should be mapped to operating responsibilities: who designs, finances, governs, operates, maintains, repairs and improves each critical service. The record should include engineering and maritime competence, border coordination, enterprise capability, finance, data, economic diplomacy and research. A programme should identify shortages, supervised practice, succession and the funding needed to sustain competence. Training attendance is an input; competent performance, continuity during personnel changes and the ability to improve the service are outcomes. The wider AIC2030 human architecture can inform this work without creating another gateway pillar or an automatic professional designation. (LOGI-CONSULT 2026a section 4.16 and Pillar VII)

Territory in the gateway decision

A territorial decision brings together land, services, people and market reach. It asks whether a proposed productive location can operate, whether its traffic can be accommodated, whether workers can reach it and whether its goods can reach customers. The answer should inform the investment sequence before the site and infrastructure programme become difficult to change.

This approach creates a practical division of work. Port institutions establish maritime and interface requirements. Municipal and territorial bodies address their own planning and public-service functions. Utilities establish feasible service. Employers and productive-platform operators define operating demand. Enterprises provide evidence about actual transactions and constraints. An agreed decision process connects their findings.

The cumulative argument now connects ocean service chains, corridor hand-offs and productive places. Land, utilities, suppliers and competent people make operating commitments feasible; accepted information and lawful decisions make them compatible across institutions. Chapter 6 develops those decision arrangements and continuity responsibilities. The proposed port anchors the relationship through its maritime competence and agreed interfaces, without absorbing the powers of territorial bodies, enterprises or other authorities.

Key takeaways: The productive territory extends beyond the port estate. Local capability needs market access and service reliability. Assess who gains, where income remains and how capability reproduces. For reflection, use the Chapter decision guide; controlled terms are defined in the glossary.

6 Making the connected system operate

Chapter objectives: Connect information to authorised decisions; assess operating competence and continuity; identify institutions and funding needed for dependable service.

Architecture becomes an operating relationship

The connected system operates when each critical service has accepted information, competent decisions and the resources to act. We establish those relationships through a clear purpose and operating boundary. The corridor's Economic Operating System describes how institutions and economic capabilities organise the five flows; it does not prescribe a single software platform. This chapter sets out the proposed responsibilities, commitments and continuity arrangements that make coordination usable.

The practical starting point is a consequential task. A gateway may need to coordinate the transfer of perishable goods, revise a vessel-service plan, clear an evacuation backlog or restore a critical connection. For that task, the architecture identifies the participants, sequence, conditions and exceptions. It then establishes whether the service can be delivered routinely and sustained when conditions change.

Assets remain important. A process cannot move cargo through an unavailable berth or supply refrigeration without adequate energy. Institutional design is equally concrete: an operator cannot implement a release that the competent authority has not issued. The operating model must establish which constraint is binding in the particular situation and how the proposed response addresses it.

Gate institutions and decision rights

Gate Institutions exercise responsibilities that materially affect access, movement or continuity. Customs, maritime authorities, border agencies, infrastructure managers and relevant metropolitan bodies can perform such functions. Their importance arises from the decisions they control and the dependencies around those decisions. The gateway assessment maps those relationships before proposing a coordinating arrangement.

The decision chain runs from an identified issue through reliable information to a competent decision, an accountable action, a deadline and an effective escalation route. Each part needs an owner. A logistics provider may identify a problem without the power to resolve a public hold. A regulator may make a decision while an operator lacks the equipment or access needed to execute it. The architecture makes these distinctions visible.

Minimum Viable Authority, abbreviated MVAu, is the bounded set of lawful decision arrangements sufficient for the selected coordination task. It includes reserved powers, execution, escalation, remedies and accountability. Its institutional form may use existing agencies, an inter-agency agreement, contractual commitments or a competent corridor body. There is no presumption that a new authority is always required.

Authority and ownership remain separate. A port can own land while a concession allocates terminal operations to another party. An information service can maintain shared records without deciding regulatory status. A carrier can make commercial routing decisions that a public convenor cannot direct. Clear interfaces allow coordination across these differences rather than requiring common ownership.

Interoperability and Sovereign APIs

Interoperability is the ability to exchange and use information across the relevant systems and institutions. It requires shared meanings, reliable identity, appropriate access, secure transfer and an agreed understanding of what the information can support. The receiving institution must be able to act on the record within its own procedures and responsibilities.

A Sovereign API is the AIC2030 term for a permissioned interface through which sovereign systems exchange authorised information while retaining control over their own functions. A practical design specifies which event or record is exchanged, its source, permitted users, updating arrangements and correction process. It also specifies the status of the information when the originating system is unavailable or a record is disputed.

Standards can reduce repeated integration work, but implementation must respect differences in competence and resources. An institution with limited connectivity may need a controlled alternative for participating in the service. A cross-border arrangement may begin with a small set of events and expand as use becomes reliable. Wider access follows a justified operating need and an authorised basis.

Minimum Viable Legality names the legal substrate necessary for the particular exchange and decision. It concerns matters such as the lawful basis, recognition of records, responsibilities and available remedies. The monograph supplies an architectural question, not a uniform legal instrument for every African jurisdiction. Application requires the appropriate jurisdictional review.

Data as the Sixth Mode of Transport is retained as an authorial metaphor for the movement of trusted instructions, records and transactions across physical modes. It emphasises an operating dependency that can constrain cargo movement. Data remains one of the five canonical economic flows; the metaphor adds neither a new physical mode nor a sixth canonical flow.

Digital maturity from islands to corridor intelligence

The Mombasa blueprint's reference ladder describes five digital conditions: Foundational, Connected Systems, Intermediate Ecosystem, Integrated Corridor and Intelligent Ecosystem. It moves from paper-based work through agency automation and inter-agency integration to corridor exchange and predictive capability. Its historical current and target annotations describe the source edition, not a new assessment of Mombasa.

The same blueprint also presents an implementation roadmap: basic adoption, platform-based clearance, systems integrated across-borders, predictive analytics and full corridor intelligence connecting code, carbon and capital. Durban's roadmap similarly moves from foundations through port integration, corridor integration and predictive intelligence to an intelligent OceanGate. These are related source ladders with different emphases; their level numbers should not be treated as identical assessment results.

For application, define observable capabilities at each interface: accepted records, interoperable systems, authorised decisions, tested exception handling, measured service effects and learning. Predictive or autonomous functions need bounded permissions and accountable intervention. Digital maturity supports the wider Intelligent Corridor; the ultimate economic test remains productive capability, retention, reinvestment and environmental performance. (Nursimulu 2025b, 29, 92; Nursimulu 2025a, 226)

Table 10 Mombasa digital maturity reference levels

Mombasa reference level	Source descriptor	Capability described
1 Foundational	Manual Processes	Paper based work without digital links
2 Connected Systems	Digital Islands	Agency automation without integration
3 Intermediate Ecosystem	Inter Agency Integration	Connected agency systems with limited corridor exchange
4 Integrated Corridor	Smart Trade Corridor	Data exchange between national and corridor partners
5 Intelligent Ecosystem	AI Enabled Smart Corridor	Predictive services traceability environmental analytics and cyber secure trade

Regulatory legibility and proportionate information exchange

A corridor can fail even where each agency believes it has followed its own rules. Different interpretations of documents, risk classifications, admissibility or responsibility can interrupt an otherwise compliant shipment. Regulatory legibility requires parties to know which rule applies, who can make the decision, what evidence is accepted, how long the process should take and where a contested decision can be reviewed. Alignment should include the handling of exceptions, rather than only the routine electronic message.

Interoperability can preserve distinct legal regimes while making their interfaces usable. Harmonisation and mutual recognition remain options where appropriate and lawfully agreed. An operating compact cannot create either by declaration. Formal dispute resolution requires an applicable legal or contractual basis; technical clarification and facilitated dialogue should be named accordingly so that participants do not mistake them for binding adjudication.

Information exchange should follow purpose and necessity. Define the data required for each decision, the lawful basis for access, retention periods, confidentiality, onward use and mechanisms for correcting errors. A custodian's system visibility must not become unrestricted access to competitive intelligence. Local hosting alone does not establish control: access permissions, encryption, contractual rights, service dependencies and usable recovery arrangements determine whether institutions can continue operating.

Digital continuity also rests on physical infrastructure: power, communications routes, cable landings, sensors and the people who maintain them. Redundancy should address common points of failure rather than count duplicate assets that share the same vulnerability. Data restraint and operational resilience should be designed together, with a minimum information set sufficient to preserve critical services during disruption. (Nursimulu 2026e, 49–52, 103–107, 139–140, 282, 306, 319–326)

BlueTech evidence and accountable decisions

BlueTech observations become corridor intelligence through an accepted decision process. The record should connect the measurement, its uncertainty, the person competent to interpret it, the institution authorised to act and the resulting service change. A water quality alert might prompt a production review; it does not itself establish a legal closure or commercial rejection. The relevant operator or competent authority acts within its own responsibility.

Specify who validates sensors and methods, checks data quality, corrects errors and maintains the service. Access and sharing arrangements should distinguish environmental evidence, scientific research, personal information and commercially sensitive records. Reuse requires clear permissions and an account of purpose. A shared platform should provide the information needed for the task while preserving the responsibilities of scientific institutions, operators and public bodies.

Continuity includes practical competence, spares, calibration, communications and safe fallback when observations or analytical systems fail. A participating enterprise must know whether an interruption suspends a service, requires manual inspection or permits another accepted evidence route. These requirements connect BlueTech to the port's existing maintenance, workforce and custodial arrangements.

Digital twins and accountable intelligence

A digital twin can represent vessels, cargo, infrastructure, service capacity and relevant external conditions. Its usefulness depends on which decisions it supports and how accurately it represents the constraints that matter. An attractive visualisation with incomplete operating relationships can give participants unwarranted confidence.

The representation needs a maintained model boundary, known data sources and visible assumptions. Users must distinguish actual events, accepted plans and forecasts. Where the model recommends an action, the decision owner should be able to examine the relevant reasoning and constraints. A forecast can prompt preparation or checking without becoming an instruction that bypasses competent judgement.

Official use requires explicit acceptance within a defined scope. A system does not acquire legal authority because it reproduces an operational process or holds a record. Institutions must establish which representation they will use, for what purpose and with what correction and review arrangements. Where the twin and the physical operation diverge, a workable reconciliation process is essential.

The most useful intelligence loop ends in learning. Compare the anticipated condition with what happened, investigate the difference and update the model or process. Persistent prediction error may reveal poor data, changing demand, an omitted constraint or behaviour shaped by incentives. Correcting that error improves the architecture rather than merely improving its appearance.

Corridor operating plans and accountable coordination

A Corridor Operating Plan connects vessel berthing and discharge to terminal capacity, train paths, truck appointments, clearance, warehouse and inland reception, production windows, energy availability and payment readiness. It records planned volumes, equipment constraints, cutoffs, accepted information and the institution responsible for each commitment. Shared schedules become useful when responsible actors can revise commitments and communicate the consequences. A coordination centre can monitor exceptions, convene decisions and track corrective action. Harbour masters, customs authorities, terminal operators, carriers and transport providers retain their respective safety, regulatory and commercial responsibilities. The centre needs an explicit boundary, decision protocol and escalation route rather than an assumed single line of command across public powers. Performance compacts make interdependence reviewable. Each commitment should name its owner, service definition, baseline, reporting source, review frequency and response to failure. Monthly operating reviews can address recurring exceptions; quarterly reviews can resolve institutional dependencies; annual reviews can reconsider role, investment and productive outcomes. The cadence follows the service and must be resourced. Accountability requires both an institution responsible for execution and a competent body able to approve material changes. Consultation and information duties should be recorded separately. Cross-border escalation follows agreed channels and time limits, with continuity arrangements while a dispute is unresolved. (Nursimulu 2025b, 85–89; Nursimulu 2025a, 107–108, 128–130) For each material exception, identify the accepted evidence record and version, execution owner, competent approver, response deadline and escalation recipient. Record continuity arrangements and who verifies closure. Disputed information must remain visibly disputed; coordination cannot override reserved safety or regulatory decisions. Inland readiness should be assessed before increasing discharge rates or scheduling additional calls. Compare cargo arriving during the relevant operating window with the evacuation and reception capacity actually available during that same window. Separate cargo classes, seasonal peaks and terminal constraints. A nominal annual capacity ratio can conceal an acute daily mismatch, while temporary imbalance can be absorbed safely by a properly designed buffer. The service compact should record the common event definitions, booking cutoffs, promised windows and the actor authorised to change each commitment. Missed connections should remain visible alongside average transit time. Selective air-freight interfaces may serve urgent parts, pharmaceuticals or perishables where cargo value, certification and service economics justify them. They are not a requirement for every gateway. Synchronisation also needs room to recover. Tightly coordinated schedules can propagate disruption when there is no receiving flexibility or usable alternative. Test fallback bookings, temporary storage, alternative routing and the time required to restore the normal plan. Reliability concerns the whole enterprise journey, including its capacity to recover after a missed handover. (Nursimulu 2026c, 392–404)

Authority sufficient for the critical interface

Apply Minimum Viable Authority to the failure identified at the critical interface. A missing mandate, overlapping powers, fragmented responsibility, a decision-maker without information, an authorised decision without execution and ineffective cross-border escalation require different remedies. Use the decision-rights specification above to establish the arrangement sufficient for the task. A corridor compact, strengthened existing body, professional corridor institution, statutory authority or multistate organisation may be appropriate in different circumstances. Before creating a new institution, establish which decisions cannot be made or enforced through current arrangements, what jurisdiction is involved, how funding and oversight will work, and how operators will participate without capturing public decisions. Institutional form follows the evidenced authority requirement. Creating a council without the means to act can add another layer of Architectural Debt. (LOGI-CONSULT 2026a sections 4.6, 5.5 and 9.7–9.9)

Investor services and quality infrastructure

A productive platform needs a credible route from an investor's interest to an operating enterprise. The relevant services can include business registration, land access, construction permissions, environmental assessment, utilities, work permissions and customs arrangements. A consolidated interface should explain requirements, track applications and resolve dependencies with the competent authorities.

Delegated officers can make that interface effective where the legal framework permits. Their decision powers, limits, records, response times and escalation duties should be explicit. An administrative memorandum cannot override a statutory reservation of power. The service should distinguish an approval it can issue from a referral or application it can only coordinate.

Quality infrastructure connects metrology, testing, certification and standards advice to the intended market's requirements. An issuer, method or accreditation must be recognised for the receiving party's decision; producing a certificate locally does not ensure acceptance elsewhere. Shared facilities should specify recognition, funding, turnaround, cost and access for smaller firms. Early use can help enterprises configure products, document compliance and reduce avoidable rejection.

The blueprint's targeted incentive approach considers sector, enterprise size and site function. In application, incentives require a lawful basis, transparent eligibility, fiscal-cost assessment, performance conditions and review. Their economic purpose is to enable additional capability where justified; the investment case must remain credible beyond temporary concessions. (Nursimulu 2025a, 120- 122; Nursimulu 2025b, 60- 61)

Accepted evidence and enforceable transactions

Cross-border digital exchange is useful only when the receiving party can rely on the record for its intended decision. For each document, signature, certificate or test result, identify who issues it, who must accept it, the relevant law or agreement and the procedure for correction or dispute. Technical interoperability cannot itself establish mutual legal recognition.

Contract enforcement, secured transactions, insolvency and available dispute mechanisms affect trade and financing alongside cargo procedures. Proposed reciprocal arrangements require competent authorities, legal review and actual agreement. A corridor platform should route unresolved matters to those authorities and preserve available remedies; it should not imply that a common digital interface creates a supranational court or guarantee. (Nursimulu 2026c, 323–337)

Energy demand and investment within the gateway role

The declared gateway role determines the energy services to assess. A seafood gateway, repair cluster, transit terminal and marina have different demand patterns. Separate terminal equipment, refrigeration, pumping, lighting and communications from industrial electricity, process heat and specialist fuel needs. Vessel services introduce further questions of fuel pathways, storage, safety and compatibility. Analyse timing and continuity across the complete service before choosing generation, storage, connections or equipment.

A gateway energy plan connects equipment adoption to usable supply, distribution capacity, tariffs, maintenance and backup. Where credible customers and workable operating arrangements support shared provision, reconcile port, energy and enterprise activation dates. A single aggregate energy target cannot represent all of these dependencies.

The marina energy proposition illustrates this reasoning on a specialised waterfront. Oboda describes a possible relationship between yacht visits, energy, water and destination services. The transferable lesson for the continental architecture is to examine whether the gateway's intended economic role creates complementary requirements that can support viable shared services. It remains a proposed configuration, rather than a measured development outcome. (Oboda n.d.)

Potential demand, observed purchases and committed demand are different grounds for investment. Capacity should be assessed against the customers likely to use it, the conditions under which they will purchase and the consequence of losing a major user. Adding customers can improve utilisation or increase simultaneous demand. Shared infrastructure should therefore be justified by measured operating profiles and explicit service commitments.

Coordination can sometimes make an existing connection more useful by shifting a controllable load within an agreed window. Essential loads, safety, product quality and departure requirements establish limits. Information systems need permission, operating rules and competent staff to turn a forecast into an action. Storage and microgrids require their own technical and economic assessment; their presence alone does not establish resilience or affordability. (Pacific Northwest National Laboratory n.d.)

Investment sequencing should reconcile the dates when energy supply becomes usable, port capacity is activated and enterprises begin production. Establish credible load profiles, offtake commitments, connection rights, tariffs and responsibility for interruptions. Public support for shared energy infrastructure requires a clear beneficiary account and a comparison with maintenance, efficiency or smaller distributed alternatives.

Environmental claims depend on the actual production pathway and lifecycle boundary. Shore power requires consideration of the electricity mix and vessel utilisation; alternative marine fuels require attention to upstream emissions, safety and infrastructure. The relationship between port, energy and industry strengthens the proposed model only when its service and ecological conditions are made explicit. (Nursimulu 2026c, 143–147, 219–226, 405–421)

Energy gateways and exposure beyond the terminal

A port can serve as an energy gateway for the productive territory as well as consume energy itself. Distinguish fuel import and storage, bunkering, industrial electricity and process heat, offshore support and possible export production. Each has different demand, permissions, hazards, infrastructure and customers. An export announcement does not establish usable capacity, contracted offtake or retained industrial capability.

Appraise shared infrastructure against committed demand and compatibility. A future-fuel proposition needs evidence of supply pathway, acceptable quality, storage and handling safety, vessel uptake, technical skills and lifecycle emissions. Test whether the same capital could more effectively support essential domestic industrial energy, grid reliability or maintenance. Export revenue and domestic productive benefit require separate accounts rather than an assumed equivalence.

Route and customer concentration also shape viability. A gateway dependent on a particular shipping passage, transshipment network or anchor customer should examine interruption, insurance and security exposure, vessel diversion, changed inventory needs and loss of demand. These are appraisal scenarios, not claims of a present disruption at every African port. Verify whether a proposed alternative has usable capacity and permissions. Multiple map connections do not establish redundancy.

Identify which energy commitments remain useful if a fuel pathway or shipping network changes. Cost phased capacity, adaptable interfaces and the proposed risk allocation rather than assume flexibility is free. Relate the choice to actual energy demand, the reachable gateway role and the productive territory, with safety and ecological limits binding. Energy exports are one possible function, not the automatic purpose of the future port.

Network shifts, strategic competition and gateway exposure

Red Sea disruption has redirected services around the Cape of Good Hope, lengthening voyages and changing demand for bunkering, repair, stores, crew support and contingency calls. UNCTAD reports that Africa recorded the fastest growth in scheduled liner-shipping connectivity between June 2024 and June 2025, supported by rerouting away from the Red Sea. This is a dated network effect, not

proof of permanent demand at every African port. (UNCTAD 2025a)

A gateway should translate a route shift into explicit decisions: which services are actually demanded; whether capacity, safety, energy and skills can support them; which revenues persist if traffic normalises; and which investments remain useful across scenarios. External finance from shipping groups, strategic operators, public institutions or Gulf and Chinese investors must be assessed transaction by transaction through ownership, concession rights, data access, lifecycle obligations, local participation and exit provisions. The identity of the financier is context; the allocation of control, risk and productive capability is the architectural question.

Energy and the continuity of service

We begin with the service that must remain available. A cold store may need protected power for a defined duration, while some discretionary loads can be deferred. A terminal may be able to modify its operating plan during a constraint but still need reliable energy for safety and critical equipment. Prioritisation requires an agreed operating rule and a physical system capable of carrying it out.

The proposed energy transition should preserve a credible service pathway. Compare equipment and fuel options over their lifecycle, including utilisation, supporting infrastructure, emissions, operating costs and competence. The companion freight monograph's sequence of Avoid, Optimise, Shift and Clean is relevant here: remove avoidable movement and wasted energy, improve the necessary service, use appropriate modes and then clean the remaining energy and assets. (Nursimulu 2026f)

Fossil-Smart, as used in that companion, disciplines necessary remaining fossil use while reducing avoidable consumption and supporting transition. It does not create an exemption from applicable requirements or establish that a particular fuel choice is sustainable. At gateway scale, the practical application is a measured service and energy account with a defensible improvement pathway.

When the responsible institution is the constraint

The proposed architecture must remain usable when cooperation is weak or a responsible institution fails. Distinguish lack of resources from conflicting mandates, weak enforcement, procurement problems and deliberate obstruction. Allegations of corruption require evidence and due process; poor performance alone does not establish misconduct. A digital platform cannot resolve a conflict of interest embedded in the institution that controls its records or decisions.

For the chosen service, identify decisions that can be verified, the authority responsible and the route for challenge. Record conflicts and related interests, separate the authorisation and verification of expenditure where practicable, preserve procurement and performance records, and require reasons for exceptions. Oversight needs access to sufficient evidence and protection against retaliation.

Commercial confidentiality should protect legitimate interests without concealing material obligations or public exposure.

If the institution cannot provide a necessary permission or credible commitment, the programme should narrow the proposed test, seek a lawful alternative or defer. A new coordinator must not acquire statutory powers by agreement among commercial participants. Formal remedies, independent review and changes in governance require the competent legal and public process. Chapter 8's political-economy treatment carries this diagnosis into reform sequencing; the Durban stress case examines continuity rather than proving institutional capture.

Neutral operation custodianship and restraint

A shared technical service may need a Neutral System Operator. Its mandate should define the service, information rights, commercial boundaries, oversight and funding. The operator supplies the agreed function. Its shared-service role does not authorise it to intermediate trade flows, finance or insurance, assume balance-sheet risk, or appropriate participants' commercial relationships. It does not acquire public decision rights or a right to exploit participants' trade information beyond the

authorised arrangement.

Custodianship preserves coherence and continuity through recurring attention to interfaces, evidence, decisions and institutional memory. A custodian can convene reviews, maintain a record of commitments and identify unresolved constraints. Any power to decide or enforce must be separately established. Independence in judgement requires protection against both commercial capture and unaccountable institutional power.

Strategic restraint is the discipline that makes this role credible. The shared arrangement should not use its position to favour particular operators, appropriate market relationships or expand its mandate without review. Funding, procurement, access rules and conflict management should reflect the same boundary. Neutrality is demonstrated through conduct that users can examine.

The programme's proposed arbitration and Corridor Reboot functions are retained with distinct meanings. Operational escalation restores a decision path or service under agreed authority. Formal arbitration determines disputes under an appropriate legal and contractual basis. Corridor Reboot means an authorised process for activating fallback, reconciling records and restoring stable service; it cannot suspend statutory requirements or override an institution by metaphor.

Structural decongestion and empty container discipline

Congestion recovery should follow the chain of constraints. Equipment availability, crane productivity, yard configuration, clearance, labour deployment, truck arrival, rail reception and inland evacuation can interact. OPI provides a pressure profile; operating investigation establishes which interventions can relieve it without transferring congestion downstream.

The Durban blueprint proposes four connected intervention families: terminal professionalisation and governance, digital synchronisation, modal rebalancing and spatial logistics discipline. Useful actions include funded maintenance, coordinated inspections, reliable gate appointments, rail-terminal windows and inland reception facilities. Their sequence should follow the binding constraint and confirmed delivery capacity.

Empty containers require their own operating account. Ownership and release rights, carrier instructions, depot space, repositioning costs, export demand and equipment condition shape where empties can go. Shared visibility can support depot planning, return appointments, triangulation and coastal repositioning. Relevant measures include empty dwell, yard share, unnecessary lifts and the availability of suitable equipment to exporters.

Restrictions on long-haul trucks or compulsory transfers should be assessed against service availability, user cost, competition, safety and implementation capacity. The source distance rule is a contextual proposal. Its transferable principle is to coordinate metropolitan freight access with viable inland and modal alternatives. (Nursimulu 2025a, 105–113; Nursimulu 2025b, 85–89)

Continuity precedes efficiency

Continuity precedes efficiency is an AIC2030 design principle for critical functions, expressed within the doctrine as the First Law of Intelligent Corridors. It asks what must remain available and how stable service can be restored when a dependency fails. Efficiency remains a necessary objective, but a service that performs well only under ideal conditions may expose enterprises to intolerable interruption.

The principle requires choices. Alternative equipment, routes, energy and staff have costs. The programme must compare criticality, plausible disruptions, restoration time and affordability. A usable alternative has the necessary capacity, permissions, competence and commercial arrangements during the same event. A route shown on a map is only the beginning of that test.

The historical Durban case in Gateway applications and comparative cases distinguishes restoration of NAVIS N4 from recovery of other interfaces after the July 2021 Transnet breach. It also records reported manual processes and customer engagement. That contemporaneous government account, rather than independent forensic evidence, informs the service-level continuity questions below. (Department of Public Enterprises, South Africa 2021)

For this architecture, the response is to define continuity at service level. Record the interruption, minimum capacity retained, activation time for alternatives, time to stable operation and backlog recovery. A restored central system may still leave a collection, documentation or receiving interface impaired. The service test must reach the users affected by the interruption.

Cybersecurity belongs inside this continuity design. Access controls, recovery arrangements, protected copies, incident response and competent staff support the service. Manual fallback also needs control: identities, cargo records, authorisations and subsequent reconciliation must remain usable. The technical and institutional design should be exercised together.

Digital commons sustainable services and cyber continuity

Shared digital services require governance and a sustainable operating model. The design should distinguish public performance information, agency records, commercially sensitive transactions, personal information and optional analytical services. Access, purpose, security, retention, correction and permitted reuse need explicit rules. A port's coordinating role does not confer ownership of all participant data.

Funding may combine public support, participant contributions, service charges or other justified arrangements. The model must specify who pays for operations, cybersecurity, upgrades, user support and eventual replacement. Pricing should be transparent and should examine exclusion risks for smaller enterprises. Commercial analytics should not depend on unauthorised exploitation of confidential records.

Interoperability should preserve operational independence and exit options. Appropriate measures include documented interfaces, data portability, recoverable backups, tested restoration and arrangements for changing providers. Multi-cloud or multi-jurisdiction hosting is one possible design choice, not an assurance of resilience by itself. Dependencies and lawful data conditions require assessment.

Cyber continuity needs separation of critical systems, appropriate access controls, incident responsibilities and tested fallback. A compromised connection can propagate risk, but a failure need not expose the entire corridor if the architecture limits access and preserves independent functions.

Manual or degraded-service procedures should be designed, trained and exercised where they can safely sustain essential work. (Nursimulu 2025b, 135–137; Nursimulu 2025a, 93, 179–181)

Traceability and the cost of market acceptance

Traceability should connect a consignment to evidence that a buyer, regulator or assurance body accepts. Product origin, chain-of-custody and environmental records need defined methods, reliable observations, correction procedures and responsibility for verification. A digital record does not prove the underlying event merely because it is permanent or widely shared.

Environmental measurement should distinguish operational emissions, relevant upstream impacts and exposure to physical climate risks. The applicable market requirements, reporting boundary and verification method must be stated. Avoid treating one destination market's requirements as universal African obligations or assuming that a carbon record automatically earns preferential finance.

Compliance costs can exclude smaller suppliers. A shared service should specify who pays for measurement, certification, data access and maintenance, while protecting commercial information and providing a practical route to challenge errors. Measure accepted transactions and enterprise access alongside the number of records generated. (Nursimulu 2026c, 369–375, 412–421)

Research embedded in execution

Research becomes operating infrastructure when it establishes baselines, tests causal explanations, evaluates interventions and returns usable learning to those making decisions. A gateway research partnership can connect operators, universities, technical institutions, enterprises and public authorities around specific service questions. Its mandate should include access to appropriate evidence, methodological independence and a procedure for handling commercially sensitive information.

The research function should distinguish service monitoring from evaluation. Monitoring identifies what changed; evaluation asks why it changed, for whom and under what conditions. A redesigned clearance interface might reduce elapsed time while shifting costs to small traders. The evaluation should make that distribution visible. Methods, definitions, revisions and limits should be documented so that the evidence remains interpretable after personnel or systems change.

A research platform does not acquire regulatory, lending or commercial powers merely because it produces trusted analysis. Its contribution is disciplined learning and professional formation. Institutions should specify who commissions work, who can challenge findings and how results influence the next operating decision. Proposed centres and partnerships should be identified as proposals until their establishment and responsibilities can be demonstrated. (Nursimulu 2026e, 316–318, 328–336)

A usable alternative during disruption

An alternative asset becomes an alternative capability only when it is accessible, operationally ready, commercially usable, authorised, staffed, suitable for the cargo and available during the same disruption. Its information connections and duration of service must also be credible. A neighbouring port with nominal spare capacity may be unusable if access roads, permits, storage or vessel services cannot support the diverted flow.

Continuity assessment should therefore record critical capacity retained, maximum tolerable interruption, decision latency, time to activate the alternative, time to minimum stable service, backlog clearance and the finances required to sustain the response. Test physical, energy, digital, institutional, climate, market and financial disruptions. The exercise should change operating arrangements and investment priorities where weaknesses are found. (LOGI-CONSULT 2026a section 4.8)

Architectural Debt and institutional memory

Architectural Debt is the accumulated burden created when past choices leave essential interfaces poorly connected, responsibilities unresolved or lifecycle obligations unfunded. A capability not yet needed or developed is not automatically debt. The diagnosis concerns a consequence of earlier decisions that now increases cost, complexity or vulnerability.

Evidence can include repeated re-entry of the same records, recurrent emergency coordination, an incompatible asset, dependence on one individual or maintenance that repeatedly interrupts a service. These observations still require diagnosis. A lawful inspection, justified manual decision or temporary response to an exceptional event is not automatically debt. An assessment should identify the originating choice, current failure, continuing cost, affected service and feasible remedy.

The remedy follows the cause. Maintain an asset where neglect is decisive; revise a hand-off where the process is weak; align information where inconsistent records cause error; change an agreement where responsibility is unresolved. Integration, repair, revised contracts, standardisation, repurposing and retirement can all be rational responses, and may resolve the problem more effectively than construction.

Institutional memory keeps those lessons available. Decisions, exceptions, operating assumptions and unsuccessful interventions need records that successors can use. Temporal architecture connects this memory to recurring review, competence and funding. The gateway becomes more capable when it can explain why its arrangements exist and adapt them without repeating avoidable failures.

Continuous management needs an agreed performance constitution: boundary, role, event definitions, measures, thresholds, custodians, publication rules and action responsibilities. Monitoring must connect operational exceptions to decisions and follow their closure. It must also record productive outcomes, continuity and the next capability requirement. An observatory is one possible institutional home. The lasting requirement is a funded ability to observe, decide, act, learn and revise the service. (LOGI-CONSULT 2026a sections 4.7 and 5.11)

Negotiating cooperation and earning trust

Cooperation has a cost and a distribution. A terminal may want cargo collected sooner while a receiver faces expensive inland storage. A truck operator may accept a booking system only if an appointment produces dependable service. A public agency may require assurance that shared information will not be mistaken for a regulatory decision. Smaller suppliers may fear that visibility exposes their customers to a more powerful intermediary. These are candidate tensions to investigate, rather than findings about particular institutions.

The agreement needs to address the transaction each participant is being asked to change. The seafood scenario makes this concrete. A revised receiving window can protect the processor's production schedule but increase a transport provider's waiting or handling costs. Someone must accept and fund that consequence. Calling the arrangement a shared benefit leaves the central commercial question unanswered until the parties agree who provides what and on which terms.

Trust grows through commitments that participants can examine. Information should have a stated purpose, reliable provenance and defined correction arrangements. A provider should be able to see how its performance is measured and challenge an incorrect record. Commercially sensitive information should reach only the parties entitled to use it. A convenor should disclose conflicts and have a review route for decisions in which it has an interest. These arrangements make trust an operating relationship rather than an appeal to goodwill.

Resistance can identify a defective proposal. Workers may reasonably question displacement or inadequate training. A small firm may face a subscription charge larger than its expected benefit. A public institution may lack the staff needed to fulfil the proposed response time. Consultation must be able to change the design when such concerns are established. Participation is credible when the costs and obligations are feasible, with a lawful alternative for users who cannot adopt the same technical interface immediately.

Other resistance may protect discretion or an advantageous commercial position. That possibility requires evidence about conduct and incentives, rather than an assumption that every objection is improper. The response remains accountable negotiation, transparent service rules and the use of competent enforcement where warranted. Architecture supplies no mandate to bypass legitimate disagreement.

Institutional evolution can begin inside existing organisations. Name a sponsor able to commission the bounded work, identify decision owners, establish commitments and test their execution. A workshop or published framework cannot carry recurrent obligations on its own. The loss of an institutional home can be described as architectural orphaning. Its remedy is a funded sponsoring and custodial function with a succession path, not necessarily a new corridor authority.

Contracts and institutional arrangements must address missed commitments, operator failure and sponsor withdrawal through correction, record access, orderly transfer, fallback and termination. Specify the service available during dispute resolution and review these provisions to sustain gateway durability.

Authority, information and continuity make a service operable. They also create funding and risk obligations. The investment decision must therefore finance the capability and its dependencies, while examining its productive contribution.

Key takeaways: Installation is only one step in sustained operation. Assign responsibility, competence and funding to interfaces. Exercise continuity arrangements and learn from failures. For reflection, use the Chapter decision guide; controlled terms are defined in the glossary.

7 Investment and productive value

Chapter objectives: Compare interventions against a common service baseline; distinguish savings from productive value; apply the Port Value Account and investment sensitivity.

Invest in a capability the economy can use

Investment should create a capability the connected economy can use. The requirement may justify a berth, equipment, an inland connection, a cold-chain service or an institutional change. This chapter relates that choice to demand, funding obligations, risk and the value that remains in participating economies. Project form follows the diagnosed need. This ordering changes appraisal. A terminal expansion should be examined alongside cargo demand, shipping commitments, evacuation, energy and maintenance. A repair facility should be examined alongside fleet demand, skills and supplier capability. A productive platform should be examined alongside viable firms, utilities and market access. A financially attractive individual asset can still create a weak system if its essential dependencies remain unresolved. We therefore distinguish buildability, operating viability and productive contribution. Engineering establishes whether an asset can be delivered under stated conditions. Commercial and financial analysis establishes how it can operate and be funded. Economic assessment examines the additional capability and wider effects it supports. Each answers a necessary question that the others cannot settle alone.

Port governance contracts and the source of capital

The investment question begins with the allocation of functions. Public service, tool, landlord and private service port models are familiar reference configurations. Actual gateways can combine arrangements across terminals and services. The public service model places assets and operations largely with public provision. The tool model retains public infrastructure and equipment while private stevedores provide cargo handling. The traditional landlord model combines public land and basic infrastructure with private terminal equipment and operations. Private service configurations place a wider range of assets and operations in private hands. These are broad patterns rather than a substitute for examining the actual allocation. (World Bank 2025c, Tables 4.1–4.2 and sections 4.3–4.4) Public ownership of a port does not establish that every terminal, service or investment is publicly operated or funded. Equally, a privately operated terminal is not evidence that an entire port has been sold. Separate ownership of land and assets, responsibility for operation, financing obligations, regulatory powers and the rights created by contracts. The allocation of public oversight must be read from the relevant institutional setting. A concession establishes specified development or service rights and obligations for a defined scope and term. A joint venture establishes shared equity participation and governance in an entity. An operating company can be a joint venture and hold a concession at the same time. A management contract, lease or development agreement may allocate other functions. These arrangements can coexist within one gateway; their interfaces require explicit treatment. The source of capital is a further dimension. A strategic port operator contributes an operating business and network; a private equity or infrastructure fund invests under a particular mandate; a pension institution invests against its own liabilities and return requirements; a development financier operates under its development and financial mandate. Debt providers hold a different claim from equity owners. Public or private classification alone explains little about these differences. For the African Fifth-Generation Port, the question is which combination can fund dependable maritime service, enable the wider productive relationship and sustain it through changes in demand and ownership. No universal ownership percentage or single management model answers that question.

Table 11 Port management reference models

Reference model	Typical provision pattern	Question for the productive gateway
Public service port	Public assets and core operations	Are investment, maintenance and enterprise interfaces adequately funded and accountable?
Tool port	Public infrastructure and equipment; private cargo handling	Do equipment and labour responsibilities support a coherent service?
Landlord port	Public land and basic infrastructure; private terminal assets and operations	Do contracts connect terminal delivery with shared gateway requirements?
Private service port	Wider private ownership and operation	How are public oversight, access and corridor relationships secured?

Capital mandates, investment horizons and control

Investors should be examined through mandate, contribution, risk, decision rights and exit. Private equity funds vary in strategy and holding period; infrastructure funds and direct institutional investors also vary. Do not presume that all financial investors seek rapid disposal or that a long-term mandate automatically protects public value. Examine fund duration, leverage, distribution policy, maintenance commitments and transfer arrangements in the specific investment.

Primary investment that finances additional capacity or equipment differs from a secondary purchase of existing shares. The latter changes ownership and can release capital to the seller, but its transaction value is not automatically new expenditure at the gateway. A refinancing can change debt cost, maturity, distributions or exposure without adding physical capability. Report these transactions separately when describing capital mobilised for development.

Decision rights can matter as much as equity percentages. Review board representation, reserved decisions, vetoes, financing consents, technical control, customer contracts, data access and related-party arrangements. A minority partner may hold material rights; a majority shareholder may remain constrained by obligations and the competent public institutions. Ownership does not by itself establish the practical capacity to direct the connected system.

A terminal's earnings, a fund's investment return and the corridor's Productive Yield measure different outcomes. They can reinforce one another when dependable services support enterprise activity and future demand. They can diverge where extracting distributions, deferring renewal, restricting access or leaving interfaces unfunded improves one account at the expense of the wider economy. Assess the mechanism and actual behaviour rather than infer outcomes from investor identity.

Appraise construction, ramp-up, operation, renewal and changes of control. Test shareholder transfer, refinancing, operator replacement and material-customer withdrawal. A commercially reasonable exit can preserve service when obligations, information, competence and funding remain effective.

Capital participation and network influence

Carrier-related investment can operate within or across the ownership and contractual arrangements described above. Assess actual contractual rights rather than inferring control from a port-model label or an investor's name.

Capital participation can influence capacity timing, technology choices, terminal access and the incentives surrounding shipping and inland services. Separate the roles of carrier, terminal operator, investor and shipping alliance; an operating alliance is not necessarily an asset owner. Examine exclusivity, common-user access, information rights, reinvestment duties, refinancing and termination conditions against the wider productive service.

Regional coordination should disclose dependencies and preserve legitimate commercial confidentiality. Cooperation on infrastructure interfaces, safety and continuity must not become cargo allocation or price coordination. Where one participant has strong market influence, the programme should test whether smaller users and alternative service providers retain practical access. (Nursimulu 2026c, 148–162, 255–268, 338–344)

Market power and practical access

The rights and dependencies described above become a competition question when users lack workable alternatives. Examine the relevant market, switching constraints and actual access before concluding that integration creates benefit or exclusion. R1 supplies the regulatory context; the following tests apply the AIC2030 architecture to gateway access.

Assess berth and terminal access, allocation of scarce windows, information privileges, related-party dealings, exclusive service requirements and commercial bundling. Test whether an independent carrier, haulier or productive user can obtain a workable service under transparent conditions. Nominal common-user status is insufficient where available slots, compatible equipment or accepted information make access impracticable. A concession or joint venture should be examined alongside its operating agreements, not by equity percentages alone.

The gateway investment decision should preserve the benefits of network participation while specifying enforceable access and continuity obligations. Record oversight, complaint procedures and remedies within competent authority. Shared corridor coordination should not become price fixing, customer allocation or exchange of competitively sensitive information without a lawful basis. Where demand depends on one carrier or customer, appraise withdrawal and diversion scenarios and identify who bears stranded-capacity risk.

What dated investment examples demonstrate

DP World's December 2020 Ndayane announcement described DP World Dakar as a joint venture with the Port Authority of Dakar, with development and operating responsibilities for the proposed new port. It also referred to the existing Dakar concession. The example demonstrates that joint venture participation, a concession relationship and development responsibilities can coexist. The announcement establishes the described structure at that date; it is not a current construction status report or evidence that anticipated development outcomes have occurred. (DP World 2020b)

In September 2020, DP World and CDPQ announced the expansion of a global ports and terminals investment platform, including a scope extending into linked logistics services. This illustrates cooperation between an operator and institutional capital at portfolio level. It should not be labelled indiscriminately as a private equity takeover, nor should the platform's headline size be treated as committed expenditure at every participating port. (DP World 2020a)

On 21 October 2026, CPP Investments and OMERS announced agreements to sell their ABP stakes to a fund managed by IFM Investors. The announcement stated that completion remained subject to approvals and was expected in the first half of 2027. This is a dated example of proposed ownership transition in an established port business. It reinforces the need to distinguish an agreed transaction from a completed transfer and a share purchase from new asset investment. (IFM Investors, CPP Investments, and OMERS 2026)

Architectural Finance and the cost of coherence

Architectural Finance is an AIC2030 proposed funding category for the institutional and operating foundations that make connected investment usable. It can include diagnosis, interface design, permissions, integration, competence, continuity and recurring review. The term does not name an established financial product or guarantee a source of capital.

Four funding envelopes require identified payers and commitment routes: preparation for evidence and design; implementation for agreed capability; recurring funding for operation, maintenance and security; and continuity and verification for alternatives, exercises and review.

A preparation grant can establish an interface but leave its maintenance unfunded. A project loan can finance equipment while excluding the staff needed to operate it. A donor-supported platform can become unusable after its initial service contract ends. These are lifecycle design questions to resolve before the investment proposition is presented as sustainable.

Candidate arrangements include corridor-readiness facilities, results-based preparation or implementation grants, capitalised custodial endowments and appropriately underwritten continuity or performance-risk arrangements. Their availability, legal basis, governance and commercial feasibility must be established; none is represented as an existing commitment.

Possible payers include public institutions, service users, operators and development partners according to purpose and mandate. Charges must be related to the service and its incidence. A shared arrangement that benefits many participants can be difficult to finance through one firm's voluntary payment. The programme should make that collective-action problem explicit and compare workable funding options. Capital acts as a system auditor when financiers test these dependencies and obligations. Their judgement is one source of discipline alongside public appraisal and user evidence; willingness to finance does not by itself establish public value.

Financing BlueTech capability and productive adoption

A BlueTech investment should identify whether it finances research, technical validation, demonstration, routine service or commercial expansion. These activities have different uncertainties, time horizons and sources of repayment. Grant-funded investigation, shared testing infrastructure, a service contract and enterprise equity cannot be assessed through one undifferentiated project return.

Funding should purchase a defined advance in evidence or usable capability. Before a field trial, state the operating conditions, acceptance requirement, customer or public service purpose, expenditure limit and next decision. Scale requires credible demand or an explicitly funded public function, technical performance and an affordable maintenance path. Where the service addresses early interface readiness, pre-trade capital may contribute; BlueTech as a whole is not synonymous with that funding category.

The Port Value Account should record direct service value added separately from the enterprise activity the technology enables. Measure retention through resident income, skills, supplier capability and the capacity to maintain or improve the service at named locations. Patent counts, equipment installations and investment announcements do not by themselves establish Productive Yield. A useful follow-up asks whether the capability remains available and can support another productive cycle.

Pre-trade capital and the transition to repeat finance

Some productive services require expenditure before repeat transactions provide sufficient evidence for routine financing. Pre-trade capital addresses this early interface risk: initial consolidation, capacity commitments, pilot production, product validation, shared testing, workforce preparation or integration between agencies and operators. The expenditure should make a specific service test possible. It should not become an open-ended budget for uncertainty that has never been defined.

Architectural Finance funds the coherence of the wider system, including shared interfaces and capabilities that conventional project boundaries can omit. Pre-trade capital describes a timing and risk function within that broader architecture. It may support a commercially operated activity, a shared service or a public capability. The appropriate funding form could be a grant, recoverable grant, equity, contracted service payment or another instrument justified by the activity and applicable mandate.

Each commitment should identify the uncertainty being funded, permitted uses, the party bearing loss, evidence required to continue and an expenditure limit. The subsequent funding route must also be specified: operating revenues, working capital, longer-term investment or closure. Development banks, commercial financiers and institutional investors should be assessed against their actual mandates and risk capacity; no provider category is universally eligible or universally excluded.

Repeat trade can strengthen the case for infrastructure and finance, but some enabling assets must exist before trade can develop. Sequencing therefore compares the cost of readiness with the cost of waiting and the consequence of failed demand. Stage commitments around verifiable evidence, retain an option to stop and avoid treating an early pilot as proof that a large capital programme will be viable. (Nursimulu 2026e, 285–289, 297–299)

Capital absorption and investment sequence

Gateway Capital Absorption is the capacity to use, govern, operate, maintain and economically sustain additional investment. It includes procurement and delivery capability, competent counterparties, complementary infrastructure, recurrent resources and the demand required to put assets to work. A signed financing agreement is only one part of the investment pathway.

Sequence matters where capabilities depend on one another. A productive site may need utilities before tenants can operate. Additional handling capacity may require an evacuation improvement. Electrification may depend on supply reinforcement and technicians. The programme should identify these relationships and distinguish work that can proceed in parallel from work that must precede another commitment.

The appropriate sequence can also preserve options. A modest service improvement may test demand before a dedicated facility is justified. A flexible layout may accommodate different cargo uses. A phased agreement may limit exposure while participants establish a reliable service. The value of adaptability should be considered alongside the cost of staged delivery.

A credible capital proposition requires demand, revenue or public funding, capable sponsors, risk allocation and workable market conditions. Clearer architecture leaves capital scarcity, credit constraints, currency exposure and political risk to be addressed. Continuity planning must also test capital withdrawal and changes in lending or insurance alongside physical and institutional disruption.

A capital architecture for the complete productive system

Gateway transformation requires several financing functions with different economics. Common infrastructure may need long-duration capital and public support. Productive platforms need development finance aligned to occupier demand. Enterprises need equipment investment and growth capital. Trade and production need working capital. Skills, coordination and information services need durable operating funding. A single investment envelope should reveal these differences.

Project preparation connects ambition to financeable choices. It develops demand, engineering, permissions, environmental requirements, governance, operating arrangements, financial models and risk allocation. The investment pipeline should distinguish concepts, prepared projects, approved commitments, financial close, disbursement and operational assets. Mobilisation announcements should not be counted as completed productive investment.

Domestic institutional capital, regional investors, diaspora participants, international partners and development institutions can perform complementary roles. Their participation follows mandate, risk appetite, currency, duration, liquidity and return requirements. The blueprints' capital shares and fund structures are authored configurations; they are not universal financing ratios or evidence of committed funds.

The transoceanic capital function connects African projects to appropriate financial, legal, technical and market networks. The blueprints propose Mauritius IFC as a structuring interface. The continental model defines the function, project preparation, syndication, trade finance, governance and investment administration, while allowing the suitable jurisdiction and service providers to follow the transaction's requirements.

Investment orchestration can follow curation, preparation, investor alignment, execution, monitoring and reinvestment. Deal rooms and roundtables provide a structured setting for that work. Their value depends on credible projects, capable sponsors, transparent terms and follow-through; convening alone does not establish bankability or financing authority. (Nursimulu 2025b, 108–112, 140–141, 151; Nursimulu 2025a, 209–220, 229)

Investable rights, distributed portfolios and fiscal responsibility

Investment requires a precise account of what the investor can finance, control, earn and lose. A physical asset, a service business, a licence and a concession are different objects. A special-purpose vehicle or trust is a legal arrangement through which rights and obligations may be held; its existence does not establish asset quality or remove underlying risk. Permissions, tenure, cash flows, maintenance duties, termination provisions and environmental liabilities must be examined in their own right.

A distributed portfolio can connect complementary opportunities across gateways and productive territories without placing every asset under one institution. It may contain common interfaces, commercial services and public enabling works, each with its own financing logic. Portfolio appraisal should reveal dependencies and correlated exposures: several projects relying on the same shipping service, buyer or exchange settlement channel may diversify geography while retaining a common failure risk.

Capital allocation should preserve productive agency in the participating territories. A financing platform earns its role by making credible investments easier to prepare and execute, rather than requiring all African transactions to pass through one jurisdiction. Returns, fees, taxes, ownership, procurement and reinvestment should be transparent enough to assess where value is retained and where it leaves.

Custodianship does not create an implied sovereign guarantee. Any guarantee, first-loss commitment, subsidy or contingent public obligation must be separately authorised, priced where applicable, budgeted and disclosed under the responsible jurisdiction's rules. A public body's participation or a coordinating institution's endorsement must not be represented as blanket financial backing. Investors retain responsibility for due diligence.

Settlement and liquidity form part of service continuity. A usable trade route needs an accepted payment process, foreign exchange arrangements where relevant, documentary acceptance and a way to manage delayed receipts or disputed delivery. Alternative physical routing is incomplete if finance or documentation becomes ineligible during the switch. Operating and financing agreements should establish which changes require consent and how lawful continuity is maintained. (Nursimulu 2026e, 60 - 62, 211–212, 220–229, 300–308)

Aligning terminal investment with the productive corridor

The arrangement should define the productive service the investment is intended to strengthen. Identify terminal performance, receiving interfaces, inland or maritime connections, enterprise requirements and responsibilities outside the operator's control. World Bank guidance identifies demand risk, competition and supporting transport infrastructure as material PPP issues. These relationships require explicit decisions rather than an assumption that terminal capacity will generate the complete service. (World Bank n.d.)

Performance commitments can connect reliable handling with maintained assets, authorised data exchange, workforce competence and agreed interface responses. Establish a baseline and a means of checking compliance. Wider enterprise outcomes belong in the programme's economic account, with contribution and attribution distinguished; an operator should not be assigned sole responsibility for outcomes it cannot control.

Financing should preserve the resources necessary for renewal and service delivery under credible demand scenarios. Analyse the effect of debt, currency exposure, distributions, capital calls and any public support. Where an operating shortfall is covered by a public commitment, show the contingent exposure explicitly. Private financing does not remove the need to establish who ultimately bears each risk.

Apply the access tests developed earlier to vertically integrated terminals, inland logistics and zones. Coordination benefits should be examined alongside service choice, capacity allocation, prices, affiliated transactions and data treatment for independent users. The appraisal must address both fair access and the commercial arrangements needed for viable investment. The same discipline applies to BlueTech and energy. A shared observation service, common power connection or training facility may benefit several operators without producing sufficient revenue for one terminal company. Identify the beneficiary, funding route and accountable owner. Some functions can be purchased through service contracts; others may require public or collective provision. Their absence should be visible before the terminal financing closes.

The purpose is a durable relationship between investable assets and productive opportunity. Public authorities, operators and investors need a credible commercial structure, while enterprises need a usable gateway. The chosen ownership and financing configuration should be judged by whether it can sustain both requirements, with appropriate oversight and evidence.

Port prices and the cost of a usable service

Pricing determines whether productive users can afford the service that investment creates. The World Bank's Port Reform Toolkit identifies economic regulation as a means of examining fair pricing, competition and investment incentives. The architectural application here is to assess the complete user journey rather than infer competitiveness from one published tariff. Regulatory arrangements must follow the applicable national framework; this monograph does not prescribe a single regulator for every African gateway. (World Bank 2025b)

Distinguish the object charged. Port dues and marine-service charges concern use of port facilities or services; terminal handling concerns cargo operations; storage concerns occupation of terminal or depot space. Container demurrage and detention generally concern carrier equipment retained beyond agreed free time, commonly inside and outside the terminal respectively. Terminology, combined charging arrangements, clocks, free periods and liability vary by tariff and contract. A comparison must verify those terms rather than assume that labels identify identical services.

Construct a consignment cost record naming the payer, recipient, charge basis, currency, taxes, event triggering the clock, free period and dispute route. Link invoices to actual release, collection and return events. Distinguish a cargo owner's failure to collect from equipment, booking, customs or receiving constraints outside its control; establish liability under the relevant arrangements rather than assign it through the architecture. A lower handling tariff may coexist with a more expensive complete journey.

Test pricing against service and lifecycle funding. Charges that support safe maintenance and renewal can be necessary; an apparently low price achieved by deferring upkeep can undermine continuity. Equally, investment recovery does not justify opaque charges or discrimination. A gateway review should examine published terms, changes and notice periods, service commitments, access, complaints and competent oversight. Its decision is whether the proposed revenue and accountability arrangement can fund a dependable service without imposing unjustified barriers on productive users.

Keep financial affordability separate from economic appraisal. An avoided invoice is a cash saving for its payer but may partly be a transfer of income within the economic boundary. Real resource savings require a separate valuation. Chapter 7's investment comparison and Port Value Account therefore need an incidence record alongside the cost ledger: who pays less, who loses revenue, who funds recurring services and whether a viable enterprise receives a dependable rather than merely cheaper connection.

Revenue risk and sovereign interest

The financial account identifies who receives revenue, who pays the costs and who bears uncertainty. Port charges, terminal revenues, logistics fees and enterprise margins accrue to different actors. Public benefits may be substantial even where an interface service cannot recover all costs from direct users. Conversely, a strong private revenue stream does not by itself establish additional national economic value.

Risk allocation should follow the party's capacity to manage the risk and the purpose of the investment. Demand, construction, operating performance, energy, currency and regulatory change require separate treatment. Public guarantees and minimum-revenue commitments can transfer exposure to the state. Their fiscal and contingent obligations belong in the appraisal alongside the promised service.

Sovereign Gateway Interest concerns enduring trade access, continuity, strategic decision rights, financial sustainability and future options. It can be protected under different ownership and operating models. The test concerns the actual concessions, contracts, dependencies and review rights. Neither state ownership nor private participation provides an automatic answer.

Commercial exclusivity deserves particular attention where one platform, operator or carrier can affect access for others. An anchor commitment may support investment while reducing flexibility. The decision should compare the service secured, the dependence created, competitive effects and credible alternatives. The architecture makes the trade-off explicit for the competent institutions.

The gateway investment decision

The Gateway Investment Gate applies three stages. Strategic Necessity establishes the role served, the capability gap or continuity requirement, its constraint significance, non-capital alternatives and the appropriate sequence. Gateway Value and Sustainability tests Corridor Value Contribution, Gateway Investment Additionality, Sovereign Gateway Interest and Gateway Capital Absorption. Viability and Delivery then examines demand, technical feasibility, economic justification, commercial structure, risk, financing, lifecycle funding, operating readiness and delivery responsibility. These tests apply to the total arrangement, including public investment, concessions, joint ventures and private capital. The sovereign-interest examination covers trade access, continuity and alternatives, decision rights, data and technology, concentration, fiscal and currency exposure, lifecycle competence, productive capability, contractual alignment and future choices. State ownership and private participation each require scrutiny of the actual rights and obligations. They do not predetermine the finding. The gate connects investability with the gateway's ability to use and sustain the capability. A financeable asset may still lack the institutions, staff, complementary services or recurring resources needed for operation. The application protocols set out the concession and joint-venture checks and the controlled decision categories, including alternatives to proceeding with new investment. Where OPI is used in this diagnosis, its raw measures and calibrated component profile support investigation. The headline does not establish causation or choose between scheduling, evacuation and berth investment; the application protocols explain its measurement and scoring boundaries.

Comparing investments for one productive service

The Gateway Investment Gate can be applied to a choice between scheduling improvement, inland evacuation and berth expansion. We use a constructed gateway serving 100,000 eligible import containers annually. The service boundary runs from vessel arrival to accepted receipt by inland productive users. Every input and outcome below is an illustrative assumption. The example is not a diagnosis of Port Louis or another named port, and its figures are separate from the seafood consignment illustration.

Strategic Necessity begins with the cause of failure. A field assessment would link anchorage, berth, discharge, release, collection and inland receipt events, distinguishing cargo held for compliance from cargo available for collection. Berth occupancy, equipment reliability and receiving capacity would be examined together. Evidence that released cargo waits for collection would justify testing evacuation; evidence that workable arrival windows are missed would justify scheduling trials. Persistent berth scarcity after those constraints are addressed could justify capacity assessment. The numerical benefits below assume these mechanisms for demonstration; they do not establish them.

For comparability, all options are assumed to begin operation at the same appraisal date, serve subsets of the same eligible population and sustain constant benefits for ten years. The minimum service requirement in the constructed example is 95% of eligible consignments received within their agreed delivery windows, with safe operation maintained. None of the assumed average time reductions demonstrates this reliability threshold. A field recommendation would require its separate verification. Implementation delay, ramp-up or disruption would change the comparison.

Gateway Value and Sustainability examines benefits across the complete service. At an assumed economic resource cost of USD 50 per avoided container-day, scheduling saves 30,000 container-days annually, evacuation 120,000 and berth expansion 50,000. The illustration uses a 10% real discount rate, constant real costs and benefits, investment paid at the appraisal date, annual flows at year end and zero residual value. These are transparent calculation conventions, not prescribed appraisal parameters.

Table 12 Illustrative investment comparison for a common gateway service

Annual equivalent result	Scheduling	Evacuation	Berth capacity
Initial investment USD million	2.00	12.00	40.00
Additional annual operating cost USD million	0.40	1.00	1.50
Benefiting containers per year	60,000	80,000	50,000
Days saved per benefiting container	0.50	1.50	1.00
Annual benefit USD million	1.50	6.00	2.50
Annualised cost USD million	0.73	2.95	8.01
Annual equivalent net benefit USD million	0.77	3.05	-5.51
Break-even resource value USD per container-day	24.18	24.61	160.20

Evacuation has the largest annual equivalent net benefit under these assumptions; scheduling also has a positive result. Berth expansion would require additional evidenced benefits or different costs to justify commitment. This is an economic screening comparison, not a financial return calculation or an instruction to fund either positive option. Viability and Delivery still requires technical feasibility, environmental and social assessment, credible demand, commercial arrangements, competent operators and funded lifecycle obligations. A positive economic result does not identify a borrower, repayment source or budget commitment. Selection remains conditional on the binding constraint, separately verified service reliability and institutional readiness. The decision record must identify the payer, funding instrument, recurring obligations and outstanding conditions.

The five capabilities change what is appraised. Maritime and Operational Excellence establishes safe operating capacity and vessel-service requirements. Gateway Integration tests whether collection and inland receipt can use the improvement. Gateway Decision Intelligence assigns authority to revise arrival, release and receiving plans. Productive Value Creation asks which production or market commitment becomes dependable. Custodial and Compounding Leadership establishes maintenance, retained competence and review through subsequent operating cycles. In this example, an expansion that improves berth performance while leaving collection unusable would fail the complete-service test.

Sequence remains a decision rather than an assumption of permanent exclusivity. A bounded scheduling trial may provide evidence sooner and at lower initial expenditure; an evacuation investment may follow if the measured residual constraint supports it. Berth capacity can be reconsidered when the resulting service and demand justify expansion. The comparison must price delay in benefits, trial expenditure and transition costs. A combined programme requires incremental benefits measured against the preceding stage; overlapping time savings cannot be added.

The Port Value Account later in this chapter traces the productive implications of improved service. Dependable inputs may support production continuity, more demanding processing or supplier development, but those consequences require enterprise evidence beyond a delay saving. The seafood demonstration makes the same distinction at consignment scale. The application protocols provide this investment comparison's ledger and sensitivity tests. The next step is to test the diagnosed constraint and service response before committing to additional capacity.

Investment supporting the proposed 40% nearshoring ambition should follow selected product and service chains, not a general obligation to process every import locally. Appraisal should test demand, enterprise readiness, customs arrangements, skills, dependable energy, working capital and recurring service costs before selecting facilities or equipment. It should distinguish activities suited to the port estate from those better located in adjacent zones or inland centres, with named investors, operators and competent authorities.

Corridor credit, liquidity and enterprise access

The Corridor Credit Engine and Corridor Liquidity Engine proposals connect verified trading activity with financing assessment. Delivery records, accepted invoices, purchase orders and payment histories can help a lender understand performance and cash conversion. Their usefulness depends on authenticity, lawful access, reliable counterparties and the ability to resolve contested transactions.

Trade and receivables finance require credit assessment, authentic eligible transactions, enforceable claims, suitable payment arrangements and controls against duplicate financing. Inventory finance, warehouse receipts and supply-chain finance address different parts of the operating cycle.

Documentary collection is not a bank payment guarantee. Data can support underwriting without becoming enforceable collateral. Securitisation requires additional legal and portfolio conditions; neither visibility nor a platform establishes an entitlement to credit.

An enterprise facility should address the actual gap: inventory, input purchases, receivables, equipment, guarantees or currency exposure. Smaller suppliers may need contracts and payment discipline as much as a new finance platform. Anchors, financiers and service providers should examine how risk and financing cost are distributed along the chain.

A practical application can link a bounded set of firms, buyers, accepted records and a willing financial institution. Its measures should include approval and rejection reasons, cost, repayment, disputes, production effects and participation. Approval outcomes and pricing should be reported alongside the operating evidence. (Nursimulu 2025b, 94–95, 105–106; Nursimulu 2025a, 181–182, 209, 214–215)

Working capital and the financial exposure of the corridor

Fixed investment and operating liquidity require separate decisions. A funded berth or railway does not ensure that a producer can purchase inputs, carry stock or wait for a buyer to pay. Follow the selected enterprise's cycle from advance payment and production through shipment, delivery, invoicing and settlement. Record the currency and timing of each obligation, including the additional financing days caused by uncertain service.

A corridor financial exposure map should identify each borrower, asset owner, revenue stream, currency mismatch, guarantee and contingent public obligation. The corridor is not one legal balance sheet. Seniority, currency, financing source and use of proceeds are separate structuring dimensions; a local-currency loan can be senior or subordinated. Public guarantees require limits, reporting, an accountable sponsor and a stated review or exit arrangement.

More reliable trade may improve cash conversion or a project's risk profile, but the financing effect must be demonstrated for the borrower and instrument concerned. Any risk adjustment must avoid counting an improvement both in debt or equity pricing and in a separate cost-of-capital deduction. Neither retained value nor faster cargo movement establishes an automatic reduction in sovereign spreads. (Nursimulu 2026c, 246–306, 422–435)

Regional investment additionality and strategic options

Where gateways serve overlapping markets, investment appraisal must include the regional asset base and credible project pipeline. Distinguish new, diverted and induced demand and avoid counting the same forecast cargo in several business cases. Cargo won from another gateway may support an investor's revenue without creating equivalent additional regional productive value. Test combined utilisation and the consequences for debt, guarantees, currency exposure and maintenance if competing projects proceed.

Duplication can nevertheless provide justified resilience, customer choice or access. Compare those benefits with their lifecycle cost, readiness and actual use during disruption. Consider whether existing or committed assets, shared infrastructure or coordinated sequencing can meet the requirement. Under uncertain demand or technology, phased, modular and contingent commitments can preserve future options. A full expansion should follow defined evidence and demand triggers rather than an irreversible commitment made solely to secure hub status. (LOGI-CONSULT 2026a sections 5.9 and 9.4- 9.6)

Creation, capture, retention and reinvestment

Value creation is the additional economic value produced. Capture concerns the actors receiving income or other benefit. Retention concerns what remains within a defined economy or region as enterprise, wages, skills, assets, fiscal resources or productive capability. Reinvestment concerns the portion used to strengthen future capacity. These relationships need separate accounts.

A transshipment service can generate terminal and maritime revenue while using imported equipment, external services and overseas finance. Local engineering, procurement and professional capability can change the retained share. A processor can increase exports while importing most inputs. Neither pattern can be judged from gross trade value alone. The analysis needs the relevant costs, ownership, transactions and productive effects.

Domestic and regional objectives may also diverge. A gateway can improve access for a neighbouring economy while most service income accrues at the port. Regional complementarity can still create mutual benefit, but the distribution should be visible. Negotiated arrangements are stronger when participants understand the actual benefits and obligations rather than assuming identical interests.

Retained earnings may fund equipment and training; port resources may sustain maintenance and interfaces; public revenue may support complementary services. Assess whether these commitments strengthen subsequent productive capability, using the evidence requirements developed later in this chapter.

Value retention, productive agency and reinvestment

Value retention should distinguish equity ownership, local value added, income retained, capability embedded, fiscal contribution and reinvestment. Each has a different denominator and evidence requirement. An African shareholder can own equity in a weak productive operation, while an internationally connected firm can develop substantial local suppliers and technical capability. The architecture examines the actual channels through which value and agency remain.

The proposed 40% ambition covers value-chain activity in African nearshoring hubs for selected imports from outside Africa for African markets. The 60% ambition covers value-chain activity undertaken in Africa, including regional corridors, for exports from Africa. Private ventures propose 65% local and 35% international participation. Public port ownership is proposed at 90% national and 10% metropolitan government. Each requires defined boundaries and applicable law; activity and ownership shares do not establish domestic value added. (Nursimulu 2025a, 21; Chapter 4)

Productive agency includes the ability to determine products, absorb technology, negotiate partnerships, serve markets, structure capital and reinvest. Firms need quality, productivity, cash discipline, standards and dependable delivery to sustain that agency. Gateway services support these capabilities through reliable access, technical services, suppliers and commercially usable market connections.

Connect interventions to Chapter 4's Productive Yield dimensions through a baseline and contribution pathway. Trace whether retained value finances maintenance, skills, innovation, suppliers or productive assets for the next cycle. (Nursimulu 2026d Industrialist Framework; Nursimulu 2025b, 50–61; Nursimulu 2025a, 21–22, 216–220)

Productive Yield and Gateway Value Density

Use the eight Productive Yield dimensions defined in Chapter 4 to identify the capabilities an investment is intended to strengthen. At this stage, the task is to specify the contribution, evidence and time horizon rather than repeat the taxonomy or assign an unsupported universal score. (Nursimulu 2026f)

For a particular intervention, select the dimensions that have a credible pathway and identify observable change. A cold-chain interface may affect processing, market access and resilience. A maintenance programme may improve continuity and technical capability. A supplier-development arrangement may affect enterprise participation and retention. The evidence requirement follows the mechanism and the time needed for the outcome to appear.

Gateway Value Density relates productive or retained value to a specified gateway resource, such as land, energy, infrastructure capacity, cargo handled or service transactions. It can illuminate scarce-resource choices, but its meaning changes with the denominator and valuation boundary. Ratios using different resources cannot be treated as the same indicator or averaged without a valid method.

The account must also avoid double counting. A logistics saving received by a firm, a resulting margin change and a value-added effect can overlap. A wage, a supplier payment and an export receipt are different parts of an economic account. The appraisal should reconcile them and explain which benefits are additional, which are transfers and which remain uncertain.

Relating productive outcomes to gateway evidence

The eight shared Productive Yield dimensions retained in this monograph describe intended development outcomes. F01 section 4.11 provides gateway-specific causal pathways, including input and export access, production continuity, location viability, scale, logistics services and clustering. Its Appendix M provides a master performance crosswalk through movement, transformation, retention, circulation, capability, capital formation, resilience and system learning. These structures serve different analytical purposes. Their labels should be cross-referenced through the observed mechanism, without substituting one list for another or treating them as equivalent scores.

Classify the relationship as Directly Enabled, Materially Strengthened, Facilitated, Spatially Associated or Unverified. Establish the baseline or credible without-intervention condition, the enterprise affected, alternative explanations, time horizon and confidence. Spatial association supports no claim of causal additionality. Record retained value separately through enterprises, employment, skills, services, productive assets, fiscal value, strategic capability and reinvestment.

More value per hectare or cargo unit can illuminate a choice, but essential food, energy, affordable access and strategic redundancy may justify a lower monetary ratio. External capital, expertise and technology can strengthen retained capability; external payments should not be called leakage merely because they cross a border. Retention measures must remain compatible with competent delivery, safety, access and productive competition. (LOGI-CONSULT 2026a sections 4.11–4.13 and Appendix M)

From maritime activity to enduring productive capability

A wider gateway economy can grow around energy, water, repair, food supply, logistics, knowledge and financial services. Its development contribution depends on which functions become viable, where their value added accrues and whether participating enterprises acquire capability. High customer expenditure, a busy waterfront and renewable equipment can coexist with limited local productive development.

The investment proposition should therefore include supplier access and progression. Identify which services African enterprises can provide now, which standards or equipment prevent participation, what investment closes the gap and whether the acquired capability can serve other customers. Skills transfer needs practical responsibility and opportunities to perform the work. A supplier programme should show greater competence and commercial choice over time.

Retention should be reported at declared geographic boundaries. A service purchased from a supplier in another African economy may reduce the host territory's retained share while strengthening a regional productive relationship. Separate host economy income, wider African participation and capability at named locations. The corridor architecture is assessed through both the distribution of current benefits and the capacity available for another productive cycle.

The Port Value Account

The Port Value Account is an application of Productive Yield and Gateway Value Density to a specified port service and its connected economy. It separates three questions: what value is created inside the accounting boundary; what additional enterprise activity the gateway enables outside it; and where the resulting income and productive capability remain. These are related accounts, with different evidence requirements, rather than three totals to add.

Report nearshoring activity shares separately from monetary local value added: 40% activity establishes neither 40% local value added nor domestic content. Define the accounting boundary and calculate output less intermediate consumption. Record imported inputs, resident and non-resident income, displaced activity and attribution separately; prevent repeated counting of assembly, packaging or logistics receipts across reporting levels.

Define the activity, time period, prices and geography first. A port operator, a gateway service cluster and a multi country corridor are different boundaries. State whether retention means accrual to residents of the host economy, to residents across participating African economies, or capability remaining at named productive locations. Reporting several boundaries can show distribution more clearly than a single continental percentage.

For direct creation, derive gross value added from output less intermediate consumption. Distinguish consumption of fixed capital to obtain net value added. Allocate the result to labour compensation, relevant production taxes less subsidies and operating surplus or mixed income. Firm accounts must be reconciled to these economic definitions before aggregation; revenue, cargo value and asset valuations are not substitutes. Reconcile receipts to output for the stated period: customer advances require reconciliation to service delivery; loan proceeds and equity contributions are financing, not output. Keep intermediate purchases, capital acquisition and income distribution distinct so that cash movement and investment expenditure are not mistaken for newly created value.

For enabled value, identify the enterprise relationship and explain how the gateway changes feasible production, cost, reliability, quality or market access. Use additional enterprise value added where a defensible baseline and comparison exist. Where they do not, report the supported activity and mechanism without claiming its full value as additional. Supplier and customer transactions can overlap the direct account; an input-output analysis requires its own assumptions and treatment of duplication.

Retention is a distribution question. Trace labour and capital income by residence and show taxes accruing within the chosen boundary. Separately identify imported inputs, cross-border factor income and transfers using consistent accounting treatment. Foreign ownership is not equivalent to total leakage: resident employment, taxes, suppliers and retained capabilities may still be substantial. Domestic ownership does not establish domestic reinvestment.

Reinvestment and capability reproduction require follow-up. Profit distribution, financing flows and capital expenditure should be recorded separately from value creation. Show investment in skills, equipment, suppliers, standards and future service capability, with the location and beneficiary. This allows the account to ask whether the current cycle finances or enables a stronger next cycle.

Three Questions for Evaluating Productive Contribution

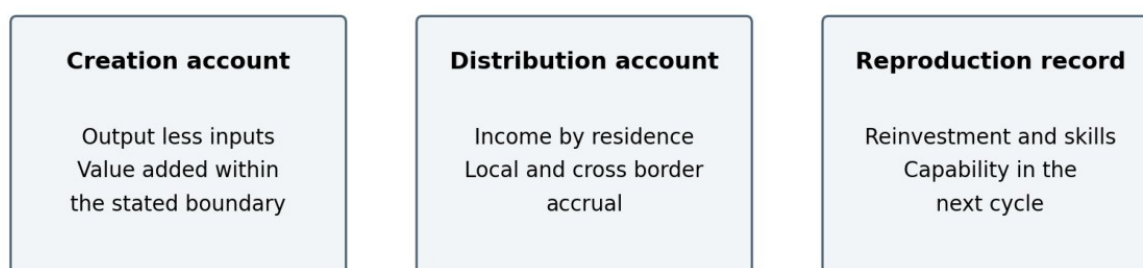
Infrastructure performance: are maritime and gateway services safe, dependable, efficient and sustainably funded, including appropriate public funding?

Connected economic performance: can enterprises commercially use these services to reach inputs and customers, given delivered costs, reliability and working-capital requirements?

Productive transformation: do these relationships support additional activity, retained value and capability for subsequent expansion? Operating gains alone do not establish transformation.

These questions are complementary, not development levels or a new index. Productive Yield, Gateway Value Density and the Port Value Account retain their distinct purposes and boundaries. Accounting evidence requires enterprise and longitudinal observations to assess transformation and attribution.

Figure 11 The Port Value Account



Enabled enterprise activity is assessed separately with overlap and attribution checks

These records explain related economic questions and are not additive totals

Source: Rhavy Nursimulu, AIC2030; author formulation applying Productive Yield and Gateway Value Density to a defined service and geography.

A numerical illustration of the account

The following arithmetic uses invented units for one service business over one year. It explains the account and is not an estimate for Port Louis, Mombasa, Durban or another port. Assume output of 100, intermediate consumption of 55 and consumption of fixed capital of 5. Gross value added is 45 and net value added is 40.

The 40 is allocated to labour compensation of 22, production taxes less subsidies of 4 and net operating surplus of 14. In this simplified example, the surplus is distributed as interest of 3 and profit of 11. Nonresident receipts are assumed to be labour income of 2, interest of 3 and profit of 8. The interest of 3 is allocated from the surplus of 14, not deducted again from value added or counted as an additional contribution. Field accounts must distinguish financing payments from financial-service charges under the stated accounting convention.

Income accruing to residents and government within the chosen boundary is consequently 27: resident labour income of 20, production taxes of 4 and resident profit of 3.

This is an accrual-based distribution illustration. Reinvested earnings of a foreign investor remain attributable to that investor while the associated investment can strengthen productive capacity at the host location. Cash retention, income residence and installed capability must therefore be shown separately. The example omits other taxes, transfers and real-world accounting adjustments; it should not be labelled a national accounts estimate.

If an inland enterprise reports an additional 12 of net value added, present that claim separately with its baseline, attribution and overlap checks. Do not report 52 as total gateway value without a consolidated boundary and reconciliation. If the service business invests 6 in equipment or training, report the expenditure and resulting capability separately; expenditure alone does not establish successful reproduction.

Table 13 Illustrative Port Value Account

Illustrative record	Units	Interpretation
Output	100	Service output; not cargo value
Intermediate consumption	55	Inputs consumed in production
Gross value added	45	100 less 55
Consumption of fixed capital	5	Depreciation in economic terms
Net value added	40	45 less 5
Nonresident factor income	13	Assumed wages 2 plus interest 3 plus profit 8
Income within the stated residence boundary	27	Resident wages 20 plus production taxes 4 plus resident profit 3
Enabled enterprise value	Reported separately	Requires additionality and overlap assessment
Reinvestment and capability	Reported separately	Location, funding and demonstrated productive use

The gateway productive platform and capital feedback

The Port Louis blueprint separates gateway operations, a productive configuration platform and specialist capital services into connected functions. This division is useful beyond Mauritius. Maritime operations establish access and reliability; the productive platform turns that access into market-ready goods and services; financial and risk capabilities support transactions and the next round of investment. Their locations and institutional forms should follow the economic relationship rather than replicate the Port Louis, Freeport and Ébène geography.

Feedback must travel in both directions. Buyer requirements should influence production and compliance services; production constraints should inform schedules and equipment; transaction experience should inform credit and investment decisions. Capital decisions should in turn reflect productive demand and operating evidence. An integrated system is established when these relationships alter decisions and outcomes, not simply when organisations share a dashboard.

Apply Gateway Value Density to the capital feedback account using the defined numerator and denominator, for example retained value added per unit of cargo or per service transaction. Cargo value, throughput, assets under management and domestic value added cannot be treated as interchangeable measures. Report the boundary, period, allocation method and treatment of imported inputs, fees and transfers. Read improvements alongside total productive value, participation and service accessibility. (Nursimulu 2026e, 112–117, 231–237)

The Continuity Dividend

The Continuity Dividend is the potential benefit associated with more dependable service under disruption. It can appear as less spoilage, reduced interruption, lower emergency transport cost or a greater ability to honour commercial commitments. Its size depends on the interruption, the exposed activity and the feasible alternative. The benefit should be examined alongside the cost of maintaining the continuity capability.

An illustrative cold-chain arrangement might protect product during a power interruption through backup energy and an agreed transfer option. The gross benefit would depend on the product at risk and what would otherwise have happened. The net result includes the costs of energy, equipment, maintenance, testing and any additional handling. A large inventory value is not automatically the loss avoided.

Financing effects require further evidence. A lender or insurer may recognise dependable operations, but pricing also reflects credit, market and other risks. The monograph therefore retains a financing dividend as a proposition to investigate. It does not assign an assumed reduction in premiums or capital costs to every continuity improvement.

This approach strengthens the argument for resilience because it makes the proposition examinable. Identify the service, exposure, alternative, event probability or scenario, and beneficiary. Use sensitivity analysis where inputs are uncertain. The result can support a decision without pretending that every relevant future event has been measured.

Port Louis and the investment decision

The Port Louis application developed in Chapter 3 separates a vessel-service question from a productive-service question. The first concerns the reliable use of maritime and terminal capacity. The second concerns the chain through which ocean activity becomes processing, engineering, logistics and market access. An investment programme must connect them while maintaining separate evidence for each.

For the vessel service, evaluate the binding cause of remaining delay and the performance of the relevant equipment and interfaces. For the productive service, examine an actual enterprise chain and its commercial requirements. A new berth, a revised service window, improved maintenance and a cold-transfer arrangement address different constraints. Their sequence and justification should follow the evidence.

The proposed portfolio can then identify what proceeds, what is redesigned and what waits for stronger demand or feasibility. A common investment narrative should not conceal a weak component. Each work package needs an owner, a lifecycle account and a stated relationship to the gateway outcome. The programme becomes stronger when its dependencies are visible before commitments are made.

Who pays and what remains in the seafood example

Return to the illustrative seafood service developed in Chapter 3. Its first investment choice follows the cause of the receiving failure. An agreed service window may require scheduling effort and different working hours. A transfer option may require equipment, a contract and competent staff.

Recurrent refrigeration faults may justify maintenance capability. Additional cold storage is a different commitment, justified only if usable capacity and demand support it. These alternatives should be costed separately before they become one expansion package.

The processor may have a commercial reason to pay for a service that protects an order. A logistics provider may invest where dependable demand supports utilisation. Public institutions may fund legitimate common functions through their own mandates and appraisal. Shared benefits can exceed the amount any one user is willing to pay. In that case, the programme must establish a defensible contribution or public-funding arrangement, or accept that the service is not yet financially sustainable. No named party is assumed to have made such a commitment in this illustration.

For this service, preparation maps the transaction and tests alternatives; implementation establishes arrangements and competence; recurring funding covers staff, information, energy and renewal; and continuity and verification fund protection and evidence. Installation-only support leaves continuing obligations unfunded.

The productive test concerns the processor's ability to fulfil a viable order and the capability developed around it. Relevant observations could include accepted deliveries, use of local engineering, sustained technical competence and repeat business. Lower waiting cost is an operating gain; it becomes part of a wider productive claim only when the enterprise pathway is evidenced. A supplier payment is locally retained only within a defined account of its costs and onward payments. Reinvestment requires evidence that resources support maintenance, competence or further productive use.

Domestic financing options also belong in this account. Banks, insurers, pension funds or diaspora investors could participate where their mandates and an investable proposition permit. Participation must follow an appropriate appraisal of demand, currency, liquidity, risk and governance. Capital sovereignty concerns the capacity to develop financing options while retaining credible external partnerships. It should increase strategic choice without assuming that domestic funding is automatically cheaper or more resilient.

The architecture also considers reliability bonds, performance-linked guarantees, continuity-indexed insurance and receivables structures as possibilities for investigation. These are candidate mechanisms rather than available products or endorsed offers. A reliability commitment needs a defined service and a party able to bear the obligation. Insurance requires appropriate underwriting and evidence about exposure. A receivables arrangement depends on the actual claim and payer. Each mechanism requires its own legal and financial feasibility before it could support this scenario.

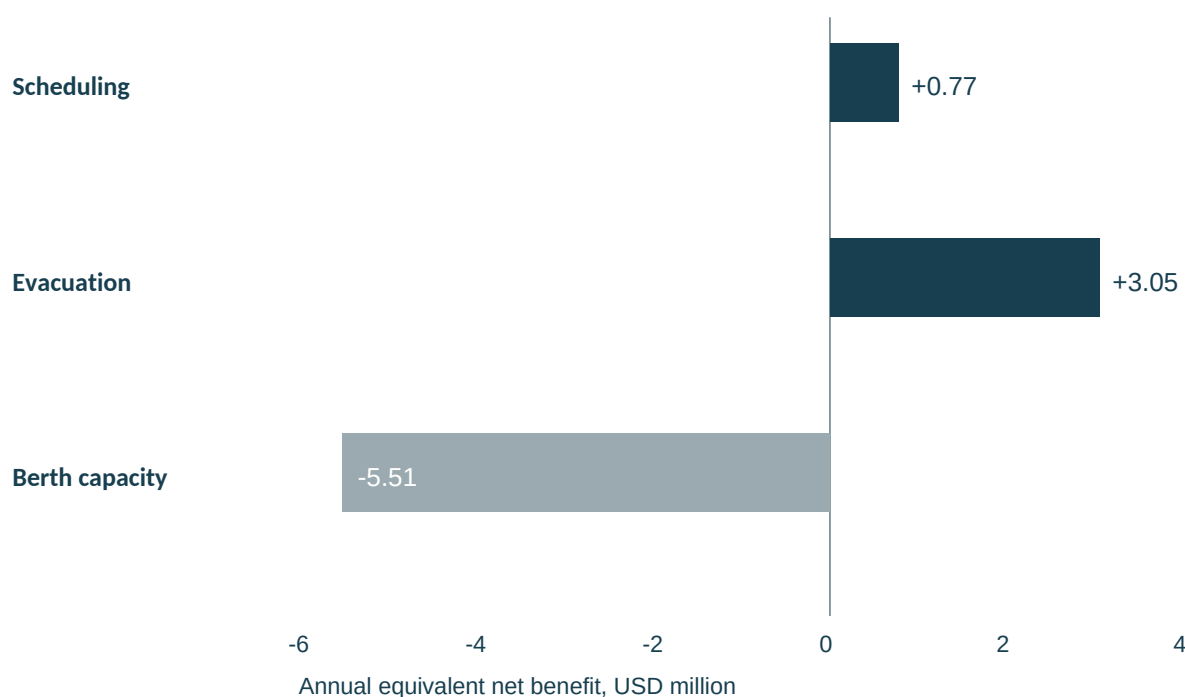
We can therefore explain the investment decision without manufacturing a return estimate. Identify the constraint, compare the feasible remedies, establish who can fund and operate the selected service, and test what productive capability it creates. The point at which records are missing becomes a precise evidence request. It need not prevent the architecture from clarifying the choice.

From Reinvestment to Productive Reproduction

Retained income, reinvestment and demonstrated capability formation require separate evidence. Trace expenditure into equipment, skills, supplier upgrading, certification or market access, then establish productive use. Productive reproduction means renewing capacity for another cycle; compounding requires evidence across successive cycles. Track utilisation, productivity, repeat orders and reinvestment, allowing for maintenance, depreciation and replacement. Examine displacement, subsidies and market changes; distinguish enterprise from territorial effects. Without successive-cycle evidence, report capability formation or an intended pathway, not demonstrated compounding. The established six-stage value cycle remains unchanged.

A coherent investment proposition needs an implementation sequence. The next chapter connects preparation, activation, operating tests and justified scale, including the political and institutional conditions required to sustain reform.

Figure 12 Evacuation gives the largest net benefit under the constructed assumptions



The comparison holds a common ten-year appraisal period and a 10% real discount rate, with USD 50 per avoided container-day. Annual equivalent net benefits are approximately USD 0.77 million for scheduling, USD 3.05 million for evacuation and minus USD 5.51 million for berth capacity.

Source: Rhavy Nursimulu, AIC2030; constructed investment comparison, Table 12 and calculation record.

Decision use

Break-even delay values are USD 24.18, USD 24.61 and USD 160.20 per container-day respectively. These values use a different unit from the bars. The illustration is an economic screening calculation; demand, reliability, lifecycle costs, permissions and financial viability require separate evidence.

Key takeaways: Locate the binding constraint before committing capital. Preserve accounting boundaries and avoid double counting. Test weaker demand, continuity obligations and distribution of income. For reflection, use the Chapter decision guide; controlled terms are defined in the glossary.

8 Building the transition

Chapter objectives: Sequence transition around a minimum viable service; assign accountable delivery and review; distinguish a proposed architecture from demonstrated outcomes.

Begin with a service that matters

The transition begins by making a consequential service work reliably. A gateway needs a clear problem, credible evidence and a coalition capable of carrying improvement through. It can establish those conditions at one interface before attempting wider change. This chapter sets out how to activate the architecture, test its consequences and sustain or revise it on the evidence.

Select the first task by consequence and feasibility. A perishable transfer, a recurrent equipment constraint, an essential-import service or a specific export connection can provide a useful entry. The task should matter to identifiable users and have an observable operating outcome. Its scope should be large enough to test the important dependencies and bounded enough to assign responsibility.

The sponsor must have an appropriate mandate to commission the work and convene the necessary participants. A diagnostic mandate records the question, geography, flows, institutions, information access and review arrangements. It does not presuppose the solution. The investigation may support an interface redesign, an asset improvement, maintenance or a different service configuration.

Minimum architecture and evidence gates

Minimum Viable Architecture, or MVA, is the smallest context-specific set of operating conditions sufficient for the selected coordination function to be tested and sustained. Minimum Viable Authority supplies the corresponding decision arrangements. Minimum Viable Gateway Architecture, or MVGA, is the gateway-specific application within the controlled framework. Their boundaries and assessment purposes should remain distinct.

Minimum means sufficient for the service. A cross-border release interface has different requirements from a low-risk schedule information service. The architecture establishes the essential conditions and tests whether they work together. Participation may grow gradually, but a selected task cannot rely on an indispensable permission, receiving service or competence that does not exist.

The programme's indicative windows are retained as planning propositions: baseline at 0–6 months, authority arrangements at 6–18 months, minimum operating architecture at 12–24 months and durable adoption at 24–60 months. These windows overlap and are not empirical delivery forecasts. Evidence, dependencies and competent decisions govern progression.

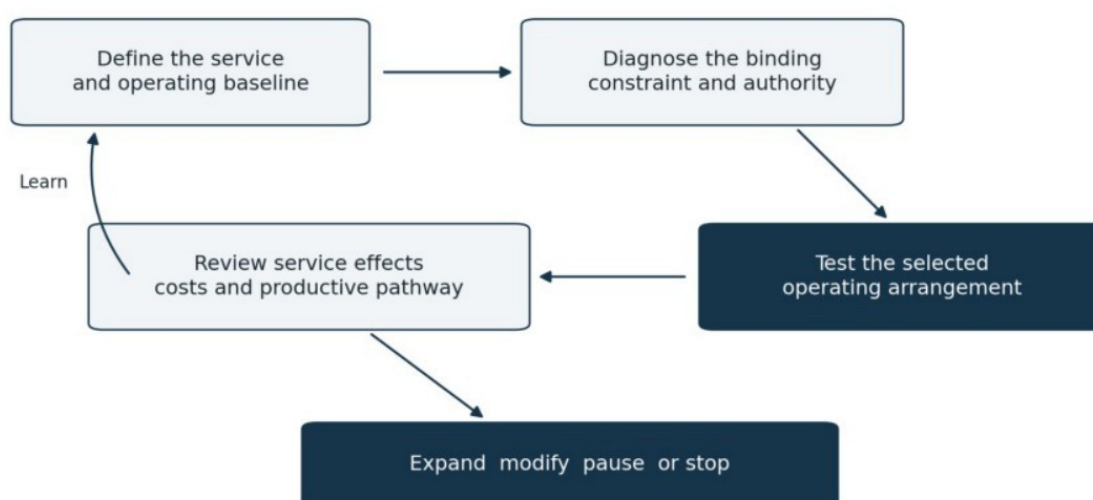
The following release sequence expresses the decision logic. It allows progress, modification, pause or termination as the findings require.

The Economic Consequence of an Architectural Decision

Use Table 14 to connect each material decision to intended users and productive demand, the capabilities required together, competent authority and funded operating responsibilities. Specify the expected service change and productive consequence, with a baseline, review period and evidence proportionate to the intervention. Distinguish directly controlled commitments, jointly influenced results and wider economic effects. Completion of an asset is not proof of its productive contribution. Where outcomes diverge, the competent parties must review assumptions and decide correction, adaptation, deferral or termination, respecting contracts, statutory duties and essential-service continuity. The responsibility records and measurement specifications in the application protocols support these gates; they do not create additional decision authority.

Table 14 Implementation release gates

Gate	Decision to make	Evidence required
Purpose and baseline	Is the problem sufficiently defined?	Users, service boundary and traceable operating conditions
Authority and commitment	Can the necessary participants decide and act?	Competent mandates, commitments, reserved powers and escalation
Operating test	Can the selected service work under real conditions?	Accepted interfaces, competent staff, security, resources and fallback
Economic review	Does the improvement justify its costs and distribution?	Observed service effects and credible productive pathways
Scale and continuity	Should scope expand or change?	Repeatable results, funded lifecycle capability and resolved material exceptions

Figure 13 Operating decisions and the learning cycle

Source: Rhavy Nursimulu, AIC2030; author proposed implementation logic. Progression depends on evidence and competent decisions.

From architecture through activation to justified scale

Architecture establishes the capability, dependencies, authority, operating owner, lifecycle resources and benefits pathway. Activation makes the design work through people, mandates, procedures, contracts, information and operating funds. Scaling is a separate decision: demand, repeatable performance, absorption, continuity and benefits must justify expansion. A commissioned facility or installed platform is a delivery output; its operating capability and productive consequences need subsequent evidence.

The intervention sequence should first consider preventing damaging activity, operating and maintaining existing services better, integration, institutional or contractual reform, and repurposing. Upgrade or construction follows where additional physical capability is justified. Stabilisation, integration, transformation and compounding describe different purposes; a programme may need several in parallel while respecting their dependencies.

Assign a strategic custodian, decision authority, delivery owner, operating owner, interface owners and benefits owner for each material initiative. Agree the baseline, outcome, measurement period, sources, external dependencies and reassessment trigger. The benefits chain follows delivery output, functioning capability, interface improvement, gateway performance, productive outcomes, retention and reinvestment. Failure at a link requires diagnosis rather than attributing all later economic change to the project. (LOGI-CONSULT 2026a sections 5.1–5.8)

Transition architecture and continuity of reform

A transition programme should distinguish immediate stabilisation from structural transformation. Restoring equipment, clearing a recurrent backlog or protecting critical power may be urgent. Changes to mandates, partnership structures, shared platforms and productive investment require a different preparation and adoption sequence. Both horizons should be coordinated so that short-term action supports the longer architecture.

Four forms of continuity are material. Legal continuity establishes the lawful treatment of existing mandates and contracts. Operational continuity protects essential services during change. Digital continuity preserves usable records, interfaces and safe fallback while platforms evolve. Capital continuity addresses funding obligations, investor information and the treatment of existing commitments. These functions turn an ambition for durable reform into specific work.

A delivery structure needs a legitimate sponsor, strategic oversight, a capable technical secretariat and accountable workstream leaders. The source transformation units cover maritime operations, digital integration, productive platforms, capital and territorial development. Their functions can be allocated to existing institutions or purpose-built arrangements where justified. An independent advisory roundtable can contribute continuity and challenge without assuming ungranted public authority.

Sequencing should follow dependencies and readiness. A later phase can proceed when the required capability is demonstrated, material exceptions are resolved and lifecycle funding is credible. Blueprint dates are planning horizons. A current programme needs a refreshed baseline, realistic resources and milestones appropriate to its own starting point. (Nursimulu 2025b, 119–120, 149; Nursimulu 2025a, 173–183, 221–229) For each existing Table 14 gate, retain a dated decision naming the competent approver, accepted evidence, conditions and action owners. Record the source and authorisation of recurring funds, material exceptions, corrective deadlines and closure verifier. A failed test requires correction and retest, modification, pause or termination; the timetable alone does not authorise release. Carry findings into the next operating review.

The political economy of corridor transition

Corridor reform crosses actors whose responsibilities and incentives do not coincide. National governments consider fiscal revenue, employment and strategic control; municipalities bear local costs; operators respond to contracts and commercial demand; inland users need dependable access. A technically coherent proposal may therefore fail without an agreement about benefits, costs and decision rights.

The transition assessment should identify who gains, who bears adjustment costs and which responsibilities or revenue streams change. Distinguish legitimate charges and public obligations from abusive practices. A reform compact should provide lawful arrangements for workforce transition, agency responsibilities, reporting and dispute resolution. It should not compensate illicit rents or presume that all opposition is illegitimate.

Differences in market size can create concerns about hub capture. Smaller economies and inland partners need meaningful participation in service design, evidence review and investment decisions affecting them. Data-sharing arrangements should address confidentiality and lawful control, rather than interpret every limit on disclosure as resistance to transparency.

Small and informal traders require particular attention to fees, documentation, digital access and appeals. Representation and phased compliance can help where properly designed, but formalisation should be assessed against actual access and costs. Early service improvements can demonstrate benefits and sustain cooperation across political cycles. Long-lived assets still require review mechanisms so that continuity does not become protection for a failing design. (Nursimulu 2026c, 485–491)

Installed stewardship and pilots that prove coordination

A stewardship function is installed when people, authority, finance, procedures, accepted records and review mechanisms exist together. A policy statement or a newly named office is insufficient. The installation sequence should identify the host institution, accountable sponsor, operational staff, service commitments and the recurrent budget. It should also explain what happens if a participating institution withdraws or the lead sponsor changes.

Proof of custodianship requires a bounded test of a shared function. A feeder governance pilot can test schedule transparency, interface commitments and fair information access without giving the coordinator authority to set tariffs or allocate cargo. A fiduciary protocol pilot can test disclosure and responsibility without raising funds or providing guarantees. An interface stress test can reveal coordination failures without exposing competitors' commercial strategies. A technical disagreement process can test clarification and mediation while leaving binding legal determination to a competent body.

A route continuity exercise can complement these pilots by testing whether documentation, insurance and finance remain usable when a physical route changes. Each exercise needs an initial condition, named participants, an authorised intervention, evidence and a stop rule. Success should show that the shared function works within its authority. It does not by itself validate every investment, technology or development claim in the larger programme.

Programme stages can move from formation and validation to scaling, normal operation and renewal. These describe the life of an intervention; they are distinct from the five corridor development levels, gateway maturity stages and port capability model. Progress should depend on evidence rather than an assumed five-year timetable. Scaling requires confirmed demand, affordable recurrent operation and demonstrated institutional capability. Renewal includes a right to redesign or conclude a function whose purpose is no longer served. (Nursimulu 2026e, 328–336, 343–365)

The controlled operating test

The Sovereign API Sandbox is one possible setting for a bounded operating test. It specifies the flow, participants, records, access rights, decision owners and acceptance criteria. It also defines what will happen when a participant, record or connection is unavailable. The sandbox tests an authorised service; the name does not exempt it from applicable requirements.

The test should follow actual work. Select representative transactions, establish milestone definitions, observe execution and record exceptions. Introduce credible disruption scenarios where safe and authorised. Compare the result with the baseline or another justified reference. Participants need to know which commitments are experimental and which remain normal operating obligations.

Partial adoption is an important test condition. A shipment can reach a non-participating operator or jurisdiction. An enterprise can lack the technology assumed by the workflow. A public agency can provide only part of the information requested. The design must explain where the new service ends and how the remaining journey proceeds without misleading users about its coverage.

A failed test can be productive when it identifies a decisive dependency before expansion increases exposure. Record the cause and distinguish technical error, missing authority, weak competence, inadequate receiving capacity and commercial resistance. The response may be correction, reduced scope, a different model or a decision to stop. Scale is an outcome of evidence, not an obligation created by the pilot.

What Abidjan contributes to the argument

The World Bank's 2019 completion report for the Côte d'Ivoire phase of the Abidjan–Lagos programme reports port dwell falling from a 2012 baseline of 14 days to 11 days in 2018. It describes complementary reforms and investments alongside the GUCE single window. Its border passage pairs a 37-hour baseline, a 14-hour endpoint and a 48.6 per cent reduction that do not reconcile arithmetically.

That effect is not adopted here as a verified estimate. (World Bank 2019, 14–15)

The case provides an important counterweight to an overextended architectural claim. Established reform programmes can improve gateway performance through combinations of institutional work, infrastructure and operating change. AIC2030 needs to explain the decision value it adds to that work. It cannot claim every observed gain as evidence of its own model, nor dismiss useful improvement because it was delivered under another approach.

Our architectural reading asks how the interventions were connected, which dependency governed the next improvement and whether the result became usable market access for particular enterprises. Those are further questions for application. The reported dwell change answers an operational question at a defined scope. Evidence about enterprise capability, retained value and reinvestment would require additional records.

The inconsistent border presentation also shows why source discipline matters to strategy. Selecting whichever figure produces the strongest narrative would create a misleading basis for investment and comparison. The appropriate response is to preserve the uncertainty, seek reconciliation and continue with findings whose meaning can be established. A disciplined architecture must be able to carry an unresolved fact without building a conclusion on it.

Measurement from operation to productive consequence

Identify the level supported by each observation: funding and equipment are intervention inputs; an executable hand-off is operating capability; delivery reliability is service performance; and stronger processing or enterprise capability is a productive outcome.

Match the measurement to the decision and the claim. Apply the series evidence convention and distinguish claim status from input quality. Examine variation and critical interfaces: a port-wide average may conceal a failed inland connection or users facing the longest delays.

Productive effects need a stronger causal account. Trace the service change to enterprise behaviour and examine other explanations such as demand, exchange rates, power, regulation or investment undertaken independently. Where a credible counterfactual is feasible, use it. Where it is not, state a bounded contribution claim supported by the available evidence.

The application protocols specify the evidence codes, indicator records and independent-review requirements. These make the calculation and judgement examinable while allowing the main argument to follow the progression from a functioning service to productive capability.

Stress transmission and demonstrable development outcomes

Disruption travels through several economic channels. Interrupted supplies can stop production directly; delivery uncertainty can cause lost orders, higher inventories and working capital needs; financing conditions can change as risk perceptions worsen. The relative importance of these channels depends on the service and economy. Capital mediated transmission is an important hypothesis to test alongside physical and productive effects, rather than a universal explanation that displaces them.

Before a disruption, stewardship can establish accepted information, contact points, decision rights and alternative arrangements. During disruption, it can help participants recognise the event, coordinate authorised responses and identify where a decision is blocked. Afterward, it should support a documented return to workable service, settle outstanding operational questions and incorporate lessons. Coordination can reduce particular losses but cannot remove all risk or ensure that every party retains its previous position.

The performance account should connect leading service indicators with development outcomes. Schedule reliability, interface response times, accepted documentation and payment continuity describe system function. Repeat enterprise participation, capability acquisition, supplier development, retained value, ecological condition and distribution of benefit describe economic and social consequences. Report them separately before explaining their relationship. More transactions, larger funds and higher asset values do not automatically establish improved African productive capability.

Every material impact claim should identify the causal pathway, baseline, evidence and other influences. Claimed avoided losses require an explicit scenario and uncertainty range; they should not be added to observed income as though both were realised cash flows. Environmental and social benefits require their own assessments, safeguards and engagement. The architectural proposition becomes stronger when its evidence can identify where it worked, where it failed and what must change. (Nursimulu 2026e, 50–52, 72–77, 231–237, 366–371)

An integrated performance and learning architecture

The blueprint corpus proposes several measurement instruments. OPI examines operating pressure. Corridor performance dashboards examine service, trade, digital, environmental and participation conditions. The SEZ Sovereignty Index explores productive, industrial, logistics, digital, financial, environmental and human capabilities. The Corridor Livability Index addresses accessibility, services, environment, culture and opportunity. Their purposes should remain visible without multiplying headline scores prematurely.

A practical gateway programme can organise measurement in three connected layers: operating condition, system service performance and productive outcome. It should retain domain measures, critical exceptions and the experience of different users. An improved average should not hide a failed essential interface or the exclusion of smaller participants.

The later controlled frameworks govern their respective assessments. The proposed SEZ index in the Durban source should not displace the SEZ Framework v0.9 diagnostic or be presented as independently calibrated. Index development requires definitions, indicator selection, weights, missing-data rules, sensitivity analysis and application evidence. Financial-centre affiliation should not itself earn a higher score.

The learning cycle joins observation, assessment, prioritisation, alignment, delivery, measurement, learning and reinvestment. Annual reviews should examine benefits, failures, maintenance, retained capability and the next constraint. A shared register of decisions and unresolved findings allows future teams to understand why the programme changed and what evidence supports the next step. (Nursimulu 2025b, 148–149; Nursimulu 2025a, 128–130, 184–187, 203–204, 228)

Credibility and funded delivery

A gateway's credibility should be supported by repeatable performance, transparent reporting and evidence of recovery under stress. Promotion can communicate these results but cannot substitute for them. Published findings should include failures, exclusions and unresolved issues. Trust depends partly on whether users can distinguish a commitment, an operating result and an independent verification.

Delivery arrangements require a funded implementation capability. Specify project preparation, operating staff, technical support, procurement responsibilities and the cost of maintaining shared services. Use existing institutions where they can perform the task. A proposed transformation office or coordination platform needs a necessity test, a mandate and resources; its creation is not evidence of execution.

The dependency register should link investment milestones to usable services and enterprise readiness. Reviews should examine operating performance, productive participation, capital exposure and environmental limits, with correction assigned to a responsible actor. Reporting frequency should match the service and decision, rather than import a universal timetable. Better performance may support confidence, but any effect on financing terms or creditworthiness needs separate evidence. (Nursimulu 2026c, 376–383, 464–478)

Different African pathways

The configurations developed in Chapter 1 lead to different transition priorities. Transit gateways may begin with port-to-border interfaces and inland access; industrial gateways with production inputs, specialised logistics and exports; island gateways with domestic continuity, maritime frequency and selected ocean services; and smaller coastal gateways with local or regional functions. A common decision discipline accommodates those different starting points.

Regional gateway assessment should identify both competition and complementarity. Ports can compete for overlapping cargo while cooperating on safety information, continuity, selected standards or feeder services. Additional capacity can improve choice and resilience, but duplicated ambitions can also create liabilities. The economic case needs the relevant market, network and investment evidence.

Corridor sovereignty concerns the legitimate capacity to preserve trade access, control authorised information, maintain continuity and retain strategic choice. It does not imply a single sovereign corridor jurisdiction across states. Agreements need to respect each participant's powers, commercial interests and public obligations. Economic diplomacy helps negotiate those relationships where operational interdependence crosses political boundaries.

The proposed horizons of activation towards 2030, stronger institutional adoption towards 2035 and long-term development towards 2050 express an orientation. Each gateway needs its own reachable role and sequence. Durable progress comes from useful services, competent institutions and sustained commitment that can survive changes in personnel and government.

A transit gateway requires an explicit inland perspective. Producers, traders and public institutions in landlocked economies need a voice in the service requirements and in the evidence about the complete journey. A waterfront improvement can coexist with an unreliable border or inland connection. Reciprocal commitments should specify the responsibilities at those interfaces and the route for resolving a failure across-jurisdictions. The architecture's economic boundary follows the users served, while authority remains grounded in each jurisdiction.

An island gateway requires a different form of reach. Frequency, cargo balance, receiving capability and continuity of essential imports can matter more than an extended land route. The seafood scenario demonstrates why the ocean partner and its inland distribution must appear in that assessment. An industrial gateway adds another dependency: productive sites and firms must become usable alongside the maritime service. A smaller coastal gateway may support domestic distribution, fisheries and selected regional activity through a deliberately modest infrastructure programme.

Network resilience extends beyond the reliability of one corridor. A disrupted gateway can send users towards an alternative whose spare capacity, access arrangements and service availability must be verified. The design should compare plausible policy changes, maritime interruptions and loss of a key provider through scenarios with defined exposure and duration. Cooperation on accepted information and continuity can preserve options while gateways retain commercial competition. Test these anticipatory and diplomatic arrangements against the network's actual service alternatives.

A regional portfolio of complementary gateways

Assessment should distinguish port-to-port performance, end-to-end gateway competition and regional system coherence. The competitive field follows overlapping cargo segments, shipping networks, inland markets and customer substitution possibilities. Geographic proximity alone does not establish direct competition. A deep-sea gateway, specialised coastal port, feeder service, river node, dry port and productive platform may perform complementary functions.

Declared hub ambitions require evidence of network position, capturable demand, service frequency, corridor capability, operator commitment, competitive response and feasible capital. Shared information on safety, definitions, skills, continuity and investment dependencies can support regional coherence while ports retain commercial autonomy. Cooperation must preserve lawful competition and protect confidential data. A neutral regional observatory is a possible means to compare performance and project pipelines; it does not determine commercial prices or allocate customers. (LOGI-CONSULT 2026a sections 9.1–9.6 and 9.13)

Durability challenge and the programme instruments

Temporal architecture protects useful cooperation while preserving the ability to learn and change. The earlier term Irreversibility expresses an aspiration for durable progress, not immunity from lawful review or exit. Agreements should establish renewal, correction, succession, termination and treatment of shared records and assets. An arrangement is stronger when it can adapt without losing its essential service.

Challenge the architecture against simpler repair, targeted asset investment, alternative service configurations and doing less. Test demand risk, capture, coordination cost, cyber exposure, labour effects and unequal participation. Its value rests on improving the choice under these tests.

AIC2030's instruments perform different functions. Doctrine establishes organising principles. The gateway framework supplies the controlled assessment architecture. Strategic Blueprints apply the architecture to place. Practice Notes develop particular tasks. Diagnostics and measurement instruments make conditions observable. Dialogue supports institutional understanding. This thematic monograph explains the connected proposition to a wider professional and policy readership.

The Non-Substitution Principle preserves those distinctions. A monograph does not replace feasibility, engineering, procurement, statutory appraisal or project delivery. A blueprint does not confer a mandate. A platform does not create public authority. Equally, financing an isolated project does not resolve the relationships on which its usefulness depends. The instruments should support competent execution at the appropriate level.

The future we are architecting

The port model proposed in this monograph answers a practical economic question: how can maritime access help African enterprises and territories become more capable? The answer begins with dependable operations at sea and at the quay. We propose the African Fifth-Generation Port as a maritime institution that anchors an intelligent corridor and connects that operational competence to productive opportunity. Its economic role extends through ocean services, inland connections, productive locations and the people able to use them.

The five capabilities organise the port's contribution to that wider economy. Maritime and operational excellence provides the foundation. Gateway integration and decision intelligence make connected services usable; productive value creation gives them an economic purpose; custodial and compounding leadership sustains their capability and learning. Authority and operating commitments make coordination possible. Digital systems support those relationships, but their presence alone does not establish an intelligent gateway. Investment must support usable services and their continuing obligations.

The corridor's economic reach extends across the shore. Fisheries, marine engineering, ocean knowledge and other viable blue activities connect maritime resources to enterprises, markets and professional capabilities. BlueTech can support observation, assurance and applied learning within those relationships. Energy investment must respond to actual service and productive demand, with reliable supply, lifecycle resources and ecological limits. Decarbonisation remains essential to the proposed direction, while the economic ambition extends to the value these services enable people and firms to create.

Productive Yield asks whether the resulting activity creates value and develops capability. The value cycle connects creation and transformation with retention, circulation, reinvestment and compounding. Faster movement is useful when it supports such outcomes; throughput or an operating saving alone cannot establish them. Repeat commercial participation, stronger suppliers, applied knowledge and the renewal of productive assets provide pathways through which a dependable gateway can contribute to an economy that becomes more capable over time.

The continental contribution is a common architecture with differentiated applications. The four gateway configurations show how its relationships can serve different economies, with evidence and unresolved questions stated separately. Their transfer depends on each gateway's reachable role, markets, institutions and ecological conditions. Public, tool, landlord and private arrangements, including concessions and joint ventures, must be assessed through their actual rights, obligations and capacity to sustain service. People, governance and capital are integral to the productive model, not additions to a technology programme.

Application can begin with a bounded service that has an identifiable user, a baseline, responsible participants and a credible funding commitment. Test the service, follow its productive consequences and revise the design when evidence requires it. That work provides a practical entry into the wider transformation of the gateway economy. Successive applications can establish where the proposed relationships improve decisions and where they need adaptation.

The contribution of this monograph is to connect the future of the African port to the development of the economy it serves. The proposed Fifth-Generation Port anchors the land–port–ocean continuum so that reliable maritime access supports enterprise capability, retained value and further productive investment. This is the direction of the transition from smart ports to intelligent trade corridors across Africa.

Key takeaways: Start with a bounded service and usable commitments. Expand against evidence of capability. Preserve learning, lawful authority and funded stewardship beyond the initial project. For reflection, use the Chapter decision guide; controlled terms are defined in the glossary.

Gateway applications and comparative cases

This volume develops the maritime gateway applications of Port Louis, Mombasa, Durban, Abidjan–Lagos and Tanger Med. Re-Architecting African Freight develops the complementary inland-flow, short-sea and implementation questions; the two treatments address different decisions (Nursimulu 2026f).

This volume develops the maritime-gateway and ocean-economy applications; Re-Architecting African Freight develops complementary movement and productive-system questions. Repeated geographies serve these distinct analytical purposes. The four blueprint applications configure the same five port capabilities for ocean services at Port Louis, productive transit through Mombasa, Durban’s industrial spine and the distributed Abidjan–Lagos system. Each identifies purpose, operating relationships, authority, investment and evidence. The seafood demonstration develops a conditional service decision; Tanger Med and the July 2021 Durban disruption add external comparison and historical stress analysis.

The applications draw on the author’s strategic blueprints. Dated operator and observatory reports support their stated observations. Configuration proposals and numerical demonstrations illustrate design and assessment reasoning; field records are needed to establish achieved capability, productive effects or gateway-wide conclusions.

A worked seafood service from ocean to market

This demonstration develops the seafood design scenario used in Chapters 3 and 7. It is illustrative, not an observed enterprise case or a claim of measured impact. Its numerical assumptions are constructed solely to show the decisions and accounting. The dated Port Louis operating observations in the following application are separate evidence and are not inputs to these calculations.

In this illustrative scenario, the operating question is whether refrigeration interruptions or missed receiving and shipping windows prevent an accepted delivery. Processor and event records must distinguish the causes. Equipment faults point first to maintenance and backup; mismatched but feasible windows to a service agreement; an unresolved lawful decision to institutional correction; and missing or unreliable event information to an information-system improvement. Additional cold storage or berth capacity requires evidence of a residual physical constraint. Remedies may need sequencing or combination; the demonstration does not assume that coordination can compensate for unavailable capacity.

For the operating design, the processor declares critical loads, allowable interruption and product-handling requirements. The utility and maintenance providers accept only commitments they can deliver; transport and storage providers confirm capacity. The investment comparison includes upkeep, operating staff, energy, replacement and contingency costs. A larger shared installation needs credible demand and connection rights beyond this single shipment.

The port and its partners then establish the service relationship. Marine-service providers and competent nautical decision-makers confirm a feasible vessel window; the terminal confirms handling and reefer capacity. Cargo collection requires the applicable public release and the receiver’s acceptance, not discharge alone. The processor declares receiving and dispatch requirements; the energy operator accepts its supply obligation; transport providers confirm feasible collection and delivery. Named decision owners act on changes. A revised time becomes a commitment only when the affected parties accept it. The shared information arrangement protects commercial confidentiality and records what changed, who decided and what followed.

Productive participation is designed into delivery. A capable local contractor may maintain electrical equipment, another supply compliant packaging and another provide refrigerated transport. Where capability is missing, a bounded progression arrangement specifies training, supervised work, performance acceptance and a subsequent commercial opportunity. Procurement expenditure is recorded alongside supplier competence and the ability to serve additional customers.

BlueTech can contribute where the diagnosis establishes a need for reliable aquatic observations or product condition measurements. For example, a validated monitoring service could inform the processor's handling decision and supply evidence for an accepted assurance record. TradeTech can connect that record to the consignment and the market transaction. The trial should test measurement quality, decision use, maintenance and user acceptance together; a sensor reading alone does not establish product compliance or market access.

The numerical illustration below compares two possible service arrangements for one consignment. It holds the financed principal and annual financing rate constant. It assumes that a change in the receiving and dispatch plan reduces financing days while changing direct service expenditure. The assumptions are not targets for Port Louis, quoted prices or estimates of a real project's return.

Table 15 Illustrative consignment assumptions and arithmetic

Variable	Initial arrangement	Revised arrangement
Financed principal	USD 100,000	USD 100,000
Annual simple financing rate	12%; actual days / 365	12%; actual days / 365
Days financed	27	20
Direct logistics and coordination cost	USD 9,500	USD 9,200
Financing cost	$100,000 \times 0.12 \times 27 / 365 = \text{USD } 887.67$	$100,000 \times 0.12 \times 20 / 365 = \text{USD } 657.53$
Combined service and financing cost	USD 10,387.67	USD 9,857.53
Illustrative difference	Reference arrangement	USD 530.14 lower: USD 300 service cost plus USD 230.14 financing

The USD 9,200 revised direct cost can be read as USD 9,500 plus USD 700 of coordination expense less USD 1,000 of avoided handling or storage. These are assumptions, not a provider quotation. The USD 530.14 difference is a consignment cost comparison, not additional national value added, a return on investment or released principal. Fees, foreign exchange, tax, capital expenditure and changes in product losses are excluded and would need separate appraisal.

Holding the USD 300 direct saving constant, reducing the financing rate to 6% lowers the combined saving to USD 415.07; increasing it to 18% raises the saving to USD 645.21. With no reduction in financing days, only the assumed USD 300 direct saving remains. Any new recurring service or capital charge must be compared with these benefits rather than financed on the apparent time gain alone.

Table 16 Responsibilities and evidence in the worked service

Interface	Decision owner or responsible party	Evidence to retain
Arrival and transfer	Competent nautical actors confirm feasible vessel movement; carrier and terminal confirm windows; transport and receiver accept transfer.	Nautical acceptance, arrival revisions, handling and reefer readiness, release status, booking, actual pickup and receipt.
Production continuity	Processor sets critical requirements; utility and maintenance providers deliver contracted services.	Load and interruption records, repair response, product- condition and rejection records.
Assurance and acceptance	Competent authority or recognised assurance body decides within its mandate; buyer accepts contractual conformity.	Document validity, test method, recognition basis, correction and dispute record.
Finance and settlement	Finance provider decides credit; buyer and seller perform the agreed payment terms.	Eligible claim, principal, currency, fees, financing dates and settlement.
Exception and recovery	Affected parties revise their commitments; coordinator records and escalates without taking over statutory powers.	Options considered, authorisation, added cost, revised promise and recovery time.

A missed outbound sailing illustrates the stress test. If the revised arrangement adds seven financing days, the assumed financing saving disappears at the same rate and principal. Additional cold storage, insurance and handling may also change the comparison; their amounts are not assumed here. Participants must verify an alternative sailing or reception option, its cargo suitability, legal permissions and actual capacity. If no feasible alternative exists, they revise the buyer commitment rather than report nominal route redundancy.

From operating savings to productive capability

The USD 530.14 comparison identifies one operating benefit within the assumed consignment. The wider productive pathway depends on what a dependable service allows the enterprise to do. If reliable handling, assurance and delivery allow the processor to honour repeat orders, it could use its equipment and workforce more consistently or undertake additional processing for a reachable buyer. Those opportunities still require demand, suitable production capability and accepted product standards. Their value cannot be inferred from the consignment saving.

Supplier development provides another connection. A maintenance contractor that learns to diagnose and repair refrigeration equipment could retain technical competence and serve other firms. Packaging and transport providers could improve their own delivery capability through repeat commercial work. The port's contribution is to connect dependable maritime access with those enterprise services, while BlueTech and TradeTech can support the knowledge and assurance the chosen task requires. Capability persists when people, equipment, accepted practices and commercial opportunities remain usable beyond the first shipment.

The Port Value Account developed in Chapter 7 distinguishes direct service value added, additional enterprise activity enabled, and where income and capability remain. Processor value added follows output less intermediate consumption within a defined boundary. Packaging, repair and transport invoices are evidence of commercial relationships, not amounts to add again to processor value added.

Resident income, imported inputs and reinvestment require their own records. BlueTech observations and TradeTech records support accepted decisions only when measurement quality, recognition and rights are established.

Retention and reinvestment require decisions as well as a functioning service. A lower bill may benefit the processor, be passed to its customer or reflect lower income for another provider. It does not automatically become additional local income or an investment budget. Where viable activity generates retained income, enterprises could allocate some to maintenance, staff development or productive upgrading, subject to their costs and obligations. Further investment may require finance beyond the operating saving. Compounding would mean that retained skills, service capability and reinvestment support subsequent productive activity; evidence must trace that progression across repeated cycles.

An empirical application would need matched consignment events, temperature and energy records, invoices, payment dates, supplier outcomes and a credible comparison period. Changes in fish prices, order size, product mix and seasonal conditions could explain results independently of coordination.

Until those records are obtained, this example demonstrates a method of decision and accounting; it does not validate an economic impact.

Finally, test a supply outage, changed sailing and loss of a major buyer. Determine which services continue, which commitments change and who bears the cost. Review whether energy and supplier capabilities remain useful to other enterprises. This is the connection between the port's wider economic role and corridor intelligence: an authorised, adaptive service linking ocean activity, productive territory and trade, with evidence of what remains after the transaction.

Port Louis and the ocean economy gateway

Role and scope. The Port Louis blueprint proposes an island gateway connected to an ocean hinterland, productive services and capital capabilities. Its future-port role joins dependable maritime access to seafood, maritime engineering, regional services and productive intermediation. A seafood transaction offers one bounded application: landing or imported supply, handling, processing, assurance, storage, shipping and payment must form a usable service. This is a selected design relationship, not a claim that every seafood business uses an identical chain. (Nursimulu 2026e, 136–147, 185–200)

Operating configuration. The proposed port would organise compatible vessel and enterprise service windows, access to specialist facilities, and dependable connections with regional partners. Maritime engineering requires technicians, spares and maintainable equipment; seafood requires suitable handling, assurance, energy and market access. Ocean research and BlueTech can support the knowledge these activities need. Decision intelligence connects changes in arrivals, product condition or receiving capacity to the parties able to respond. The resulting service ecosystem extends the gateway's contribution beyond moving cargo.

Authority and investment. Port institutions would sustain maritime access and shared interfaces within their mandates, while operators, enterprises and competent authorities retain their respective responsibilities. Common facilities, dependable energy and shared operating services need identified funding and upkeep; processing, engineering and other enterprise investments need their own demand and revenue case. Capital intermediation can help prepare and connect these requirements to appropriate investors. The port's custodial contribution is to maintain the relationships and continuity arrangements through changes in operators or projects.

Constraint and proposed intervention. Begin with call and consignment records to distinguish waiting for a berth from waiting for cargo, a connection or another service. Link a selected seafood enterprise's usable delivery window to the vessel and receiving plan. Compare scheduling or interface changes with additional physical capacity before selecting investment.

Value creation pathway. Dependable ocean services could support repeat processing orders, specialist engineering work and a stronger local supplier base. Identify processing and service value added in a defined geography, resident income, imported inputs and capability retained for later production. Test whether greater reliability changes reject rates, repeat orders or working capital needs. The vessel time comparison supplies no measured answer to those questions.

Continental relevance. Other island and coastal gateways can adapt the connection between maritime reliability, selected ocean services and productive intermediation. The appropriate portfolio follows their own demand, ecological conditions, technical capability and partnerships; it need not reproduce Port Louis's institutions or financial role.

Evidence. MPA reports average vessel time falling from 45.9 hours in FY2023–2024 to 39.4 in FY2024

-2025. Berth time fell from 32.2 to 31.9 and pre-berthing delay from 13.7 to 7.5. Subtraction locates 6.2 of the 6.5 hour reduction before berthing; it does not identify a cause or establish seafood outcomes. (Mauritius Ports Authority 2026, 82–83)

Evidence boundary. The published averages support an operational baseline. Transaction-level integration, authorised decision changes, productive retention and sustained stewardship remain to be demonstrated for the chosen service. The configuration is a design proposition; the following capability record identifies the evidence needed to examine its operation.

Table 17 Port Louis capability and evidence record

Port Louis capability	Finding and next evidence
Maritime excellence	Partial operating evidence; call distributions and cargo specific reliability needed.
Gateway integration	Proposed seafood interface; verify actual handoffs and receiving commitments.
Decision intelligence	Demonstrate a recorded decision changed by accepted information.
Productive value	Measure enterprise value and retention; no estimate inferred from vessel hours.
Custodial leadership	Verify recurrent funding, role separation and tested continuity.

Completing the Port Louis service decision

[S] [P] The following decision sequence applies the seafood demonstration to the Port Louis configuration. It runs from lawful supply or landing to accepted delivery and payment, connecting maritime access, handling, processing, assurance, refrigeration, transport and the buyer. It remains a constructed design, not an observed enterprise intervention. Published vessel-time observations provide separate operating context and are not inputs to the consignment calculation.

Begin with the processor's delivery commitment. Establish product requirements, accepted assurance, latest receipt and dispatch times, critical energy loads and the consequence of missing a sailing. Match these to vessel, terminal, utility and transport records. Compare refrigeration failures, unavailable receiving capacity, clearance and handling delays before choosing additional cold storage or berth capacity. The demonstration assumes a service-planning improvement; a field assessment must establish whether this is the binding constraint.

Maritime and Operational Excellence requires dependable vessel access and safe handling. Gateway Integration connects the processor's windows to terminal release, transport, energy and destination readiness. Gateway Decision Intelligence names who may revise the plan and whose confirmation makes the revision usable. Productive Value Creation examines repeat orders, processing and supplier opportunities. Custodial and Compounding Leadership maintains equipment, competent staff, accepted procedures and recurring finance across operating cycles. These are proposed responsibilities to establish through existing institutions, not evidence of an already functioning new authority.

Assign commercial commitments to the participating enterprises and operators, public decisions to the competent authorities and supply obligations to the relevant providers. Any shared coordinator needs a bounded mandate, information permissions, escalation procedure and recurring funding. The processor's investment, shared infrastructure and service coordination have different cash flows and loss bearers. A trial budget should distinguish setup, normal operation, maintenance and contingency, identify its funding source and cap exposure before activation.

Use the USD 530.14 constructed difference within the limits established in the consignment demonstration. It represents assumed direct service and financing effects, not an investment return, released principal or national value added. A field application must reconcile output and intermediate consumption through the Port Value Account, trace resident and non-resident income, supplier competence and reinvestment, and record rejected product, shifted costs and displaced provider income. No productive outcome is inferred from the saving.

OPI may support the terminal diagnosis only when its required raw observations, definitions and calibration are available. The unresolved berth-occupancy series prevents a defensible measured Port Louis headline in this application. Withholding it is an explicit finding, not an omission to fill with the constructed 7.1. Track shipment reliability, thermal excursions, receiving failures and missed sailings separately; a terminal pressure index cannot substitute for the complete service record.

[P] The decision in this constructed demonstration is to proceed with preparation of a bounded service trial, conditional on verified demand, essential permissions, accepted participant commitments, a funded continuity plan and a practicable recovery route. This is the author's design conclusion, not institutional approval or a finding of actual gateway readiness. Defer wider capacity investment pending diagnosis and appraisal. Redesign or defer the trial if its conditions cannot be satisfied.

Before activation, participants should agree a test period covering the relevant demand and sailing conditions, an expenditure ceiling, comparison method and service thresholds. Stop or suspend unsafe operation, loss of a necessary permission, failure of essential assurance or inability to preserve the product. Review accepted deliveries and productive consequences against the baseline, including market and seasonal changes. Scale only when the service works repeatedly, its recurring costs are supportable and the capability remains usable beyond one transaction. The demonstration reaches a conditional decision while leaving empirical validation open.

Mombasa and the transit gateway

Role and scope. The Mombasa blueprint connects maritime access to the Northern Corridor and productive users in inland economies. The assessment unit should be a specified transit service to a named enterprise or location, rather than all cargo passing through the port. Its purpose is dependable access that enables production and trade within the inland partner's economy. (Nursimulu 2025b, 29–43, 50–61, 68–74) Operating configuration. The proposed gateway would connect vessel and terminal plans to inland reception and the production requirements of corridor users. Testing, assembly, consolidation, repair and distribution could add productive functions along that journey where enterprise demand supports them. Coastal maritime services and BlueTech relationships give the gateway a seaward productive dimension alongside its inland role. Decision intelligence would allow the responsible institutions and operators to respond to changed clearance, collection or receiving conditions before they interrupt the enterprise service.

Authority and investment. The coastal gateway and inland partners would agree service responsibilities, accepted information and escalation arrangements while retaining their separate powers. Port, transport, utility and platform investment would be linked to the same productive requirements. Enterprises would finance their own processing and service capabilities, with working capital considered alongside fixed assets. A funded joint review arrangement would give inland users a continuing voice and keep interface commitments usable beyond a single project.

Constraint and proposed intervention. Trace the selected consignment through discharge, release, collection, border processes and acceptance at its productive destination. A faster port exit can move the delay to a depot or border. The service commitment must identify which institution acts on each event and what the inland user can expect when the plan changes.

Value creation pathway. More dependable component and input supply could support inland production, while consolidation, testing and suitable shipping services could extend access to buyers. Test whether the service enables more dependable input supply, market access or production at the inland location. Measure income and capability in that territory as well as at the coast. Transit throughput is not a sufficient measure of shared productive benefit.

Continental relevance. The transferable proposition is a gateway-inland partnership organised around productive use. Other transit gateways can adapt it to their own border arrangements, enterprise geography and maritime services, with benefits examined in the landlocked economy as well as at the coast.

Evidence. The Northern Corridor dashboard reports containerised import dwell of 83 hours for July-September 2025, compared with 99 in the matching 2024 quarter. It excludes consignments delayed beyond 21 days for compliance or legal reasons. Pre berth waiting was 14 hours compared with 24; the measure includes waiting at a vessel's convenience. These are distinct populations and measures. (Northern Corridor Transport Observatory 2025, 5–8)

The same dashboard reports road transit averaging 85 hours from Mombasa to Malaba in July-September 2025, against 77 in the matching 2024 quarter, while Mombasa-Busia fell to 59 hours from 79. The divergent route observations show why improved port dwell cannot establish improvement throughout the corridor. These series are not matched consignment journeys; they cannot be added to dwell time to construct an enterprise delivery baseline. (Northern Corridor Transport Observatory 2025, 11–12)

Evidence boundary. The dashboard supports a defined operating baseline but does not isolate the selected transit enterprise's journey or causal productive outcome. The next test requires linked consignment records and inland partner participation. Aggregate improvement should be reported alongside excluded cases and service variability, with a separate account of unresolved failures.

Table 18 Mombasa capability and evidence record

Mombasa capability	Finding and next evidence
Maritime excellence	Published waiting and dwell observations; retain definitions and exclusions.
Gateway integration	Verify the entire transit service and inland acceptance.
Decision intelligence	Link clearance and dispatch information to authorised changes.
Productive value	Establish inland enterprise outcomes and geographic distribution.
Custodial leadership	Verify joint service review, escalation and funded continuity with inland partners.

Durban and the industrial gateway

Role and scope. Durban OceanGate proposes an industrial gateway connected to the Durban- Gauteng spine and regional productive networks. A component supply service to a named manufacturer is a suitable assessment unit. It connects terminal performance to production requirements, freight services, working capital and continuity. The proposition is grounded in the blueprint's industrial spine; the selected manufacturer remains an application to establish. (Nursimulu 2025a, 140–161)

Operating configuration. The proposed industrial gateway would connect dependable marine and terminal services to evacuation, inland platforms and factory receiving plans. Maritime engineering and equipment maintenance would support both port reliability and a skilled service economy. Energy and utility arrangements would serve productive demand as well as cargo handling. Decision intelligence would connect changes in vessel arrival, equipment availability and factory requirements to feasible operating responses. The industrial spine would thereby be designed around production continuity and supplier capability, rather than throughput alone.

Authority and investment. Port and terminal responsibilities would be connected to transport operators, industrial users, utilities and territorial institutions through explicit commitments. Maintenance and renewal funding would sit alongside investment in usable rail, road, platform and factory interfaces. Ownership, concession or partnership choices would be examined for the capabilities and continuity they sustain. Common services need an accountable custodian; productive enterprises and capital providers retain their own commercial decisions and risks.

Constraint and proposed intervention. A single average would obscure the divergent terminal changes. Diagnose the chosen terminal, cargo and period, then connect cargo availability to collection, linehaul and the factory's latest acceptable receipt. A faster ship operation has limited productive value if evacuation or destination readiness remains the binding constraint.

Value creation pathway. More dependable access could reduce interruption and allow manufacturers and service firms to undertake more demanding work. Examine production interruptions, usable inventory, service costs and changes in supplier capability. Any estimate of avoided loss requires a stated comparison and alternative explanations. Maintenance capability, local engineering and supplier development can form part of the retention account if their contribution is evidenced.

Continental relevance. Other industrial and resource gateways can adapt the connection between port recovery, energy, productive territory and enterprise capability. The useful sequence depends on the constraint affecting production; neither Durban's modal ambitions nor its proposed institutional arrangements become continental requirements.

Evidence. Transnet Port Terminals reports FY2024–2025 ship working hour productivity of 36 moves at

DCT Pier 1, compared with 34 previously; Pier 2 recorded 37 compared with 38. These are ship working hour measures, not gross crane productivity or a port-wide congestion index. (Transnet 2025, 10–11)

Evidence boundary. The terminal observations support differentiated diagnosis. They cannot establish the original OPI's raw inputs or score, demonstrate factory outcomes or justify a current gateway-wide generation designation. Calibrated operating evidence and a connected enterprise record are required. The original OPI illustration remains an illustration and is not used as a measured Durban baseline.

Table 19 Durban capability and evidence record

Durban capability	Finding and next evidence
Maritime excellence	Terminal specific productivity observations; verify full service distribution.
Gateway integration	Demonstrate connection from release to factory acceptance.
Decision intelligence	Record responses to arrival, equipment and receiving changes.
Productive value	Establish production, inventory and retained capability effects.
Custodial leadership	Verify maintained interface commitments, skills and continuity arrangements.

Abidjan–Lagos and the distributed maritime productive corridor

Role and scope. The Abidjan–Lagos Atlantic Corridor blueprint proposes a coastal productive system linking the Abidjan, Accra–Tema, Lomé, Cotonou–Porto Novo and Lagos areas, their maritime services and inland relationships. This fourth application illustrates how the same five port capabilities would be configured across several gateways and jurisdictions. Its subject is a proposed distributed maritime- productive system, rather than one port expanding its authority across the coast.

Configuration proposition. The blueprint explores differentiated combinations of industrial transformation, transshipment, distribution, inland access and metropolitan demand. These functions are hypotheses to test with firms and institutions, not exclusive assignments to cities. A common service architecture could connect coastal and inland production while retaining port competition and national authority. Shared safety information or continuity arrangements do not require common commercial ownership.

Operating configuration. Each participating port would provide dependable maritime services and connect its users to the productive functions the chosen service requires. Inland production, coastal suppliers and selected maritime connections could form complementary relationships without fixed assignments to cities. Shared information would support authorised decisions about reception, dispatch and disruption. Supplier development, processing and technical services would give the connections productive depth; continuing interface review would sustain them. Blue Economy activities could enter where the selected service genuinely depends on ocean resources, maritime capability or knowledge.

Constraint and proposed intervention. Establish a bounded service linking a named inland producer, its chosen gateway and a buyer in another participating market. A processed-food consignment is an illustrative choice, not a documented trial. Trace inputs, compliant packaging, production, inspection, port reception, the selected maritime or land service, destination distribution and payment. Record the obligations of every participant before specifying the shared platform.

Dependency and buffer decision. Determine whether the principal constraint is production readiness, energy continuity, certification, transport frequency, border handling or working capital. Examine consolidation and buffer storage where arrival and demand patterns differ. Compare available routes using total delivered cost, variability, access and receiving readiness. A regional design should not assume that short-sea shipping, rail or a particular gateway is preferable before the service economics are established.

Value creation pathway. The proposed network could connect processing, supplier capability and market access across several territories, allowing a commercial relationship to support production at more than one node. Identify the value added and capability developed in each participating territory, including supplier qualification, maintenance, processing and distribution. Avoid double-counting the same income or cargo value at successive nodes. Examine who retains the income and who bears public support or compliance costs. A viable port transaction can coexist with weak wider supplier participation, which is a separate finding to address.

Authority and finance. Investment would follow the shared service's requirements while retaining identifiable sponsors, borrowers and risk bearers for common infrastructure, enterprise assets and working capital. Each customs, safety, certification and payment decision remains with its competent authority or contractual party. Any coordination platform needs agreed responsibilities, accepted records and a dispute route. A regional strategy does not itself provide a common guarantee or harmonised legal regime.

Continental relevance. This configuration is adaptable to other coasts and multi-gateway economic regions where production, markets and maritime services are distributed. Cooperation can improve selected interfaces and continuity while preserving competition, user choice and national authority. Its value lies in usable productive relationships, not in treating every port as part of one institution.

Evidence. Version 2.2 records the author's strategic propositions and supporting discussion. A harmonised transaction-level baseline across the participating gateways remains to be established. Named facilities, current operating conditions and institutional proposals require verification before an implementation decision. No regional readiness category, congestion score or fifth-generation designation is assigned here.

Evidence boundary. The application demonstrates why a continental architecture must accommodate a distributed multi-port system. To test its performance, obtain matched consignment records, service commitments, receiving-capacity data, cash-cycle information and enterprise outcomes within a stated period. Test disruption at one node and the actual availability of alternatives. The next application step is to collect these operating and productive records. (Nursimulu 2026c, 109–168, 204–235, 323–344, 392–404, 452–491)

The four applications transfer different relationships. Mombasa tests whether a coastal service becomes dependable productive access for inland users. Durban tests whether operating recovery restores an industrial service. Port Louis tests whether maritime reliability supports ocean-related enterprise and productive intermediation. Abidjan–Lagos tests whether independent gateways can sustain a distributed productive service across borders. None supplies a score of continental readiness or establishes that the proposed architecture is already implemented.

Their published observations cannot form a performance league table. Port Louis vessel-time averages, Mombasa container dwell and pre-berth waiting, and Durban terminal ship-working-hour productivity have different populations, event boundaries and periods. Abidjan–Lagos has no harmonised transaction baseline. Compare the quality of the specified service, authority and evidence within each configuration; numerical comparison requires equivalent definitions and matched cargo, terminal, period and geography. An unavailable observation remains a research requirement rather than an estimated result.

Tanger Med as an external productive gateway comparator

[SR] Tanger Med supplies a comparator independent of the four authored blueprints. Its official activity-zone account reports MAD 174 billion of business volume in 2024 and identifies industrial and logistics activities within the wider platform. This is group-reported activity, not independently estimated national value added, retained income or a causal measure of port investment. The dated port throughput observation in Chapter 1 concerns a different unit and boundary; the two quantities must not be added. (Tanger Med Special Agency n.d.; Tanger Med Port Authority 2025)

The architectural interpretation is that productive-gateway assessment must examine the relationships between maritime service, industrial locations and the enterprises using them. Co-location and scale provide a reason to investigate those connections; they do not prove that every interface is integrated or that the AIC2030 model explains the reported activity. Geography, trade access, industrial policy, enterprise investment and shipping networks are alternative or complementary explanations to examine.

Apply the same five-capability questions used in the blueprint cases. Maritime and Operational Excellence requires service-reliability evidence beyond throughput. Gateway Integration requires linked port-to-enterprise events and usable connections. Gateway Decision Intelligence requires evidence that accepted information changes an authorised decision. Productive Value Creation requires enterprise value-added and supplier evidence. Custodial and Compounding Leadership requires maintenance, skills, renewal and reinvestment records over time. The activity account alone does not complete any of these assessments.

The transferable investment question is which productive service the proposed gateway can credibly support. A smaller gateway may need a specialist connection, shared utility or border interface before additional terminal capacity. Tanger Med's scale and institutional form therefore provide comparison, not a template: the appropriate configuration still follows demand, access, ecology and existing capability.

The bounded finding is that the external activity account supports examination of an industrial-logistics platform alongside maritime operations. It does not certify Tanger Med as an AIC2030 Fifth-Generation Port, establish retained value or validate the proposed model. Further assessment needs independently corroborated service, enterprise and institutional records and a stated comparison with other explanations.

Durban under digital disruption in July 2021

[SR] The July 2021 Transnet disruption provides a historical continuity case distinct from the later terminal performance observations. The Department of Public Enterprises statement of 29 July reports an IT breach on 22 July, restoration of NAVIS functionality at Durban container terminals by 27 July and activation of truck booking on 28 July, while other interfaces were still being restored. These are contemporaneous government reports, not independent forensic verification or a complete account of backlog clearance. (Department of Public Enterprises, South Africa 2021)

The same statement describes prioritised container evacuation with shipping lines for automotive, FMCG and agricultural users, customer engagement and manual operation in some other cargo services. Different functions and cargo streams therefore require separate recovery records. This source does not establish that every Durban service had equivalent manual fallback, that enterprise delivery had normalised or that reported data-security assurances were subsequently independently confirmed. (Department of Public Enterprises, South Africa 2021)

The architectural distinction is between restoring an application and restoring an accepted productive service. A terminal may regain its operating system while booking interfaces, receiving capacity or record reconciliation remain constrained. The five capabilities direct the assessment from safe vessel and cargo operations through collection and enterprise receipt, the authority to prioritise scarce capacity, productive consequences and the resources needed to sustain recovery. This is our analytical reading of the reported sequence, not a claim that AIC2030 directed the historical response.

For a gateway continuity review, identify which cargo can move safely under degraded conditions, which records are authoritative, who accepts manual release and how duplicate or inconsistent transactions are reconciled. Verify truck access, destination readiness and emergency communications. Record who can prioritise cargo and the safeguards against preferential treatment. Restoration targets should distinguish technical availability, transaction acceptance, backlog age and fulfilment of enterprise commitments.

Test fallback before an incident against safety, legal and commercial conditions, available people and capacity; maintain reconciliation for normal operation. Recoverable records, segmented services, trained staff or a resilient critical interface may be justified. Technology selection and economic-return estimates require their own diagnosis and appraisal, beyond this source.

The bounded finding is that the official recovery account differentiates systems, interfaces and cargo priorities within one disruption. It supports the relevance of a complete-service continuity assessment. It cannot quantify avoided industrial losses, establish a calibrated OPI or demonstrate enduring institutional capability. Further testing needs independent incident records, cargo and enterprise events, observed recovery times, loss accounts and subsequent continuity exercises. The stress case tests the questions asked by the model without claiming empirical validation of the model itself.

What the three demonstrations establish

The Port Louis design demonstration reaches a conditional service-trial decision. Tanger Med supplies an external productive-platform comparator. Durban supplies a historical stress episode. They are deliberately different evidence forms and should not be ranked as equivalent cases. Together they show how the architecture organises decisions across opportunity and disruption; they do not establish a continental causal effect or certify a gateway generation. The four original blueprint configurations remain available for adaptation and further field assessment.

Adapting the configurations across Africa

These four configurations do not exhaust the seven functional gateway roles set out in Chapter 1. They show different ways to connect maritime competence, gateway integration, decision intelligence, productive value creation and custodial leadership. A smaller gateway can apply the same reasoning to essential supply, fisheries, repair or a selected industrial service without assuming every function described here. Role, demand, institutional capability and ecological conditions determine the appropriate reach of the port's contribution.

The continental model therefore supplies a common architecture rather than a uniform project list. Each application must explain what productive activity becomes possible, which operating relationships sustain it, how responsibilities and investment are organised, and where income and capability can remain for reinvestment. The evidence record then examines whether that proposed configuration delivers the service and productive contribution intended.

Glossary of controlled terms

These meanings govern this monograph. They distinguish AIC2030 propositions from established professional usage and do not confer accreditation.

Alignment assessment

An evidence-based judgement against declared AIC2030 service requirements, scoped by geography, population and period. Unknown evidence and demonstrated shortfall are separate findings.

Architectural Debt

Accumulated interface, mandate, incentive or lifecycle obligations that can increase future integration cost or vulnerability; a diagnosis to establish through evidence.

Architectural Finance

AIC2030 proposed funding category for institutional and operating foundations; not an established financial instrument class.

Blue productive platform

Shared infrastructure, services and institutional arrangements supporting selected viable maritime enterprises and their environmental obligations.

BlueTech

Working term for technologies and applied knowledge enabling responsible understanding, protection, use and productive development of marine and aquatic systems and their connected activities. Its contribution is assessed through usable capability and evidenced outcomes.

Compounding

The process through which retained value, learning and reinvestment strengthen productive capability available for subsequent activity. As the fifth gateway maturity stage, Compounding requires separate evidence of productive outcomes, retained value, learning and reinvestment across time.

Continuity

Capacity to preserve or restore specified critical functions within declared tolerances, with funded responsibilities and tested fallback.

Continuity Dividend

Potential service or financing benefit associated with improved continuity; existence, distribution and size require evidence.

Corridor

A defined functional economic geography connecting flows, institutions, operating interfaces, productive territories and markets.

Corridor economic diplomacy

Cooperation across institutions and jurisdictions to establish the trade, investment, knowledge, standards and service relationships needed for productive corridor development.

Corridor intelligence

The capacity to develop productive capability, coordinate and adapt the connected system, and improve productive value relative to carbon, energy, material and ecological burdens. These are the productive, system and environmental intelligence tests. Trusted information and accountable action support system intelligence; they do not alone establish the full Intelligent Corridor proposition. See Gateway Decision Intelligence and Intelligent Corridor. (Nursimulu 2026b, section 10)

Corridor Operating Plan

An agreed operating arrangement linking relevant maritime, terminal, modal, inspection and inland reception commitments, with decision owners and exception procedures.

Corridor sovereignty

Effective and legitimate capacity for choice, data governance, continuity and strategic optionality within sovereign jurisdictions.

Custodianship

Continuing institutional responsibility for gateway coherence, performance, continuity and development direction, exercised within an established mandate and subject to accountability and review.

Data as the Sixth Mode of Transport

AIC2030 analytical metaphor for trusted information and instructions supporting movement and execution across physical modes.

Digital maturity

The evidenced capability of a specified digital service or ecosystem under a named source ladder; distinct from corridor development and gateway maturity.

Digital twin

Maintained operational representation with defined assumptions and controls; official status exists only within explicitly approved scope.

Economic Operating System

The proposed AIC2030 architecture organising Goods, People, Capital, Knowledge and Data through six operating layers: Physical, Industrial, Trade, Digital, Capital and Governance. An Intelligent Corridor applies this architecture to a connected economic geography through institutions, decision rights and productive interfaces. Flows describe what circulates; layers describe the capabilities and arrangements that make circulation productive. (LOGI-CONSULT 2026b; Nursimulu 2026b)

Effective Reachable Market

Commercially credible market access established through time, cost, reliability and predictability, not map distance alone.

Fifth-Generation Port

The African Fifth-Generation Port is a port that performs its maritime responsibilities dependably and exercises an authorised, evidence-led and collaborative anchoring role across the inland and ocean relationships on which its connected productive economy depends. The strategic relevance of its role must be established in context; size alone does not determine suitability. A proposed AIC2030 operating model, not a universal accredited classification. (LOGI-CONSULT 2026a, section 4.10;

Nursimulu 2026b, section 6)

Five economic flows

Goods, People, Capital, Knowledge and Data. Energy enables activity across the operating system; Governance is one of its six operating layers. Neither is an additional canonical flow.

Gate institution

An institution whose lawful functions govern consequential interfaces affecting corridor access, continuity or coordination.

Gateway

The functional system connecting maritime networks, port services, ocean activities where relevant, inland corridors, productive territories and markets. Its economic boundary differs from the port's administrative boundary.

Gateway Decision Intelligence

Capability to convert trusted visibility and analysis into timely, coordinated and accountable gateway decisions.

Gateway Value Density

Productive or retained value related to one transparently defined gateway resource denominator, such as land, energy or infrastructure capacity, for a consistent boundary and period. Different denominators produce different indicators.

Human Capital Compact

Proposed agreement sustaining competence, learning, funding, succession and institutional memory across participating organisations.

Inbound Logistics Value Added Services

Assembly, calibration, testing, packaging, controlled storage, distribution, repair or other commercially justified services that connect inbound trade to productive and market requirements.

Intelligent Corridor

An Intelligent Corridor converts movement into productive value and connects that value end-to-end across the economic system. The full canonical definition from the companion publication and the attributed later elaboration appear in Chapter 4. This glossary entry is the shared short form. (Nursimulu 2026f, 15; Nursimulu 2026b, section 6)

Irreversibility

AIC2030 long-horizon aspiration for durable cooperation; it does not remove lawful review, adaptation or exit.

Land-sea productive continuum

The connected economic geography linking maritime access, logistics interfaces, productive territories and ocean activities through material service and capability relationships.

Living Corridor

Territorial and human dimension connecting logistics, urban form, workforce access, skills, housing, safety and livelihoods.

Maritime economic domain

A functional planning boundary connecting maritime logistics, production, services, knowledge and environmental systems; it does not create statutory jurisdiction.

Minimum Viable Architecture or MVA

Smallest context-specific set of operating conditions sufficient for defined coordination functions to be tested and sustained.

Minimum Viable Authority or MVAu

Bounded lawful decision arrangements for specified coordination tasks, with reserved powers, escalation, remedies and accountability.

Minimum Viable Gateway Architecture or MVGA

Gateway-specific application in the related AIC2030 methodology; not interchangeable with corridor MVA.

Minimum Viable Legality

Proposed legal substrate for recognition, exchange and use of specified information and decisions under applicable jurisdiction.

Neutral system operator

An expressly appointed provider of shared technical services, distinct from public authority and subject to conflict controls and oversight.

Ocean hinterland

The productive and market relationships a gateway can serve through repeatable maritime connections, including island, coastal and mainland partners.

Operability Pressure Index

The author's proposed five-component operating-pressure index within a ten-indicator AIC2030 port congestion dashboard; raw-data calibration and evidence are required for measured application.

Passerelle Doctrine

The AIC2030 proposition for connecting production with market readiness and access through services that support entry, stabilisation, upgrading and graduation of firms.

Port Value Account

The service and geography specific application that distinguishes value added, enabled enterprise activity, income distribution and productive reproduction without adding overlapping measures.

Pre-trade capital

Funding that addresses defined interface readiness and early service risk before repeat trading supports routine finance; its instrument and loss-bearing depend on the specific application.

Productive Additionality

The activity or capability newly enabled, accelerated, retained or materially strengthened relative to a credible alternative.

Productive Depth

The transformation stages, supplier functions, skills, technology and knowledge embedded in the productive system.

Productive Yield

The additional productive capability and retained value that exist because a freight, corridor, urban, energy or infrastructure system is built or improved. The eight canonical dimensions are Transformation, Enterprise, Capability Development, Retention, Market Access, Spatial Diffusion, Resilience and Compounding. (Nursimulu 2026f)

Professional Guilds

Proposed peer-learning and competence communities; recognition and accreditation require decisions by competent institutions.

Reachable Role

A gateway role supported by credible demand, geography, competitive position, institutional feasibility and achievable investment.

Sovereign API

A defined permissioned interface through which sovereign systems exchange authorised information while retaining control and legal boundaries.

Sovereign API Sandbox

Controlled test of lawful data exchange, bounded decision authority, operating interfaces and fallback for selected flows.

Strategic restraint

Exercise of authorised and proportionate coordination functions with institutional non-encroachment, accountability and review.

Temporal architecture

Design of activation, continuity, institutional learning and long-horizon durability through leadership and system changes.

TradeTech

Technologies and associated operating arrangements supporting trade transactions, assurance, finance and information exchange across market interfaces. In this monograph it connects technical and productive evidence to commercially and institutionally usable trade services.

Transoceanic capital function

The project preparation, investment structuring, syndication, trade finance and governance services linking productive systems with appropriate capital networks.

Value Retention

Specified economic value and capability remaining in a defined economy; distinguish value added, ownership, transfers, leakage and reinvestment.

VCITC

Value-Chain Integrated Trade Corridor: proposed connected operating logic linking production platforms, logistics nodes, ports, SEZs and markets without requiring common ownership.

Concept provenance within the AIC2030 series

The gateway framework (LOGI-CONSULT 2026a) documents the African Fifth-Generation Port capability model and role assessment. Productive Yield and the end-to-end Intelligent Corridor are shared with the freight monograph and corridor research edition (Nursimulu 2026f; Nursimulu 2026b). The Port Louis blueprint (Nursimulu 2026e) develops Passerelle, the ocean hinterland and pre-trade capital. The Operability Pressure Index is attributed to Rhavy Nursimulu under AIC2030 (Nursimulu 2026a). These are source relationships, not independently verified first-use claims.

Intellectual lineage and AIC2030 adaptation

Chapter 2 explains the model's principal distinction and its relationship to port-generation scholarship. This crosswalk provides the detailed concept mapping: established reference point, AIC2030 adaptation and claim boundary. A cited relationship identifies an intellectual precedent or analytical analogy; it does not establish that prior literature validates the integrated architecture.

AIC2030 concept	Established field or reference point	Specific adaptation in this monograph	Claim boundary
Smart-port starting point	Maritime Single Window, Port Community Systems, digitalisation and cybersecurity ¹	Treats digital capability as one part of an accountable gateway service	Digital maturity alone does not establish corridor intelligence
African Fifth-Generation Port	Port-generation literature and port reform ²	Five connected capabilities linking maritime performance to productive value and custodianship	A proposed African operating model; no universal accreditation, first-use claim or empirical certification
Intelligent Corridor	Trade and transport corridor management ³	Extends the assessment to productive capability, ocean relationships, trusted decisions and value reproduction ⁴	AIC2030 proposition requiring field application
Gateway Integration	Port regionalisation, port-hinterland integration and corridor coordination ⁵	Tests whether maritime, border, modal, productive and market interfaces form a usable service	Does not require one institution or common ownership
Operability Pressure Index	Port-performance and congestion diagnostics ⁶	Combines five headline pressure components within a ten-indicator dashboard	Constructed scoring requires local calibration and validation
Port Value Account	Value-added, income-distribution and investment-accounting disciplines	Separates direct service value, enabled activity, retention and reinvestment within declared boundaries	Not a substitute for official national accounts or causal evaluation

Sources for the preceding table panel: 1. International Maritime Organization n.d.; World Bank and IAPH 2023; World Bank 2025b. 2. Lee and Lam 2016; Lee et al. 2025; World Bank 2025b; UNCTAD 1992; UNCTAD 1999; Russo and Musolino 2020. 3. Kunaka and Carruthers 2014. 4. Nursimulu 2026f; Nursimulu 2026b. 5. Notteboom and Rodrigue 2005; Kunaka and Carruthers 2014; World Bank 2025b. 6. Nursimulu 2026a.

AIC2030 concept	Established field or reference point	Specific adaptation in this monograph	Claim boundary
Architectural Debt	Analogy to accumulated technical and institutional obligations	Extends the diagnosis to interfaces, mandates, incentives and lifecycle funding	An AIC2030 diagnostic to establish with evidence
Custodial and Compounding Leadership	Port governance, stewardship, continuity and institutional learning 1	Adds responsibility for capability renewal, retained learning and reinvestment across operating cycles	Does not create authority beyond lawful mandates

Sources for the preceding table panel: 1. World Bank 2025b; World Bank 2025c; World Bank 2025b.

This selective crosswalk locates the specified synthesis and decision logic; it establishes neither exclusive ownership of component ideas nor a systematic review or first-use claim. Comparative application must test improvements in decisions and outcomes against feasible alternatives.

Application protocols

These protocols translate the narrative into a practical application record. They support diagnosis and delivery under competent institutional mandates. They do not constitute an accreditation scheme or reproduce the controlled scoring methodology of the gateway framework.

How to use the published method

The definitions, evidence tests, assumptions and calculation rules required to interpret a published result should be available with it. A reader must be able to assess why the finding follows from the stated evidence. Confidential records may be protected through aggregation, access controls or an independent review route, with the resulting limits disclosed.

Facilitated workshop materials, software, client diagnostics, negotiation clauses and programme management tools can remain proprietary. That boundary must not conceal a scoring rule or assumption necessary to evaluate the monograph's own claims. The public method provides a usable starting point; implementation support supplies the additional work required for a specific gateway.

Development approach and assessment boundaries

The architecture is developed through synthesis of the author's AIC2030 doctrine, controlled frameworks and strategic blueprints, interpreted alongside external scholarship and dated operating evidence. The gateway configurations illustrate different economic and institutional relationships. They provide contexts for architectural application rather than a representative statistical sample of African ports.

Constructed demonstrations explain decisions, accounting and measurement under declared assumptions. Reported observations retain their source boundaries and limitations. The architecture and application logic are established here; achieved service improvement, productive additionality and compounding require corresponding operating and longitudinal evidence.

Assessment should examine whether the architecture identifies consequential dependencies, improves intervention choices, assigns workable responsibilities and supports productive capability. Comparative applications should record simpler alternatives, failures, distributional effects and findings that require revision of the design.

Evidence calibration and methodological boundaries

For gateway capability assessment, this edition follows the F01 Core in sections 4.2–4.4: condition 0 Absent, 1 Critical Deficiency, 2 Basic or Materially Constrained, 3 Functional, 4 Strong or Integrated, and 5 Advanced or Role-Leading. Record trend as Improving, Stable, Deteriorating, Volatile or Indeterminate; role criticality as Essential, High, Moderate or Supporting; and evidence confidence as Verified, Triangulated, Indicative or Data Gap. A missing observation is not a zero capability score. Threshold sufficiency requires a separate justified finding.

F01's practitioner summary uses some different labels and a shortened 1–5 presentation. The Core classifications stated above govern this monograph's use of the method; service evidence findings and readiness categories remain separate. Meridian is a fictional illustration within F01, not a measured African case. Read its Stage 2 description as Functional in the Core terminology and interpret its preparation language through the controlled investment decisions. These interpretive conventions leave the controlled framework unchanged.

F01 reports internal architectural validation, with controlled pilots, independent multidisciplinary challenge, comparative application, threshold calibration and possible formalisation still to follow. The monograph proposes an architecture and explains its application. Neither its publication nor a successful illustration confers certification, external accreditation or universal validation. Pilot records should preserve adverse and contradictory findings, assessor disagreements, distributional effects and revisions required by evidence. (LOGI-CONSULT 2026a sections 4.2–4.4, 6.3–6.7, 7.37 and Part VIII)

The applications distinguish dated observations, authored propositions and worked illustrations. Apply the finer claim markers in the series guide within those forms. An operating improvement establishes the measured change at its stated scope; a productive or financing claim also needs enterprise evidence, a comparison and appropriate attribution. Numerical examples establish neither feasibility nor certification or port-wide generation status.

Gateway model and assessment architecture

F01, the AIC2030 Ports and Corridor Gateways Framework, provides the wider assessment architecture. Its eight pillars cover role and market reach; maritime and port operations; corridor connectivity and trade facilitation; productive geography; energy and maritime value chains; digital systems and data governance; institutions and human capability; and investment, financial sustainability and resilience. The framework contains 89 dimensions for controlled application. The five capabilities of this monograph's port model explain the operating contribution sought; the eight pillars organise the wider diagnosis. They are related structures with different purposes. (LOGI-CONSULT 2026a sections 3.3–3.6, 4.10 and Appendix J)

Assessing alignment with the model

An assessment begins with a named service, user population, geography and period. For example, a refrigerated seafood export service requires different operating evidence from a transit supply chain for industrial components. The five capabilities must each have evidence appropriate to that service. A missing critical capability cannot be compensated for by an unrelated technology investment or a high average score.

Use three evidence findings for each capability: demonstrated within the stated scope; demonstrated shortfall against the declared service requirement; or insufficient evidence. Record the requirement and supporting records before making the finding. Readiness categories describe the wider development position and suitability of the role; they are not a numerical conversion of these findings.

Service alignment requires all five capabilities demonstrated against declared requirements, with productive value creation and retention appropriate to intervention maturity. Port-wide conclusions require a defined principal-service portfolio, selection criteria, cargo and economic coverage, disclosed exclusions and material shortfalls. Independent challenge, reassessment and expiry of stale evidence support credibility.

This is an AIC2030 assessment proposition. It provides a basis for disciplined judgement; a formal certification scheme would require a separately constituted standard, thresholds, assessment governance and appeal arrangements. The gateway applications in this monograph demonstrate the reasoning without conferring such a designation.

Table 20 Evidence for the five port capabilities

Capability	Evidence required for the chosen service
Maritime and Operational Excellence	Safe access and dependable handling; defined operating distributions, maintenance and cargo integrity.
Gateway Integration	Accepted connections between maritime, clearance, transport, productive and market services.
Gateway Decision Intelligence	Trusted information changes an authorised decision, with an event and action record.
Productive Value Creation	Evidence of activity enabled, value added, retention boundary and enterprise capability; attribution limits recorded.
Custodial and Compounding Leadership	Accountable interface stewardship, recurrent funding, review, continuity and learning across time.

Readiness and gateway maturity

Fifth-Generation Port readiness and gateway maturity answer different questions. The gateway framework describes readiness as Established, Advancing, Emerging, Aspirational or Not Appropriate. These categories assess whether the port's maritime strength and authorised orchestration role are demonstrated and appropriate to its economic position. A specialist or smaller port may need excellent core services without assuming a broad orchestration role.

Gateway maturity follows the five stages Fragmented, Functional, Integrated, Intelligent and Compounding. The first concerns isolated assets and institutions; the second basic functioning; the third coordinated interfaces; the fourth proactive decisions supported by trusted information and legitimate authority; and the fifth demonstrated productive outcomes, retention, learning and reinvestment. A high average cannot compensate for a critical deficiency in an essential function.

These five system stages are distinct from the five port operating capabilities, the five corridor development levels and the digital maturity ladders discussed elsewhere in this monograph. An advanced digital tool can support an interface without establishing a compounding gateway. Productive outcomes and durable reinvestment require their own evidence. (LOGI-CONSULT 2026a sections 4.9–4.11)

Minimum capability and the limits of maturity claims

Minimum Viable Gateway Architecture is role-specific. Its common core includes safe operations, usable connectivity, lawful trade processing, reliable information, competent people, lifecycle funding, accountable authority and continuity. Additional requirements follow the selected role. A transit gateway needs functioning border and inland interfaces; an industrial gateway needs usable energy, utilities and factory connections. The minimum is a coherent service system, not a standard list of construction projects.

Capability condition, a minimum threshold, a peer benchmark and a development target answer different questions. The threshold establishes what a defined role needs to function acceptably. A benchmark provides a justified comparison. A target states an intended improvement. A gateway can meet its current-role minimum while lacking capability required for a future role. No composite average should conceal failure of an essential interface.

Within F01, deficient current-role minimum architecture normally limits maturity to Stage 2. Deficient authority, an inability to convert visibility into coordinated action or critically exposed continuity normally prevents progression beyond Stage 3. Stage 5 requires evidence of productive outcomes and credible retention and reinvestment mechanisms. These are methodological limits on an assessment conclusion, not internationally accredited port classifications. Any exceptional conclusion requires evidenced alternative capability and independent methodological review. (LOGI-CONSULT 2026a sections 3.7, 4.4, 4.6 and 4.9)

We should also be clear about the practical threshold. A gateway does not need every possible technology or participating institution to improve a service. For the selected task, however, the necessary capacity, accepted information, competent decisions, people and funding must work together. That is a functional threshold to demonstrate. It is not a score or a claim that the entire gateway has reached a new generation.

Ten questions for an initial readiness review

These questions identify evidence and decision gaps. Answer each as evidenced, partly evidenced, contradicted by the evidence or unknown, with a dated source and accountable owner. Do not convert the answers into a readiness category through an unpublished score. Established, Advancing, Emerging, Aspirational and Not Appropriate require a reasoned assessment of the intended role and the gateway framework's definitions.

Table 21 Ten questions for an initial readiness review

Capability	Question	Evidence to seek
Maritime excellence	Can the service meet its safe operating requirement?	Call and cargo records, safety conditions, service distributions
Maritime excellence	Can equipment and essential services remain available?	Maintenance, skills, spares, power and funded recovery
Gateway integration	Are the critical handoffs accepted by both sides?	Agreements, receiving capacity and exception records
Gateway integration	Do inland or ocean partners have a usable service commitment?	Delivery windows, user participation and escalation
Decision intelligence	Does trusted information reach the decision owner in time?	Timestamped event, access and decision records
Decision intelligence	Can a changed condition produce an authorised response?	Decision rights and observed exception handling
Productive value	Is the enterprise outcome and additionality pathway defined?	Firm evidence, baseline and alternative explanations
Productive value	Are creation, retention and reproduction distinguished?	Value account, geographic boundary and follow up
Custodial leadership	Are stewardship, workforce and recurrent funding installed?	Named roles, competence, budgets and review
Custodial leadership	Has continuity and institutional learning been tested?	Exercises, restoration records and adopted corrections

Define the service and the baseline

Record the purpose, users, cargo or service segment, functional geography, jurisdictions, modes, maritime interfaces and observation period. Identify the parts of the journey included and excluded. Prepare connected maps of the physical service, institutions, decision rights, information and productive relationships. Keep planned, estimated and actual conditions distinct.

The baseline needs a named custodian, traceable event definitions, an account of missing records and the users whose experience is represented. Investigate physical capacity, maintenance, demand, prices, competition, safety and policy alongside coordination. Record contested findings and alternative diagnoses. A missing dataset may be a measurement or access problem rather than proof of an operating failure.

For a suspected Architectural Debt item, record an identifier, affected interface, observable failure, cause, recurrence, severity, users affected, responsibility, lifecycle obligation, proposed remedy, payer, review date and reduction test. Distinguish debt arising from past choices from capability still to be developed.

Establish authority and accepted information

For each critical decision, record the trigger, supporting evidence, jurisdiction, lawful owner, consulted actors, executing party, deadline, escalation and review. An alert, a recommendation and an authorised instruction must have distinguishable status. Preserve reserved powers and remedies.

Table 22 Authority and accepted information

Execution requirement	Minimum documented test
Competent authority Minimum authority	Identify the statutory, contractual, delegated or intergovernmental decision owner for each jurisdiction. Specify the smallest lawful arrangement needed for the task, the limits of delegation and all reserved powers.
Neutral convenor	Name any permitted coordinating function, its funding, conflicts, oversight and limits.
Trigger and evidence	Define an event, threshold or verified exception, data provenance and validation responsibilities.
Event declaration	Assign who validates the event and who receives the notice; distinguish an alert from an instruction.
Emergency continuity	Pre-agree lawful contingencies and agencies exercising emergency powers; no automatic platform override.
Operational escalation	State response deadlines, responsible roles and the safe baseline while a question is unresolved.
Formal remedies	Preserve administrative, contractual, judicial, arbitral or intergovernmental routes as applicable.
Audit and review	Record authorisation, execution, outcome, affected rights, independent review and corrective action.
Validation and expiry	Require institution-specific sign-off, review date, amendment, suspension and termination provisions.

This retained instrument sets out minimum documented tests for the selected task. Its legal application depends on the institutions and jurisdictions involved. A shared platform cannot supply a missing mandate.

Design the pilot and the funding commitment

Record participating and non-participating users, priority flows, operating boundaries, lawful permissions, access controls, accepted event records and fallback. A Sovereign API Sandbox additionally records identity, technical scope, standards, security, data protection, acceptance tests and exit criteria. Test asymmetric adoption and failed hand-offs as well as routine exchange.

Separate preparation, implementation, recurring operation and continuity funding. Identify prospective payers, commitment routes, procurement, counterparties and lifecycle stewards. Document what remains unfunded. Name the baseline service that remains available while an experimental function is corrected or paused.

TradeTech deployment readiness requires a useful corridor task, competent sponsors, institutional and commercial participation, technical compatibility, affordable operation and a defensible scale pathway. Failure to scale should be diagnosed against all these conditions. Corridor anchoring alone does not establish demand or viability.

Specify the measurement and the claim

Apply the five claim markers and separate input-maturity states defined in the series guide. Repetition cannot turn a proposition into an established observation, and a source-reported result does not validate the framework. The indicator and claim records below implement that distinction. (Nursimulu 2026f, 9)

For each material indicator, establish the unit, boundary, event definition, period, source, calculation, exclusions and responsible custodian. Retain uncertainty and distribution where they matter. An average can conceal an important tail; a port result can conceal a failed inland connection. The observation must match the decision being made.

An independent reviewer should be able to reconstruct the material calculation and understand the judgement. That requires accessible records within legitimate confidentiality limits, a claim register and a record of contested findings. The apparatus supports the argument by making it examinable; it should not overwhelm the public narrative with repeated procedural qualifications.

Every material claim needs exact wording, an evidence status, source and locator, observation unit, date, method, uncertainty, alternative explanations, reviewer and disposition. Keep established observation, source-reported finding, authored proposition, scenario and research requirement distinct. Identify input maturity separately.

Table 23 Measurement specification

Specification	Required record
Indicator identity	Unique ID, construct, intended decision use, unit of analysis, functional boundary and population.
Calculation	Numerator, denominator, units, valuation, inflation, outliers, missingness, duplicates and versioned formula.
Time	Baseline and follow-up windows; collection and publication cadence; seasonality and multi-period effects.
Provenance and access	Source, timestamp, method, custodian, permission, confidentiality and evidence category.
Comparability	Like-for-like geography, cargo, demand, method and period; document disruptions and policy differences.
Attribution	Mechanism, alternative explanations, comparator or counterfactual; report contribution if causal identification is unavailable.
Productive Yield	Define output or capability, firm or cluster population, baseline change and composition effects.
Value Retention	Define retained value-added construct, beneficiary geography, intermediate purchases, transfers, leakage and reinvestment.
Gateway Value Density	One declared productive-value numerator and one denominator for the same boundary and period; report units and sensitivity.
Release review	Observation, association, contribution or causation; unresolved gaps, corrective action, reviewer, date and approval status.

The retained specification supports reproducible measurement. Apply operational monitoring at a cadence justified by the service and data; productive effects may require annual or multi-year work. An independent review should test material definitions, comparisons and sensitivities before release.

Verify economic pathways and distribution

Identify the actors creating and capturing value, the geography of retention and the period of reinvestment. Distinguish gross flows, revenue, value added and capability. Reconcile overlapping benefits. Separate investment announcements, commitments, financial close, disbursement, commissioning and actual use.

Test connections among the five flows. A goods delay can affect inventory and payment. A skills gap can prevent equipment use. An information failure can interrupt an otherwise available service. Define the dependency, responsible actors, proposed response and observed consequence. Trace the productive mechanism without treating operational correlation as proof of economic causation.

Evaluate distribution among operators, firms, workers, small traders, communities and public institutions. Document displacement, leakage and the difference between domestic and regional objectives. A Continuity Dividend needs a service, exposure, feasible alternative and the cost of maintaining protection. A financing effect requires evidence from the relevant commercial parties.

Sustain human capability and continuity

The human capability record follows fourteen gates. Apply them proportionately to the actual operating function and identify equivalent arrangements already in use.

Table 24 Human capability gates

Capability gate	Minimum evidence
Role mapping	Each role linked to public powers, delegation, employer duties and escalation; no unowned decision.
Capability baseline	Assess gaps across execution, integration and stewardship with lawful disaggregation.
Practical competence	Exercises test exceptions, permissions, security and continuity; record remediation and reassessment.
Compact activation	Signatories, obligations, duration, funding, review and exit documented.
Custodial independence	Conflicts, funding and incentives controlled; operator, adjudicator and reviewer separated where needed.
Succession	Alternates, emergency handover, decision archives and institutional knowledge are tested and funded.
Territorial access	Safe workforce mobility, small-trader participation and relevant living conditions assessed with competent local bodies.
Cross-border capability	Joint teams rehearse different legal procedures and permissions; each sovereign authority signs its own arrangements.
Monitoring	Competence, turnover, recovery and response quality assessed separately from productive impact.
Renewal	Review after shocks, staff changes, system upgrades and institutional restructuring; record revision or termination.
Guild recognition	Charter, membership, independence, competence and recognition documented; distinguish proposed from accredited status.
Labour dialogue	Displacement exposure, worker consultation, redeployment, reskilling, funding and grievances monitored.
Procedural fairness	Transparent role allocation, complaint handling, appeal and corrective action are auditable.
Skills refresh	Recurring reassessment, CPD, mentoring and knowledge capture funded as skills and technology change.

For each critical function, specify the owner, minimum service, tolerable interruption, dependencies, trigger, decision authority, fallback, resources, time to stable service, backlog recovery and review. Test normal, constrained, disruption and recovery conditions. Combine shocks where credible and safe; record the limits of untested scenarios. Network alternatives require evidence about usable capacity, access, permissions, service availability, energy, competence, duration and cost during the same event.

Complete the exercise with named corrective actions, funding, responsibilities and a date for checking whether the action worked.

Select the operating infrastructure

Nine operating domains may be relevant: cross-border digital trade workflows; sovereign and institutional information interoperability; trade-finance and insurance interfaces; relevant environmental, carbon and traceability information; data governance; performance and continuity services; repeatable operating models; public, private and multilateral partnerships; and transferable digital public infrastructure. They remain a menu for diagnosis, rather than a universal procurement package. Select the domains needed by the gateway role and task. Confirm service ownership, rights, institutional boundaries, market demand, competence, affordability and lifecycle funding. A replicable component can carry learning between gateways while its mandate, commercial model and operating assumptions are adapted to place.

Blue platform integrity and learning protocol

For each proposed platform, record its location and functional configuration, legal jurisdiction, permitted activities, ecological baseline, affected users and access rights. Identify the operator, regulator and coordinating body separately. Specify infrastructure and connectivity dependencies, available skills, demand evidence, commercial counterparties and the recurrent costs of operation and stewardship.

Set decision gates for exploration, validation, investment and operation. Each gate should identify evidence, authorised decision maker, funding limit and conditions for proceeding, pausing or stopping. Record monitoring, incident response, restoration and decommissioning obligations, including who pays. Claims about carbon, biodiversity or circularity require a stated method appropriate to the specific benefit. (Nursimulu 2026e, 118–135)

Multiport service and evidence protocol

For a distributed application, specify the participating gateway functions, inland and ocean relationships, selected enterprise service and reporting period. Map only the interfaces required for that service; do not treat an entire coastline as one assessment unit merely because its ports share a strategic blueprint. Record alternative providers, commercial access and the legal scope of each participant.

The operating record should reconcile arrival and receiving windows, buffer capacity, service failures and recovery time. The productive record should identify supplier progression and income by territory. The financing record should distinguish fixed investment from working capital and state borrower, currency and guarantee exposure. Record the acceptance basis for documents, tests and environmental evidence, including user costs and unresolved disputes.

Retain the controlled five corridor development levels, five port capabilities, five economic flows and six Economic Operating System layers for their respective purposes. Functional supplier maps, digital-stack descriptions and maritime coordination options in the Atlantic source are supporting lenses, not replacement classifications. Proposed indices, targets and institutions remain development propositions until their definitions, authority and evidence are established.

Numeric thresholds from a blueprint should not be imported as universal acceptance gates. Define units, population, time window, capacity availability and aggregation rules before using a ratio. Calibrate any proposed composite, test sensitivity and retain failures of essential functions rather than allowing averages to conceal them. Corridor lengths and catchment populations require consistent spatial boundaries before comparison. (Nursimulu 2026c, 131–162, 204–212, 255–268, 392–404, 471–478)

AIC2030 Operability Pressure Index application

The OPI dashboard records ten indicators in three layers. Vessel flow: vessel waiting time (VWT), vessel time in port (VTP), berth occupancy ratio (BOR). Terminal operations: crane productivity (CRP), yard occupancy ratio (YOR), container dwell time (CDT), equipment availability ratio (EAR). Landside and systemic: truck turnaround time (TTT), rail evacuation share (RES), congestion surcharge activation (CSA).

Reviewing possible double counting in OPI

For the same observation period and terminal population, examine how vessel waiting and berth occupancy relate to each other and to the diagnosed service constraint. Record their event definitions, time bases, aggregation and exclusions before interpreting co-movement. An indicator may share a cause with another while still contributing different diagnostic information. Where the measures track the same episode, state the possibility that the headline score gives that episode additional influence; where they diverge, examine arrival patterns, berth availability, service rates and operating restrictions. Review correlations and divergent episodes only when comparable observations are available. Do not infer a tested relationship from annual averages or from the constructed examples. Any indicator-exclusion calculation is a diagnostic check reported separately, not a replacement headline OPI. This review leaves the authored components, weights, formula and worked results unchanged.

Each scored indicator needs a raw measure, unit, observation period, population, source and a declared mapping to pressure on the 0–10 scale. The authored integer bands are 0–2 Healthy, 3–5 Under Strain, 6–8 Congested and 9–10 Severe or Collapse Conditions. The continuous-score convention and scoring extension below resolve boundary treatment. Waiting, occupancy and dwell normally increase pressure; improved crane productivity reduces it. Calibration must reflect terminal, cargo and service scope.

The five-component formula is $OPI = 0.30 s(VWT) + 0.20 s(BOR) + 0.20 s(YOR) + 0.20 s(CDT) + 0.10 s(CRP)$. Scores of 7, 8, 7, 6 and 8 produce $2.1 + 1.6 + 1.4 + 1.2 + 0.8 = 7.1/10$. Under the authored bands this falls within Congested. It illustrates the model's arithmetic. It is not a measured Durban baseline; calibration and raw observations are required for that application.

Table 25 Illustrative OPI calculation

Authored component	Pressure score	Weight	Contribution
Vessel waiting time	7	0.30	2.1
Berth occupancy	8	0.20	1.6
Yard occupancy	7	0.20	1.4
Container dwell	6	0.20	1.2
Crane productivity	8	0.10	0.8
Illustrative OPI		1.00	7.1 / 10

Illustrative calculation. Component calibration and raw measurements are required for a measured baseline. Publish the observation period and raw measurements alongside component scores, uncertainty and critical flags. Do not infer berth occupancy from vessel time in port, equate equipment availability with crane productivity or treat a carrier surcharge as proof of systemic collapse. If a core component is missing, withhold the headline index rather than silently changing the weights. The complete dashboard remains visible even where the headline index changes little. The proposed OPI target of 3.0 and a rail evacuation ambition of at least 30% by 2030 are authored planning references. They are not a universal Smart Port threshold or a certification test. Durban blueprint rail ambitions of 40–50% use other proposed scopes and require reconciliation of the denominator, cargo, corridor segment and period before use. A measured application needs calibrated thresholds, source verification, sensitivity testing and documented review.

Enterprise progression and pre-trade funding protocol

Record the firm's initial market access constraint and its entry, stabilisation, upgrading or graduation objective. Identify services purchased, support received, product and origin requirements, buyer relationships and the next capability to be developed. Set review dates and define what would demonstrate greater choice or reduced dependence. Link these objectives to the Industrialist Framework where a broader enterprise assessment is being conducted. For the funding commitment, record the interface uncertainty, expenditure ceiling, instrument, loss bearer, evidence required and handover route. Identify separately any public obligation. Test whether the service can sustain itself through revenue or an explicitly justified continuing public service arrangement. Closure and recovery arrangements should be practicable if the test fails. (Nursimulu 2026e, 264–269, 285–289)

Source reconciliation before scoring

MPA's FY2024–2025 report gives berth occupancy as 81.8% to 85.8% in Table 17 and 68% to 71% in section 6.6. The reviewed text does not explain whether these comparisons use different definitions or contain an error. A measured Port Louis OPI should therefore await clarification of the berth scope and denominator. Neither series is selected opportunistically to generate a preferred score. (Mauritius Ports Authority 2026, 81–82) The Northern Corridor dwell comparison excludes consignments delayed over 21 days for compliance or legal reasons. A wider user experience assessment should obtain those cases separately and preserve the original metric for like-for-like comparison. Ship working hour productivity and gross crane hour productivity are also kept distinct when comparing operating reports. (Northern Corridor Transport Observatory 2025, 8; Transnet 2025, 10–11)

OPI calibration and sensitivity

Use the original five-component OPI weights with declared raw observations. The measurement specification below defines the proposed event and scoring conventions; local application also requires approved thresholds, missing-data rules, a common observation window and a complete source register. Retain the ten-indicator dashboard so that the headline cannot conceal landside failure. Waiting and berth occupancy measure different phenomena but may contain overlapping information. Test their relationship over comparable periods, examine cases where they diverge and compare the index's ability to identify service failure with and without each variable. Correlation alone does not establish duplication. Crane productivity should likewise be tested as an explanatory capability variable and as an inverse pressure component. Equipment availability is a separate construct.

For continuous scores, this edition proposes the reporting intervals $0 \leq \text{score} < 3$ Healthy; $3 \leq \text{score} < 6$ Under Strain; $6 \leq \text{score} < 9$ Congested; and $9 \leq \text{score} \leq 10$ Severe. These extend the original integer bands to remove boundary gaps. They remain a proposed reporting convention; raw measure cutoffs require local calibration and subsequent validation.

The table tests arithmetic sensitivity using the original illustrative scores 7, 8, 7, 6 and 8. Equal weights give 7.20. A yard and dwell emphasis gives 6.90. Omitting crane productivity and proportionately rescaling the other original weights gives 7.00. These specified alternatives leave the example in Congested. They do not prove robustness to every plausible weight, validate any raw score or establish actual Durban conditions.

A calibration study should examine representative normal and disrupted periods and compare classifications with independently observed service consequences. Test score and ranking stability, indicator exclusion, uncertainty in raw data, cargo mix and seasonality. Publish the calibration necessary to interpret results. Cross-port results should be withheld where definitions, completeness or scoring equivalence cannot be established; the service cases here do not constitute a calibrated league table.

Table 26 OPI weighting sensitivity illustration

Specification	Weights VWT BOR YOR CDT CRP	Illustrative result
Original OPI	0.30 0.20 0.20 0.20 0.10	7.10
Equal weights	0.20 0.20 0.20 0.20 0.20	7.20
Yard and dwell emphasis	0.20 0.10 0.30 0.30 0.10	6.90
Crane component omitted	0.3333 0.2222 0.2222 0.2222 0	7.00 using exact fractions

OPI measurement and scoring specification

This proposed application extension makes the authored index reproducible without changing its five weights or ten-indicator dashboard. The measurement conventions and interpolation procedure below extend its application specification; the constructed anchor values demonstrate arithmetic only. Neither this extension nor the demonstration establishes empirically validated thresholds, a measured Durban baseline or a universal African port standard. (Nursimulu 2026a)

Begin with one named container terminal, cargo scope and calendar month. Preserve a common timestamp standard, event dictionary, observation window and source register. Report eligible populations, matched valid records, exclusions and missing observations for every component. Declare a coverage threshold and material-gap rule before inspecting results, justified by the collection design. No universal minimum sample or coverage percentage is asserted here. Withhold a measured headline where a required component, representative coverage or an approved anchor schedule is absent; do not impute zero or redistribute weights.

For this proposed specification, vessel waiting time is the arithmetic mean elapsed hours from a declared arrival-and-readiness event to first all-fast at the berth, for eligible calls first berthing during the month. Disclose the arrival boundary, readiness conditions and non-berth delay categories; retain excluded and still-waiting calls in a separate backlog record with their current ages. Publish the median and 90th percentile alongside the mean and state the percentile convention. A completed-call average alone can conceal a growing queue. This arrival-and-readiness-to-all-fast interval includes inbound movement as well as waiting. Retain separate queueing and manoeuvring timestamps where available; do not report the whole interval as pure anchorage delay or compare it directly with a differently bounded waiting-time series.

Berth occupancy is occupied berth-hours divided by available berth-hours over the month, multiplied by 100. Declare berth length or position assumptions for simultaneous vessels, closures and the treatment of unavailable capacity. Report unavailable hours separately so that denominator changes cannot masquerade as improved performance. Yard occupancy is the integral of occupied usable storage positions over time divided by the integral of usable storage capacity over the same period, multiplied by 100. Use consistent capacity units, distinguish cargo streams where possible, and disclose sampling frequency and blind intervals. Report peaks as well as the time-weighted result. A zero available-capacity denominator makes the corresponding ratio undefined: report the closure or unavailable capacity and withhold the affected component rather than assign zero pressure.

Container dwell in this demonstration means the arithmetic mean elapsed days from discharge to terminal gate-out for import containers exiting during the month. Report exceptional compliance holds separately without silently deleting them, and disclose the age distribution of inventory still present. Exports and transshipment require their own event definitions and calibrated series. Crane productivity is total declared container moves divided by total gross crane-hours for the scoped equipment and calls, not the unweighted average of crane rates. Define start and end events, interruptions, hatch-cover handling and twin-lift counting. Ship-working-hour productivity and equipment availability remain separate observations.

The five dashboard indicators outside the headline retain their own raw records: vessel time in port with arrival/departure events; equipment availability by equipment class and scheduled hours; truck turnaround with gate events and queue coverage; rail evacuation share with a declared cargo denominator and units; and surcharge activation with carrier, cargo scope, effective dates and source notice. They are not assigned invented component weights. A surcharge is a commercial signal to investigate, not independent proof of collapse.

Interpolation and calibration governance

For each headline component, declare five raw-value anchors corresponding to scores 0, 3, 6, 9 and 10. Anchor values must be strictly monotonic: increasing for waiting, occupancy and dwell, decreasing for crane productivity. Equal adjacent raw anchors are invalid. At an anchor, return its declared score. Between anchors, the score equals the lower score plus the raw-value fraction of that interval multiplied by its score increment. The raw-value fraction is the observed value minus the first anchor value, divided by the second anchor value minus the first. The same rule works for decreasing productivity anchors. Cap results beyond the endpoints at 0 or 10; reject physically impossible or invalid measurements rather than hide them through capping.

Linear interpolation is a transparent proposed convention, not an established description of congestion dynamics. Calibration should examine whether service consequences change nonlinearly, whether averages conceal peak pressure and whether different cargo or terminal configurations need separate schedules. Establish candidate anchors from documented operating requirements, capacity and service-failure observations across representative normal, seasonal and disrupted periods. Test them against independent consequences such as missed service commitments and blocked evacuation, including out-of-sample periods where feasible. Record trade-offs and uncertainty.

The application owner should name a technical reviewer and the authority accepting the calibration for publication. Their record identifies scope, sources, anchor rationale, tests, limitations, approval date and version. Fix anchors during a reporting series. A revision requires a disclosed break or a consistently recalculated history; rolling monthly minimum-maximum rescaling would destroy the meaning of a stable trend. Locally calibrated series are not automatically suitable for cross-port ranking.

Complete constructed scoring demonstration

[S] The following teaching schedule deliberately reproduces the original illustrative component scores. All anchors and raw observations are constructed, not observed, recommended or validated. They are not default thresholds for operational deployment. Percentages use percentage points on a 0-100 scale. The month and terminal are hypothetical; the example assumes complete valid records under the definitions above.

Table 27 Constructed anchor schedule and raw observations

Component and unit	Anchors at scores 0 / 3 / 6 / 9 / 10	Constructed observation
Waiting hours	0 / 12 / 36 / 72 / 120	48
Berth occupancy %	30 / 50 / 65 / 80 / 95	75
Yard occupancy %	30 / 50 / 65 / 80 / 95	70
Import dwell days	0 / 2 / 4 / 7 / 12	4
Crane moves per gross crane-hour	40 / 32 / 24 / 12 / 4	16

Table 28 Constructed component calculation and weighted contribution

Component	Calculation of pressure score	Weighted contribution
Waiting	$6 + (48 - 36) \div (72 - 36) \times 3 = 7$	$0.30 \times 7 = 2.10$
Berth occupancy	$6 + (75 - 65) \div (80 - 65) \times 3 = 8$	$0.20 \times 8 = 1.60$
Yard occupancy	$6 + (70 - 65) \div (80 - 65) \times 3 = 7$	$0.20 \times 7 = 1.40$
Import dwell	Observation equals score-6 anchor: 6	$0.20 \times 6 = 1.20$
Crane productivity	$6 + (16 - 24) \div (12 - 24) \times 3 = 8$	$0.10 \times 8 = 0.80$

[S] The weighted sum is 7.10 and falls in Congested under the continuous bands defined above. Classify the unrounded value and publish the headline to one decimal with the underlying calculation available: rounding must not obscure a category boundary. Report measurement and calibration uncertainty where either could change classification. This constructed 7.1 is neither evidence of severe structural failure nor a measured Durban score.

A reproducibility test should return every declared score at its anchor, remain between 0 and 10, increase with adverse waiting/occupancy/dwell and decrease with improved productivity. Test exact boundaries, endpoint capping, missing values, unit conversion and invalid anchors. In this constructed schedule, waiting of 24 hours gives 4.5, and productivity of 28 gives 4.5. The headline must be withheld if any required component is unavailable. An independent analyst should reproduce the component calculations before publication.

From the pressure profile to an authorised response

Read the components and dashboard before selecting investment. High waiting alongside high yard pressure could warrant examining discharge, release and collection constraints; it does not prove that berth expansion is unnecessary. Low crane productivity requires distinguishing equipment reliability, labour deployment, work mix and operating interruptions. Compare event records and feasible interventions. Chapter 7's scheduling, evacuation and berth comparison demonstrates how a diagnosed constraint can enter an investment appraisal, not how an OPI number selects a project automatically.

Keep critical operational failures visible beside the index. A safety closure, unusable inland interface or loss of essential equipment cannot be offset by low scores elsewhere. Review possible overlap between waiting and berth occupancy as described above. The earlier weight-sensitivity illustration tests arithmetic only. Calibration uncertainty, raw-data uncertainty and seasonal variation need separate analysis.

Publish terminal and cargo profiles before considering a port-wide summary. Combining locally scored series or averaging terminal OPIs can conceal incompatible definitions, anchors and bottlenecks. This specification does not authorise such an aggregation. A separate published method would need compatible raw measures, denominators, weighting, coverage and explicit critical-failure rules. Port-specific or cross-port comparisons must disclose any remaining non-equivalence. OPI remains an operating-pressure diagnostic, not a gateway maturity score, a measure of productive value or certification of the proposed Fifth-Generation Port.

Digital maturity source reconciliation

Use the Mombasa reference ladder reproduced in Chapter 6 and Table 10, sourced to p. 29 of the blueprint. Its historical current and target annotations are not current measurements. The implementation roadmap below uses different wording and must be reconciled by observable capability rather than level number.

Mombasa implementation roadmap, p. 92: 1 basic digital adoption; 2 platform clearance; 3 systems integrated across-borders; 4 predictive analytics; 5 full corridor intelligence linking code, carbon and capital. Durban roadmap, p. 226: 1 foundations; 2 port systems integration; 3 corridor digital integration; 4 predictive intelligence; 5 intelligent OceanGate. Preserve the source meanings and map observable capabilities before comparing level numbers. The Durban source also contains a Level 4 dashboard target alongside a Level 5 ambition; this edition does not claim the discrepancy is resolved.

The five corridor development levels are Movement, Integrated Trade, Economic or Development, Productive and Intelligent. Gateway maturity is Fragmented, Functional, Integrated, Intelligent and Compounding. These ladders assess different objects. A report must name its ladder, version, evidence and scope; a label alone is insufficient.

Custodianship pilot and continuity protocol

Name the shared function being tested and the precise powers the convenor holds. Specify participants, consent, accepted information, confidentiality, conflicts, review and exit. Distinguish operational coordination, nonbinding technical clarification and formal legal remedies. Establish a baseline and a bounded scenario before commencing the pilot.

Assess the time and quality of detection, coordination, authorised response and service restoration. Record costs transferred to other parties, unresolved disputes and access effects on smaller enterprises. A successful exercise should lead to a documented adoption decision, recurrent budget and review cycle. An unsuccessful exercise should identify whether the design, mandate, capability or underlying commercial proposition requires revision. (Nursimulu 2026e, 349–355, 358–365)

Corridor service compact and decision record

For each shared service, record purpose and users, participating institutions, jurisdiction, accepted event definitions, source records, operating commitments, decision rights and reserved powers. Identify the responsible executor, approving authority, consulted participants and informed parties. Add response times, escalation, dispute treatment and a safe interim operating arrangement.

A Corridor Operating Plan should connect maritime arrivals, berth and terminal capacity, rail paths, truck appointments, inspections, inland reception and return equipment as relevant to the selected task.

Confirm which commitments are binding, commercial, indicative or experimental. Establish the process for changing plans when demand, capacity or safety conditions change.

The review record identifies each exception, its cause, owner, action, resources, deadline and verification. Operating reviews address service failure; institutional reviews address unresolved mandates and incentives; annual reviews revisit productive purpose, investment, capability and distribution. A common dashboard should support this work rather than substitute for it.

Productive platform and enterprise participation record

Record the platform's productive purpose, actual and prospective customers, viable activities, location requirements, anchor demand and occupier commitments. Distinguish designation, prepared land, serviced capacity, occupied premises, operating firms and sustained output. Link infrastructure expenditure to the capability it enables and the party responsible for providing complementary services.

Assess Productive Additionality, Productive Depth, Effective Reachable Market and Diffusion. Identify suppliers and workers who can participate, the capability gaps they face and the practical services needed to close them. Record quality infrastructure, technical support, financing, payment terms, training and procurement access. Track applied capability and repeated commercial participation rather than counting attendance or registrations alone.

Where investor services are consolidated, specify which decisions officers can lawfully make. An administrative agreement cannot transfer a power that legislation reserves elsewhere. Record unresolved permissions, review routes and service standards. Incentives need transparent eligibility, cost, duration, performance obligations and review rather than an assumed universal package.

Port investment structure and continuity record

For each investment, record the port management model, asset and entity boundaries, legal owner, concession or service rights, operating responsibilities and competent oversight. Identify whether the transaction is new project funding, a share purchase, refinancing or a combination. Reconcile announced capital with committed, disbursed and productively installed investment.

Identify the strategic operator, equity investors, fund manager where relevant, lenders and any public support provider. Record their mandates, contribution, holding or debt horizons, material decision rights and distribution arrangements. Examine the effect of downside demand, foreign exchange exposure, renewal costs and contingent public obligations.

Link the structure to the selected service and its five capability evidence requirements. Establish interface funding, maintenance, skills, data obligations, access and a route for resolving failures. Define what must survive a change of control, exit or operator replacement and how continuity is demonstrated. Application requires the responsible institutions and appropriate transaction expertise; this record states the architectural questions rather than model legal clauses.

For concessions and joint ventures, apply the preceding record to control of operating and investment decisions, maintenance and renewal funding, user access and information rights. Specify continuity during distress, transfer or expiry, and match financing to revenue, asset life and risk. Verify the staff, institutions, complementary services and recurrent finance needed to operate the capability. The controlled decisions in F01 section 5.7 are Proceed, Proceed Subject to Conditions, Optimise Existing Capability, Integrate First, Resequence, Redesign, Repurpose, Defer and Do Not Proceed. Preparation is a defined action under the appropriate decision and conditions. A material exposure requires mitigation, redesign or an explicit competent decision with its rationale; a methodology finding does not itself exercise a government's legal powers. (LOGI-CONSULT 2026a sections 5.6–5.7)

Gateway investment comparison calculation record

Use this record with Chapter 7's illustrative comparison and the existing Gateway Investment Gate. It supports economic screening within the gate; it is not a separate maturity scale, an investment approval or a substitute for the full financial and economic appraisal. Retain a common without-project baseline, including realistically funded maintenance, and distinguish avoided deterioration from additional improvement.

For each option, record initial incremental investment K , annual incremental operating cost O , annual benefiting containers N , mean days saved per benefiting container d and economic resource cost per container-day v . The common appraisal period is ten years and the real discount rate is 0.10. The exact capital-recovery factor is $0.10 \times (1.10 \text{ raised to power } 10) \text{ divided by } ((1.10 \text{ raised to power } 10) - 1)$, or 0.1627453949. Calculate before rounding.

Annualised cost equals K multiplied by the capital-recovery factor, plus O . Annual benefit equals N multiplied by d multiplied by v . Annual equivalent net benefit equals annual benefit less annualised cost. Break-even delay value equals annualised cost divided by $(N \text{ multiplied by } d)$. With changing annual flows or different start dates, discount the actual dated flows; do not apply the constant annual illustration mechanically.

Scheduling therefore has annualised cost USD 725,490.79 and annual benefit USD 1,500,000, leaving USD 774,509.21. Evacuation has cost USD 2,952,944.74 and benefit USD 6,000,000, leaving USD 3,047,055.26. Berth expansion has cost USD 8,009,815.80 and benefit USD 2,500,000, leaving a shortfall of USD 5,509,815.80. At the assumed time savings and USD 50 delay value, break-even benefiting volumes are approximately 29,020, 39,373 and 160,196 containers respectively. The berth requirement exceeds the example's 100,000-container eligible population.

The USD 50 value is a constructed economic resource-cost assumption, not a tariff or market estimate. A field ledger must identify its components, their valuation basis and whose resources are released. Financing charges, demurrage, detention and storage invoices cannot be added indiscriminately: some are transfers within the appraisal boundary, while others may reflect real resource use already counted. Define geography and standing, separate resident and non-resident effects where relevant, and exclude duplicated inventory, equipment and production benefits.

The aggregate operating costs assume recurring staffing, routine maintenance and service provision. No separate major renewal, closure cost, residual benefit, tax, foreign-exchange adjustment or externality has been quantified. This omission limits the finding. Before a commitment, replace aggregate costs with dated lifecycle expenditure, assess land and transition costs, environmental and social effects, and test useful lives and salvage values. Keep a separate financial account of revenues, charges, taxes, financing terms, affordability and each participant's cash flow. The 10% economic illustration is not a financing rate or a mandated social discount rate.

Table 29 Sensitivity of annual equivalent net benefit in USD million

Assumption change	Scheduling	Evacuation	Berth capacity
Base illustration	0.77	3.05	−5.51
Half the benefiting traffic only	0.02	0.05	−6.76
Half the time saving only	0.02	0.05	−6.76
Both traffic and time saving halved	−0.35	−1.45	−7.38

These tests hold investment and operating cost constant. The narrow positive results in the single-variable downside cases provide little allowance for omitted costs. They are not evidence of resilience. Test correlated reductions, longer implementation, lower delay value, higher capital and maintenance costs and loss of a major customer. Record threshold crossings and the reason for retaining, redesigning, deferring or rejecting an option within the gate's controlled decision terminology.

For a sequence, establish the baseline after the preceding intervention. Compare the next stage's discounted incremental benefits with its incremental capital, operating and transition costs, recognising reusable assets. Record sunk expenditure separately: it cannot justify further spending. Re-estimate benefiting traffic and remaining delay instead of adding the separate options' savings against the original baseline.

The verification record links event-level vessel and consignment observations to named cargo and periods; sampling and exceptions; matched reliability measures; operator and receiver commitments; technical designs and cost quotations; demand evidence; and decision rights for each critical interface. Test mean delay alongside the proportion delivered within the agreed window and severe-delay observations. A pilot should define its comparator, duration, seasonal coverage, success criteria, expenditure ceiling and stop conditions before operation. It cannot attribute every observed change to coordination.

Finally, connect verified service changes to enterprise records, production interruptions, accepted orders, supplier capability, resident income and reinvestment. Track distributional losses as well as gains and reconcile the result to the Port Value Account without double counting. A complete record states what was observed, what remains assumed, who is authorised to act, who funds continuity and what evidence would change the decision. Empirical validation remains a subsequent task; the published illustration demonstrates a reproducible choice structure.

Capital preparation and value retention account

Classify each financing requirement as common infrastructure, platform development, enterprise investment, working capital or shared operating capability. Record sponsor, asset or service, demand, permits, procurement, revenue model, currency, duration, risk allocation, maintenance and renewal. Distinguish pipeline concepts, commitments, financial close, disbursement and productive operation.

For proposed credit or liquidity mechanisms, document accepted transactions, data permissions, authentication, claims, payment controls, counterparties, lender decisions, recourse and dispute arrangements. For an investment vehicle, identify governance, contributors, mandate, fees, risk-bearing, audit and investor protections under applicable requirements. The monograph's mechanism descriptions do not establish that a fund or facility is operational. Prepare separate accounts of ownership, local value added, income retained, fiscal contribution, skills, technology, supplier capability and reinvestment. Specify the denominator for every proposed percentage. The 40% selected-import activity ambition, 60% export value-chain ambition, 65/35 local and international private partnership and 90/10 national and metropolitan public port ownership proposal concern different propositions. Domestic capital references are separate. The Durban source contains US\$7 billion and US\$8–10 billion mobilisation envelopes; the larger allocation totals US\$9 billion.

They require scope and version reconciliation. This edition adopts their capital functions while withholding a consolidated project total. The same discipline applies to announced funds, projected jobs and GDP effects.

Risk resilience and transition continuity record

Maintain a register covering physical and climate risk, operational failure, digital compromise, financial exposure, institutional discontinuity, social conflict and ecological harm. For each material risk record exposure, likelihood, consequence, responsible institution, prevention, contingency, resources, activation trigger and recovery objective. Document dependencies whose failure can propagate across several locations. Test alternatives against the service they must sustain: cargo compatibility, access rights, spare capacity, staff, equipment, energy, information and switching time. Digital continuity should include recoverable records, restoration tests, critical-system separation, provider exit and appropriate degraded service. Financial and institutional continuity should address operating budgets, renewal, succession and unresolved obligations. During transition, preserve lawful mandates and contracts, critical operations, accepted information and credible funding. Sequence stabilisation, integration and expansion around verified dependencies. A revised milestone should state why it changed, which service remains protected and what evidence will allow the next decision.

Chapter decision guide

Use these prompts for board discussion, professional reflection or a facilitated strategy session. They summarise the chapter arguments without introducing a separate assessment method.

1 The future African port

Start with the economy served and distinguish current, declared and reachable roles. Maritime scale, service performance and productive contribution require separate evidence.

Decision questions: Which proposed role has a supported customer and service case? What evidence could show that a smaller intervention is preferable?

2 The African Fifth-Generation Port

Connect the five capabilities around a defined service. Preserve separate institutional powers and test OPI against raw observations and critical failures.

Decision questions: What must each participant be able and authorised to do? Which competing explanations could account for the same pressure profile?

3 The port and the Blue Economy

Design a complete viable service chain within ecological limits. Skills, energy, assurance and operating continuity belong within the proposition.

Decision questions: Which dependency prevents accepted delivery? Would maintenance, changed windows or additional physical capacity resolve it?

4 From port to intelligent corridor

Follow the enterprise journey to commercially usable access. Productive Yield requires outcomes beyond port exit, with benefits and costs traced across territories.

Decision questions: Where is the material hand-off failure? Which enterprise record would demonstrate improved productive capability?

5 The port city and the productive territory

Locate activities through their requirements for land, utilities, suppliers and workforce access. Include surrounding communities and rural participants.

Decision questions: Which function needs waterfront proximity? Who bears displacement, access or compliance costs?

6 Making the connected system operate

Link trusted information to accountable decisions and funded continuity. Maintain workable alternatives, records and institutional memory.

Decision questions: Who can resolve the exception? Can the alternative actually operate during the same disruption?

7 Investment and productive value

Appraise a capability the economy can use. Separate economic benefit, participant cash flow, value added, resident income and reinvestment.

Decision questions: Which alternative changes the complete service? What remains viable under correlated downside assumptions?

8 Building the transition

Activate a bounded service and progress through evidence gates. Scaling requires repeatable results, capacity to absorb investment and lifecycle funding.

Decision questions: What observation would justify scale? What would require redesign, deferral or termination?

Gateway case discussion guide

Use these prompts alongside the cases. Distinguish dated observations, the author's architectural interpretation and the evidence required for a subsequent decision.

Port Louis and seafood

Which observed failure would justify more cold storage rather than maintenance or revised receiving windows? What evidence would make the service trial proceed, change or stop?

Mombasa and inland users

What does the combined port, border and inland record show about the usable journey? Which enterprise records would demonstrate productive benefit in the landlocked economy?

Durban industrial gateway

Which terminal-specific constraint governs accepted delivery to the factory? How would operating recovery be connected to production continuity and retained supplier capability?

Abidjan-Lagos distributed system

Which agreements allow independent gateways to sustain the chosen service? Where could value be counted twice, and which transaction-level baseline is still required?

Tanger Med comparator

What evidence beyond reported business volume would establish retained value? Which alternative explanations and differences in scale limit transfer to a smaller gateway?

Durban digital disruption, July 2021

Which records distinguish restored software from restored service and backlog recovery? Who may prioritise scarce capacity, with which safeguards and tested fallback?

Application exercises

These exercises use the monograph's reported observations and constructed demonstrations. Their purpose is to practise evidence handling and decision reasoning. The answer key follows; none supplies a measured gateway assessment.

1. Read operating averages

Vessel time falls from 45.9 to 39.4 hours; berth time from 32.2 to 31.9; pre-berthing delay from 13.7 to 7.5. Locate the changes and state what further evidence is needed.

2. Reconcile a reported growth rate

A source reports 45.45 Mt against 40.99 Mt and states 10.0% growth. Calculate the rate implied by the volumes and explain how to report the discrepancy.

3. Apply the proposed OPI anchors

Using Table 27 anchors, score waiting of 30 hours, berth occupancy 60%, yard occupancy 85%, import dwell 5 days and crane productivity 20 moves per gross crane-hour. Interpret the profile.

4. Stress the investment comparison

Replace USD 50 with USD 30 per avoided container-day in Table 12, holding the remaining assumptions constant. Which options remain positive?

5. Construct a Port Value Account

Output is 200; intermediate consumption 120; consumption of fixed capital 10. Labour compensation is 40 (resident 36); production taxes less subsidies 6; interest 4, all nonresident; profit 20 (resident 8). Calculate value added and income within the stated boundary.

6. Recalculate financing time

For the Table 15 illustration, use 9% annual simple interest on USD 100,000 for 27 versus 20 days, on an actual-days/365 basis. Retain the USD 300 direct saving.

7. Classify role statements

Classify: (a) recorded throughput with a stated transshipment share; (b) a master-plan ambition to become a regional hub; (c) a claim that a feeder and inland depot can serve two additional markets within five years.

Answer key and interpretation

1. Read operating averages

Total vessel time falls by 6.5 hours: 6.2 before berthing and 0.3 at berth. The averages locate the change but establish neither cause nor enterprise benefit.

2. Reconcile a reported growth rate

The implied growth is $(45.45 / 40.99 - 1) \times 100 =$ approximately 10.88%, or 10.9%. Preserve the source-reported volumes and disclose the inconsistent percentage.

3. Apply the proposed OPI anchors

Component scores are 5.25, 5.00, 9.3333, 7.00 and 7.00. The weighted headline is 6.5417, reported as 6.5 and classified Congested under the proposed continuous bands. Yard pressure lies in the severe range; the headline must not conceal it. All data remain constructed.

4. Stress the investment comparison

Benefits become USD 0.90m, 3.60m and 1.50m. Net benefits are approximately USD 0.17m, 0.65m and minus 6.51m. Scheduling and evacuation remain positive under these limited assumptions; omitted costs and service requirements still matter.

5. Construct a Port Value Account

GVA = 80; NVA = 70. Under the simplified distribution convention, $40 + 6 + 4 + 20 = 70$. Resident and government income = $36 + 6 + 8 = 50$; nonresident income = $4 + 4 + 12 = 20$. Reinvestment and installed capability require separate records.

6. Recalculate financing time

Financing costs are USD 665.75 and USD 493.15. The financing saving is USD 172.60 and the combined saving USD 472.60. This is a consignment cost difference, not national value added or an investment return.

7. Classify role statements

(a) Current Role, subject to verified service and cargo records. (b) Declared Role, attributed to its issuer. (c) A proposed Reachable Role requiring demand, network, capability, institutional and investment evidence; the wording of the claim does not establish reachability.

References

- AIC2030 Institute. 2026. *AIC2030 SEZ Framework: From Special Treatment to Productive Transformation*. Mother Discussion Paper, version 0.9. Think Tank Working Version. August. Unpublished discussion paper.
- APM Terminals. n.d. SCCT. Suez Canal Container Terminal, East Port Said.
<https://www.apmterminals.com/en/Terminals/Africa-Middle-East/Egypt/Port-Said/Home>
- Caminhos de Ferro de Moçambique. 2025. *Porto de Nacala: Manual e Directório / Port of Nacala Handbook and Directory*. <https://www.cfm.co.mz/wp-content/uploads/2025/03/Porto-de-Nacala-Manual-e-Directorio-2025.pdf>
- Department of Public Enterprises, South Africa. 2021. *Minister Pravin Gordhan Commends Transnet for Restoring Full Ports Operations*. July 29. <https://www.gov.za/news/media-statements/minister-pravin-gordhan-commends-transnet-restoring-full-ports-operations-29>
- Djibouti Ports and Free Zones Authority. n.d. *Rail*. <https://www.dpfza.gov.dj/facilities/inland-transport/rail>
- DP World. 2020a. *DP World and CDPQ Expand Global Investment Platform to US\$8.2 Billion*. September 3. <https://www.dpworld.com/en/news/dp-world-and-cdpq-expand-global-investment-platform-to-us82-billion>
- DP World. 2020b. *DP World and Senegal Sign Agreement to Develop Ndayane Port*. December 23. <https://www.dpworld.com/en/news/dp-world-and-senegal-sign-agreement-to-develop-ndayane-port>
- DP World. 2023. *DP World and Somaliland Government Open Berbera Economic Zone*. <https://www.dpworld.com/en/news/dp-world-somaliland-open-berbera-economic-zone>
- DP World. 2026. *DP World Completes Dredging Ahead of Schedule at Senegal's Port of Ndayane*. July 27. <https://www.dpworld.com/en/news/dp-world-completes-dredging-ahead-of-schedule-at-senegals-port-of-ndayane>
- European Commission. n.d.-a. *Decarbonising Maritime Transport: FuelEU Maritime*. https://transport.ec.europa.eu/transport-modes/maritime/decarbonising-maritime-transport-fueleu-maritime_en
- European Commission. n.d.-b. *FAQ: Maritime Transport in EU Emissions Trading System*. https://climate.ec.europa.eu/areas-action/transport-decarbonisation/reducing-emissions-shipping-sector/faq-maritime-transport-eu-emissions-trading-system-ets_en
- Food and Agriculture Organization of the United Nations. n.d. *Agreement on Port State Measures*. <https://www.fao.org/port-state-measures/en/>
- Government of Mauritius. n.d. *The Seafood Hub: Background Information*. Ministry responsible for fisheries. Historical paper containing 2011 data and 2012 policy context. <https://blueeconomy.govmu.org/Pages/Departments/Seafood%20Hub/2-The%20Seafood%20Hub.pdf>
- Government of Togo. 2025. *Port de Lomé : 30,6 millions de tonnes de marchandises manutentionnées en 2024*. April 24. <https://www.republiquetogolaise.tg/logistique/2404-10567-port-de-lome-30-6-millions-de-tonnes-de-marchandises-manutentionnees-en-2024>
- IFM Investors, CPP Investments, and OMERS. 2026. *CPP Investments and OMERS Reach Agreement to Sell Entire Stakes in Associated British Ports to a Fund Managed by IFM Investors*. October 21. <https://www.ifminvestors.com/en-gb/news--insights/media-centre/cpp-investments-and-omers-reach-agreement-to-sell-entire-stakes-in-associated-british-ports-to-a-fund-managed-by-ifm-investors/>
- InterCom Togo. n.d. *Autonomous Port of Lomé*. <https://www.intercom.tg/en/institutions/port-autonome-de-lome>
- International Labour Organization. n.d. *Ports and Logistics*. <https://www.ilo.org/topics-and-sectors/industries-and-sectors/shipping-fishing-and-inland-waterways/ports-and-logistics>
- International Maritime Organization. 2026. *MEPC 84th Session, 27 April–1 May*. Official meeting summary. <https://www.imo.org/en/mediacentre/meetingsummaries/pages/temporary-mepc-84th-session.aspx>
- International Maritime Organization. n.d. *Convention on Facilitation of International Maritime Traffic (FAL)*. [https://www.imo.org/en/about/conventions/pages/convention-on-facilitation-of-international-maritime-traffic-\(fal\).aspx](https://www.imo.org/en/about/conventions/pages/convention-on-facilitation-of-international-maritime-traffic-(fal).aspx)

- Kenya Ports Authority. 2026. *Port of Mombasa Registers Impressive Cargo Growth in 2025*. <https://www.kpa.co.ke/Media/Read/188>
- Kenya Ports Authority. n.d. *[2024 cargo performance announcement]*. January–December comparison. <https://www.kpa.co.ke/Media/Read/2>
- Kunaka, Charles, and Robin Carruthers. 2014. *Trade and Transport Corridor Management Toolkit*. World Bank. <https://documents1.worldbank.org/curated/en/719971468325781473/pdf/Trade-and-transport-corridor-management-toolkit.pdf>
- Lee, P. T. W., and J. S. L. Lam. 2016. “Developing the Fifth Generation Ports Model.” In *Dynamic Shipping and Port Development in the Globalized Economy*, 186–210. https://doi.org/10.1057/9781137514295_8
- Lee, P. T. W., Z. Y. Song, C. W. Lin, J. S. L. Lam, and J. Chen. 2025. “New Framework of Port Logistics in the Post-COVID-19 Period with 6th-Generation Ports (6GP) Model.” *Transport Reviews* 45 (1): 77–93. <https://doi.org/10.1080/01441647.2024.2405205>
- LOGI-CONSULT. 2026a. *AIC2030 Ports & Corridor Gateways Framework: The Mother Framework for Gateway Assessment and Transformation*. Version 1.3.3. Master Roadmap V2.0 Aligned Complete Publication Edition. August. Unpublished controlled framework.
- LOGI-CONSULT. 2026b. *New African Economic Architecture AIC2030 Master Roadmap*. Version 2.0. Unpublished roadmap.
- Maputo Port Development Company. 2026. *Port of Maputo Achieves Historic Records in Volumes and Strengthens Its Contribution to National Development*. <https://www.portmaputo.com/port-of-maputo-achieves-historic-records-in-volumes-and-strengthens-its-contribution-to-national-development/>
- Maritime and Coastguard Agency and Department for Transport. n.d. *A Guide to Good Practice on Port and Marine Facilities*. <https://www.gov.uk/government/publications/a-guide-to-good-practice-on-port-marine-operations/a-guide-to-good-practice-on-port-and-marine-facilities>
- Maritime and Port Authority of Singapore. 2023. *Port Marine Circular No. 10 of 2023*. September 22. <https://www.mpa.gov.sg/api/media/b83939b7-76a7-4832-bcbb-ca606ce4a6cf/pc23-010.pdf>
- Mauritius Ports Authority. 2026. *Annual Report Financial Year 2024–2025*. https://www.mauport.com/wp-content/uploads/2026/07/MPA_Annual-Report_2024-2025_PRO4700-compressed.pdf
- Namibian Ports Authority. n.d. *At a Glance: Namport Overview*. <https://www.namport.com.na/about-namport/at-a-glance/317/>
- Nigerian Ports Authority. n.d. *Lekki Deep Sea Port*. <https://nigerianports.gov.ng/lekki/>
- Northern Corridor Transport Observatory. 2025. *Northern Corridor Quarterly Performance Dashboard: July to September 2025*. <https://top.ttcanc.org/uploads/attachments/cmipkheb600vvc7lj814q8bt5-quarterly-report-july-to-september-2025.pdf>
- Notteboom, T. E., and J.-P. Rodrigue. 2005. “Port Regionalization: Towards a New Phase in Port Development.” *Maritime Policy & Management* 32 (3): 297–313. <https://doi.org/10.1080/03088830500139885>
- Nursimulu, Rhavy. 2025a. *Durban OceanGate: Re-Engineering Africa’s Southern Maritime Capital and Industrial Spine*. December. LOGI-CONSULT. Unpublished blueprint; programme edition 2026.
- Nursimulu, Rhavy. 2025b. *The Port of Mombasa and the Northern Corridor in a Fragmented World: Re-Architecting Africa’s Maritime Gate and Trade Spine*. October. LOGI-CONSULT. Unpublished blueprint circulated for peer review.
- Nursimulu, Rhavy. 2026a. *AIC2030 Port Congestion Model and Operability Pressure Index*. Africa Intelligent Corridors 2030. Unpublished model specification reproduced in this monograph.
- Nursimulu, Rhavy. 2026b. *From Transport Corridor to Intelligent Corridor*. Working Research Edition 1.0. September. Unpublished working paper.
- Nursimulu, Rhavy. 2026c. *Le Corridor Atlantique Abidjan–Lagos*. Strategic Blueprint, version 2.2. March. LOGI-CONSULT. Unpublished strategic blueprint.

- Nursimulu, Rhavy. 2026d. *Next Generation African Industrialist Framework*. Version 1.0. Unpublished framework.
- Nursimulu, Rhavy. 2026e. *Port Louis Custodian of the Indian Ocean Blue Corridor: Architecting Ocean Trade Capital and Governance for the Next Ocean Civilisation*. January. LOGI-CONSULT. Unpublished strategic blueprint.
- Nursimulu, Rhavy. 2026f. *Re-Architecting African Freight: How Movement Can Build Africa's Productive Economy*. Revised October 6. AIC2030 Monograph Series. LOGI-CONSULT.
- Oboda, V.. n.d. "The Yacht Port Can Be More Than a Marina." Caribbean Ports as Energy Hubs, article 011. Aupuras. Accessed October 22, 2026. <https://aupuras.com/insights/caribbean-ports-as-energy-hubs/011-the-yacht-port-can-be-more-than-a-marina/>
- OECD. 2019. *Rethinking Innovation for a Sustainable Ocean Economy*. OECD Publishing. <https://doi.org/10.1787/9789264311053-en>
- Pacific Northwest National Laboratory. n.d. *Port Microgrids*. Port Electrification Handbook. Accessed October 22, 2026. <https://www.pnnl.gov/projects/port-electrification-handbook/port-microgrids>
- Russo, F., and G. Musolino. 2020. "Quantitative Characteristics for Port Generations: The Italian Case Study." *International Journal of Transport Development and Integration* 4 (2): 103–112. <https://doi.org/10.2495/TDI-V4-N2-103-112>
- SSATP. 2024. *Status of Digitalization and Policy Impediments in African Ports*. March. https://www.ssatp.org/sites/default/files/publication/SSATP_Africa_Ports_EN%20FINAL.pdf
- Tanger Med Port Authority. 2025. *Tanger Med Passes the 10 Million Container Mark*. 2024 activity release. <https://www.tangermedport.com/en/tanger-med-passes-the-10-million-container-mark/>
- Tanger Med Special Agency. n.d. *Business Volume of Sectors Operating at Tanger Med*. <https://www.tangermed.ma/en/business-volume-of-sectors-operating-at-tanger-med/>
- Transnet. 2025. *Transnet Port Terminals Report 2025*. Operational Performance Review. <https://www.transnet.net/getFile.ashx?id=6119>
- UN Trade and Development (UNCTAD). 1992. *Port Marketing and the Challenge of the Third Generation Port*. TD/B/C.4/AC.7/14. https://unctad.org/system/files/official-document/tdc4ac7_d14_en.pdf
- UN Trade and Development (UNCTAD). 1999. *Ports Newsletter*. No. 19. November. <https://unctad.org/system/files/official-document/posdtetibm15.en.pdf>
- UN Trade and Development (UNCTAD). 2025a. *Review of Maritime Transport 2025: Staying the Course in Turbulent Waters*. <https://unctad.org/publication/review-maritime-transport-2025>
- UN Trade and Development (UNCTAD). 2025b. *Workshop to Present the Sustainable Smart Port Assessment Report for Port Louis, Mauritius*. May 27. <https://unctad.org/meeting/workshop-present-sustainable-smart-port-ssp-assessment-report-port-louis-mauritius>
- UN Trade and Development (UNCTAD). n.d. *Liner Shipping Connectivity Index: Quarterly Analytical*. UNCTAD Data Centre. <https://unctadstat.unctad.org/datacentre/reportInfo/US.LSCI>
- United Nations Economic Commission for Africa. 2016. *Africa's Blue Economy: A Policy Handbook*. <https://archive.uneca.org/publications/africas-blue-economy-policy-handbook>
- United Nations Economic Commission for Africa. 2024. *ECA and Kribi Deep Sea Port Stepping Up for a Partnership to Develop a New-Generation Special Economic Zone Integrated to the Port*. April 16. <https://www.uneca.org/stories/eca-and-kribi-deep-sea-port-stepping-up-for-a-partnership-to-develop-a-new-generation>
- United Nations Mauritius. 2025. *Building a Sustainable Future: Transforming Port Louis into a Smart, Green Maritime Hub*. June 2. <https://mauritius.un.org/en/295492-building-sustainable-future-transforming-port-louis-smart-green-maritime-hub>
- World Bank. 2019. *Côte d'Ivoire Second Phase Project of the Abidjan–Lagos Trade and Transport Facilitation Program*. Implementation Completion and Results Report ICR00004935, P116323. December 18. <https://documents1.worldbank.org/curated/en/642881577726971790/pdf/Cote-dIvoire-Second-Phase-Project-of-the-Abidjan-Lagos-Trade-and-Transport-Facilitation-Program.pdf>

World Bank. 2025a. *Port Performance Varies Across the Globe Amid Continuing Shocks*. September 22. <https://www.worldbank.org/en/news/press-release/2025/09/22/port-performance-varies-across-the-globe-amid-continuing-shocks>

World Bank. 2025b. *Port Reform Toolkit*. 3rd ed. Modules 3, 8, 9 and 10; economic regulation, social and labour aspects. <https://www.worldbank.org/en/topic/transport/publication/port-reform-toolkit>

World Bank. 2025c. *Port Reform Toolkit*. 3rd ed. Module 4, “Private Sector Participation.” <https://documents1.worldbank.org/curated/en/099073025114541805/pdf/P176624-c26aa2d0-f173-488c-b0ba-111a9b143d2c.pdf>

World Bank. n.d. *Public Private Partnerships in Ports / Port Reform*. Accessed October 22, 2026. <https://ppp.worldbank.org/sector/transportation/ports>

World Bank and International Association of Ports and Harbors. 2023. *Port Community Systems: Lessons from Global Experience*. <https://thedocs.worldbank.org/en/doc/68e8007a36a64995a1d299069ffd7852-0430012023/original/Port-Community-System-Conference-Edition.pdf>

World Bank and S&P Global Market Intelligence. 2026. *The Container Port Performance Index 2025*. June 10. <https://openknowledge.worldbank.org/entities/publication/fd314120-c813-4377-8780-178aca5dfa1b>

Source notes

Re-Architecting African Freight is the published companion. Other AIC2030 entries are unpublished authored blueprints, controlled frameworks or working research. These notes retain source locators, provenance and limitations. They qualify the evidence; they do not imply independent validation of the author's architectural propositions. Undated items retain n.d. where a reliable publication date was not established in the source record.

AIC2030 Institute 2026. Source for Productive Additionality, Productive Depth, Effective Reachable Market, Diffusion and the eight-pillar, 40-indicator diagnostic. Working status retained.

APM Terminals n.d.. Terminal location and network context, not a substitute for the CPPI observation boundary.

Caminhos de Ferro de Moçambique 2025. Cargo and hinterland context only; do not merge Nacala general/container facilities with the distinct Nacala-à-Velha coal terminal.

DP World 2020b. Announced joint venture, concession context and development responsibilities.

DP World 2023. Operator-reported openings and inland-market ambition, not legal clearance or verified current corridor performance. Geographical wording does not adjudicate sovereignty or recognition.

DP World 2026. Construction milestone, not evidence of commissioned port service.

Department of Public Enterprises, South Africa 2021. Official contemporaneous statement; system and interface restoration are distinguished from independent forensic or impact evidence.

Djibouti Ports and Free Zones Authority n.d.. Used only for the stated terminal–rail relationship; advertised transit times, capacities and financing figures are not adopted as current verified results.

European Commission n.d.-a. Regulation (EU) 2023/1805 overview and implementation guidance.

European Commission n.d.-b. Geographical coverage, phase-in and greenhouse gases. Reporting year and surrender year must be distinguished.

FAO n.d.. Consult the treaty and relevant national measures for an individual application.

Government of Mauritius n.d.. Undated historical paper containing 2011 data and 2012 policy context. Pages 1–3 used for the documented service chain concept; no current capacity or legal claim inferred.

Government of Togo 2025; InterCom Togo n.d.. Transshipment context. InterCom Togo, Autonomous Port of Lomé, supplies inland-access context. No end-to-end enterprise performance inferred.

IFM Investors, CPP Investments, and OMERS 2026. Agreement subject to approval; expected completion H1 2027.

International Labour Organization n.d.. Sector priorities and references on social dialogue, safety, training and working conditions.

International Maritime Organization 2026. Official meeting summary, Net Zero Framework section. Used as a dated negotiation record, not proof of adoption or entry into force.

International Maritime Organization n.d.. Official account of the 2022 amendments effective 1 January 2024 and the Maritime Single Window requirement.

Kenya Ports Authority 2026. January–December volumes: 45.45 million metric tonnes against 40.99 million in 2024. The stated volumes imply approximately 10.9%, not the release's reported 10.0%; the earlier 41.1 million 2024 baseline remains unreconciled.

Kenya Ports Authority n.d.. Reports 41.1 million tonnes in 2024 and 36.0 million tonnes in 2023.

Kunaka and Carruthers 2014. Introduction, printed pp. 1–8; Module 3, pp. 93–110.

LOGI-CONSULT 2026a. Sections 1.4–1.10, 2.2, 3.2–3.4, 4.5–4.11. Controlled framework in progressive validation.

LOGI-CONSULT 2026a. The reference edition is Version 1.3.3, Master Roadmap V2.0 Aligned Complete Publication Edition, August 2026, 114 pages. The internal edition identifier governs the citation. Relevant methodological passages are sections 3.1–3.7, 4.2–4.16, 5.1–5.11, 6.3–6.7 and Part IX; Appendices J, M, N and Q. The application protocols explain how the Core classifications are used where summary terminology differs; they do not amend the source framework.

LOGI-CONSULT 2026b. Source for the intellectual hierarchy, value cycle, operating architecture and framework relationships.

Maputo Port Development Company 2026. 2025 operating account; used for cargo and corridor context, not a harmonised comparison with Nacala.

Maritime and Coastguard Agency and Department for Transport n.d.. Sections 4.5–4.7, particularly towage planning, vessel-specific capability, environmental limits and competent marine-service provision. UK guidance used as a professional reference, not as law applicable across Africa.

Maritime and Port Authority of Singapore 2023. Used for announced implementation scope and training; expected benefits remain prospective.

Mauritius Ports Authority 2026. Printed pp. 81–83, Tables 17–19 and sections 6.6, 7.1–7.3.

Namibian Ports Authority n.d.. Authority-level cargo and corridor context; do not allocate combined Namport observations indiscriminately to Walvis Bay.

Nigerian Ports Authority n.d.. Concession and public-private partnership description, not a verified current ownership register.

Northern Corridor Transport Observatory 2025. Printed pp. 5–8 and 11–12, sections 2.1–2.2, 3.1 and 4.1.

Notteboom and Rodrigue 2005. Publisher abstract used for the bounded account of logistics networks, hinterland relationships and governance beyond the port perimeter; no full-text evaluation is claimed.

Nursimulu 2025a. Printed pp. 65–130, 140–187, 190–229.

Nursimulu 2025b. Pp. 29–43, 50–61, 68–74, 83–95, 98–120, 127–151.

Nursimulu 2026a. Original ten-indicator dashboard and five-component specification. Formula, illustrative scores and calibration requirements are reproduced in this monograph.

Nursimulu 2026b. Sections 6–10, especially the end-to-end definition, six operating layers, three intelligence tests and five corridor development levels. Full definition reproduced from section 6, pp. 11–12.

Nursimulu 2026c. 507 PDF pages; printed pagination 1–506. Principal integration sources: Chapters 8, 14, 17, 19–24, 27–28, 32–35, 37–39, 42, 44–45 and 47. Independent strategic propositions; not an official governmental programme. Page references use printed pagination. Proposed institutions, numerical thresholds and indices are not verified operating conditions or universal standards.

Nursimulu 2026d. Parts III–IV and enterprise capability, market reach, partnership, productive agency and capital formation sections.

Nursimulu 2026e. Printed pp. 45–77, 103–147, 170–212, 220–237, 261–371.

Nursimulu 2026f. Publication edition revised 6 October 2026, 120 pages. Shared conventions: p. 6 disclosure; p. 9 evidence and input maturity; pp. 12–16 definitions and hierarchy; p. 63 Productive Yield dimensions. Cross-volume references use this edition's printed pagination.

OECD 2019. Chapter 2, section 2.1.2 and Table 2.1, selected ocean technologies and applications. The working BlueTech definition and its role in the AIC2030 architecture are specified in this monograph.

Oboda n.d.. Concept proposition, accessed 22 October 2026.

Pacific Northwest National Laboratory n.d.. Technical and economic planning considerations, accessed 22 October 2026.

SSATP 2024. Relevant locator: printed pp. 12–13 (performance); p. 46 (digitalisation drivers). Observational study; not causal validation of the AIC2030 model.

Tanger Med Port Authority 2025. Container quantities are reported in TEU; the activity comparison does not establish retained productive value.

Tanger Med Special Agency n.d.. The page displays 26 December 2024; the observation period is 2024. Operator-reported activity, not a national value-added estimate.

Transnet 2025. Operational Performance Review, printed pp. 10–11, container moves per ship working hour.

UNCTAD 1992. Bibliographic and conceptual lineage reference.

UNCTAD 1999. Technical note on fourth-generation ports. Read alongside Lee and Lam (2016).

UNCTAD 2025a. Used for the dated Red Sea rerouting, voyage-distance and African connectivity observations.

UNCTAD n.d.. Use the stated period and geography when comparing observations.

United Nations Economic Commission for Africa 2016. Official publication overview reviewed for the aquatic scope and sustainability premise.

United Nations Economic Commission for Africa 2024. Reported activity and future development are distinct.

United Nations Mauritius 2025; UNCTAD 2025b. Assessment and proposed directions, not implementation verification.

World Bank 2019. Printed pp. 14–15. The dwell comparison is retained as source-reported. The inconsistent border percentage and endpoint are not adopted as a verified effect.

World Bank 2025a. Used for dataset scope, the vessel-time focus and the reported improvement of Dakar and Port Said.

World Bank 2025b. The port-specific tests in this monograph are architectural applications, not quotations from the toolkit.

World Bank 2025b. Used for the bounded comparison of stated scopes, not as evidence of the AIC2030 model's effectiveness.

World Bank 2025c. Tables 4.1–4.2, printed pp. 8–9; sections 4.3–4.4. Broad patterns are synthesised from the allocation table and model descriptions; project responsibilities must be established individually.

World Bank and IAPH 2023. Official report landing page, Port Community Systems: Driving Trade in the 21st Century. Used for the collaborative platform scope and implementation dimensions.

World Bank and S&P Global Market Intelligence 2026. Used for the dated global vessel-turnaround observation; the index does not measure complete corridor service or productive value.

World Bank n.d.. Key considerations in structuring PPPs: demand and revenue risk, competition and supporting infrastructure. Accessed 22 October 2026.

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Selected topic references and principal discussions. Page numbers refer to this edition; source-list occurrences are excluded.

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- OPI: see Operability Pressure Index.

Productive Yield: see also Port Value Account; Retention;
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