

Bridging Global Metrics and Local Realities - A Modelling Framework for Sustainability in Ports

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Department:
Science, Technology and Innovation
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CSIR
Touching lives through innovation

Ports: Complex social–ecological systems



Ports: Complex social–ecological systems



Ports Sustainability is a business imperative

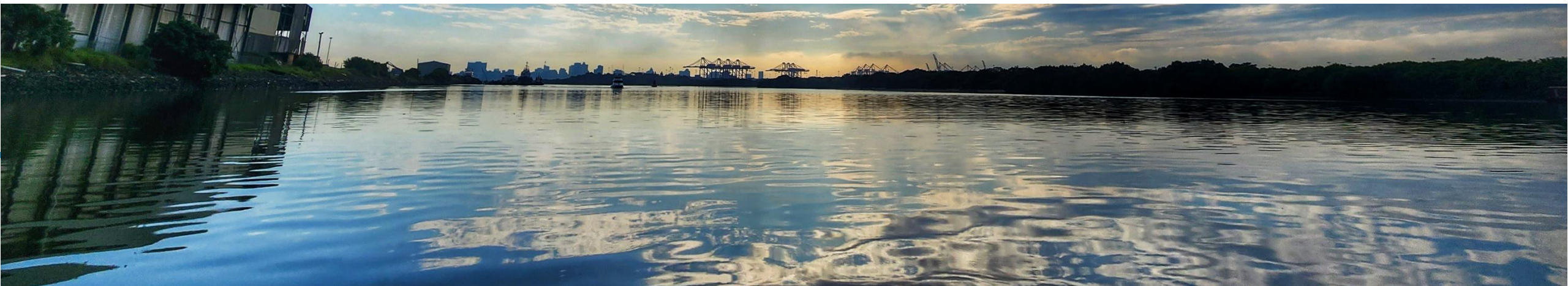
- Societal license to operate
- Access to funding
- Competitiveness

To demonstrate Sustainability you need an index

- A conceptual and mathematical framework to evaluate and aggregate diverse raw data into a single, standardized numerical score (a model)
- Deal with complexity and assist in better management of natural resources



Process of developing a “Ports Sustainability Performance” (PSP) Index

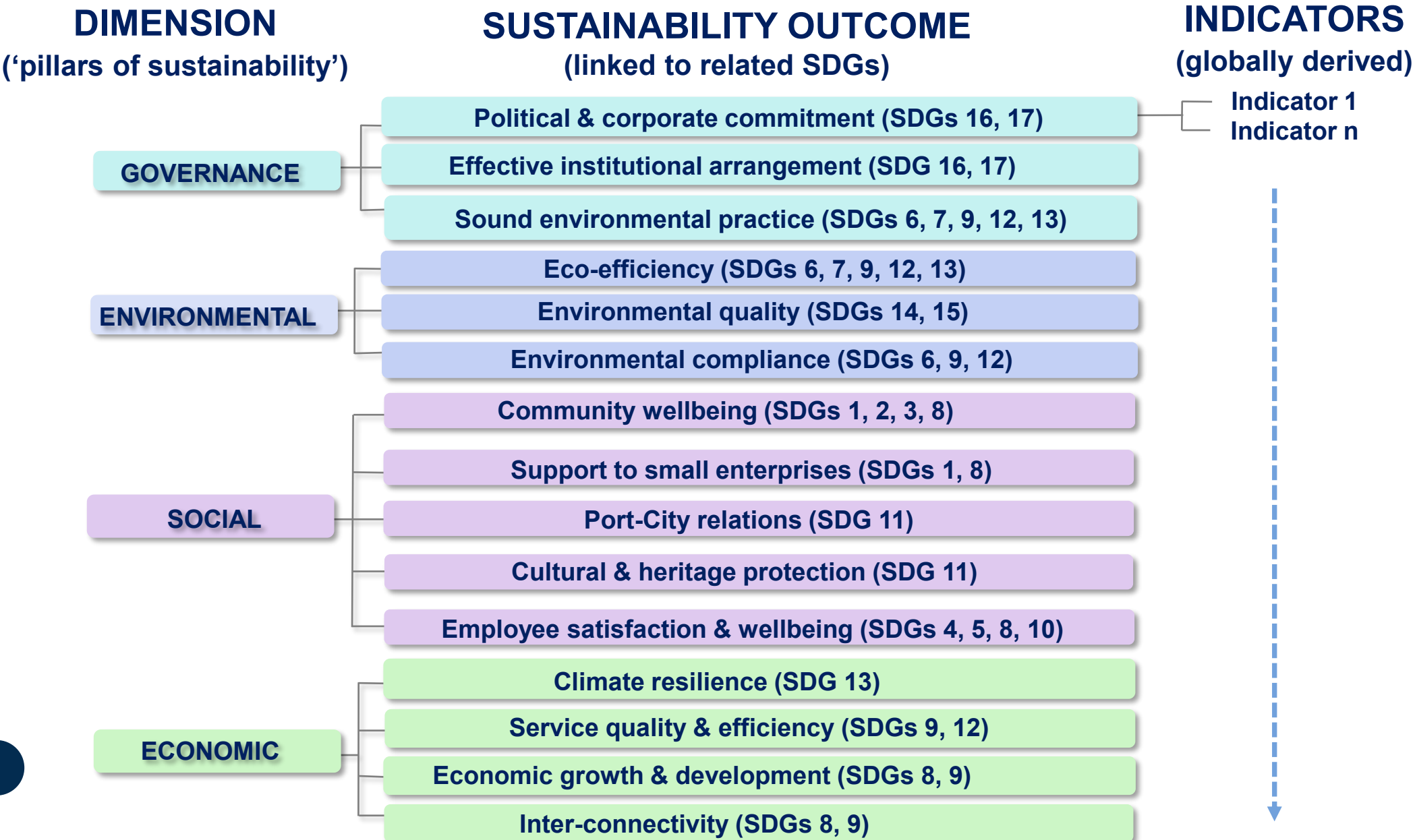


Critical review of global literature

Commonalities in global port sustainability indexes & indicators

Brazil	Roos and Neto. 2017. Tools for evaluating environmental performance at Brazilian public ports (environment/economic consequences).
China	Chen and Pak. 2017. A Delphi analysis on green performance evaluation indices for ports in China .
Finland	Brunila et al. 2023. Sustainable small ports: performance assessment tool for management, responsibility, impact, and self-monitoring (environment).
Spain	Peris-Mora et al. 2005. Development of a system of indicators for sustainable port management. González Laxe et al. 2017. Assessment of port sustainability through synthetic indexes. Application to the Spanish case.
Singapore	Xiao and Lam. 2017. A systems framework for the sustainable development of a Port City: a case study of Singapore's policies.
South Korea	Oh et al. 2018. The evaluation of seaport sustainability: The case of South Korea.
Thailand	Saengsupavanich et al. 2009. Environmental performance evaluation of an industrial port and estate: ISO14001, port state control-derived indicators (environment).
Taiwan	Chiu et al. 2014. Evaluation of Green Port Factors and Performance: A Fuzzy AHP Analysis (check may only be environment). Shiau and Chuang. 2015. Social construction of port sustainability indicators: a case study of Keelung Port. Lu et al. 2016. Identifying crucial sustainability assessment criteria for container seaports.
UK	Asgari et al. 2015. Sustainability ranking of the UK major ports: Methodology and case study (all).
Vietnam	Roh et al. 2016. Towards sustainable ASEAN port development: Challenges and opportunities for Vietnamese ports.
Global	Schipper et al. 2017. A sustainability assessment of ports and port-city plans: Comparing ambitions with achievements. Stein and Acciaro. 2020. Value Creation through Corporate Sustainability in the Port Sector: A Structured Literature Analysis.
Asia	Lirn et al. 2012. Green performance criteria for sustainable ports in Asia (environment).
Europe	Puig et al. 2017. Tool for the identification and implementation of Environmental Indicators in Ports (TEIP).
WIO region	Ogara et al. 2023. An indicator-based approach to assess sustainability of port-cities and marine management in the Global South.

Prototype Framework for PSP Index (based on global commonalities)



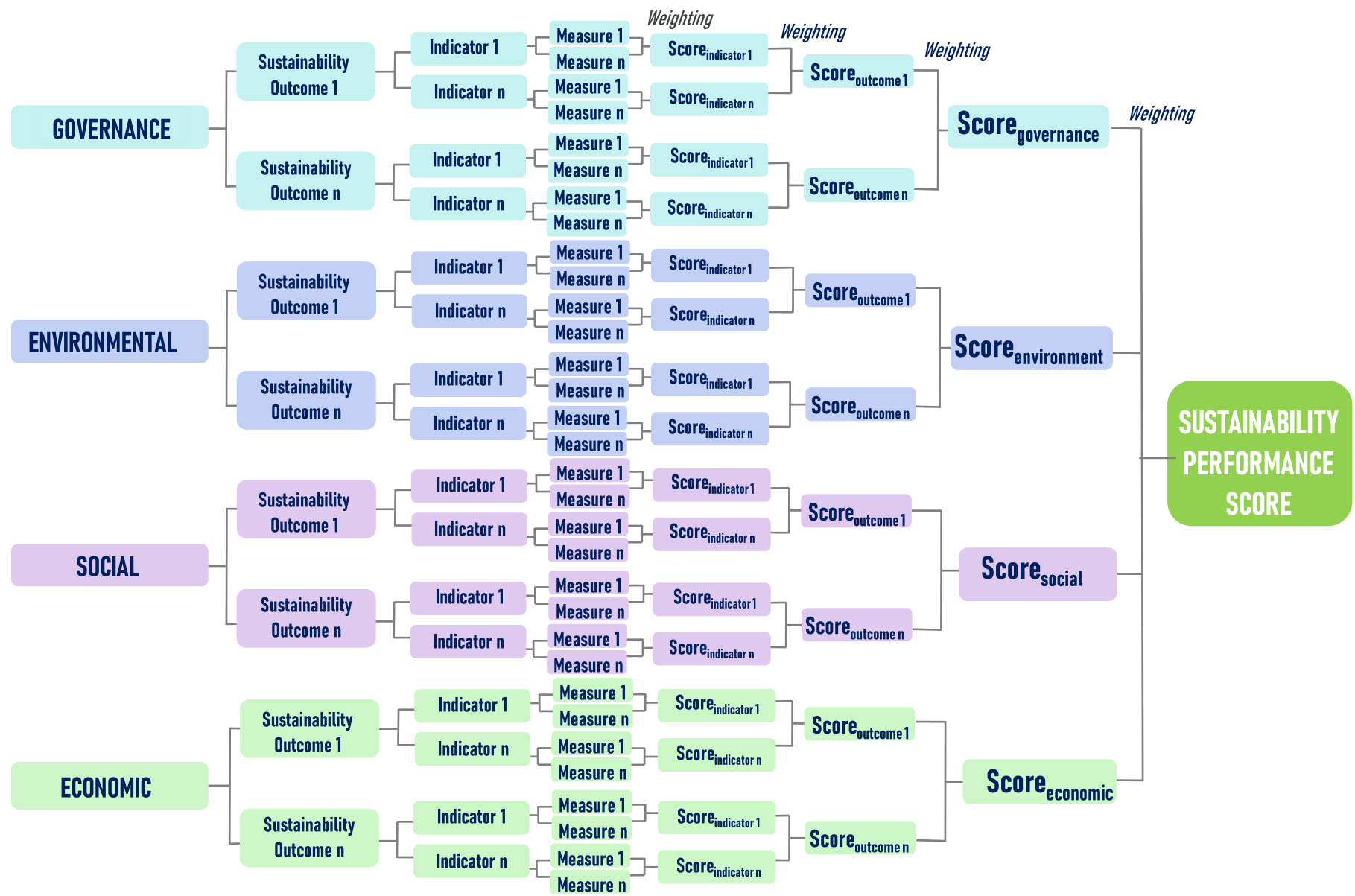
Local customization (with the end user)

Measures and targets for selected indicators

- PSP Framework and broad global-derived indicators were mostly recognizable to ports in pilot studies
- Worked separately with core team from port(s) in local customization process:
- Reviewed and refined Indicator list
- Defined Measures for quantification of indicators (what to measure?)
- Sustainability targets (what ideally should be met?)
- Rating systems (e.g., 4 = meet target, 0 = no target met) (to determine status)



Scoring: A user-friendly matrix

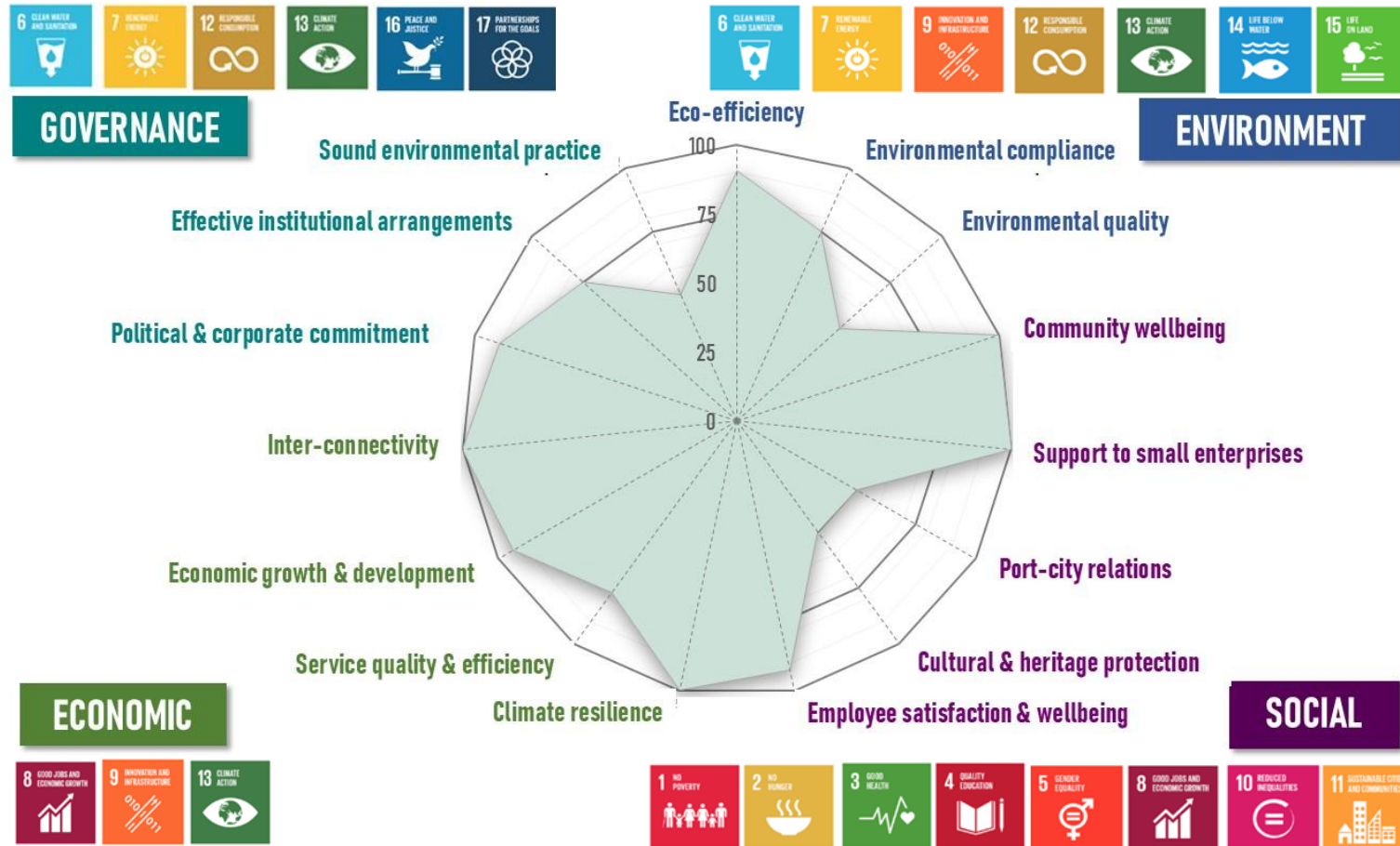


Scoring: A user-friendly matrix (spreadsheet)

- Develop easy-to-use Excel spreadsheet model to calculate scores
- Rating normalized to a score out of 100
- Weighting is flexible – default equal weighting, but can be adjusted to emprise specific priorities

Sustainability Outcome			Indicator			Measure			Weighting			Score			Rating (out of 100)					
			Measure	Indicator	Outcome	Dimension	Max	Part	Measure	Indicator	Outcome	Dimension	Max	Part	Measure	Indicator	Outcome	Dimension	Max	Part
DIMENSION: GOVERNANCE																				
Political and corporate commitment			Legislative framework in place to enable sustainable planning, development, and operations in ports			(National) legislative/thermal policy/regulatory framework supporting sustainability in ports			1	0.25			4	100	100					
			Organizational culture towards sustainable development			Adoption of a TNPA sustainability outcomes framework (e.g. Sustainability performance index)			1	0.25			4	100	100					
			Dedicated budgets allocated and implemented for sustainable development			a. Funding allocated to environmental issues			0.5	0.25	0.20		4	100	80					
			Public Communication			b. Training allocated to social issues (Corporate Social Investment)			0.5	0.25			4	100	80					
Effective institutional arrangements			Formal in-house institutions overseeing for environmental/social matters in port			Media releases and public documents reporting on environmental and social matters (e.g., TNPA)			0.5	0.25			4	75	75					
			Dedicated institution to engage with port customers (stakeholder operators)			a. Formal environmental department at port level overseeing for environmental matters			0.5	0.25			4	75	75					
			Dedicated institution to engage with stakeholders outside port boundaries			b. TNPA Sustainability Forum implementation at port level			1	0.25	0.20		4	75	75					
			Strategic Environment Assessment (SEA) undertaken			TNPA Customer Engagement Meetings implementation at port level			1	0.25			4	75	75					
Sound management practice			Dedicated collaboration arrangement between port & adjacent city (local authority)			Part consultative forums (specifically Climate Change Cluster)			1	0.25			4	75	75					
			Environmental Impact Assessment (EIA) undertaken			Homework of Understanding			1	0.25			4	75	75					
			Environmental Management Systems (EMS) undertaken			SEA process undertaken for new development at port level/implementation of EMS - Transit			1	0.20			4	25	25					
			Environmental Management Systems (EMS)			SEA process undertaken for new development at port level			1	0.20			4	25	25					
Management Plans/Programmes (MPLs/Frameworks or Standard Operating Procedures (SOPs) pertaining to sustainability			a. Air quality			Implementation of EMS - Transit Integrated Management Systems (TMS) - (ISO 14001, 45001)			0.00				4	1	25					
			b. Marine environmental quality			a. Air quality			0.00				4	1	25					
			c. Solid/groundwater			b. Marine environmental quality			0.00				4	1	25					
			a. Biodiversity management programme (protection of sensitive areas, trade-offs, etc.)			c. Solid/groundwater			0.00				4	1	25					
			b. Wastewater (effluent and stormwater) and permit			a. Biodiversity management programme (protection of sensitive areas, trade-offs, etc.)			0.00				4	1	25					
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Visualization: 'Circles of Port Sustainability'



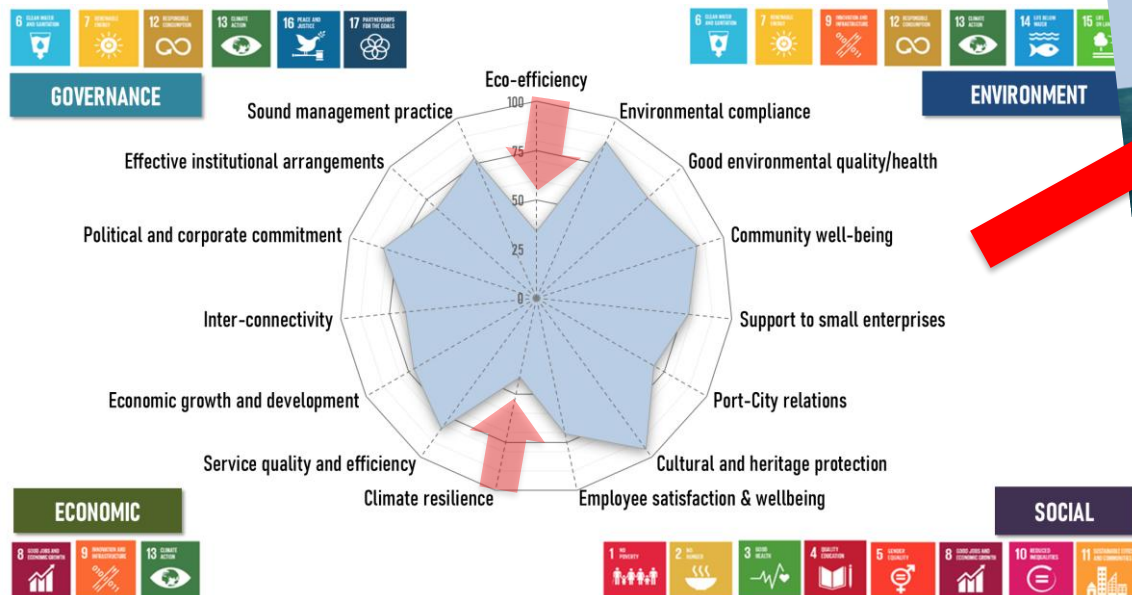
Sustainability Reporting:

- Temporal comparisons – tracking progress over time (e.g., Annual Sustainability Outcome Reports)
- Spatial comparisons - NB! Measures, Targets and Ratings for Indicators must be similar for 'comparing-apples-with apples'

Management Tool:

- Transparent design of PSP index enables identification of specific 'areas for improvement'
- Inform strategic planning within Integrated Port Management Framework
- Guide long-term investment decisions towards increasing port competitiveness

SECTION	TOOLS	SECTION	TOOLS
Planning	Guidance on Strategic Environmental Assessment	Operations	Guidance on Environmental Management Systems
	Site selection and Master Planning		Circular Economy in Ports
	Planning for Climate Change		Examples: Sustainable Port Development Actions
Design	Scenario Analysis Tool for Planning		Securing External Finance for Port Development Projects
	Guidance on Environmental Impact Assessment		Sustainable Use of Materials and Land
	Concept of Nature-based Solutions		Energy Efficiency Management
	Design for Biodiversity Offsets		Management of Carbon Footprint
Construction	Building-with-Nature Design Approach		Management of Water Consumption
	Ecological Enhancement Options		Waste Management
	Construction Environmental Management Plans		Ballast Water Management
	Dredge Management (also relevant in Operations)		Guidance on Sustainable Hull Cleaning
	Considerations for Port Decommissioning		Towards Improving Port Environmental Quality



Learning points: Science to Practice

- Co-design: involve stakeholders (the user, ports)
 - Data
 - Knowledge
 - Ownership
- Keep it Simple: design for application by the user (ports)
- Transferable (West Indian Ocean)
 - Community of Practice
- Actionable outputs



Thank you

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