Prof. Jill Slinger
Towards a framework for integrated and sustainable port development
Lessons from Port of Rotterdam

- Objectives for city and port (liveability, economics)
- Working/building with respect for nature
- Stakeholder-inclusive & value-based
- Integrated, adaptive design

Maasvlakte 2
Features of port expansion

- Resting areas for protected birds
- Liveability measures
- Marine protected area
**SHAPING THE PORT OF THE FUTURE**
The societal, economic and management challenges

**Sustainable Ports in Africa**
- University of Ghana + multiple partners
- Bottom-up approach > generic framework, tools
- Case study of Tema in Ghana

![Diagram showing the relationships between socio-economic, eco-system (dis)services, natural/coastal system, ecological system, and environmental dynamics.]

[Map of Africa highlighting Ghana.]
Port of Tema, Ghana

- Flood risk
- Eroded beaches
- Lagoon under pressure
- New port development area
- Crowded fishing port
- Existing port
Project Approach

- **T_{-1}** Historic development
- **T_0** Existing port (status quo)
- **T_1** Expansion (standard design)
- **T_1^+** Incremental value addition (green port)
- **T_1^{++}** Out of the box (green port ++)
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Stakeholder workshop: Tema

Interactive co-design
Steps in a stakeholder-inclusive, ecosystem-based design (1)

- Acknowledge that complexity requires co-design
  - Conscious choice for humans, environment & economy
- Adopt a stakeholder-inclusive strategy
  - Local knowledge & values
- Develop ecosystem-based systems understanding
  - Identify opportunities; change-oriented
Steps in a stakeholder-inclusive, ecosystem-based design (2)

- Integrated **engineering** designs
  - Conventional plus Building with Nature designs
  - Explicate trade-offs between engineering and ecological design principles
  - Adaptive
  - Oriented to the identified local values
  - Include management & monitoring strategies
Steps in a stakeholder-inclusive, ecosystem-based design (3)

- Evaluate & select between engineering designs
  - Interactively with stakeholders (value-based)
  - Discuss trade-offs
- Assess the added value of the approach
  - Quality of selected engineering design
  - Ecosystem health
  - Matching to identified social values
  - Process costs and constraints
The Sustainable Ports framework…

Set-up overarching co-design process

- Value-based
- Stakeholder-inclusive
- Ecosystem-based
- Future-proof

Port design hierarchy
(de Boer et al. 2018)

1. Alternatives to port development
2. Port site
3. Port layout
4. Structures & Materials

Systemic elements of the approach

contextualize

Integrated engineering design

how?

Methods & selection criteria

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