SuPort:
Appraising Port Sustainability

Arup

Craig Covil

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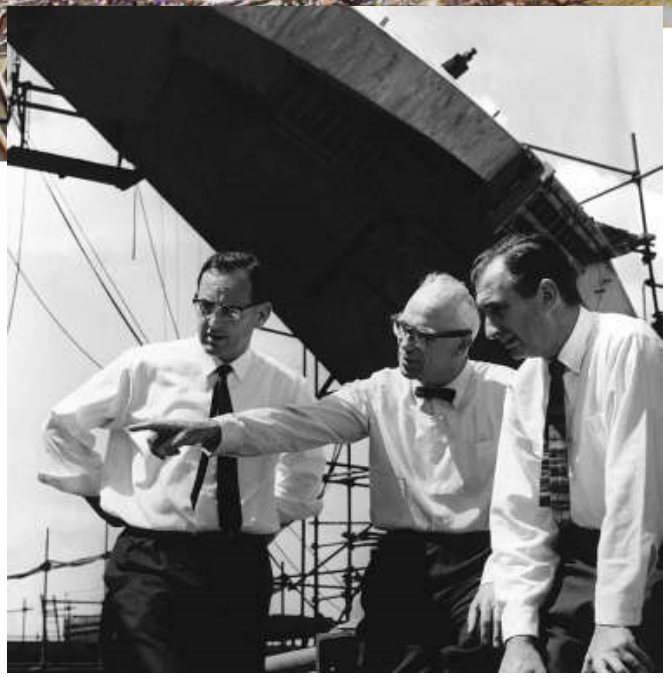
Agenda

- **Intro to Arup**
- **Climate Change Risks: Implications to Maritime**
- **Plausible Futures for Ports in 2050**
- **SuPort: Port Sustainability Appraisal Tool**

- **Tomorrow – break out session**

Greening Port Facilities

- Sir Ove Arup founded his practice in London in 1946 based on a belief in ‘total design’
- Today we understand this as a commitment to sustainability.



On site at the Sydney Opera House, 1966


C8

UC San Diego, Scripps Institution of Oceanography Vaughan Hall Replacement Facility, La Jolla, California

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* denotes Representative Offices

Worldwide Presence | Over 10,000 staff ❖ in more than 90 offices ❖ in over 30 countries

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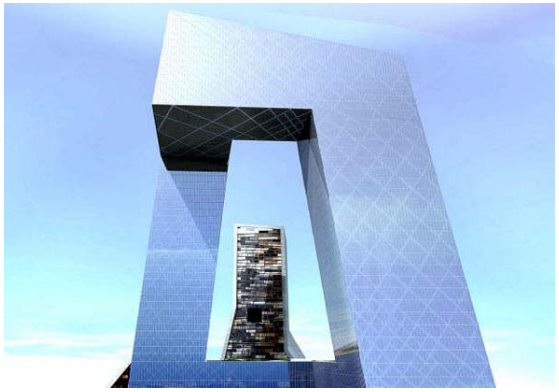
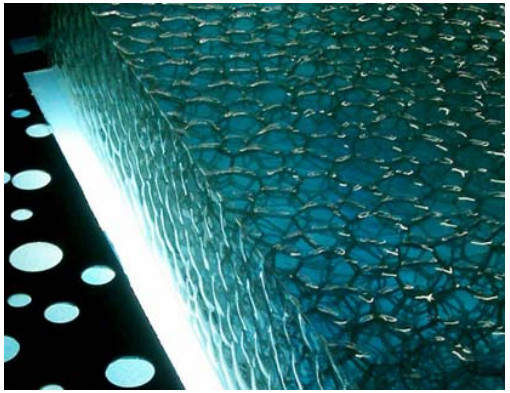




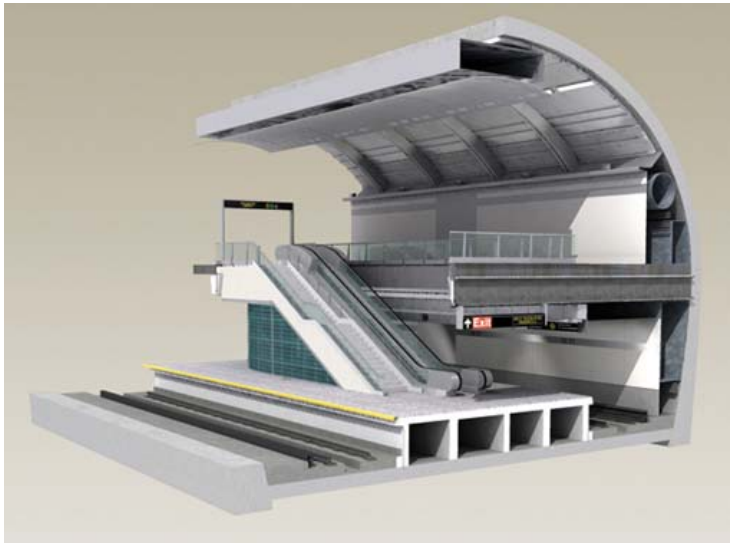


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Costa Azul LNG, Baha California

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- Acoustic consulting
- Advanced geometric design
- Advanced technology and research
- Airport planning
- Architecture
- Audio visual and multimedia
- Bridge design
- Building design
- Building modelling
- Building physics
- Civil engineering
- Cost management
- Economic planning
- Economics and planning
- Electrical engineering
- Energy strategy
- Environmental consulting
- Façade engineering
- Facilities management
- Fire
- Fluid dynamics
- Geotechnics
- Hydrogeology
- Infrastructure design
- Interchange design
- International development
- IT and communications systems
- Landscape architecture
- Lighting design
- Management consulting
- Maritime engineering
- Masterplanning
- Materials
- Mechanical engineering
- Oil and gas engineering
- Operations consulting
- Planning policy advice
- Power generation
- Product design
- Project management
- Public health engineering
- Quantity surveying
- Renewable energy
- Research
- Resilience, security and risk
- Seismic design
- Site development
- Software products
- Specialist technical services
- Sports architecture
- Structural engineering
- Sustainability consulting
- Sustainable buildings design
- Sustainable infrastructure design
- Theatre consulting
- Town planning
- Transaction advice
- Transport consulting
- Tunnel design
- Urban design
- Vertical transportation design
- Water engineering
- Wind engineering

Rating Tools & Building Performance Labeling

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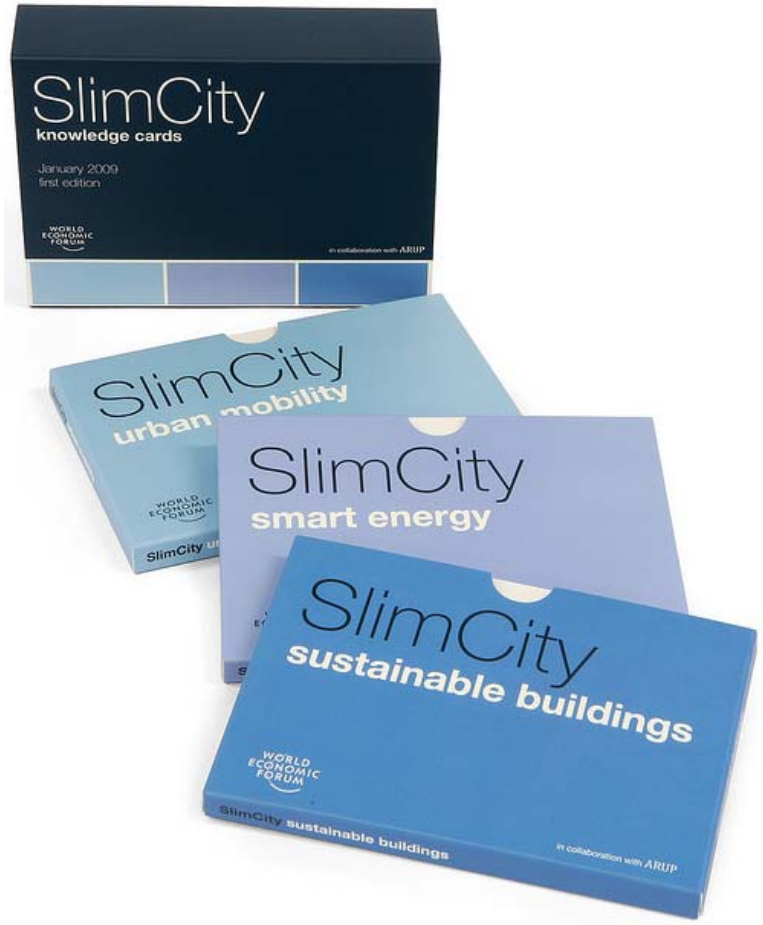
- Drivers of Change Oceans

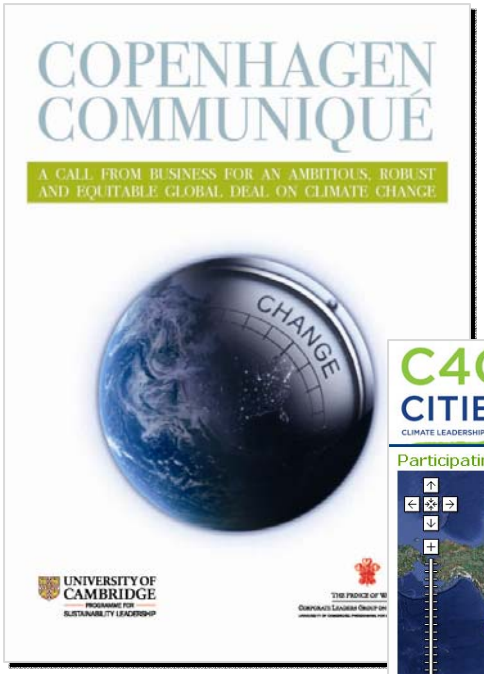
www.driversofchange.com

- Slim City
  - World Economic Forum



http://www.driversofchange.com/docvis/slimcity/

- Copenhagen Communiqué
- Technical Advisor to the C40 Large Cities Climate Leadership Group
- TED
- Plausible Futures



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ΔClimate

Implications for maritime

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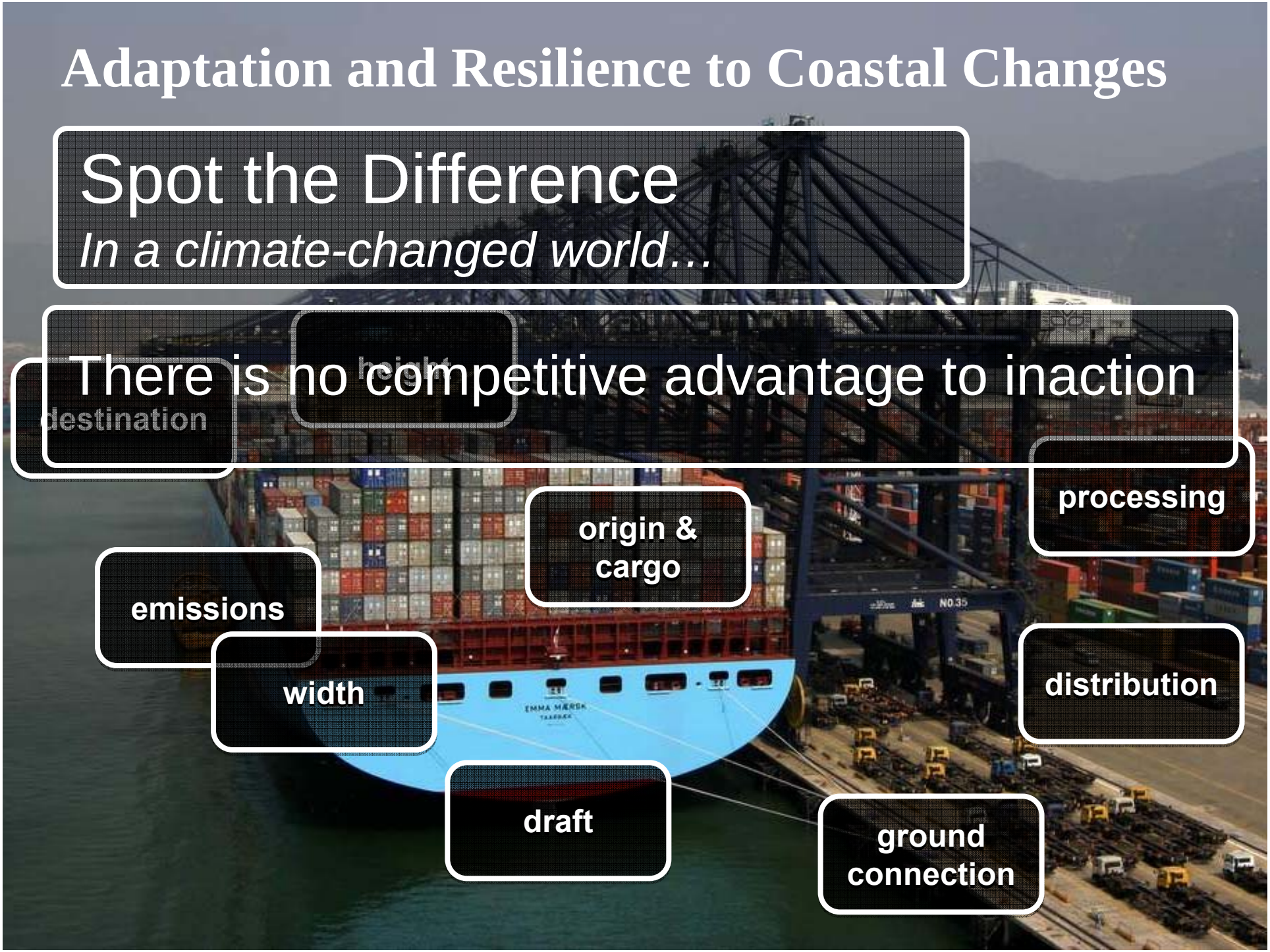
Adaptation and Resilience to Coastal Changes



Increased Value Concentration: Increased Risk

Count of observed hurricanes

1926: Ocean Drive, Miami, FL

Great Miami Hurricane:

$157 billion economic loss

(2005 dollar value)

Projected population

1996: Ocean Drive, Miami, FL

Hurricane Andrew:

$55 billion economic loss

(2005 dollar value)

Source: Swiss Re. Sigma

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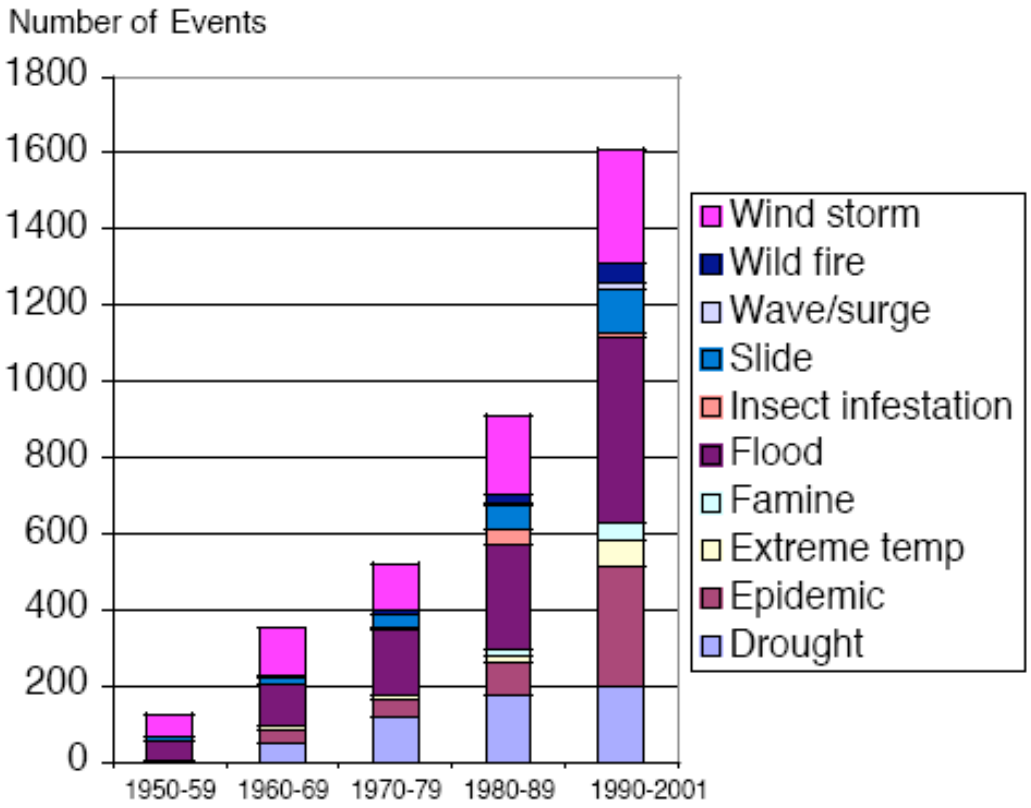
Increasing Risk

The frequency of extreme events is increasing.

With it, the nature and structure of those events are changing.



Changing nature and structure of events: 1950-2001

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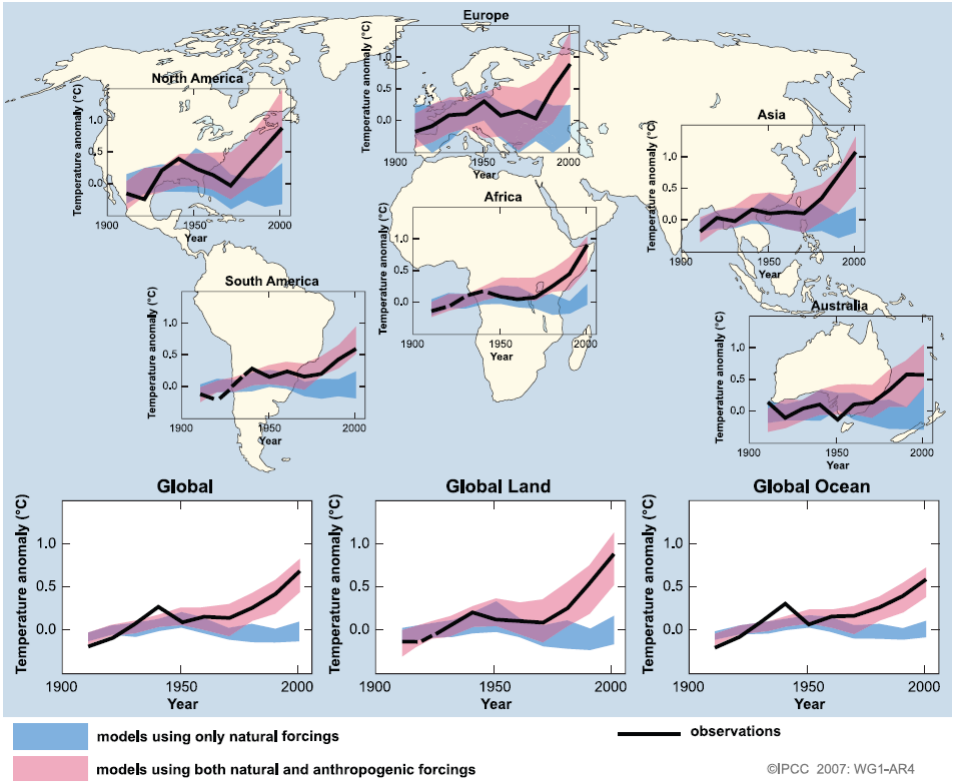
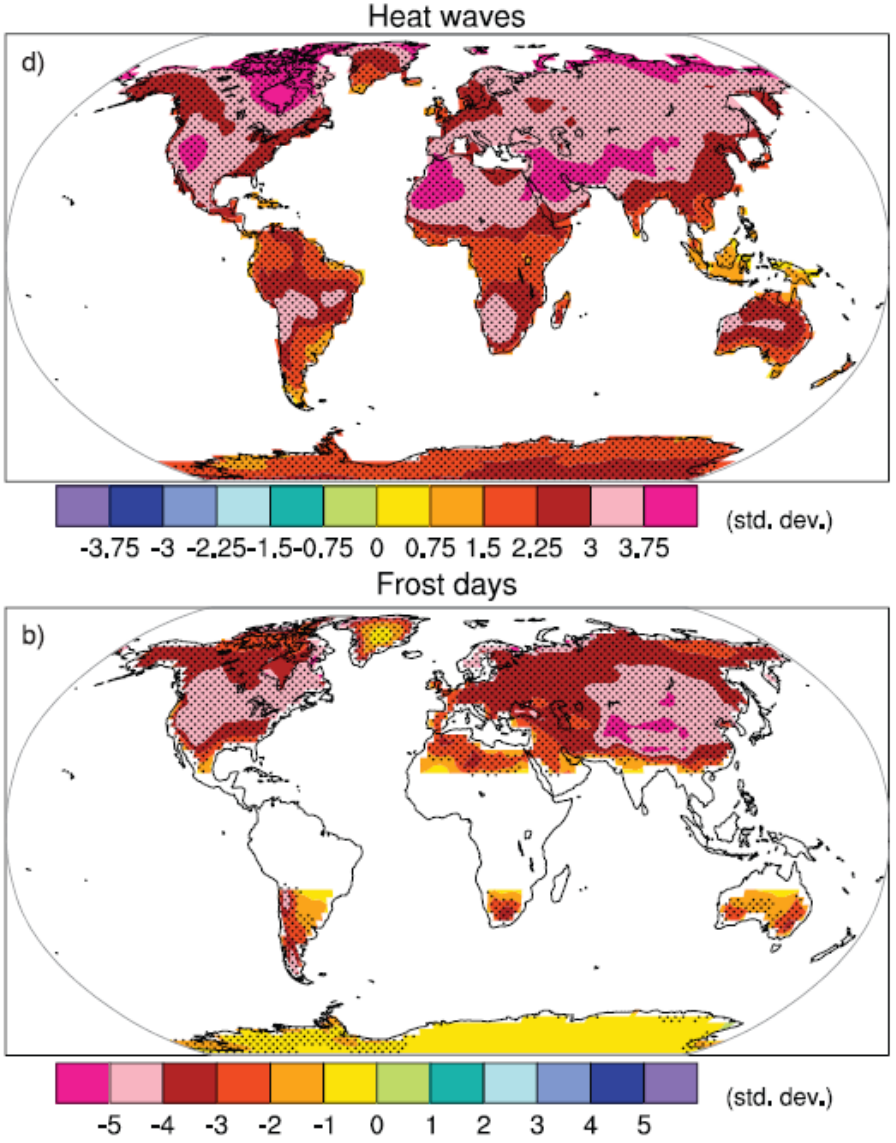
- Observed



- Predicted

2080– 2099 minus 1980–1999



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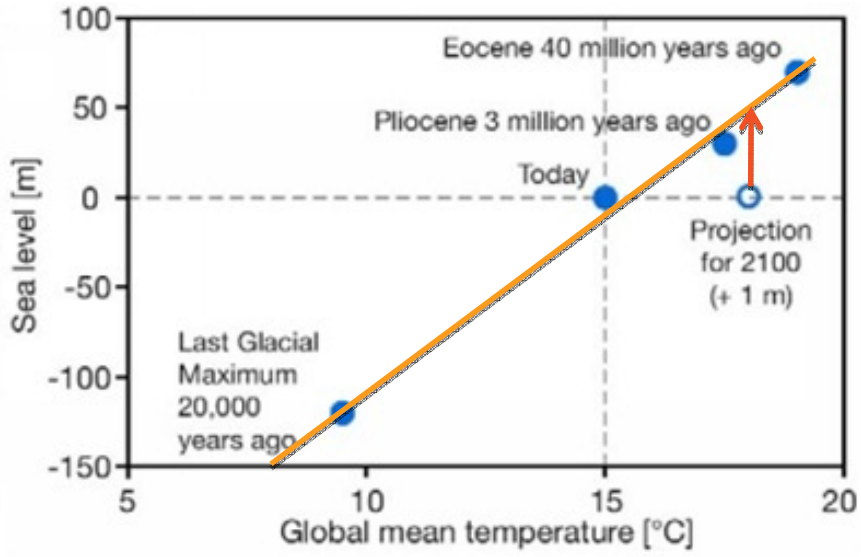
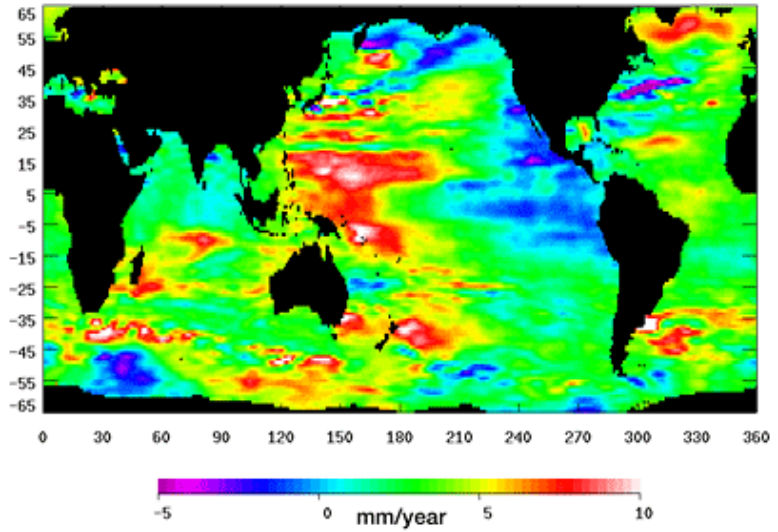
- Observed

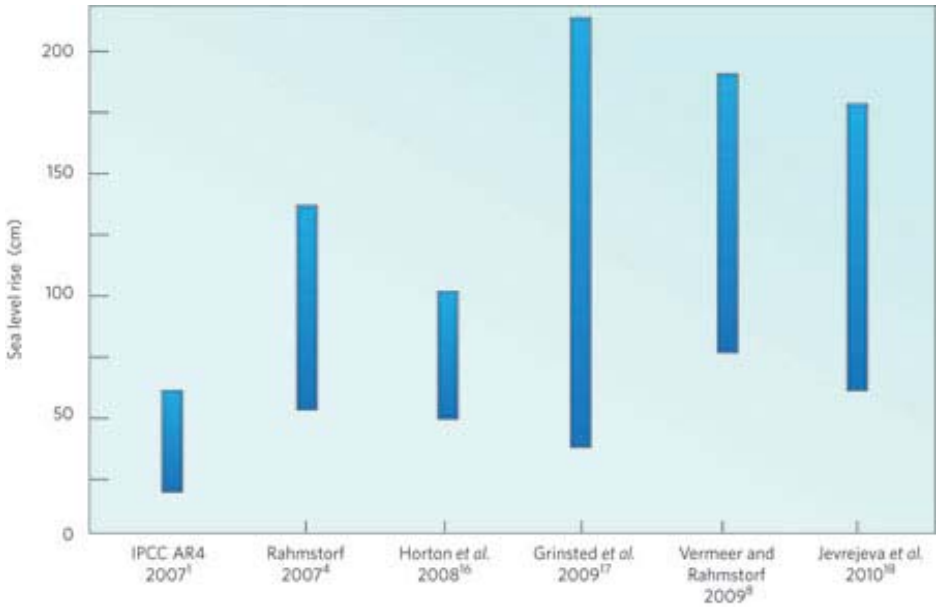


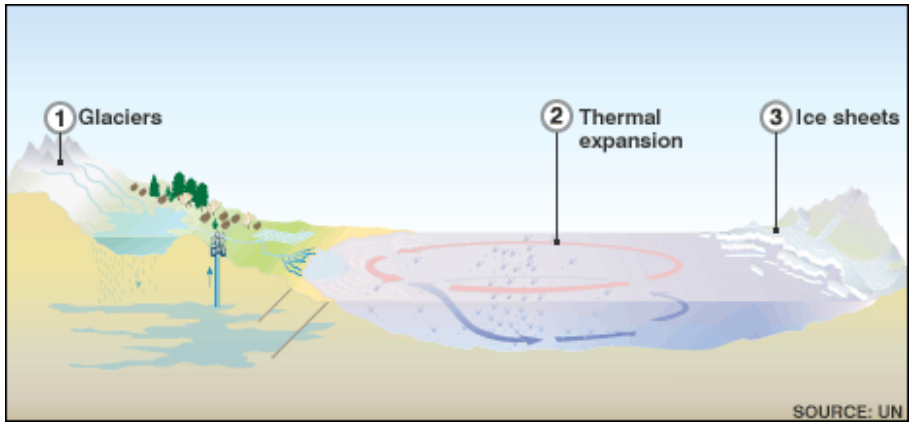
(WGBU, after Archer, 2006)



Global Trends 1993-2008

- Predicted





SLR Mechanisms

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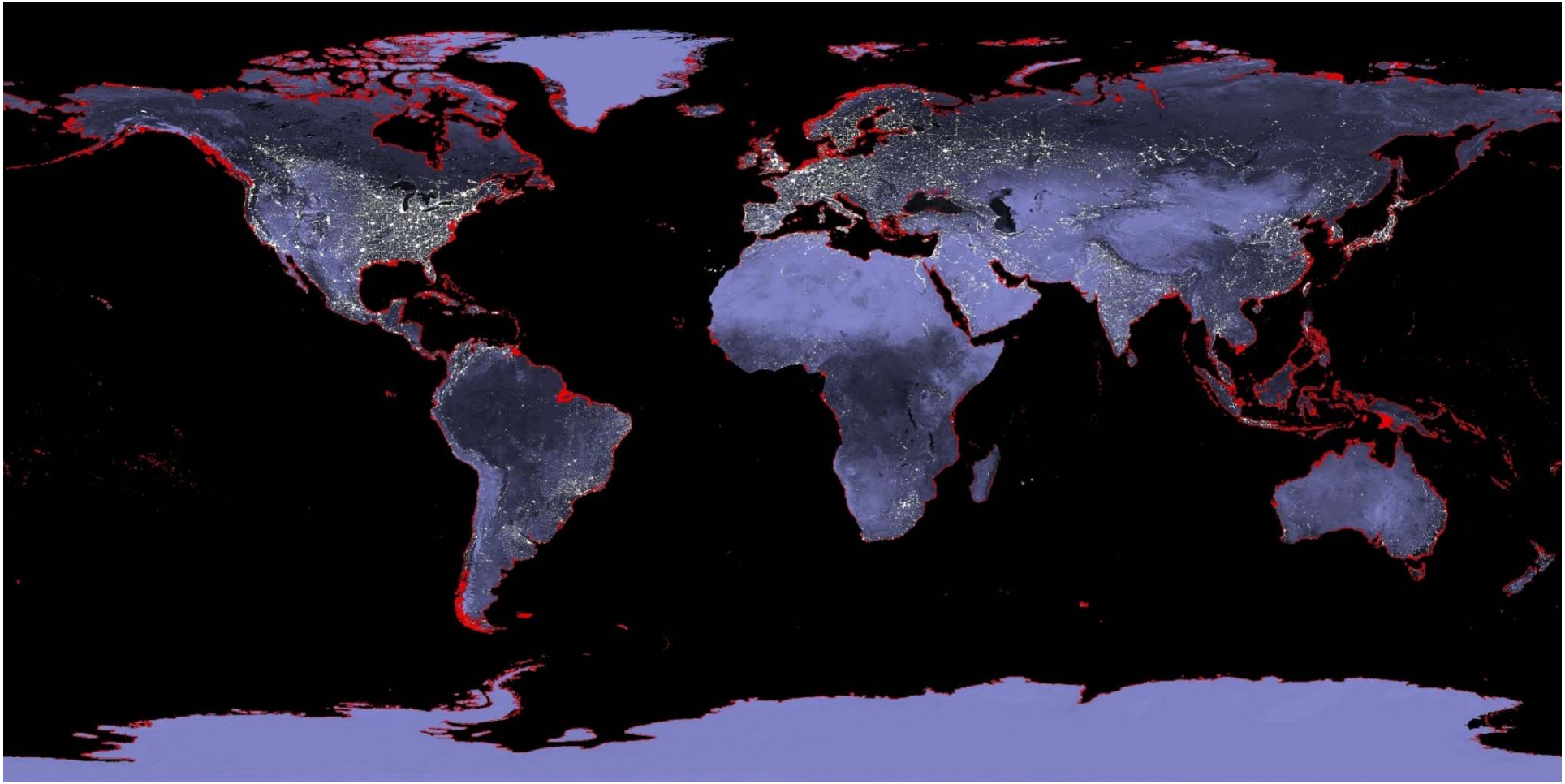
How does the science inform coastal zone infrastructure?

1-meter sea level rise



Source: NASA

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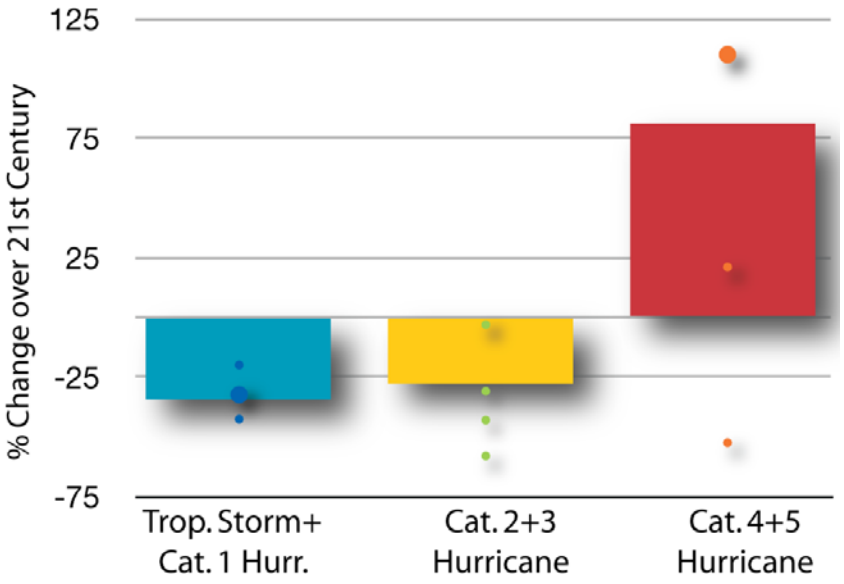
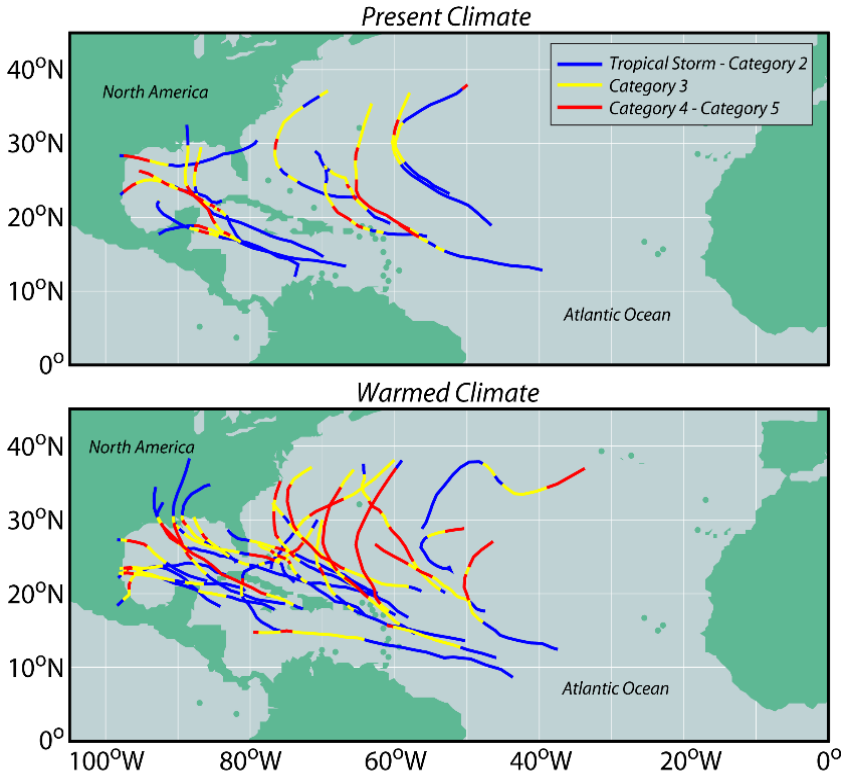
- Observed



- Predicted



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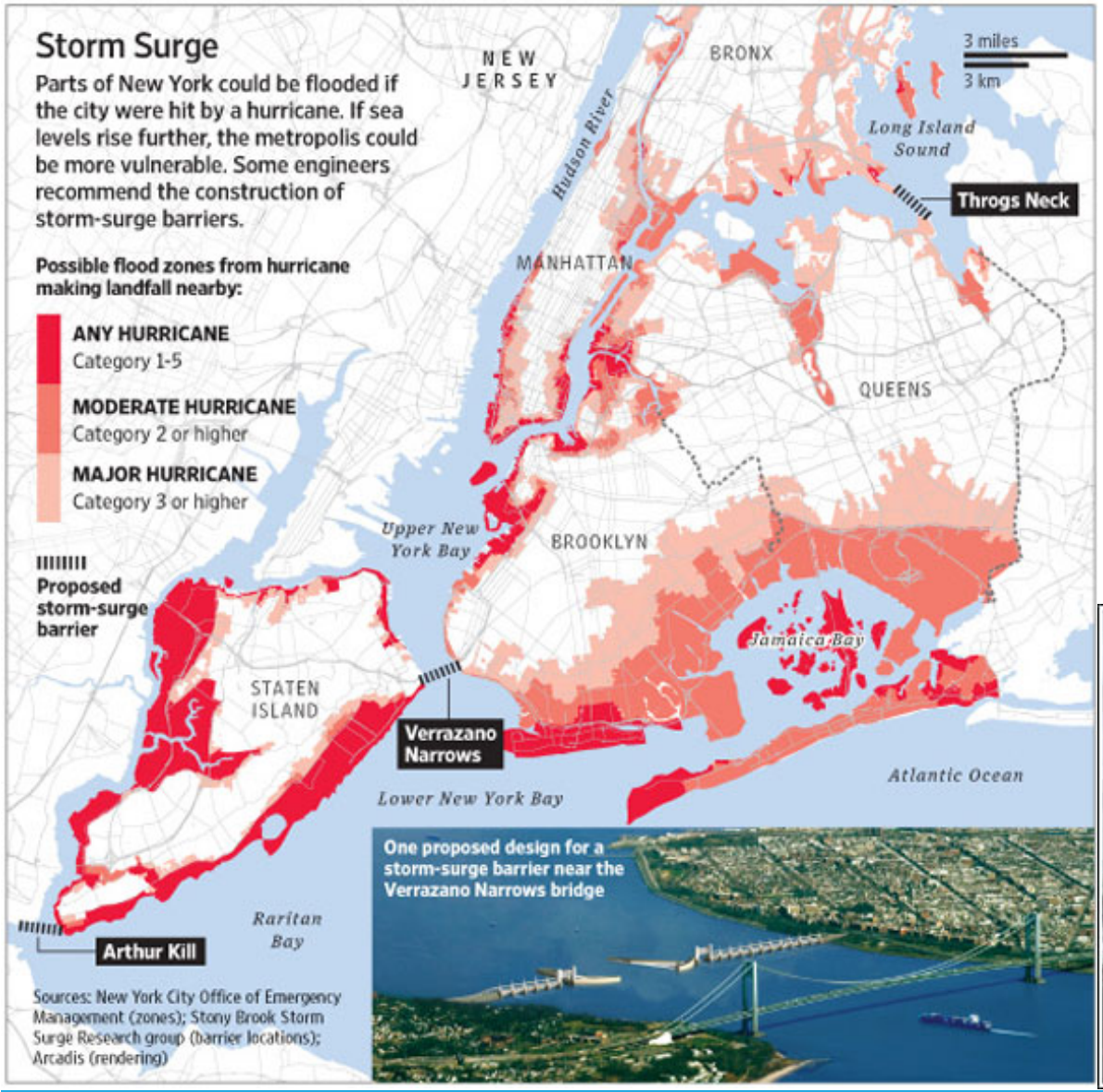
How does the science inform coastal zone infrastructure?



Sources: http://coastalcare.org/wp-content/uploads/2010/09/ny-slr.jpg
http://www.nasa.gov/images/content/161530main_surge_tide_lg.gif

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Extreme Event	Baseline (1971-2000)	2020s	2050s	2080s
Flood heights associated with 1-in-10 yr flood (in feet)	6.3	6.5 to 6.8	7.0 to 7.3	7.4 to 8.2
Flood heights associated with 1-in-100 yr flood (in feet)	8.6	8.8 to 9.0	9.2 to 9.6	9.6 to 10.5
Flood heights associated with 1-in-500 yr flood (in feet)	10.7	10.9 to 11.2	11.4 to 11.7	11.8 to 12.6

10 foot (3 meter) sea level rise. Source: NYC Panel on Climate Change

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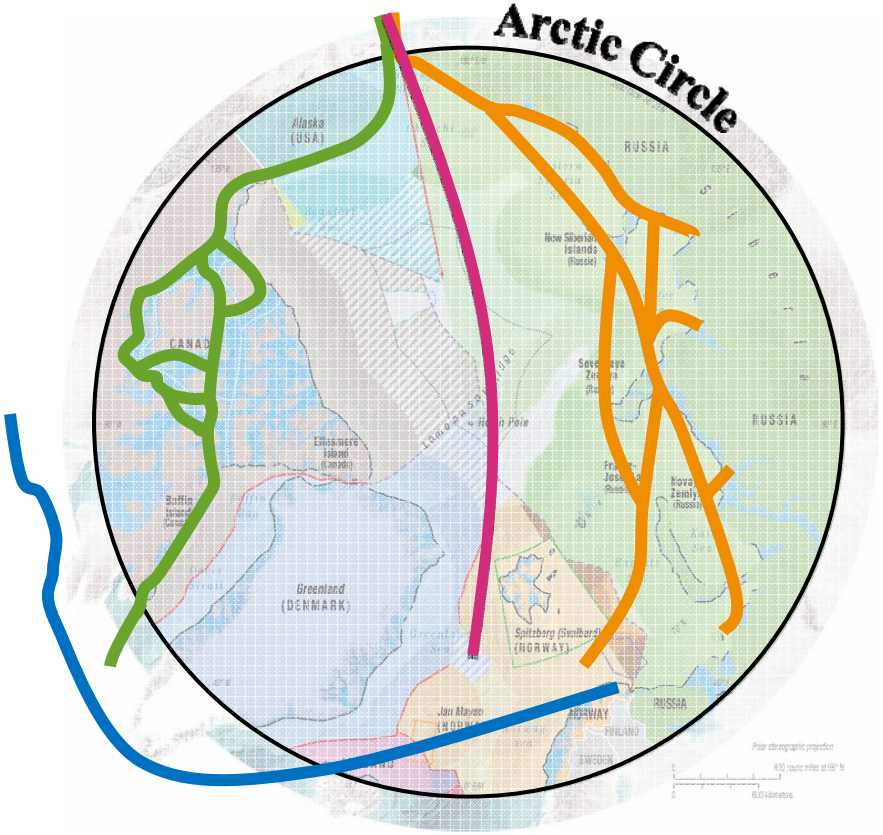
Maritime Business Opportunities

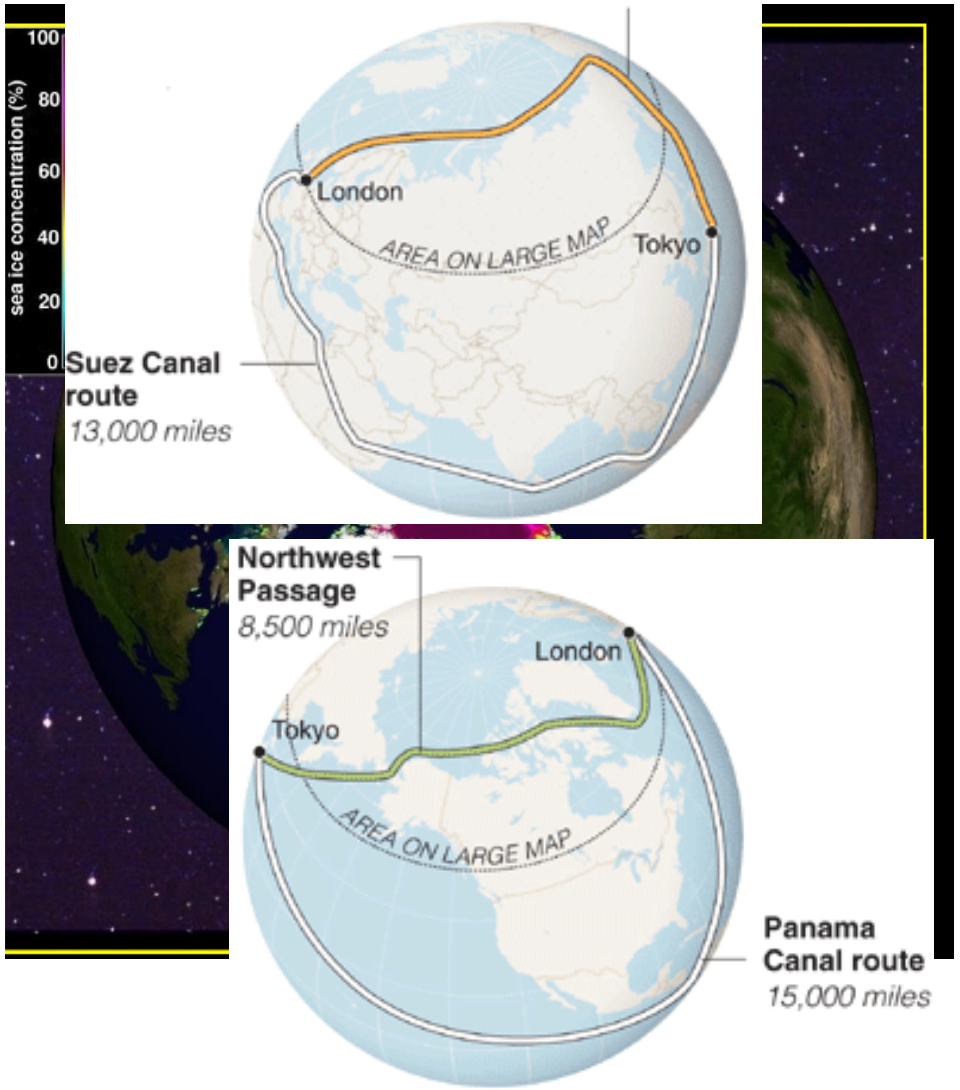


Arctic Bridge

Northern Sea Route

Northwest Passage

Transpolar Route



http://www.nytimes.com/imagepages/2005/10/09/international/20051010_ARCTIC_GRAPHIC.html
http://nsidc.org/seaice/characteristics/difference.html

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4Futures

Plausible scenarios for global ports to 2050

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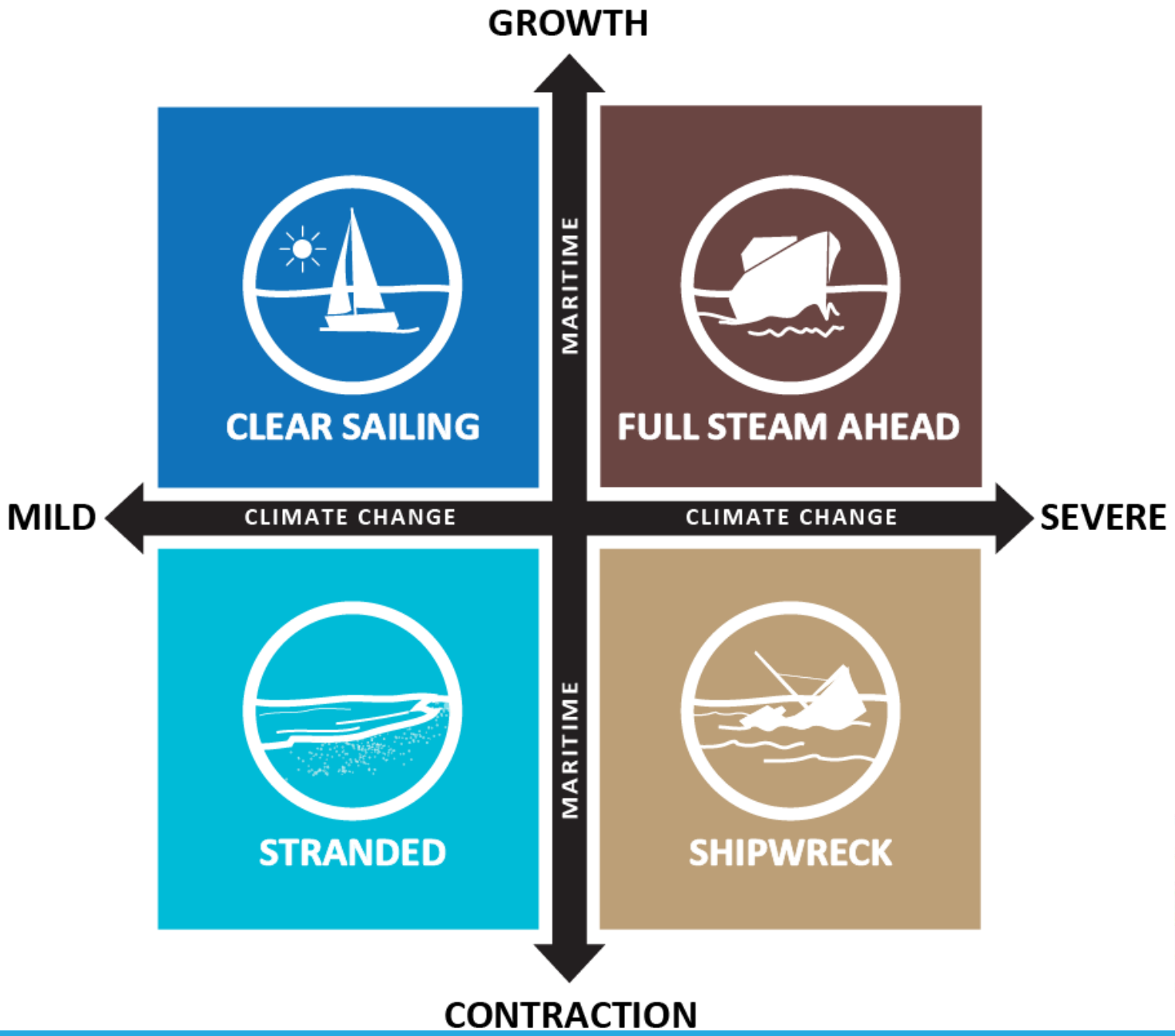

Social
Technological
Economic
Environmental
Political

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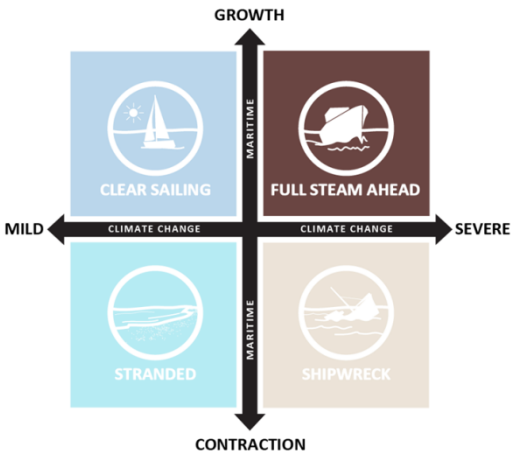

Arctic passages open year-round

Increased reliance on engineered solutions

Infrastructure will become functionally obsolete before traditional design life

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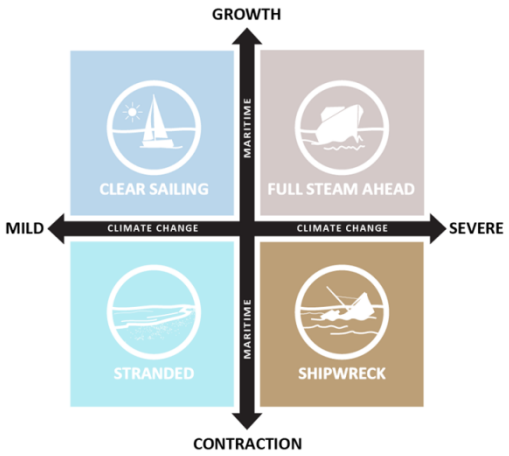
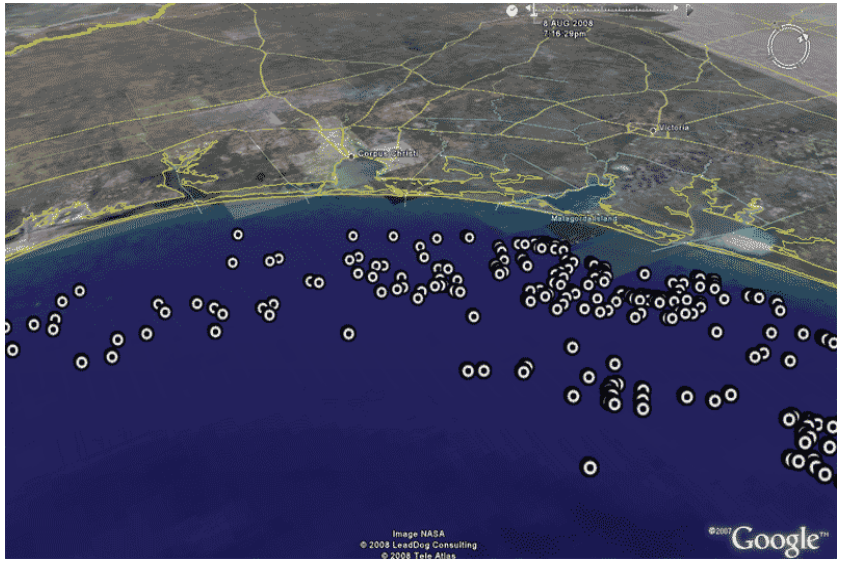


Increased focus on intermodal, land-based transportation hubs

Ports increasingly become unable to obtain insurance due to climate risks



Increased dependency on fossil fuel

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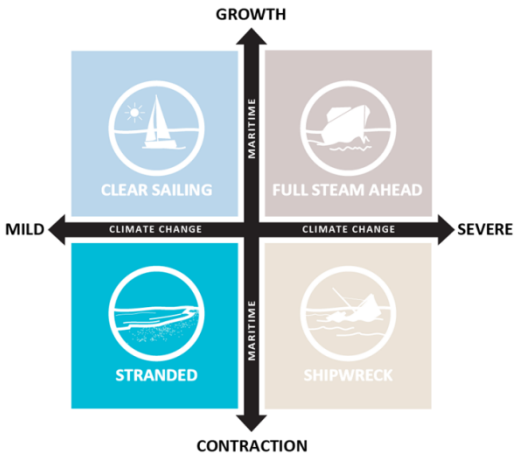

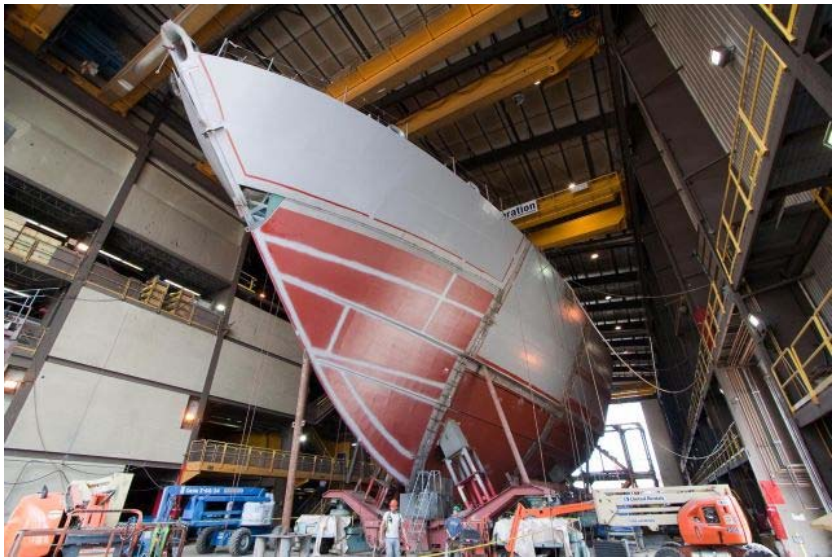

High-efficiency ship design regulations and construction

Limited Arctic passage creates bottlenecks at Panama / Suez Canals

Extreme social pressure for environmental protection

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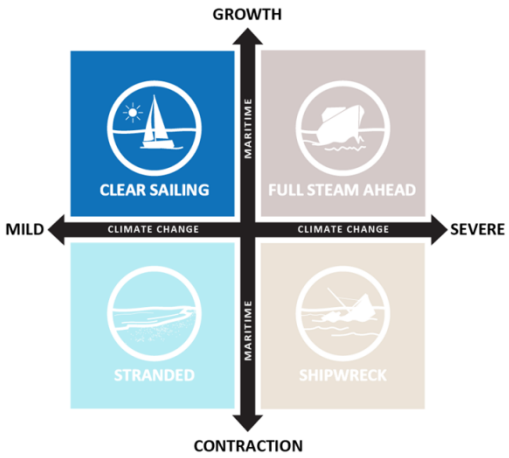

Global and bilateral intergovernmental agreements, global price of carbon

Stricter environmental regulations for ports and shipping companies

Emergence of mega ports shifts trade power

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Solutions

Pathways to Sustainable & Resilient Ports

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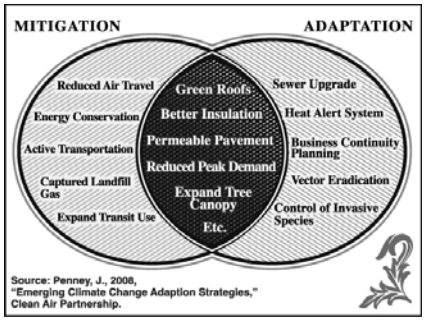
Climate Change mitigation and adaptation

- **Mitigation: proactively tackling the causes**
  - Limited window of opportunity
- **Adaptation: reactively adjusting to the impacts**
  - Reducing vulnerability
  - Finding opportunity
  - Phasing



If we act today

Cost

~1% global GDP each year

If we do nothing

Like losing

~ 5% – 20% global GDP each year, every year

STERN review ON THE ECONOMICS OF CLIMATE CHANGE

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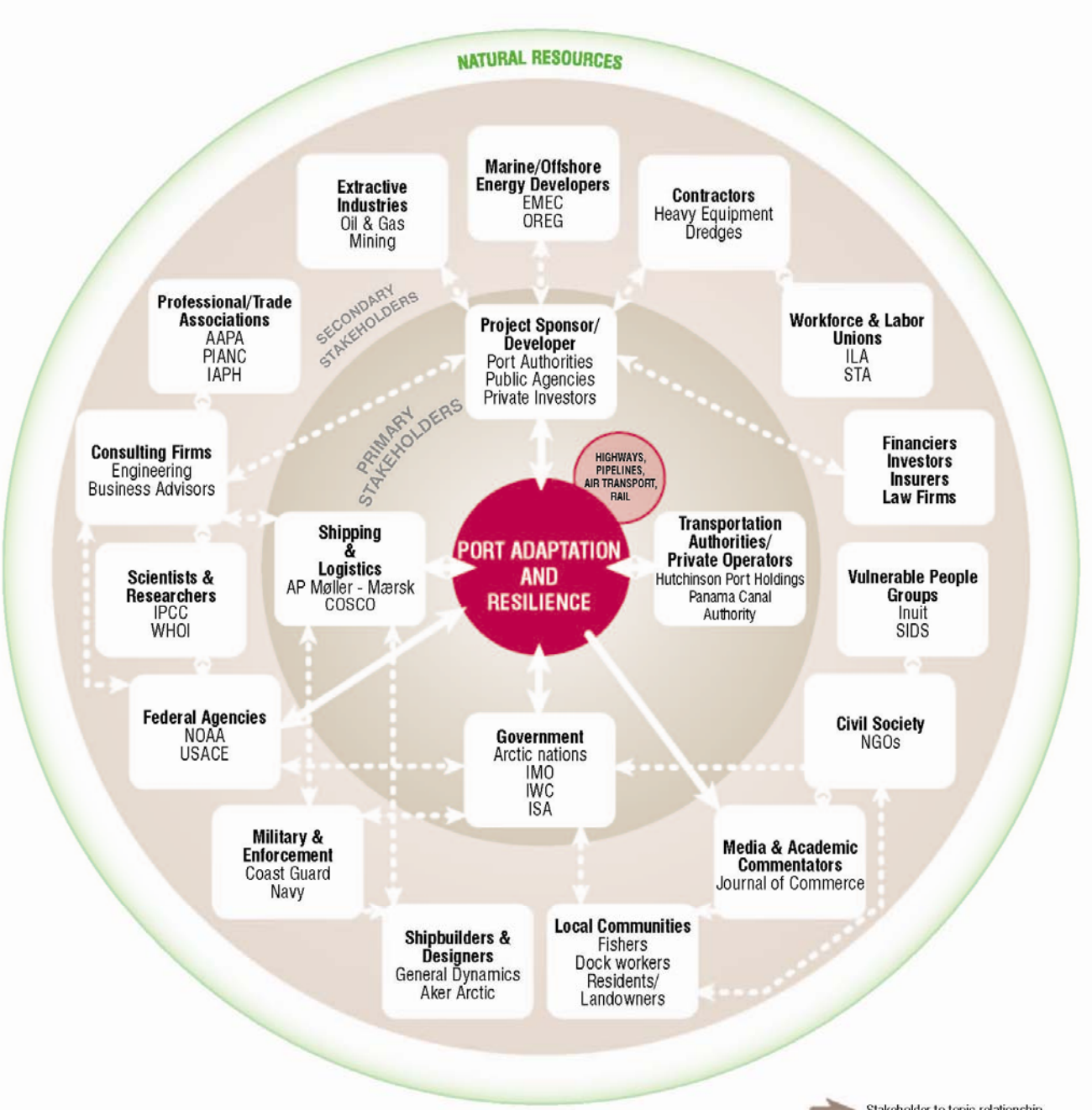
NATURAL RESOURCES
Extractive Industries
Oil & Gas
Mining
Marine/Offshore Energy Developers
EMEC
OREG
Contractors
Heavy Equipment
Dredges
Professional/Trade Associations
AAPA
PIANC
IAPH
SECONDARY STAKEHOLDERS
Project Sponsor/ Developer
Port Authorities
Public Agencies
Private Investors
Workforce & Labor Unions
ILA
STA
PRIMARY STAKEHOLDERS
Consulting Firms
Engineering
Business Advisors
HIGHWAYS, PIPELINES, AIR TRANSPORT, RAIL
Financiers
Investors
Insurers
Law Firms
Shipping & Logistics
AP Møller - Mærsk
COSCO
PORT ADAPTATION AND RESILIENCE
Transportation Authorities/ Private Operators
Hutchinson Port Holdings
Panama Canal Authority
Scientists & Researchers
IPCC
WHOI
Vulnerable People Groups
Inuit
SIDS
Federal Agencies
NOAA
USACE
Government
Arctic nations
IMO
IWC
ISA
Civil Society
NGOs
Military & Enforcement
Coast Guard
Navy
Media & Academic Commentators
Journal of Commerce
Shipbuilders & Designers
General Dynamics
Aker Arctic
Local Communities
Fishers
Dock workers
Residents/
Landowners
Stakeholder to topic relationship
Stakeholder to stakeholder relationship
© Arup 2010

Solutions for Maritime Stakeholders

Port expansion, contraction, relocation	Risk and Contingency Planning	Regulatory Compliance and Foresight	Adaptation to Physical Impacts of Climate Change	Supply chain management
Life-cyle cost and durability analysis	Green Ships and Green Facilities	LEED and other sustainability certification	Coastal defenses	Multi-modal transport hubs and strategic planning
Public Infrastructure Adaptation	P3 Transaction Advice	Waterfront redevelopment and regeneration	Port masterplanning	Tourism and recreation infrastructure
Fuel switching, Cold-ironing	Arctic Navigation	Carbon emissions accounting and mitigation	Infrastructure adaptation to new vessels	Environmental assessment and remediation

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Arup SuPort Tool:
Appraising Port Sustainability

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New situation: economical, social and of relationship with the environment
New obligations and opportunities for the Ports
Commitment to go beyond legislative compliance
Evaluation, Management and Implementation of Sustainability as a Development Framework

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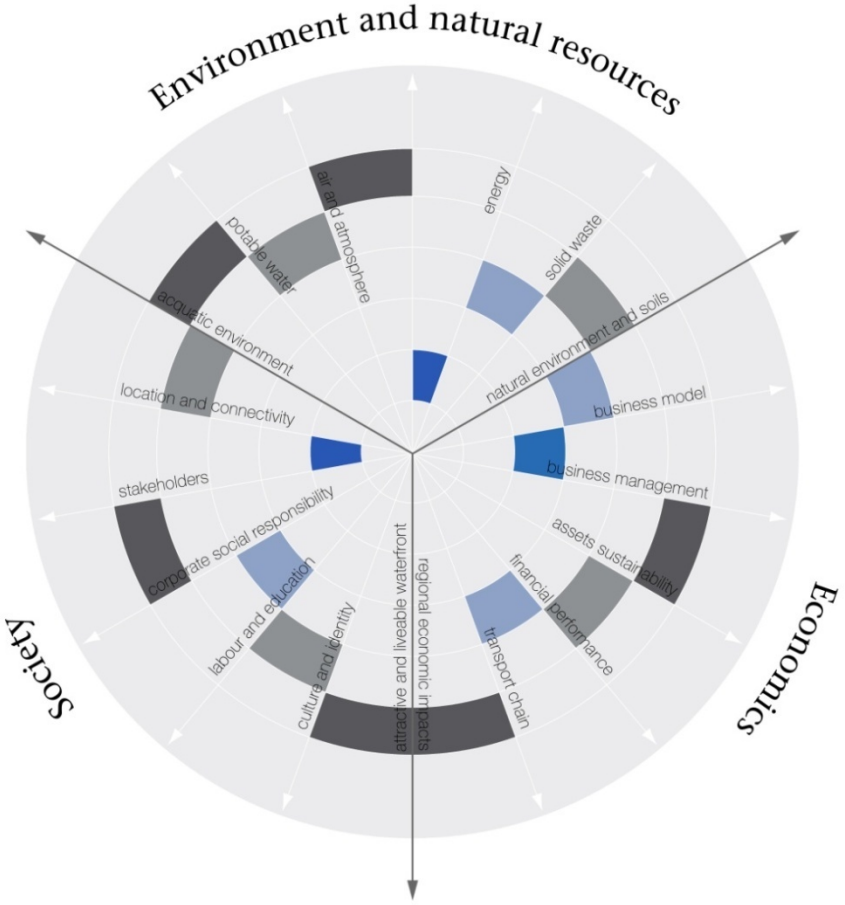
Arup and the Port of Santander in Spain reached an agreement to develop a tool to appraise a port sustainability: **SuPort**.

This initiative rose from a joint R&D project, which built upon the current activity of the Port of Santander to adapt this tool and test it on a real case.

SuPort has been developed with the input from experts on a wide range of areas of expertise: logistics, infrastructures, economics, social science, environment, etc.

Definition



SuPort is a sustainability evaluation and diagnosis tool for existing maritime transport related facilities:

- SuPort deals not only with environmental issues → it evaluates the sustainability triple bottom line (allocating weight to economic and social issues).
- SuPort is oriented to existing operations → it provides a snapshot of their current or future performance in terms of sustainability.
- Provides a quick SWOT analysis by identifying strengths, weaknesses, opportunities and challenges

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Categories

ENVIRONMENT	SOCIETY	ECONOMICS
AQUATIC ENVIRONMENT	LOCATION AND CONNECTIVITY	BUSINESS MODEL
POTABLE WATER	STAKEHOLDERS	BUSINESS MANAGEMENT
AIR AND ATMOSPHERE	ATTRACTIVE AND LIVABLE WATERFRONT	ASSETS SUSTAINABILITY
ENERGY	CULTURE AND IDENTITY	FINANCIAL PERFORMANCE
SOLID WASTE	LABOUR AND EDUCATION	TRANSPORT CHAIN
NATURAL ENVIRONMENT AND SOILS	CORPORATE SOCIAL RESPONSIBILITY	REGIONAL ECONOMIC IMPACTS

3 Dimensions

18 Categories

82 Indicators

SuPort synthesizes the indicators to provide a comprehensive view of the sustainability of the port activities.

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Indicators

ENVIRONMENT AND NATURAL RESOURCES

N1	AQUATIC ENVIRONMENT
N1.1	Port water quality
N1.2	Hardscape and stormwater management
N1.3	Foul water management
N1.4	Flood risk management
N1.5	Ship liquid waste management - MARPOL I-II-IV

N2	POTABLE WATER
N2.1	Potable water network efficiency
N2.2	Potable water use
N2.3	Use of non-potable water (grey, sea and storm water)

N3	AIR AND ATMOSPHERE
N3.1	Dust and air quality
N3.2	Greenhouse gases emissions reporting
N3.3	Noise
N3.4	Light Pollution
N3.5	Odours
N3.6	Ship air emissions – MARPOL VI

N4	ENERGY
N4.1	Energy efficiency of installations
N4.2	Lighting efficiency
N4.3	Renewable energy use
N4.4	Clean fuel supply (ships and port equipment)
N4.5	Onshore power supply

N5	SOLID WASTE
N5.1	Non-dangerous waste management
N5.2	Hazardous waste management
N5.3	Ship solid waste – MARPOL III - V

N6	LAND NATURAL ENVIRONMENT
N6.1	Contaminated soils
N6.2	Habitat restoration and protection and biodiversity management
N6.3	Plague control (ballast water and ship sediments)
N6.4	Dredging and land reclamation management
N6.5	Landscaping and visual impact
N6.6	Climate change provision

SOCIETY

S1	PROXIMITY AND ACCESSIBILITY
S1.1	Accessibility (internal)
S1.2	Accessibility (external)
S1.3	Information accessibility
S1.4	Accessibility to the shoreline
S1.5	Citizen proximity to port industry activity

S2	STAKEHOLDERS
S2.1	Stakeholder relations
S2.2	Improved positive community
S2.3	Port community social contributions

S3	CULTURE AND IDENTITY
S3.1	Social identity and heritage preservation
S3.2	Social and economical interaction and diversity
S3.3	Community relationship development
S3.4	Cultural program

S4	LABOUR AND EDUCATION
S4.1	Entrepreneurship and creativity (education)
S4.2	Employment (quality and diversity issues)
S4.3	Employee retention
S4.4	Trade union relationships

S5	CORPORATE SOCIAL RESPONSABILITY
S5.1	Management Systems
S5.2	Internal and External Reporting
S5.3	Supply Chain
S5.4	Social Footprint

S6	ATTRACTIVENESS AND LIVABILITY
S6.1	Amenities and services
S6.2	Local environmental quality
S6.3	Health
S6.4	Safety
S6.5	Security and contengency plans (ISPS compliance)
S6.6	Comfort
S6.7	Walkable and open waterfront

ECONOMICS

E1	BUSINESS MODEL
E1.1	Workforce age
E1.2	R&D+I (investing on)
E1.3	Private investment
E1.4	Split of incomes sources
E1.5	Clients diversity

E2	BUSINESS MANAGEMENT
E2.1	Service quality / Performance audit results
E2.2	Service delivery unit costs compared with peers
E2.3	Quay utilization rate (congestion)
E2.4	Storage area utilization rate
E2.5	Land use

E3	ASSETS SUSTAINABILITY
E3.1	Maintenance of assets
E3.2	Asset flexibility
E3.3	Ability to expand
E3.4	New construction sustainability plan
E3.5	Sustainable procurement and materials

E4	FINANCIAL PERFORMANCE
E4.1	Debt service coverage ratio (DSCR)
E4.2	Return on assets
E4.3	Efficient pricing (road, parking, insurance, fuel, etc)

E5	TRANSPORT CHAIN
E5.1	Sustainable traffic mix
E5.2	Modal share sustainability
E5.3	Inland transport external costs
E5.4	the port as a total transport hub

E6	REGIONAL ECONOMIC IMPACTS
E6.1	Direct Employment
E6.2	Indirect Employment
E6.3	Contribution to the regional GDP
E6.4	Support for local industries
E6.5	Gross Added Value

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N3.1 Dust and air quality

Dust causes a threat not only to human health and the environment, but also to facilities maintenance due to its corrosive properties. The main source of air dust is bulk handling and storing. Other air pollutants may be generated by these activities (PM, COx, SOx, NOx, VOCs, heavy metals, etc). The port entity must limit the harmful effects of these substances by means of preventive measures. Besides, the port entity should control the pollutant capacity of ships at berth.

Measurement	
Value	
3	There is an air quality management plan put in place, which deals with both dust and air pollutants emissions. As part of this plan, preventive active measures are taken such as providing systems to prevent pollutants dispersion during the loading or unloading of vessels (such as covered conveyor belts) or covering stacking areas, and providing them with special systems to catch dust in each transfer point. The port entity checks the Environmental Ship Index (ESI) of incoming ships.
0	National/Local air emissions regulations are met (European Ambient Air Quality Directive 1999/EC/30 or equivalent). The port entity has never received a fine/complaint regarding dust/air contamination issues. Ships berthing into the port entity comply with Marpol convention Annex VI.
-3	National/Local air emissions regulations are not met on a regular basis. The port entity has received a fine/complaint regarding dust/air contamination issues, and no action was taken. Ships berthing into the port entity do not comply with Marpol convention Annex VI.

Questions

- Has the port entity got an air quality management plan? If so, what does in include?
- What measures is the port entity implementing in order to avoid air quality issues?
- Has the port entity ever received community complaints for low air quality? If so, has any action been taken?
- Has the port entity ever received fines for not complying with national/local air quality regulations? If so, has any action been taken?
- Are the incoming ships checked by the port entity in terms of its air quality perfomance? (i.e. compliance with Marpol convention Annex VI, ESI)

References

- Marpol convention Annex VI: Prevention of Air Pollution from Ships. Entry into force: 19 May 2005
- IAPH tool box for port clean air programs (iaphtoolbox.wpci.nl)
- http://www.porttechnology.org/fa_terminal_handling/Environmentally-friendly-dust-control-solutions/4471.html
- http://www.australiandustcontrol.com.au/

Correlation to other indicators

- BREEAM - Europe Industrial: Pol4
- ESPO - Environmental Code of Practice: Issue 7 (Port area)
- EPA Strategy for sustainable ports: Emissions Reduction Actions 4.A - 4.C
- Green Port Guidelines: EM2
- (Spain) Indaport: Indicator #1
- SPeAR: air quality indicators
- Santader: C51, P44, P39

Notes

Picture source: Arup photo library
According to ESPO, air quality is the second most important environmental consideration for European ports (first one for large ports handling >25 million tons). Dust takes up the eight positions on the same ranking.

S1.5 Citizen proximity to port industrial activity

The proximity of the urban cities to the waterfront area defines the linkages of these with the sea, benefiting from the economic advantages that imply a privileged geographical location at the time of receiving and shipping goods by sea. Port facilities have been enriching the cities, but sometimes make it hard to enjoy the coast due to industrial port activity. Given this, new initiatives have foreseen displacement of the main port activities to areas more distant with less interference with daily life and neighborhoods.
Land previously suitable for use of operations of port industrial activities has become unusable (due to restrinctions in legislation) presenting an excellent opportunity to introduce new attractors in areas of high centrality, related to landscape and shoreline.

Measurement	
Value	
3	All the industrial port activity is far from the urban areas. There are no complaints from neighborhoods to Port Entity due to ongoing of industrial activitied.
0	In compliance with current legislation related with Environmental Impact Assessment of Industrial Activities and itsviability of being closer or not to urban areas.
-3	Industrial port activity is close from urban areas and neighborhoods. There are complaints from stakeholders because of the ongoing activities.

Questions
- How many people live nearby and are affected by industrial port activities? - How far is the industrial port area to the neighbors? - Is there any complaint by the proximity of port activity?

References	Correlation to other indicators
- Environmental Impact Assessment - The WHO European Healthy Cities Network - Urban Planning Lows - Sustainable port and urban planning	- SPeAR; Transport (Ec), Transport (En), Form and Space - LEED-ND; NPDc11

Notes
http://www.bahiadialghero.it/public/images/org/alghero/panorami-125.jpg

SuPort: How does it work?

Values: each indicator will have a value between -3 and +3.

	Category/Indicator	Values 3 2 1 0 -1 -2 -3	Weights		Scores
N1	**AQUATIC ENVIRONMENT**				
N1.1	Port water quality		1	12.5%	0.38
N1.2	Hardscape and stormwater management		1	12.5%	0.25
N1.3	Foul water management		1	12.5%	-0.13
N1.4	Flood risk management		3	37.5%	0.75
N1.5	Ship liquid waste management - Marpol I-II-IV		2	25.0%	0.00
				100.0%	**1.25**

+ 3 Best practice

0 In compliance with current legislation

- 3 Worst practice

Weight: each indicator will have a weight, which will enable the particularisation of the tool for each application**.**

	Category/Indicator	Values 3 2 1 0 -1 -2 -3	Weights		Scores
N1	**AQUATIC ENVIRONMENT**				
N1.1	Port water quality		1	12.5%	0.38
N1.2	Hardscape and stormwater management		1	12.5%	0.25
N1.3	Foul water management		1	12.5%	-0.13
N1.4	Flood risk management		3	37.5%	0.75
N1.5	Ship liquid waste management - Marpol I-II-IV		2	25.0%	0.00
				100.0%	**1.25**

In this example, indicator N1.4 represents the most critical issue. Indicators N1.1, N1.2 and N1.3 are the relatively least important

SuPort: How does it work?

✓ **Scores:**

	Category/Indicator	Values 3	2	1	0	-1	-2	-3		Weighs	Scores
N1	**ENVIRONMENTAL QUALITY**										
N1.1	Port sea/river water quality								1	12.5%	0.38
N1.2	Air quality								1	12.5%	0.25
N1.3	Noise								1	12.5%	-0.13
N1.4	Light pollution (impact on land and water)								3	37.5%	0.75
N1.5	Odour								2	25.0%	0.00
										100.0%	1.25

Indicator score = Value x Weigh(%)
Example: 3 x 12.5% = 0.38

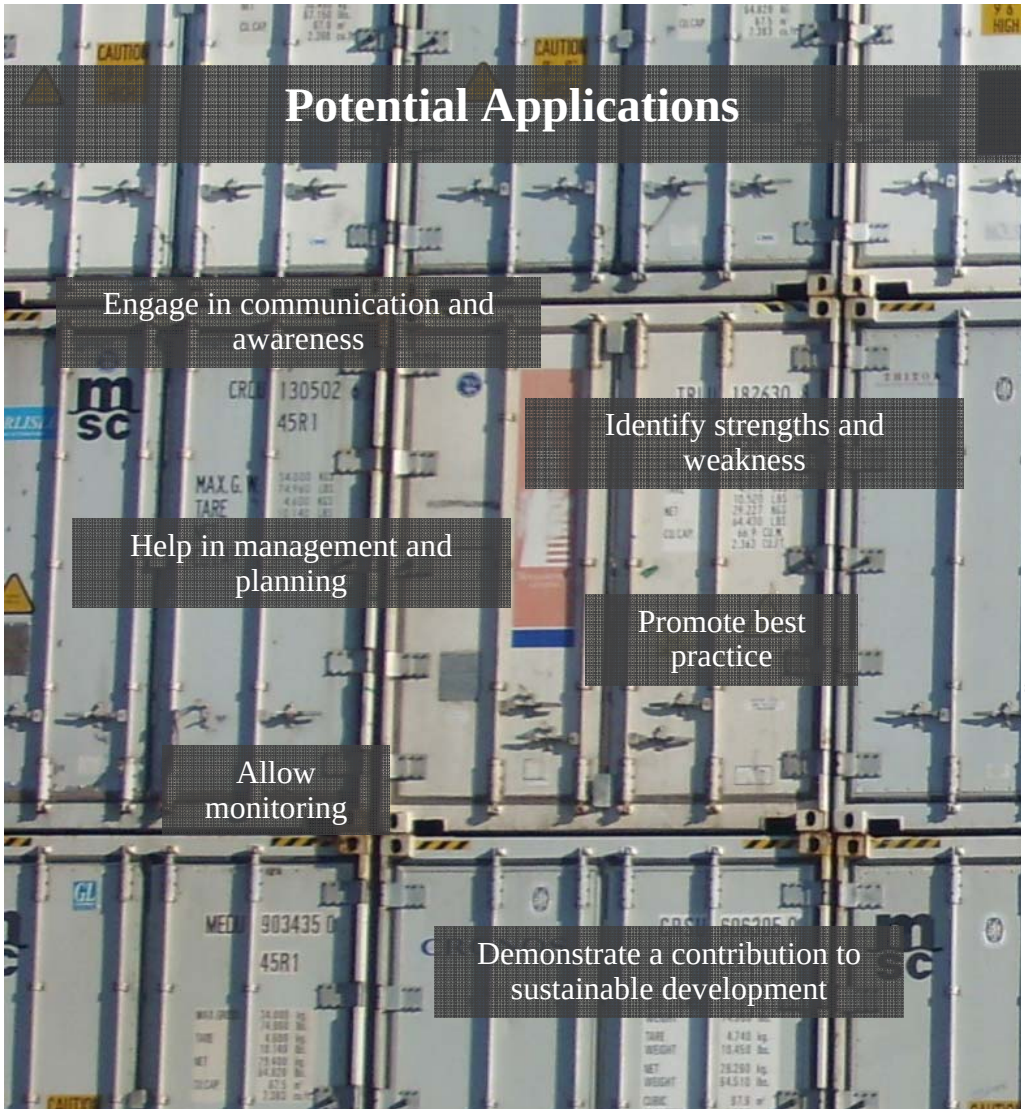
Category score = ∑Indicators score

✓ Accordingly, SuPort has flexibility enough to add a weight to the Categories within a Dimension

Dimension/Category		Values [3,2.5]	(2.5,1.5]	(1.5,0.5]	(0.5,-0.5]	(-0.5,-1.5]	(-1.5,-2.5]	(-2.5,-3]	Weighs	Scores	
ENVIRONMENT & NATURAL RESOURCES											
N1	ENVIRONMENTAL QUALITY			1.25					1	11%	0.14
N2	ENVIRONMENTAL IMPACT				-0.25				2	22%	-0.06
N3	ENERGY AND ATMOSPHERE				0.25				1	11%	0.03
N4	WASTE MANAGEMENT	3.00							3	33%	1.00
N5	WATER USE				0.14				1	11%	0.02
N6	ENVIRONMENTAL MANAGEMENT						-2.20		1	11%	-0.24
										100%	0.88

The scheme of application is the same: Score for each Dimension is the aggregate of the weigh-up scores of its categories

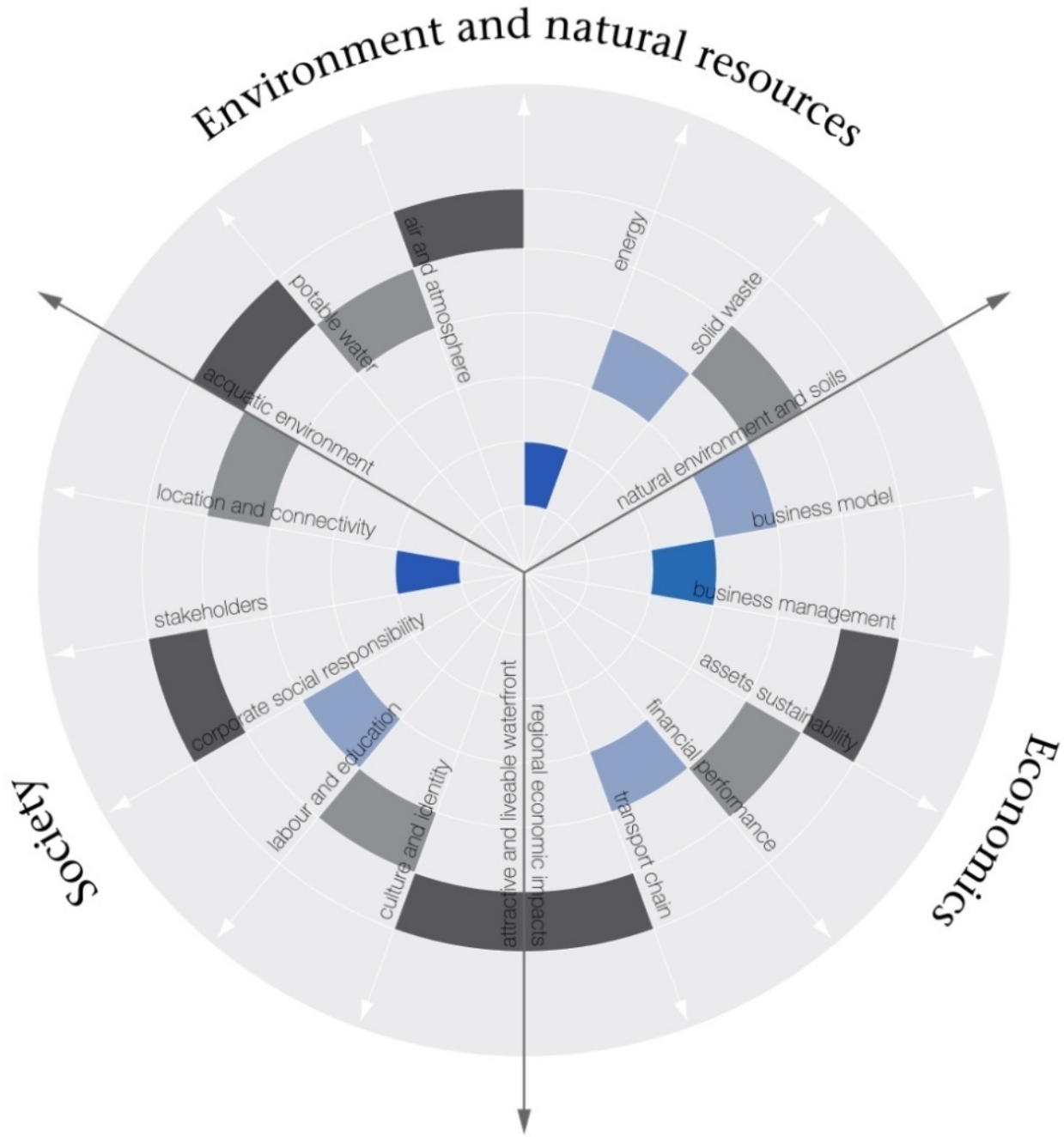
ARUP



SuPort provides a framework which enables ports and terminals operators and maritime facility owners to:

- Analyse their current performance
- Identify areas for improvement
- Go beyond detached solutions to isolated problems in order to provide a strategic integrated solution.
- Evaluate how the performance would be if the actions were taken successfully.

ARUP


Environment and natural resources
Economics
Society
air and atmosphere
potable water
acquatic environment
location and connectivity
stakeholders
corporate social responsibility
labour and education
cultura and identity
attractive and liveable waterfront
regional economic impacts
transport chain
financial performance
assets sustainability
business management
business model
natural environment and soils
solid waste
energy

ARUP

Questions

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Thank You

Land based facilities:

- Refrigeration storage
- Admin & offices
- Energy storage / supply
- Cold ironing
- LNG facilities
- Data Centers
- Maintenance facilities
- Dry/wet docks
- Tug Facilities
- Laboratories

CapEx vs OpEx
Holistic Integrated
whole system approach