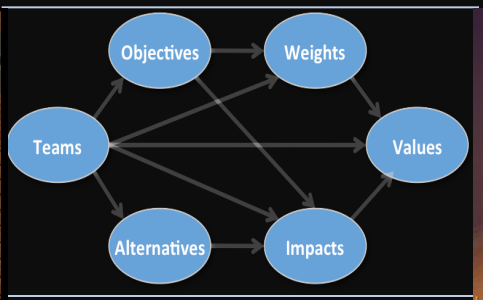
Stakeholder vulnerability assessment of maritime infrastructure:
Method development and pilot project for Rhode Island



Austin Becker, PhD

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Departments of Marine Affairs and Landscape Architecture

University of Rhode Island

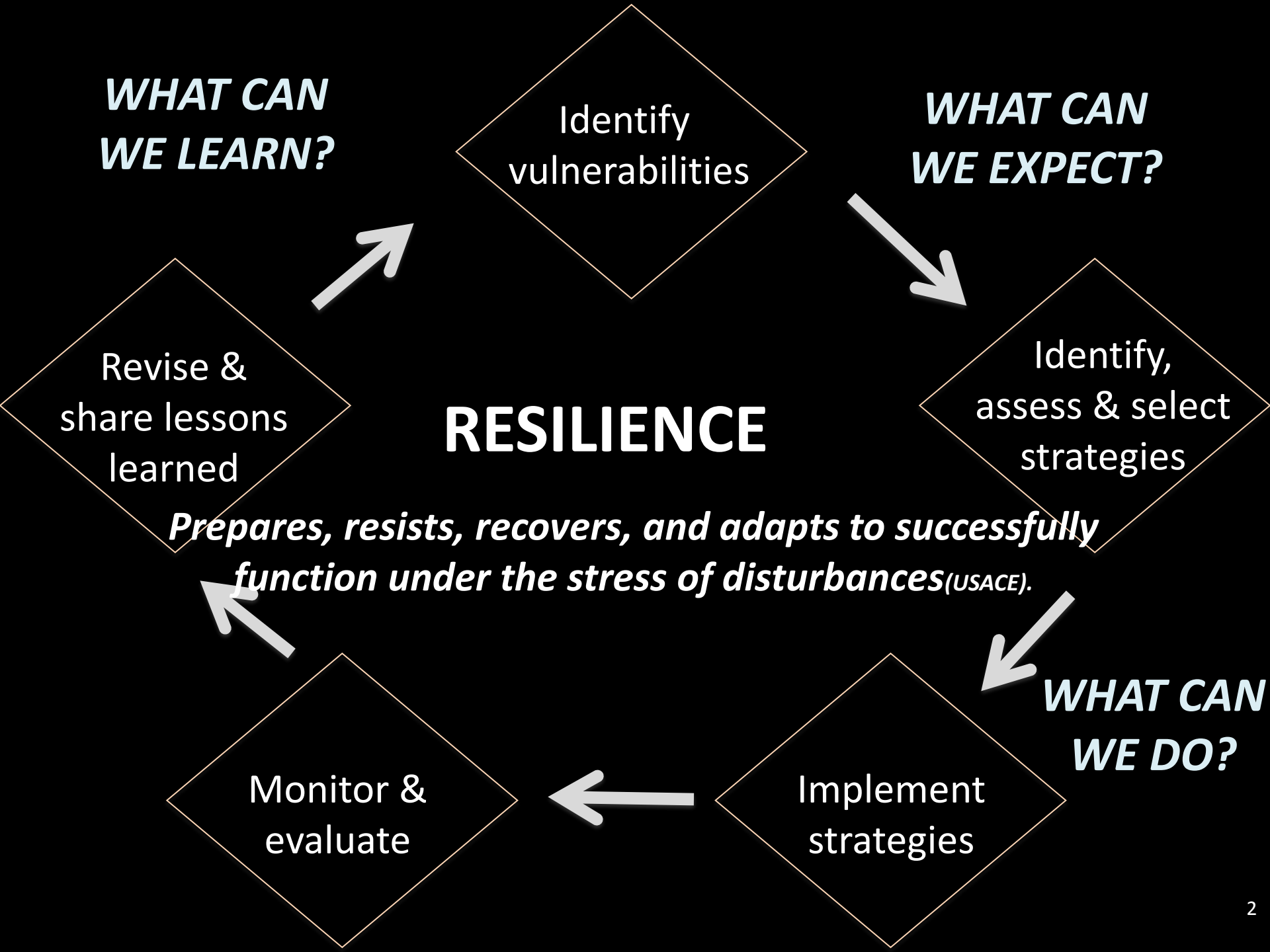
THE UNIVERSITY OF RHODE ISLAND
COLLEGE OF THE ENVIRONMENT AND LIFE SCIENCES

TRB
TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

Innovative Technologies for a Resilient Marine Transportation System

Transportation Research Board

4-25-14


WHAT CAN WE LEARN?
Identify vulnerabilities
WHAT CAN WE EXPECT?
Revise & share lessons learned
RESILIENCE
Identify, assess & select strategies
Prepares, resists, recovers, and adapts to successfully function under the stress of disturbances(USACE).
WHAT CAN WE DO?
Monitor & evaluate
Implement strategies

Complex seaport stakeholder cluster

Provide research assistance
Generate new knowledge

Generate profits
Facilitate commerce
Steward for public health/well being
Environmental protection

Internal Port
(port authority or port operator)

Generate profit
Make port an economic engine
Create jobs

Protect adjacent communities
Environmental advocacy

(Based on Winkelmans and Notteboom, 2007)

Cascading consequences for port stakeholders

1) Direct damages
(e.g., structures, equipment, freight, land, etc.)

2) Indirect costs
(e.g., lost wages, business interruptions, cleanup costs)

Rotten Meat From Katrina Still in Gulfport Neighborhood

surrounding Regnault Avenue.

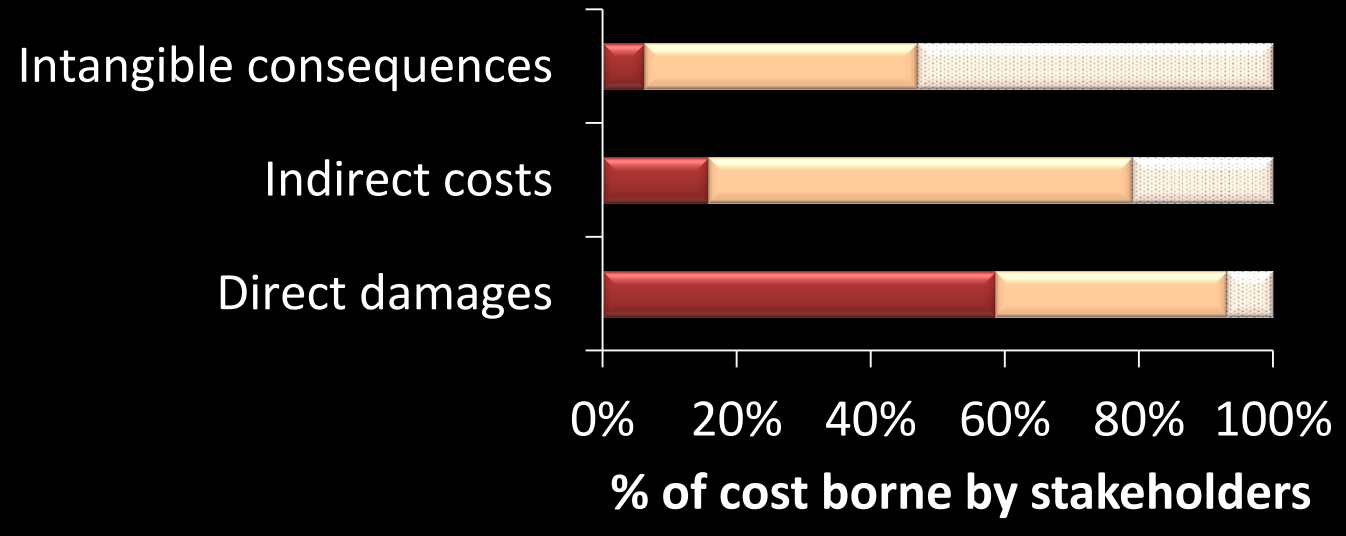
"It's nine months now. They say, 'Well, you ought to be used to it by now.' You ain't gonna get used to that smell. My gosh," said resident Gary Tatum.

The meat had been stored at the Port of Gulfport. Katrina washed it in to yards covering an eight block span. The meat in the yards has been picked up, but the meat in hard-to-see areas has not.

3) Intangible consequences
(e.g., quality of life, environmental damages, loss of essential services)

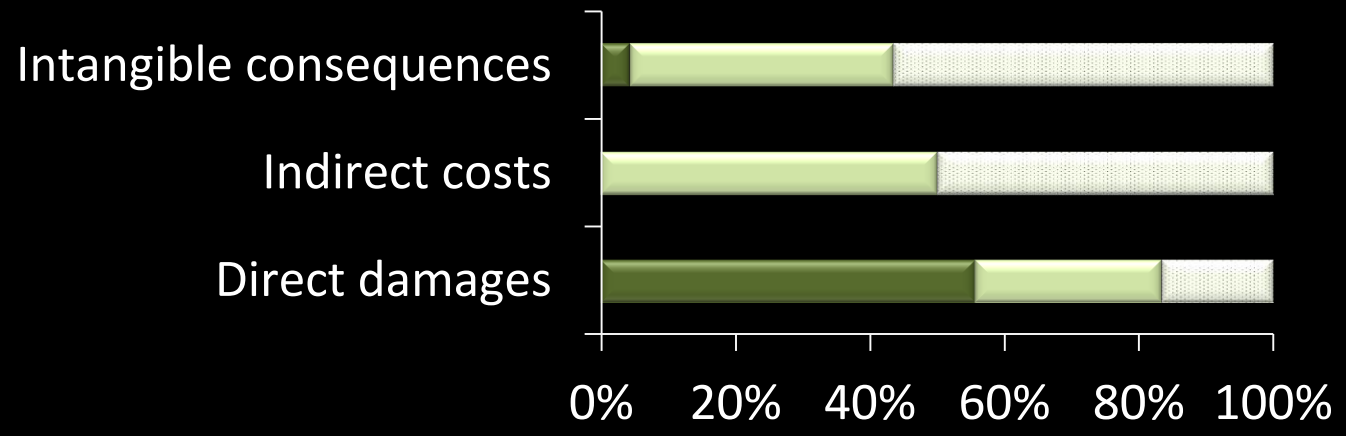
(IPCC 2012)

External stakeholders bear high % of costs



Gulfport

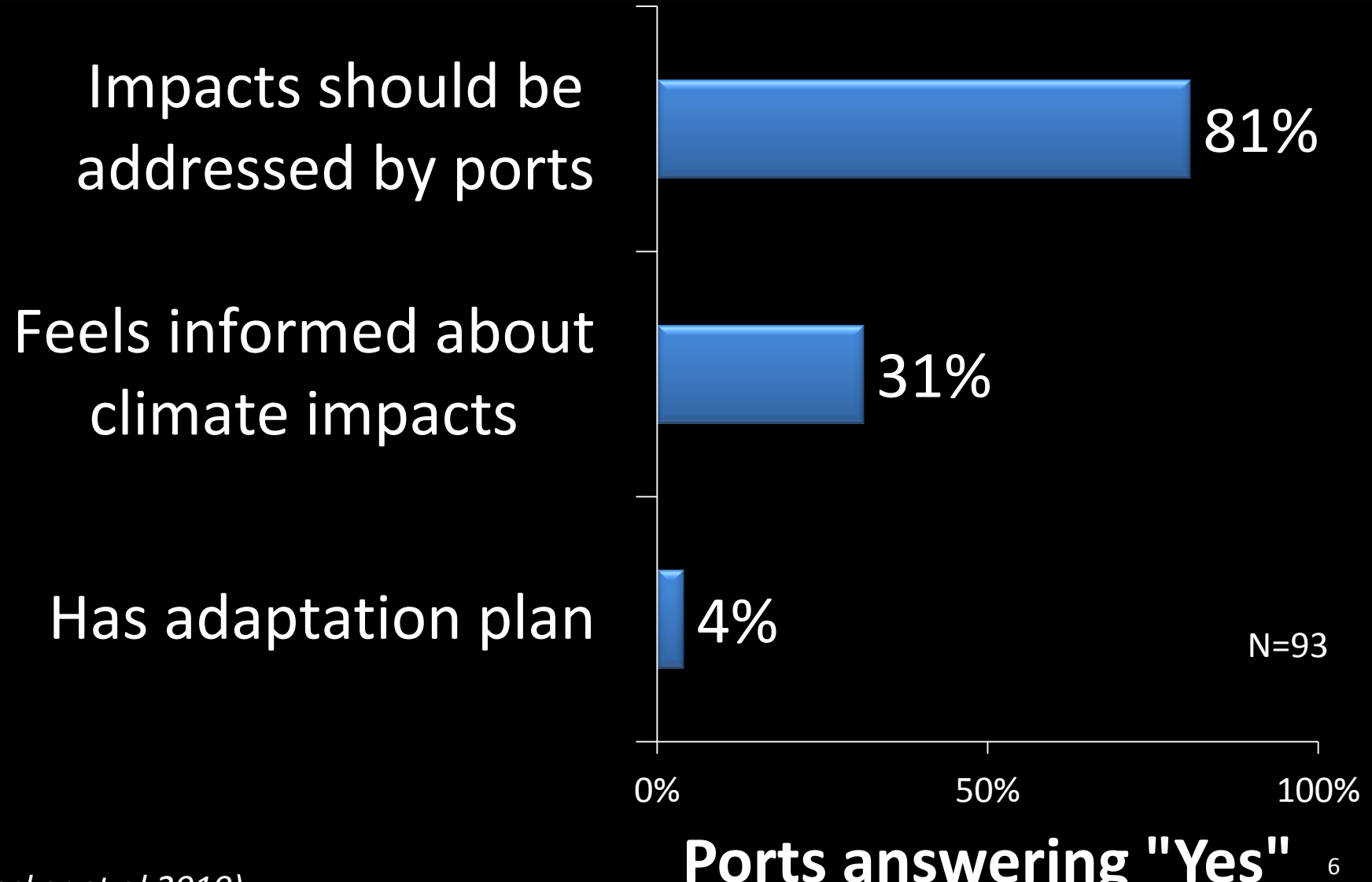
- Port
- Shared
- External stakeholders



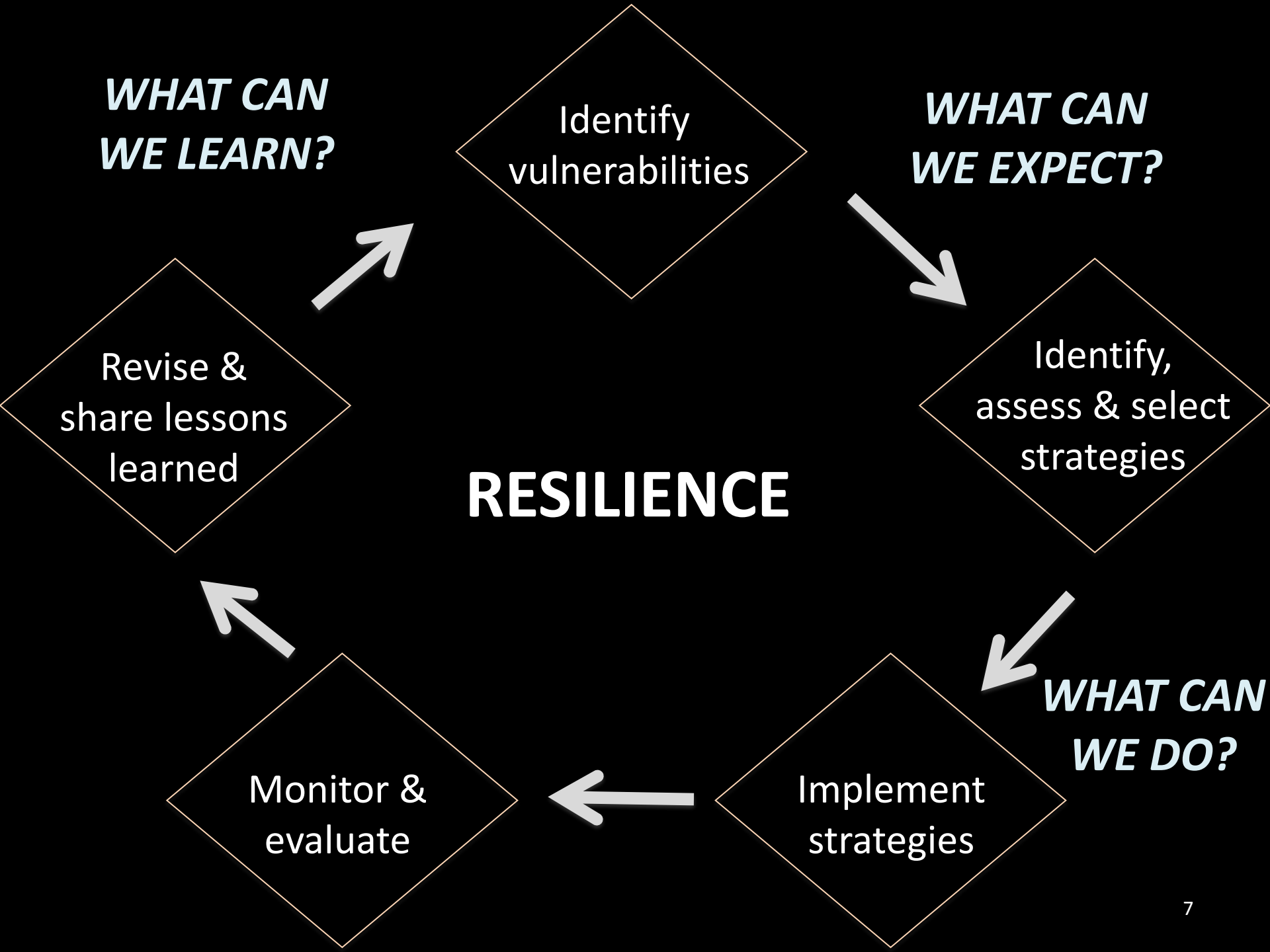
Providence

- Port
- Shared
- External stakeholders

Ports concerned, but little action thus far



(Becker et al 2010)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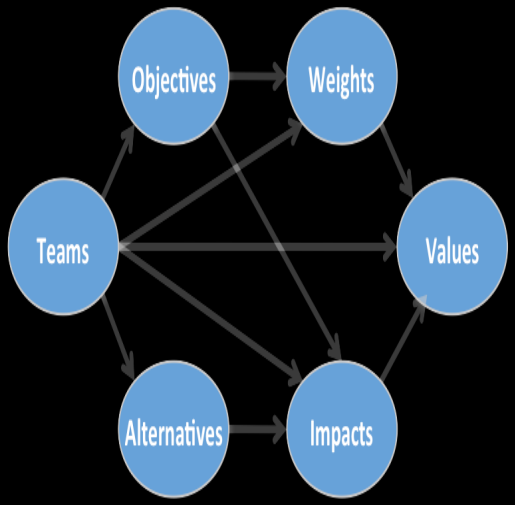
Setting a research agenda

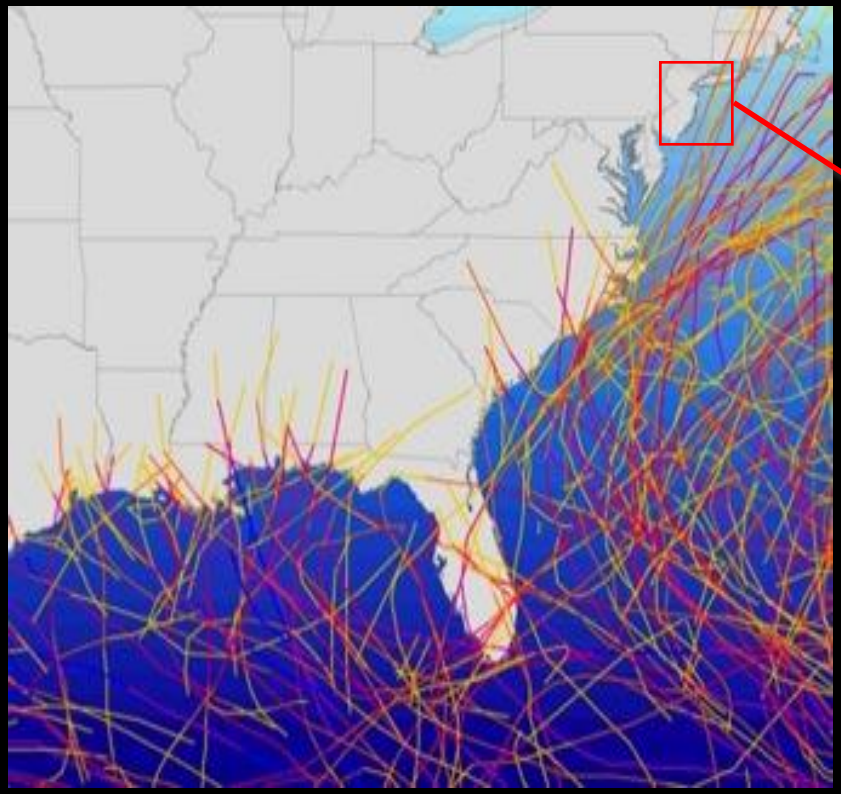
What can we expect? What can we do?



Stakeholder-based vulnerability assessments

Public – Private - NGO

Problem Identification
Vulnerability Assessments –



- Energy port
- High exposure
- NO recent hurricane

Case Study of Providence, RI

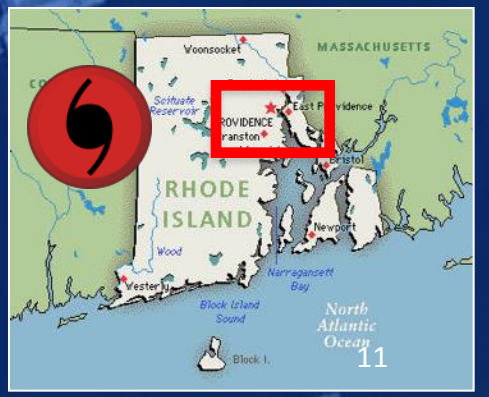
Becker, A. et al. (*In press*).

Method and process

1) Identify stakeholders
2) Create storm scenario & thought prompts

   Maps, visualizations, HAZUS data, etc
3) Conduct workshop with stakeholder group
4) Elicit perceptions, rankings, priorities
5) Synthesize and input to decision making process (e.g., investments, priorities, policies)

Hurricane Sandy Type Event

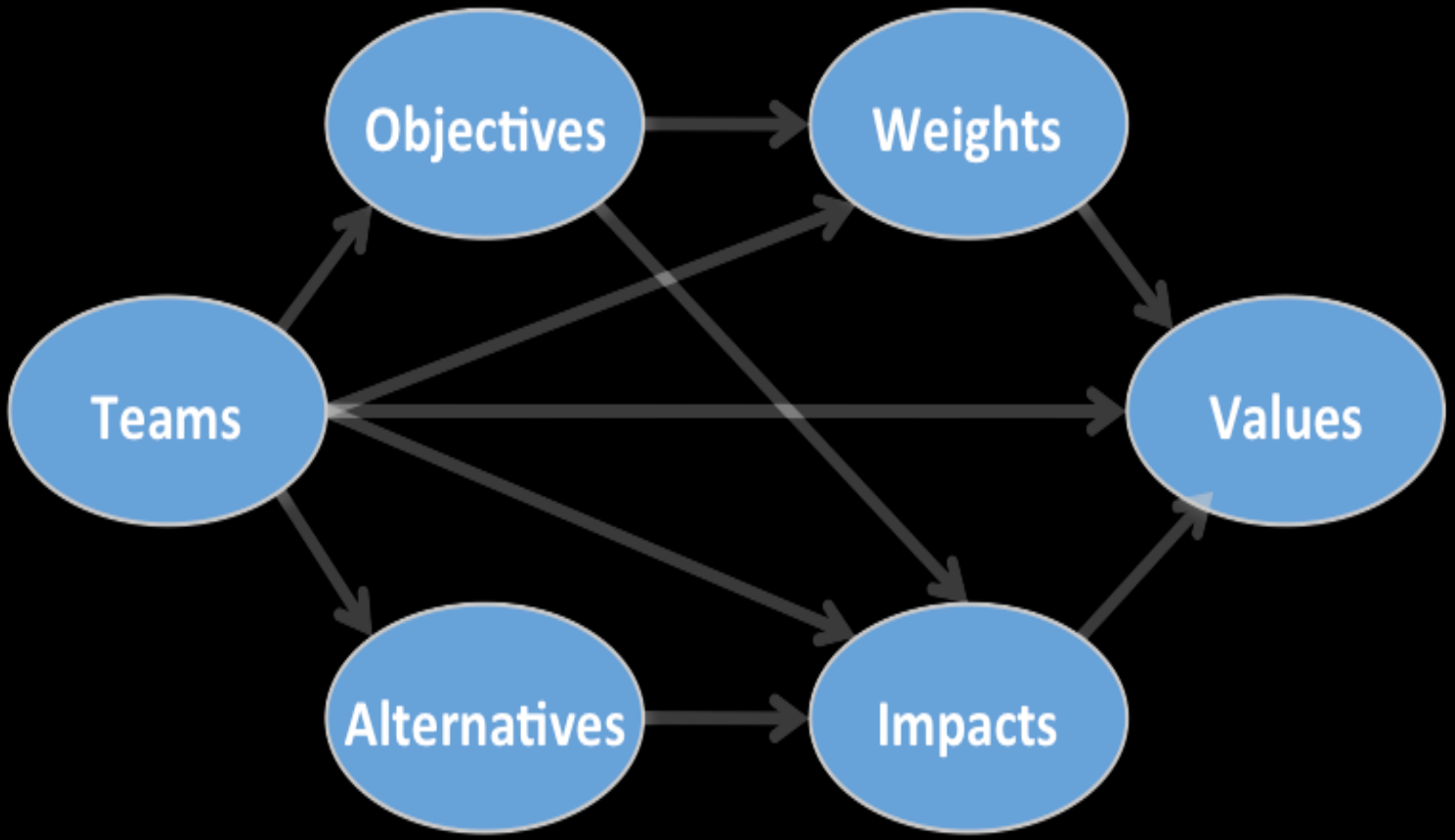


Port of Providence in Cat 3 simulated hurricane
(Surge layer provided by Applied Science Associates)

Visualizations

https://www.dropbox.com/s/qi6wzw3h9pxxgug/Floodwater%20Simulation%201.wmv

Decision support tools

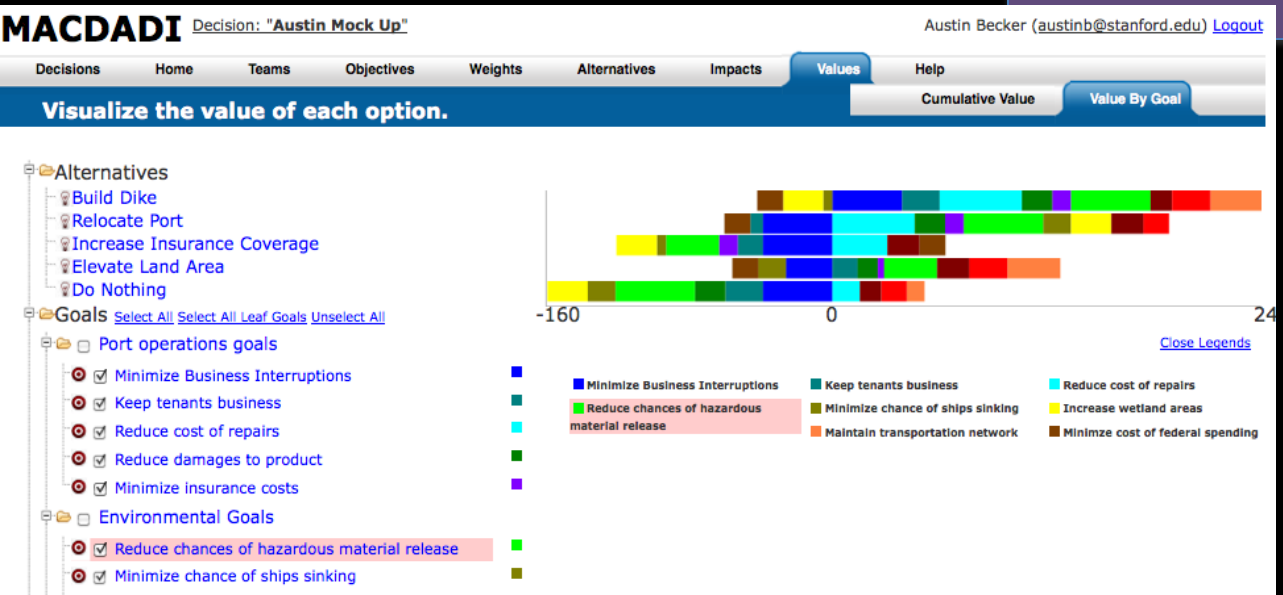


Stakeholders

Goals/missions

Impacts of concern

Strategy alternatives



(Haymaker, 2006)

Advantages of stakeholder approach

Allows for a variety of inputs
(e.g., visualizations, surge maps, HAZUS outputs)

Engages full stakeholder network in resilience planning
(i.e., towards COPRODUCTION)

Informs decision makers of user concerns/priorities

Can lead to information sharing and behavior change

Helps create enabling environment for investment in adaptation

Emerging issues…

1. How do stakeholders perceive:
    1. Responsibility for adaptation?
    2. The impacts that concern them most
    3. The costs associated with adaptation
    4. The threshold for investment

2. How do user perceptions of impacts compare to “decision maker” perceptions?

1. How do various “strategies” meet the objectives of stakeholdes?
    1. Engineering strategies (e.g., build a dike, elevate)
    2. Policy strategies (e.g., better building codes, zoning regulations)
    3. Incentives (e.g., insurance reductions)

Funding support for this work from
RI Dept. of Transportation and the URI Transportation Center
Many thanks to the Transportation Research Board

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EXTRA SLIDES BELOW

Ports: Critical, complex, constrained

Critical - Economic engines at every scale

Complex – Multiple stakeholders across space and time

Constrained - Dependent on specific and environmentally-sensitive locations

(Asariotis and Benamara 2012; Notteboon and Winkelmans 2003; EPA 2011; AAPA 2013)

Fundamental shift…

(P)Catastrophic events

I year

5-10 yrs

My career (~35 years)

The rest of my life (~55 years)

My child's life (~100 years)

My grandchild's life (~105 years)

Engineering & Design – 5 years

Permitting & Regulatory Process – 10 years

Construction – 10 years

Project Design Life – 50 years

Actual working life – >75 years

TODAY

2023

2050

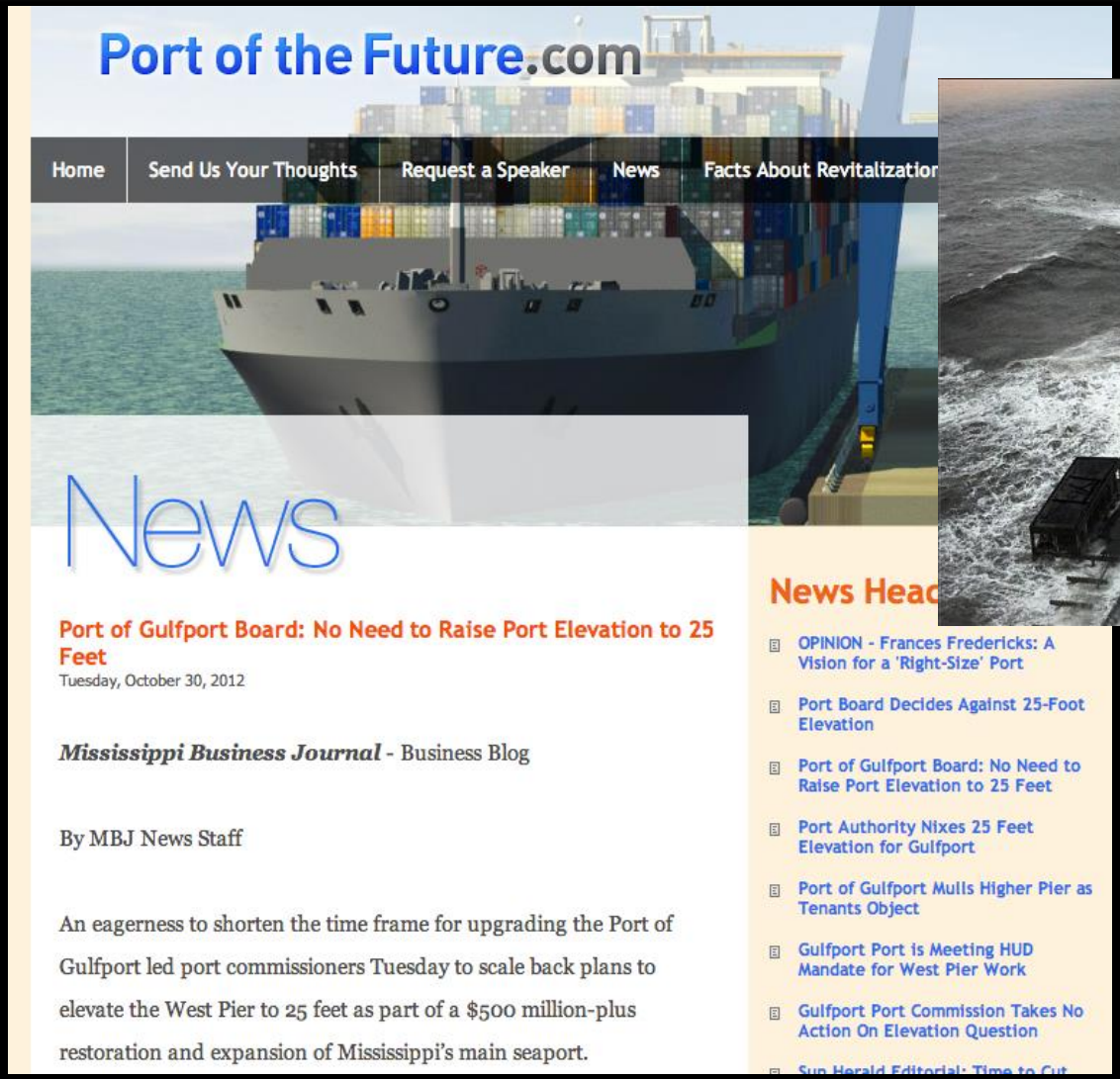
2100

2150

2 0

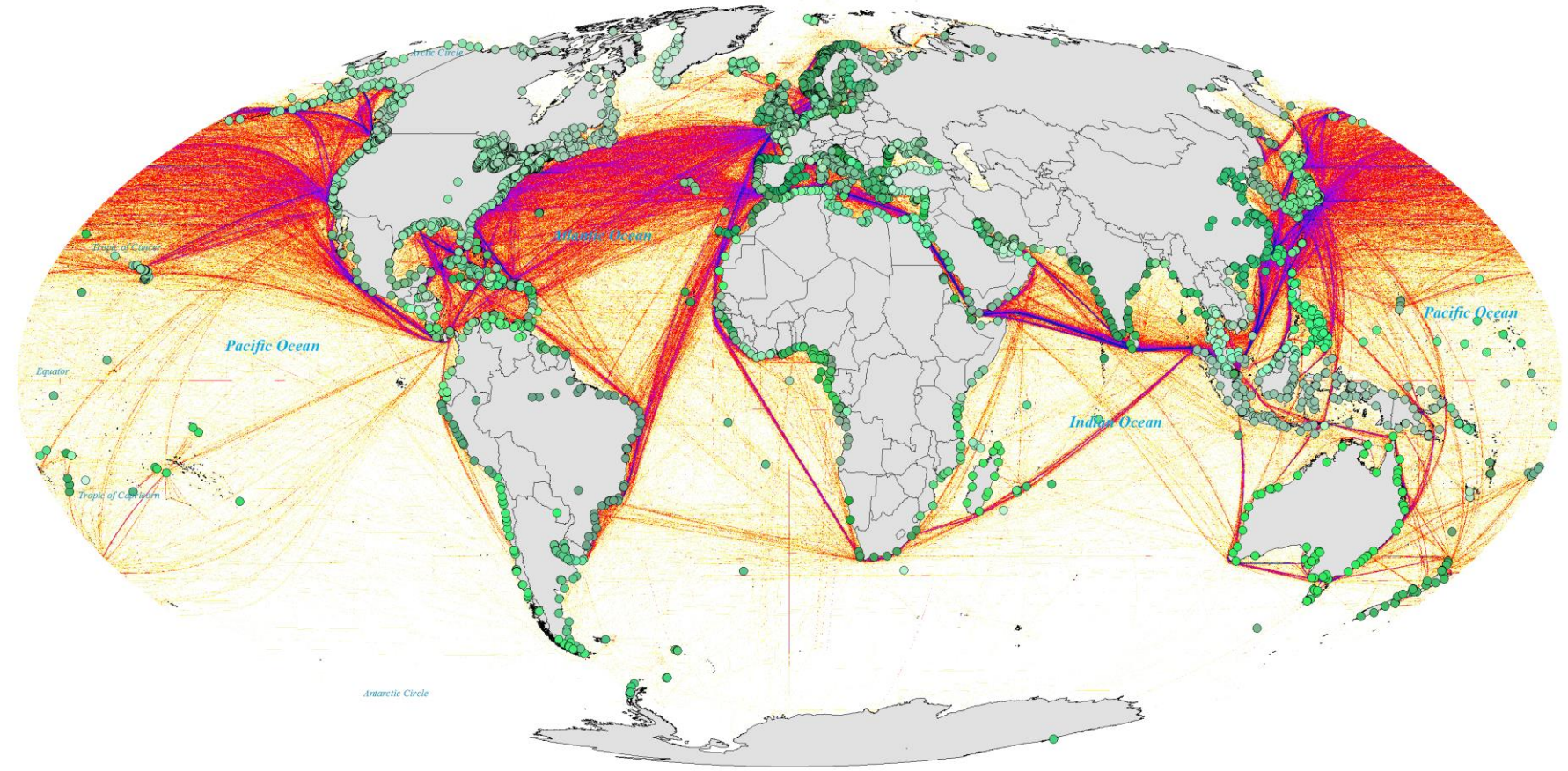
Time

Port decisions do not always account for stakeholder concerns



Oct. 29, 2012

"Super storm" Sandy

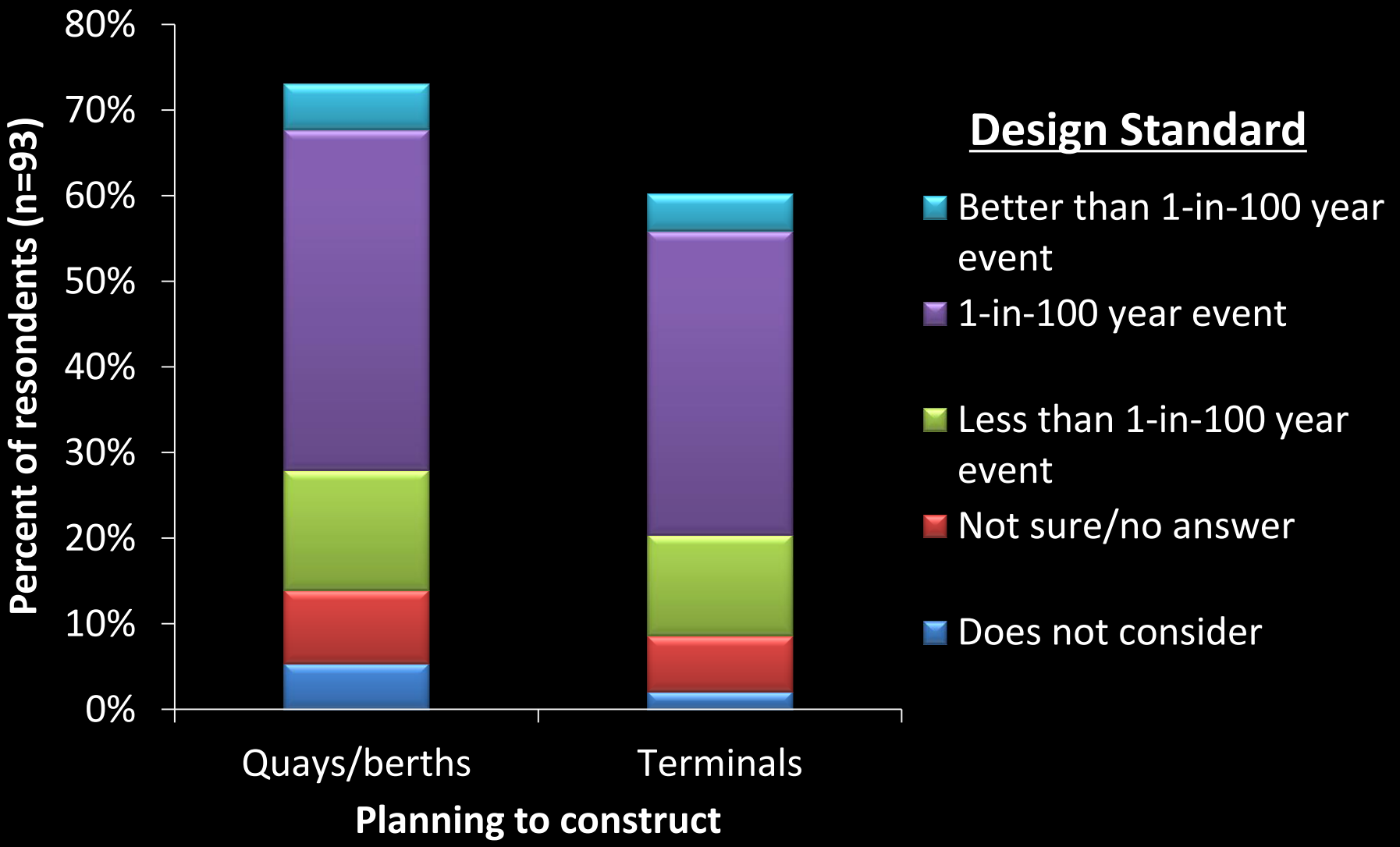


Shipping Routes & 3700 World Ports

Mollweide Projection
Central Meridian: 0.00
Map by Austin Becker
Data from Pub 150 World Port Index and http://www.nceas.ucsb.edu/globalmarine/impacts

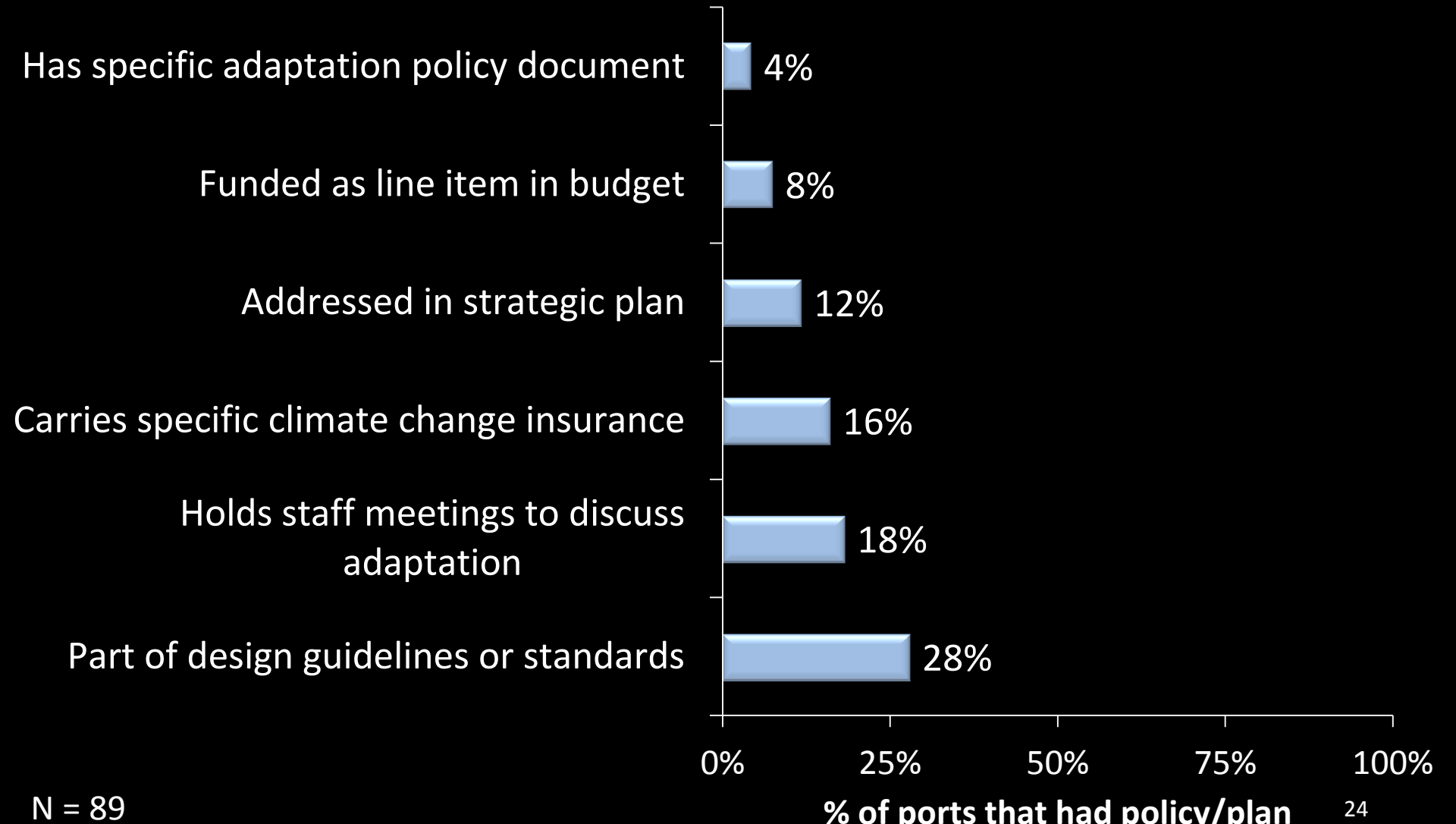
PROBLEM SPACE

Unsuitable design standards for climate change



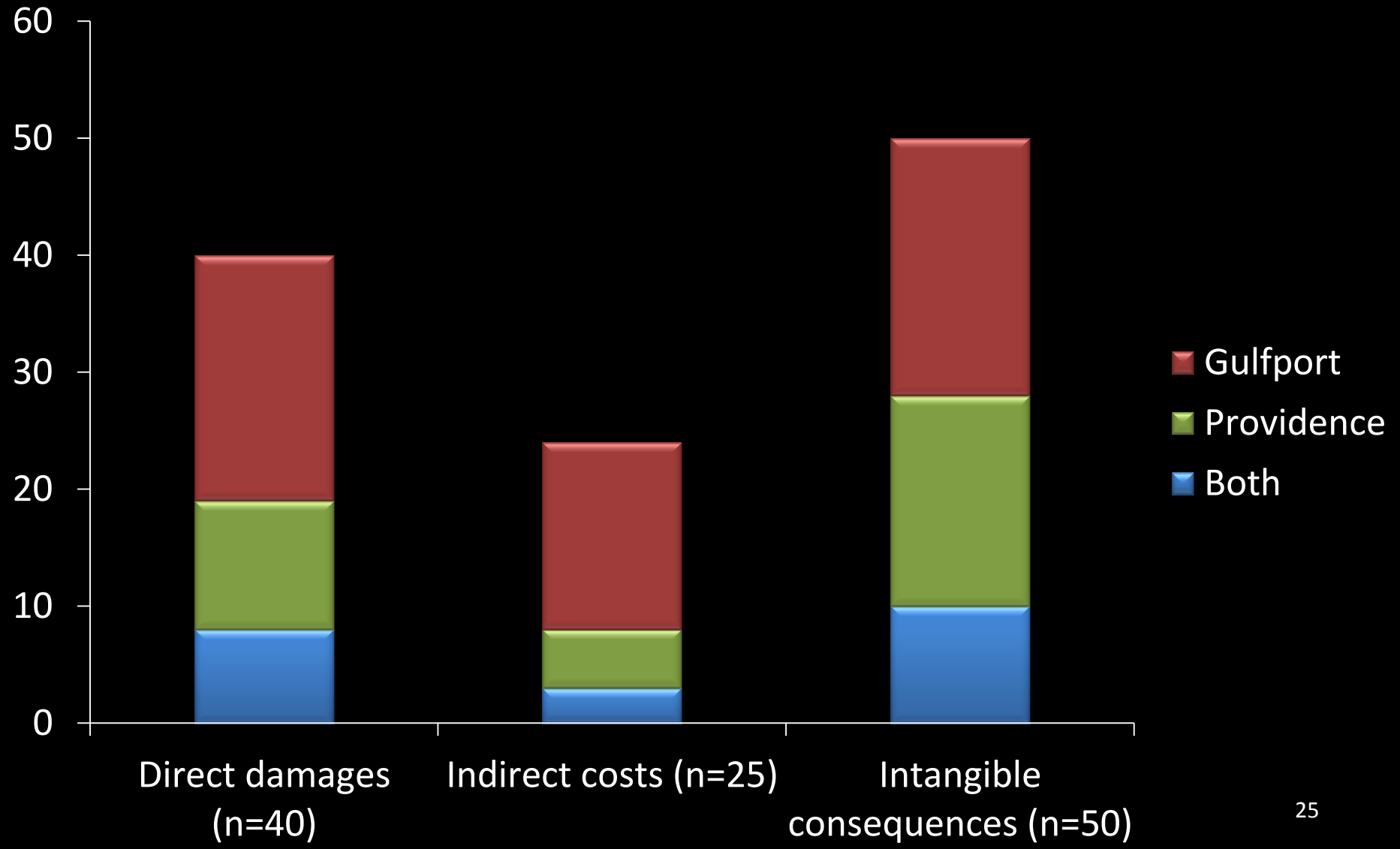
PROBLEM SPACE

Ports have few formal plans that address adaptation



N = 89

Majority of 115 impacts: Intangible consequences

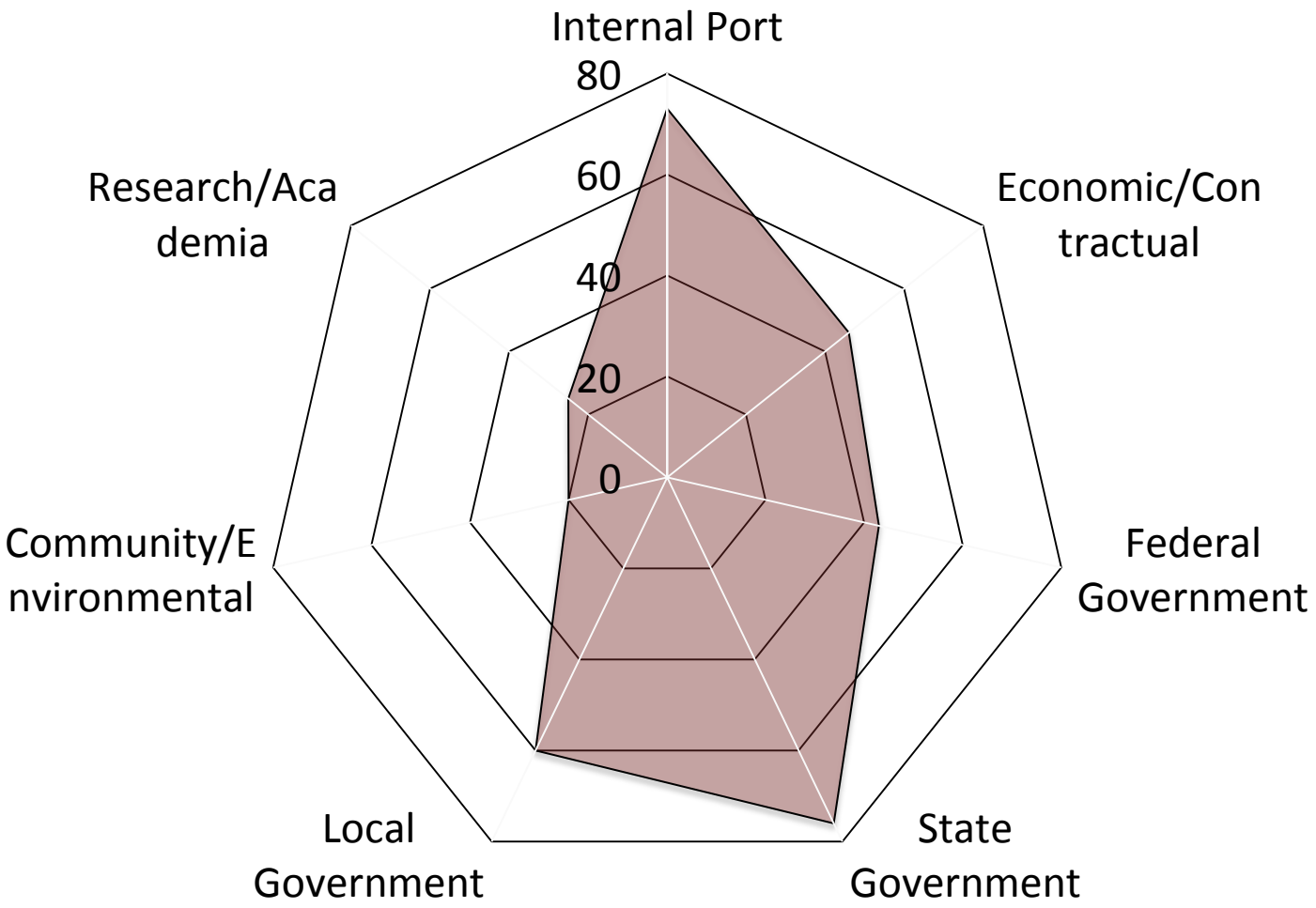


128 port resilience strategies

STAKEHOLDER GROUPS BEST POISED TO IMPLEMENT STRATEGIES

TYPES OF STRATEGIES

- Building codes and land use regulations (10)
- Long-range planning (6)
- Construction and design
  - OFF port lands (12)
  - ON port lands (12)
- Private sector and insurance (10)
- Emergency response, preparation & recovery
  - Business continuity plans (3)
  - Drills & pre-event trainings (4)
  - Post-storm actions (2)
  - Response & recovery guidance (13)
  - Storm preparations (11)
- Research (13)
- Capacity building
  - Collaborations (7)
  - Empower government (6)
  - Improve info flow (4)
  - Lengthen planning horizons (6)
  - Shifts in thinking (9)
- *Total (128)*



Overview

BACKGROUND

1 Ports cities and the climate change challenge

CONTEXT

2 Setting the table for adaptation research

RESEARCH AGENDA

3

a) Vulnerability assessments

b) Risk indices

c) The leadership vacuum

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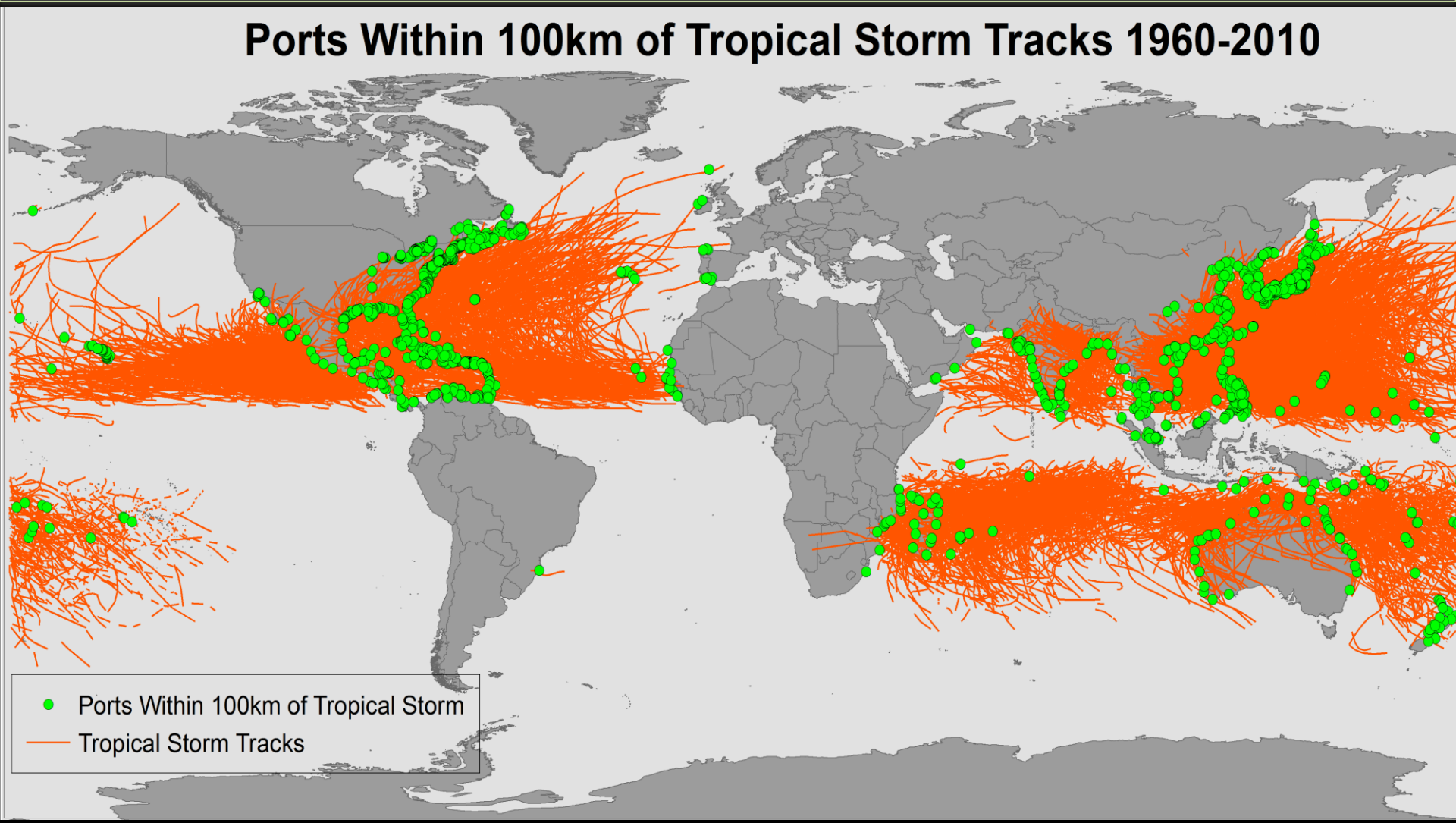
2100

Ports and port stakeholders in harm's way



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Resilience challenges for ports in the face of climate change

Doubling of Cat 4 and 5 tropical storms

1-in-100 year storm event of today

Sea levels to rise 0.7 – 1.9 meters by 2100

1-in-3 year storm event of 2100

Inland flooding

(Bender et al. 2010; Grinsted et al. 2013; Rahmstorf 2010; Emanuel 2013; IPCC 2012; Tebaldi et al. 2012)

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