

# Institutionalizing Resilience: Insights from Initiatives at 10 U.S. Seaports

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## Introduction

### Climate change presents complex problems for maritime infrastructure

- Seaports are necessarily located in hazardous coastal environments and are unable to relocate their infrastructure to less vulnerable locations<sup>1</sup>
- Yet, their physical and administrative complexities (e.g., interdependencies between seaport infrastructure systems and overlapping jurisdictions) present complex problems for seaport resilience planning<sup>2,3</sup>

### Academics & practitioners advocate resilience assessments

Resilience has been proposed as a new paradigm for complex systems management in the face of evolving risk and uncertainty associated with climate change<sup>3</sup>. Yet, it is uncertain how processes of planning for resilience—e.g., resilience assessments—impact seaport planning cultures and what the challenges of operationalizing resilience concepts. This study evaluates resilience assessments by:

1. Elucidating **key benefits & challenges** of resilience assessments for decision makers
2. Identifying **resilience enhancement strategies** that seaports implement
3. Analyzing resilience assessment impacts on **seaport adaptive capacity**

## Methods

### 1) Case study selection

#### 10 seaport resilience assessment case studies that used different resilience assessment approaches:

- Contractor Assessment: Consulting firm leads the assessment (*higher cost, more involved*)
- Hazard Mitigation Plan: Seaport develops plan under FEMA to qualify for disaster relief (*cost and involvement vary*)
- Ports Resilience Index (PRI): Qualitative assessment tool<sup>4</sup> to identify weaknesses and strengths in operations and management related to preparedness, recovery, and adaptability (*no cost, less involved*)

### 2) Data collection – Survey and focus group interviews

- Content analysis of seaports' resilience assessment documents
- Online pre-survey with each informant – resilience enhancement strategies (from assessment documents) implemented & not implemented
- Semi-structured focus group interview with two-four staff from each port (12 total interviews)

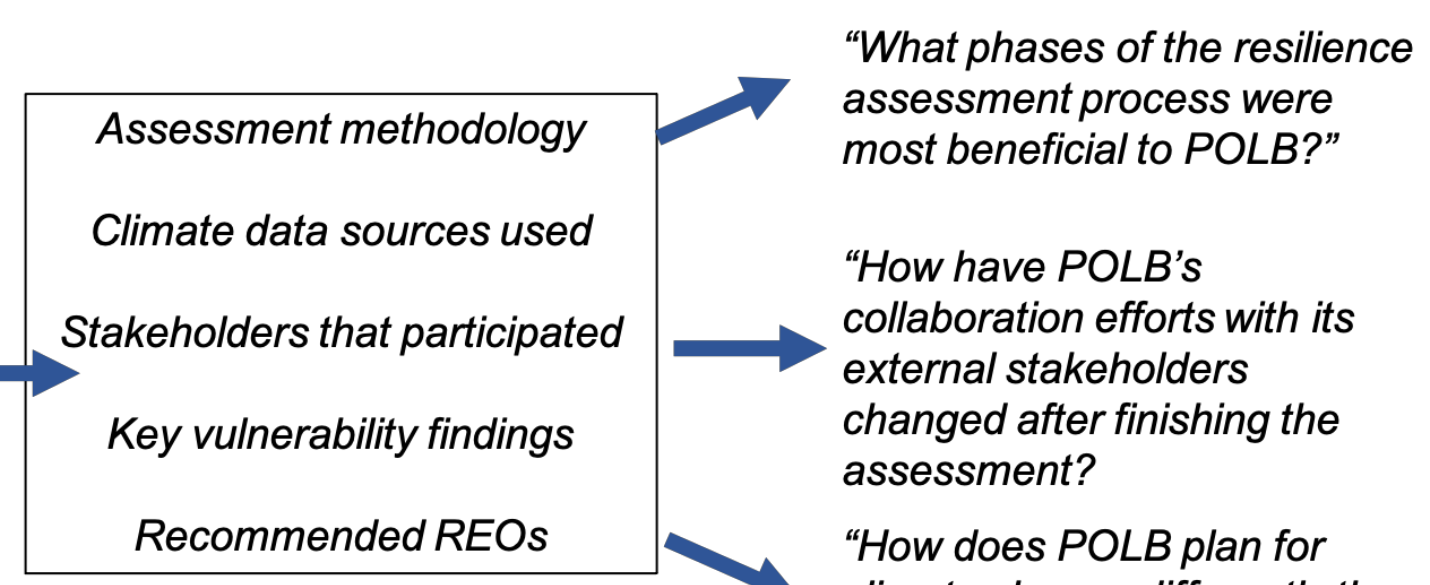
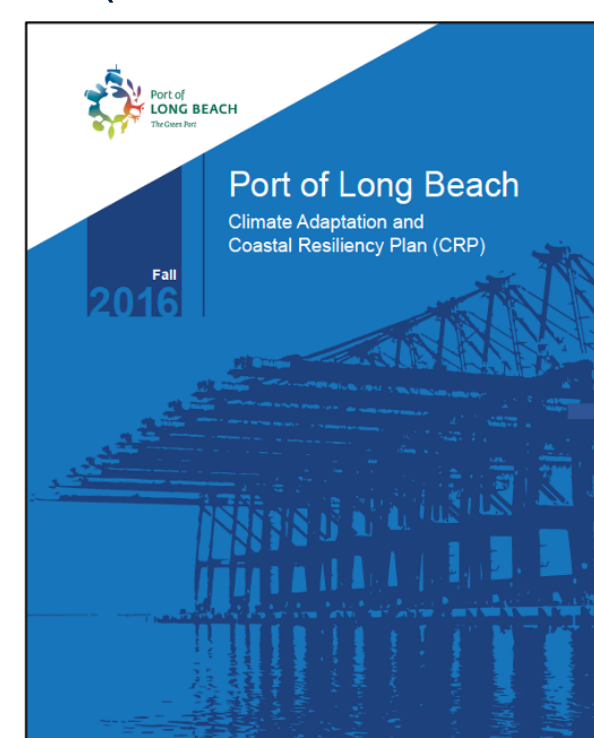


Figure 1. Example of document review workflow

## Results – Key benefits

- 102 statements coded as eight benefits (Fig. 2)
- Informants valued a nuanced understanding of their vulnerabilities resulting from the assessment & resilience assessments enhanced their seaports' social capital with internal and external stakeholders

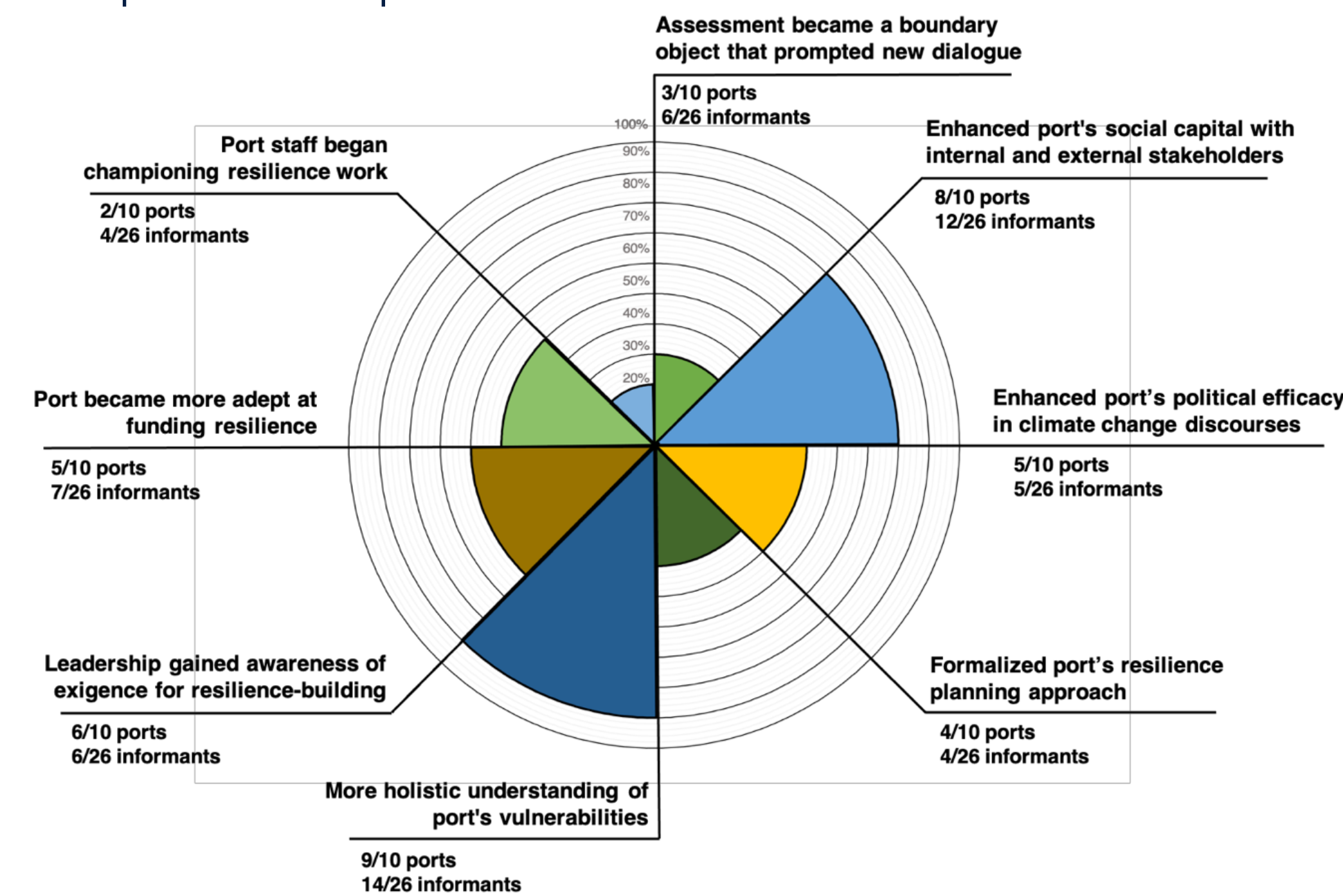


Figure 2. Eight benefits associated with resilience assessments identified in 12 interviews with 26 seaport decision makers.

## Results – Key challenges

- 56 statements grouped into 21 challenges categories
- Most challenges were case-specific, but four main challenges existed
- Engaging stakeholders was a widespread challenge

Table 1 – Four main challenges mentioned in 12 interviews with 26 seaport decision makers

Challenge	Example
<b>Engaging stakeholders</b> (different priorities, scheduling conflicts, etc.)	"It was difficult to talk to people, to get them to speak back to you, and give you information. Many of the commercial stakeholders think that everything they do is proprietary information..."
<b>Addressing vulnerabilities that lacked scientifically robust data</b>	"It was really challenging is the areas that don't have a lot of good data...you start talking about sea level rise...I'm either going to be at 19 feet elevation or 20 feet elevation or I'm going to be four feet under. So, which do you start to try to plan for?"
<b>The lack of an archetype resilience assessment model challenged the organization of the assessment</b>	"Most challenging to start was that [the assessment] was something brand new...I needed something to go on, some sort of adaptation plan...and it just simply didn't exist...It was a challenge because we were kind of starting fresh, with a new thing."
<b>Communicating vulnerability findings to stakeholders could negatively impact seaports' marketability</b>	"...some port leaders have felt like, 'If we start showing these maps of sea level rise, is that going to deter investment into our waterfront?...are these investment groups going to say, 'Oh my gosh, [that port] is going to be flooded!'?"

## Results – Resilience enhancement strategies

- 157 total strategies counted in resilience assessment documents and fell into one of six typologies (Fig. 3)
- Construction & design strategies were most frequently mentioned (Nm=60) and implemented (Ni=25)



Figure 3. Heat map of mentioned resilience enhancement strategies that respondents indicated had been/will be implemented, may be implemented, and will not be implemented after completing a resilience assessment

## Conclusions

- Survey and interview results suggest the potential for resilience assessment interventions to breakdown documented institutional barriers to resilience building at seaports (and in other contexts) & build adaptive capacity (supported by findings in the literature)
- We present a novel approach to evaluate resilience assessments using informants' perceptions of the process AND actual actions that come out of assessments
- Important findings to inform guidance material

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