

# **Energy efficiency retrofit selection in shipping – science or social experiment?**

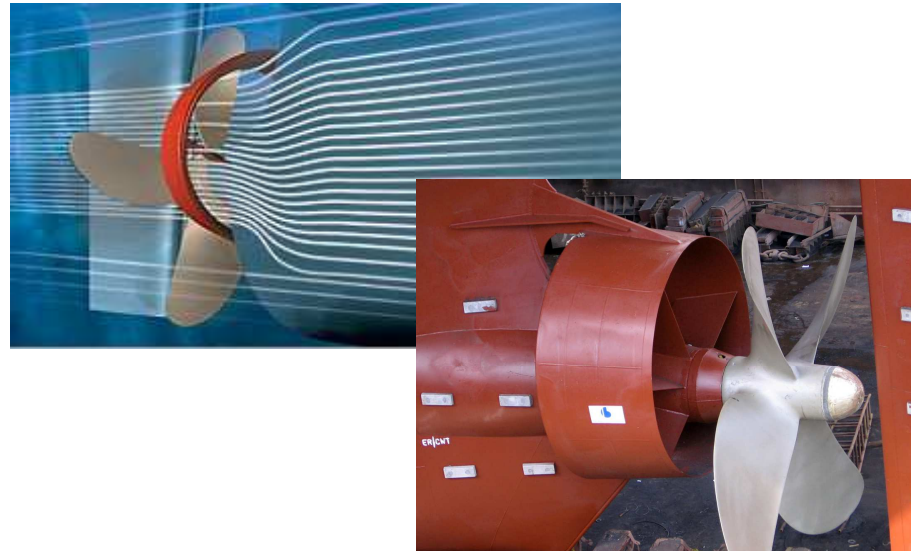
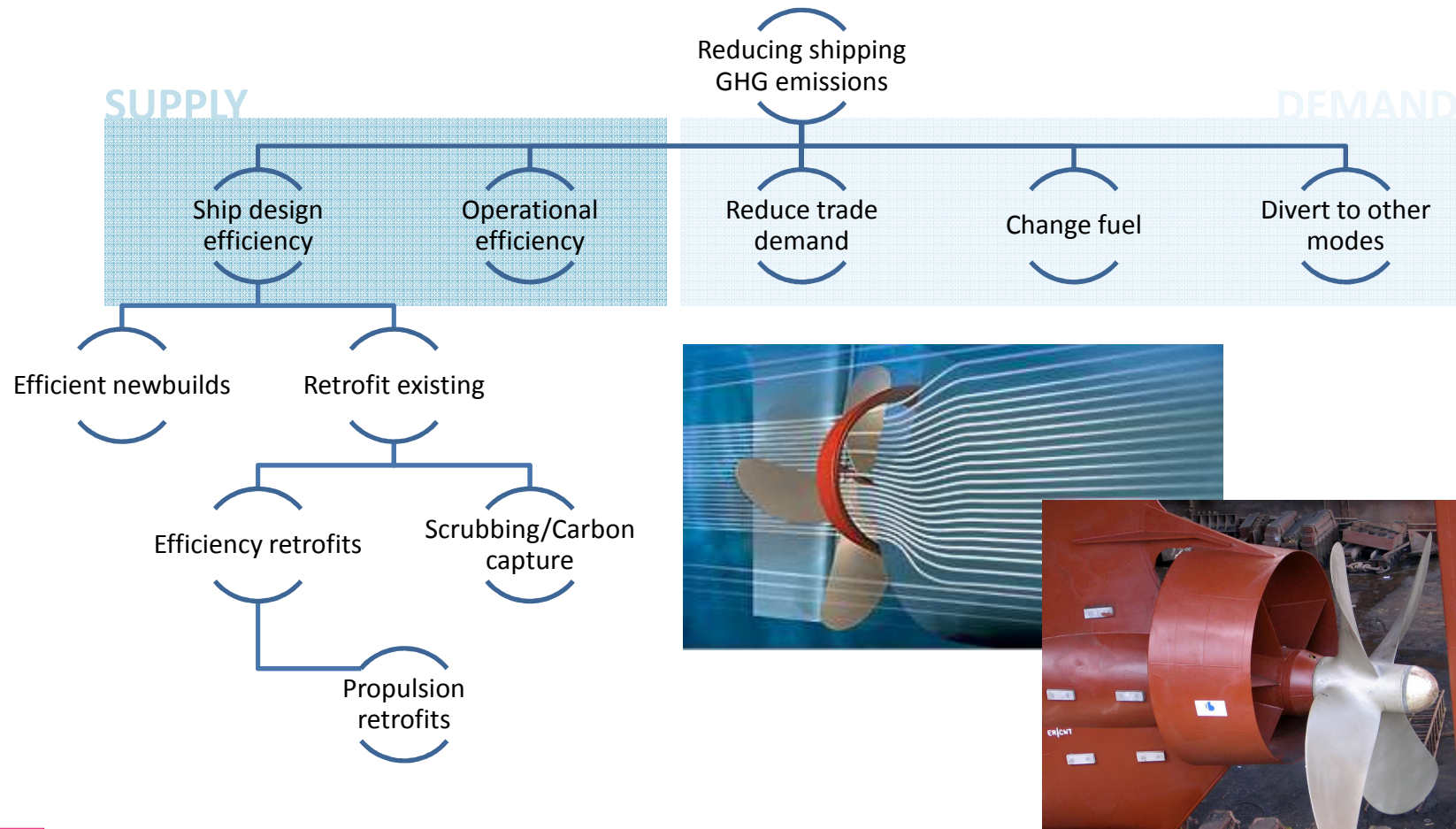
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# Reducing GHG emissions



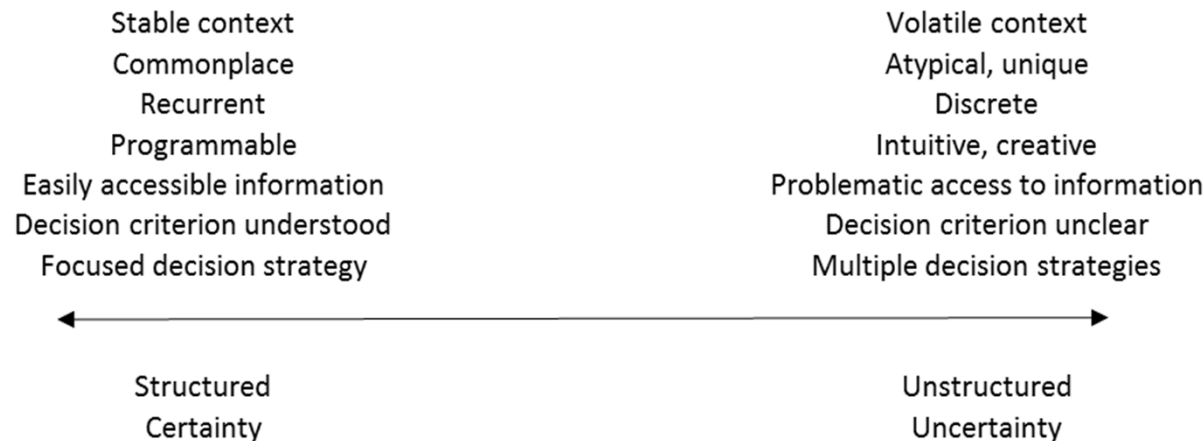
# Why retrofits?

- Vessels are seeing extended lifetimes ( $\approx 30\%$  of vessels that will be operating in 2025 have already been built)
- Reduce the gap in a two-tier market (Stulgis, 2014)
- Retrofitting will always be required as older ships compete with younger tonnage especially if operating under a carbon tax or other MBMs (Raucci, 2017)

Increasing efficiency is will always be relevant



# Decision-making as problem solving



Characteristics of problem structure (Simon, 1960)

Decision-making is a subset of problem solving

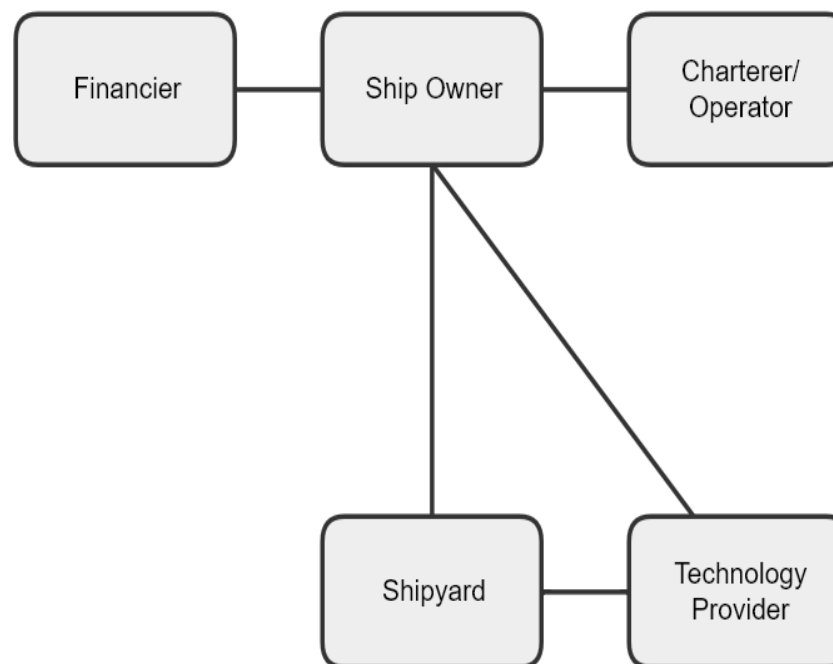


# Decision-making features

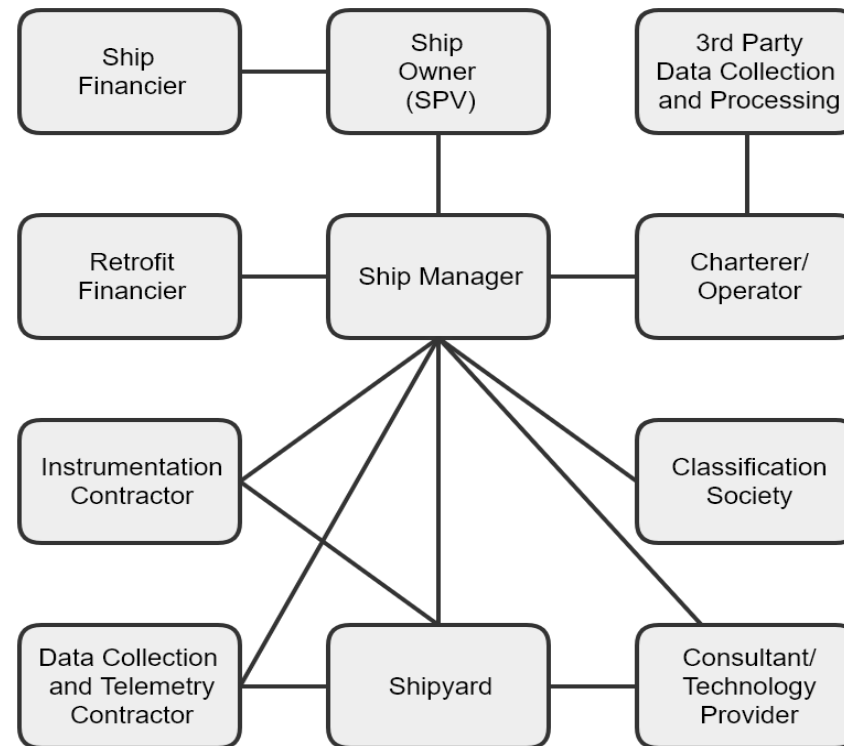
- Complexity
- Multi-disciplinarity
- Multiple stakeholder involvement
- Optimisation criterion
- Use of information



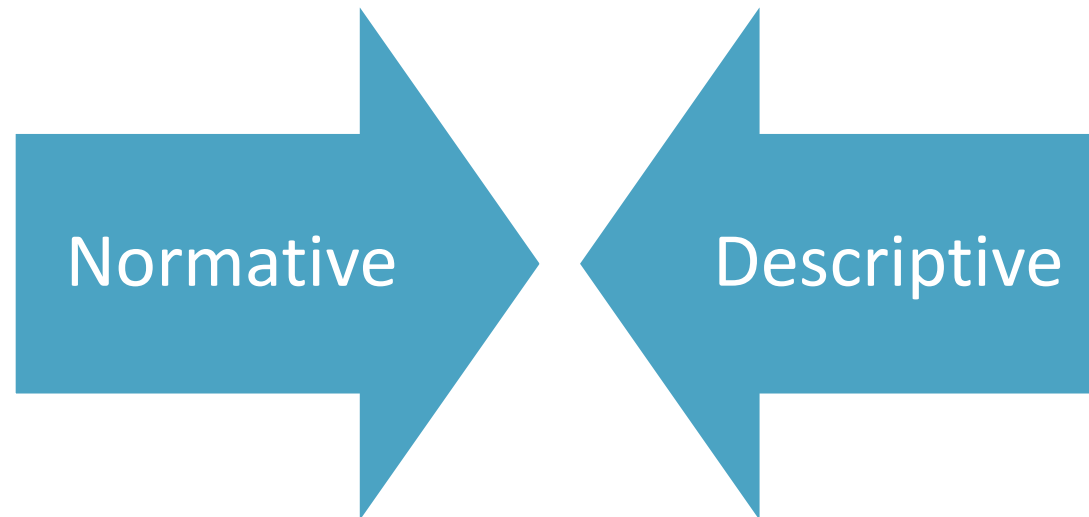
# Direct stakeholders



# Direct stakeholders



# Decision-making models





# Normative

- Rationality
- Utility
- Classic economic theory

$$1 + 1 = 2$$



# Descriptive

- Irrationality

Behavioral  
economics

Diffusion of  
innovation

Social  
psychology

Sociology

$$1 + 1 = 42$$



# Decision-making in shipping

- With reference to energy efficiency:
  - Very poorly documented
  - Very poorly evaluated



# Decision support in shipping

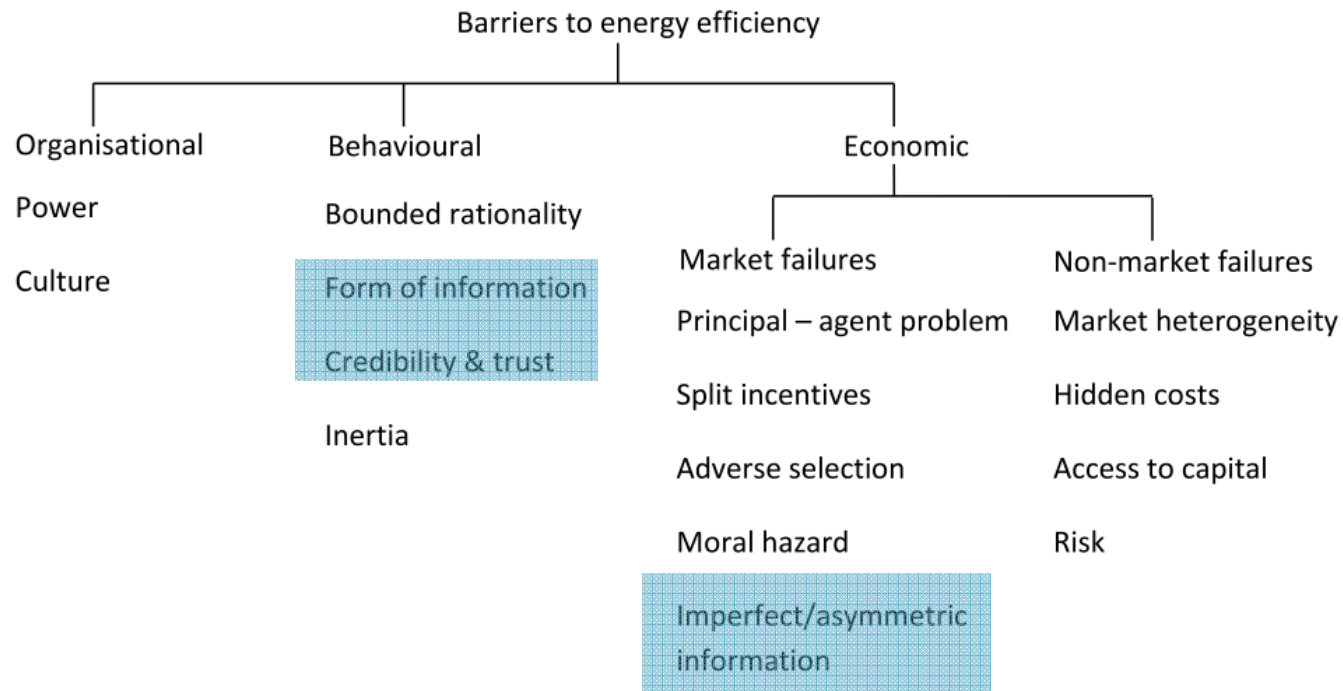
- Very theoretically focused
- Embrace power of computation

but . . .

- Very opaque and inaccessible
- Do not answer the questions that stakeholders want answered

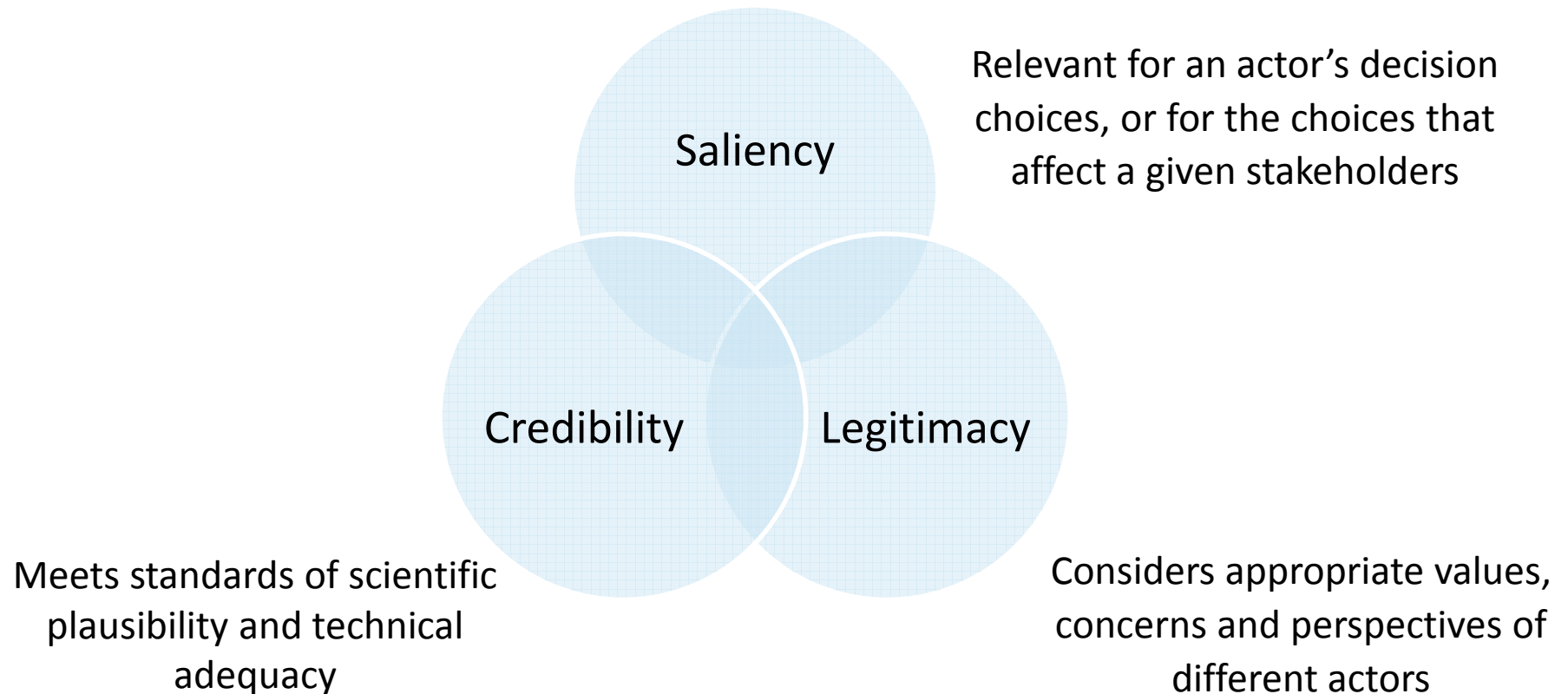


# Barriers to energy efficiency



Rehmatulla, N., & Smith, T. (2015). Barriers to energy efficiency in shipping: A triangulated approach to investigate the principal agent problem. *Energy Policy*, 84, 44–57.

# Information creation-use gap

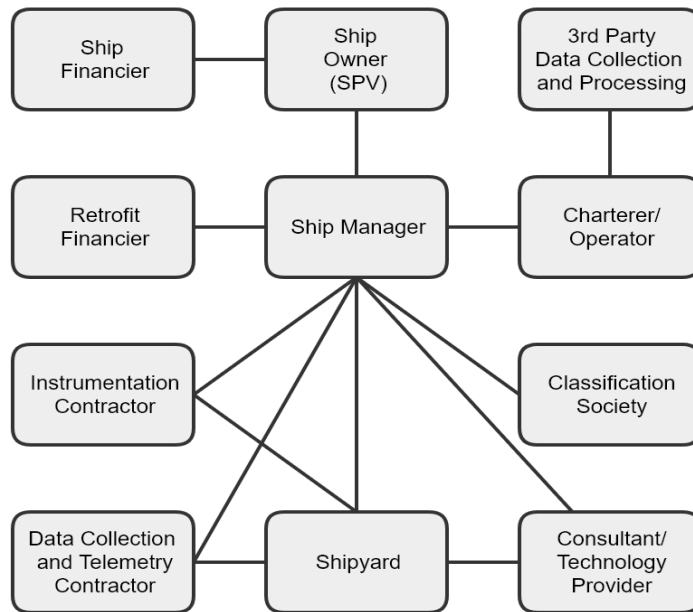


Cash, D. et al., (2002). *Saliency, credibility, legitimacy and boundaries: linking research assessment and decision making*. Harvard University.

Li, F., & Pye, S. (2017). *Energy Pathways under Deep Uncertainty : What do Decision Makers Really Think is Important?* - Interview findings.



# Who needs decision support related to efficiency?



- ### Indirect Influencers
- Academia/Research
  - NGOs
  - Marine intelligence
  - Owner associations
  - Shipper
  - Shipbuilder
  - DAQ service providers
  - Engine manufacturers
  - Brokers
  - P&I clubs

- ### Regulatory Bodies
- IMO/Nations
  - EU
  - Class
  - Standards
  - Flag states
  - Port authorities



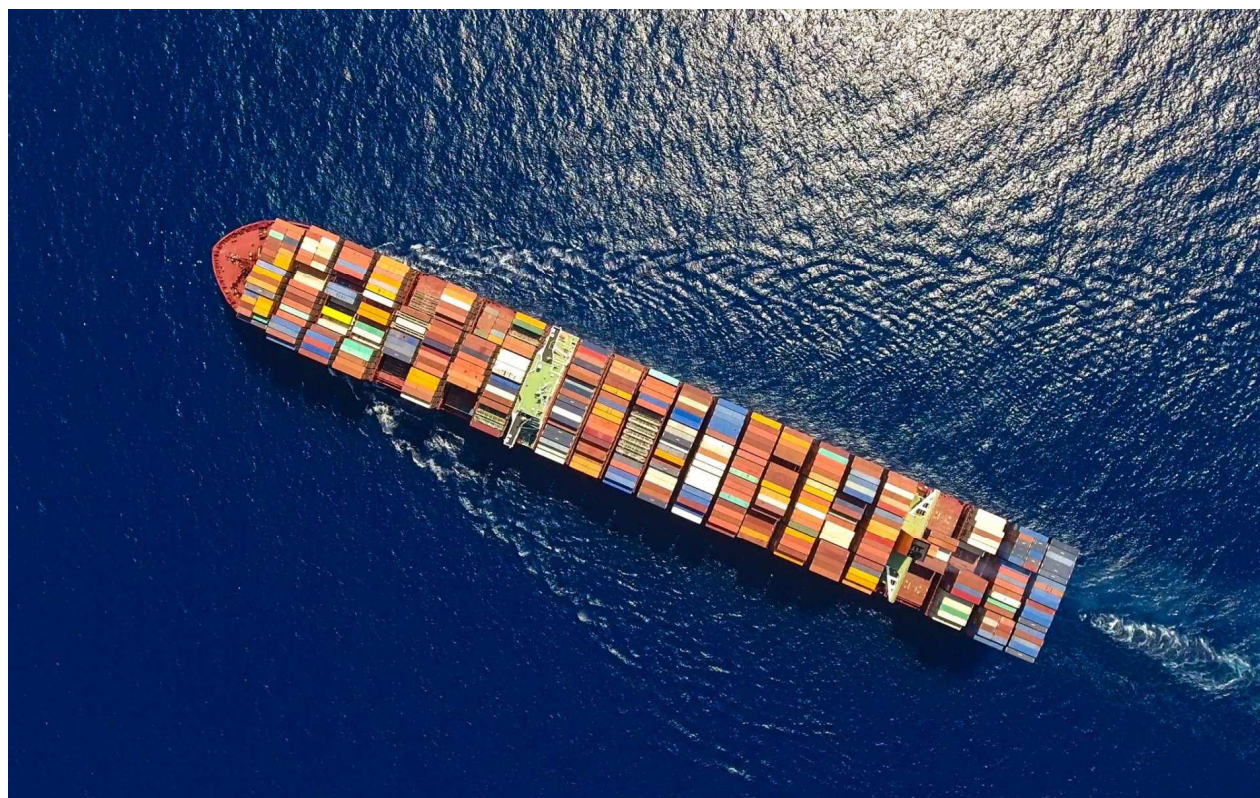
# Work looking forward

- Case study and interviews into decision making related to retrofitting
- Investigate and develop methods to close the information creation-use gap
- Aiming to increase transparency while doing so





# Questions?



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