Economics of Ocean Observing Systems

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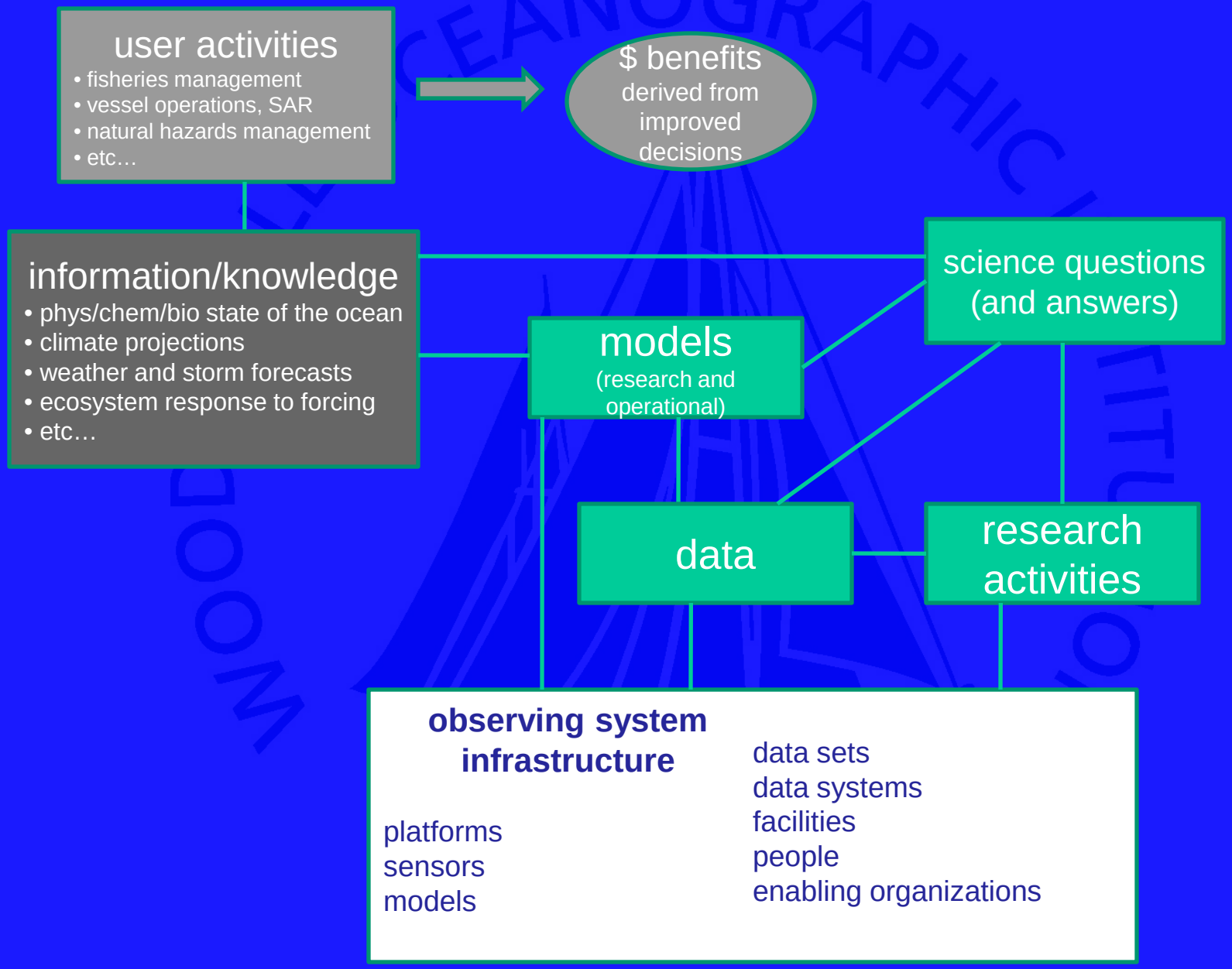
Outline

- Theory: Value of information approach
- Practice:
  - Estimates of potential benefits
  - Measurements?
- Economics and design of OOS

OOS Infrastructure and Benefits



Rationale for Ocean Observation

- Transportation (shipping, LNG terminals, …)
- Energy (wind power, …)
- Commercial fishing & aquaculture
- Recreational boating & fishing
- Homeland Security, Search & Rescue
- Resource management and hazard mitigation (algal blooms, coastal flooding & erosion, …)
- Marine science – understanding the oceans
- ……

All involve making decisions that require information about the marine environment.

Nature of Benefits: Value of Information

Information → Decisions

Short Run
(Operational Decisions)

Long Run
(Planning and Investment Decisions)

Increases in Scientific and Technical Knowledge
Technical Change

How to measure benefits?

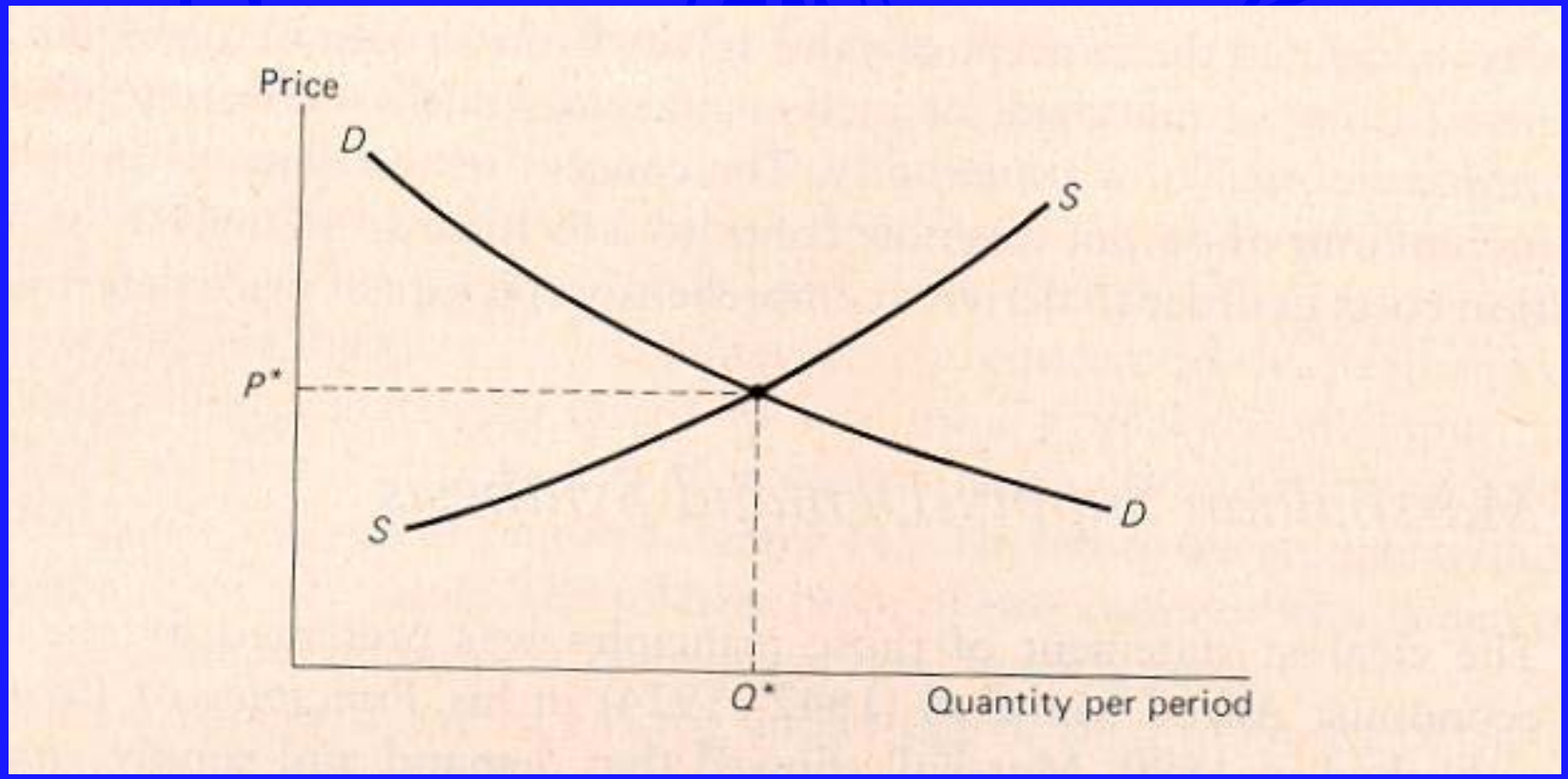
- “Impact” measures
  - Jobs, wages, tax revenue
  - Output (sales, revenue)

- Problem: these can be misleading as indicator of real benefit to the nation

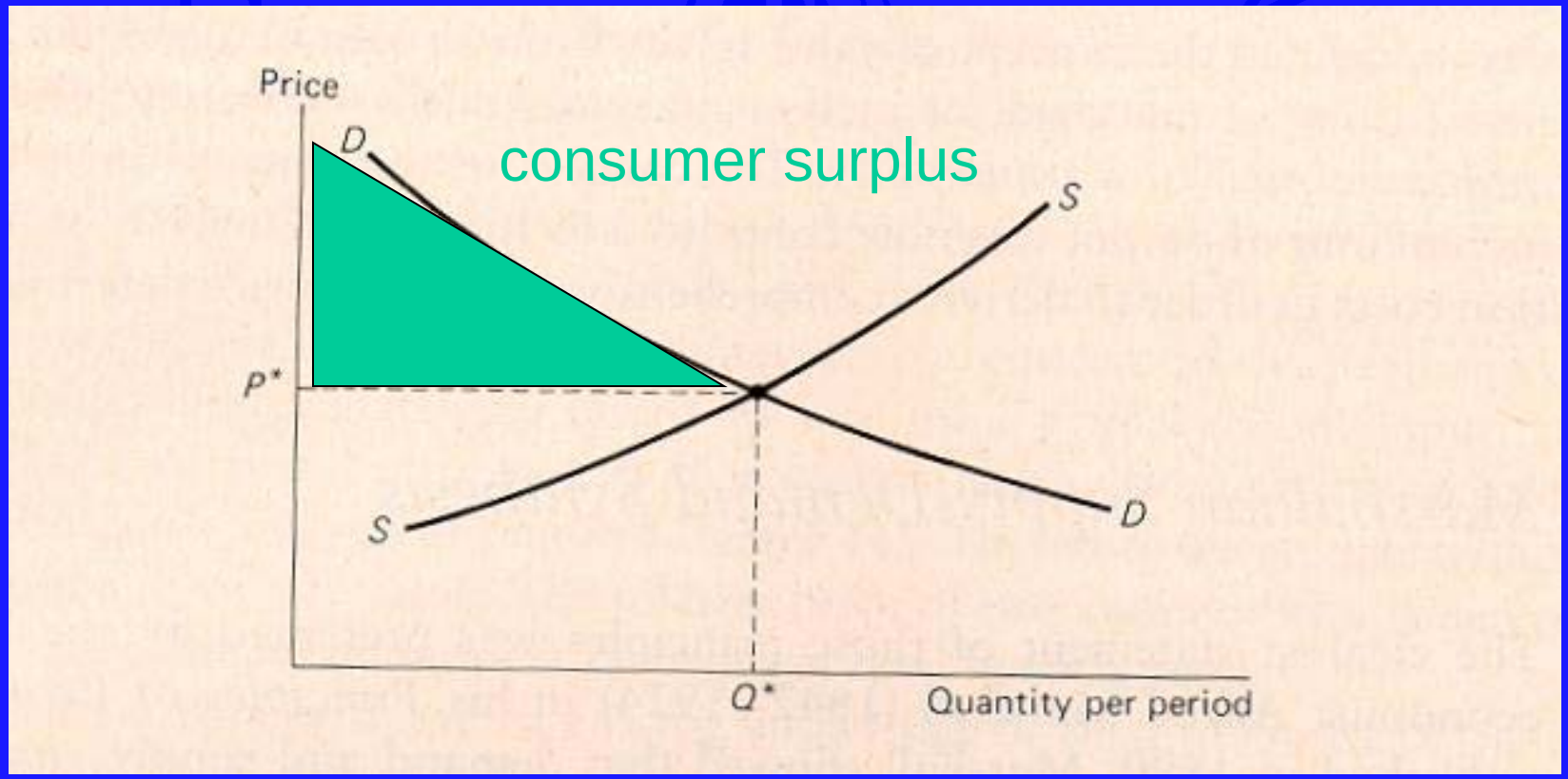
Benefit = change in value added ("social surplus")

- Producer Surplus:
  - What producers receive, minus what it costs to produce
- and Consumer Surplus:
  - What consumers would be willing to pay, minus what they actually pay
- Net change in "welfare"

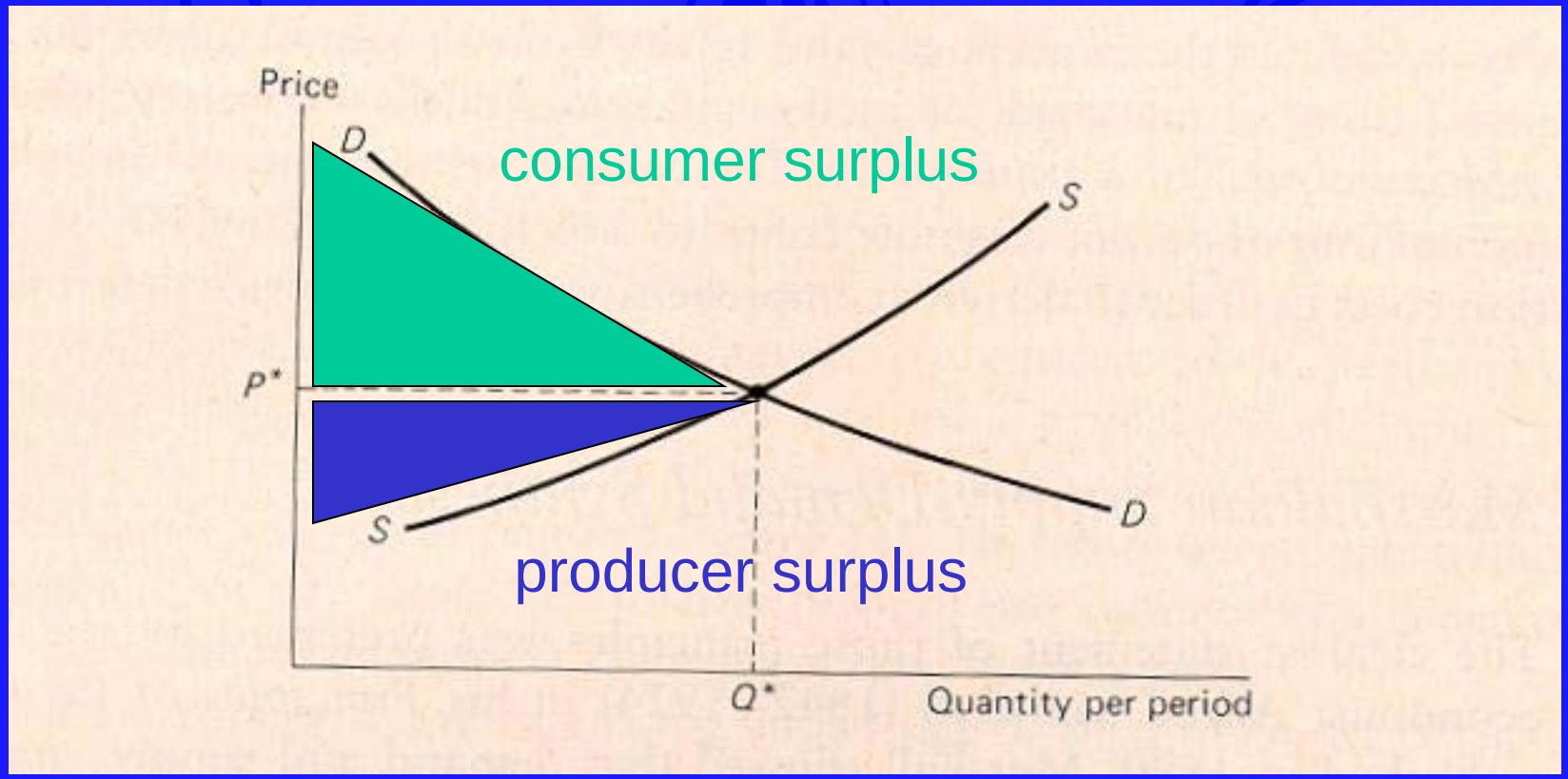
Supply, demand, and surplus



Supply, demand, and surplus



Supply, demand, and surplus



Benefit = change in value added

- Changes in social surplus
  - Producer surplus
    - What producers receive less what it costs to produce
  - Consumer surplus
    - What consumers would be willing to pay less what they actually pay
  - Net change in economy ("welfare")
- Often hard to estimate/measure in practice
- Proxies:
  - Increased goods and services
  - Lower cost goods and services

Modeling the Value of a Forecast

- Information about the underlying state of nature (uncertainty)
- Information about change in (quality of) information
- Model of behavior (operational or investment decisions of users)
- Model of physical outcomes (state of nature)
- Model of economic implications

Sector	Application	Order of Magnitude of Possible Annual Benefits ($ millions)	Regions with greatest benefits
Recreational Activities	Recreational Fishing	100s	Great Lakes, Gulf of Mexico
	Recreational Boating	100s	Great Lakes, Gulf of Mexico, Atlantic
	Beaches/Shore Recreation	100s	Florida, California
Transportation	Transportation-Freight	10s	Florida, Mid Atlantic
	Transportation-Cruise Ships	10s	Florida
Health and Safety	Search & Rescue	10s	All
	Oil Spills	10s	All
	Tropical Storm Prediction	10s	Atlantic, GoMex
Energy	Electricity Load Planning	10s to 100s	Great Lakes, California, Atlantic
	Ocean Structures	10s	Gulf of Mexico
Commercial Fishing	Commercial Fishing	100s	Alaska, New England

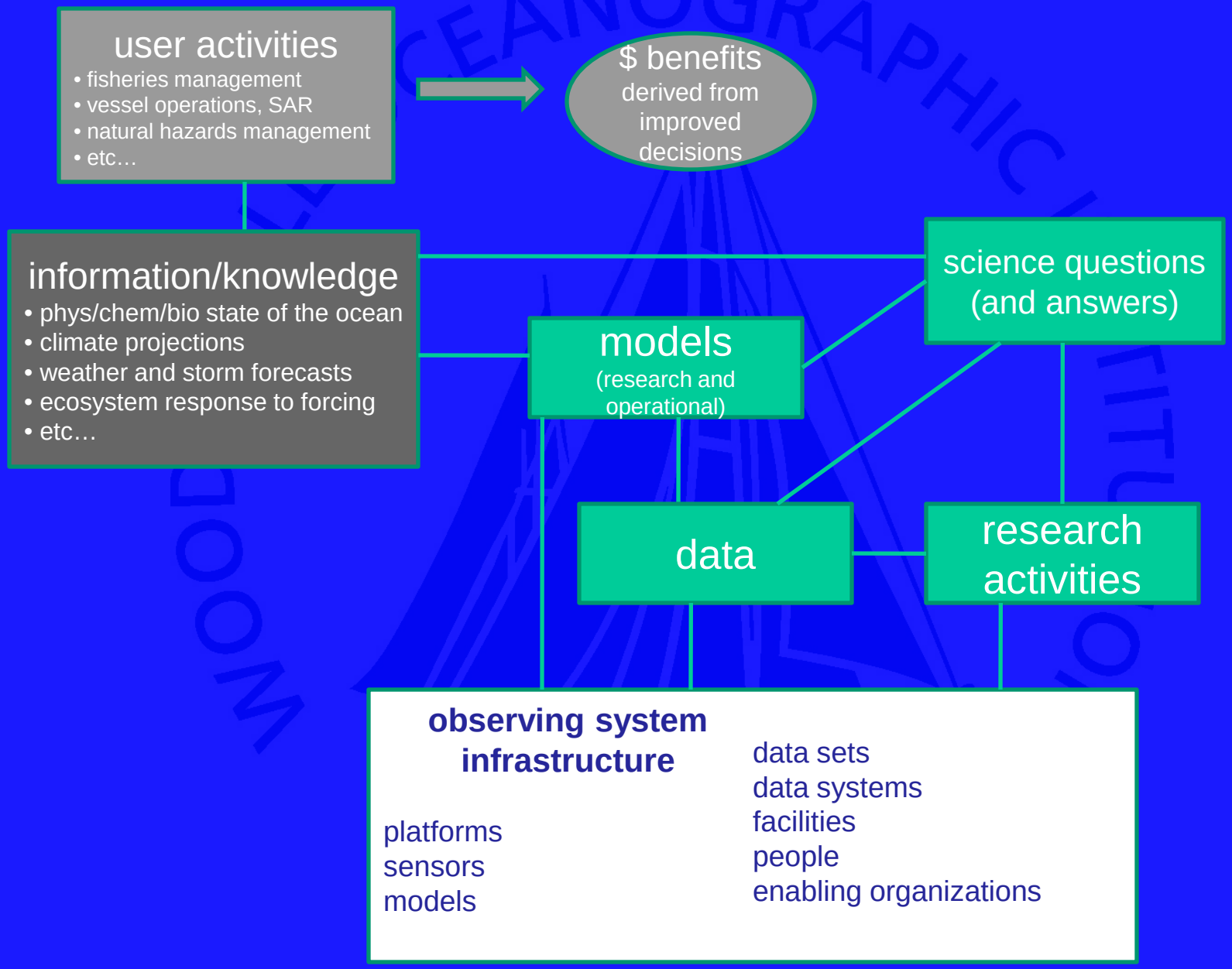
Measuring the Value

- Almost never done
- Requires tracking users and use instances, and measuring economic outcomes
- Surveys can be (partially) automated
- Sustained interactions with users

Beyond “what is the value?”: Optimizing OOS Design

- Goal: economically efficient decision support
- Requires OSSEs combined with economic benefit models
- How does economic value generated change with configuration of OOS?

OOS Infrastructure and Benefits



Closing Thoughts

- Economic analysis is potentially useful
- …but limited progress on economics of OOS
  - It's not inexpensive
  - It can be disruptive
  - Politically useful?
- I'm still interested.

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