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The path to an integrated marine management systems analysis approach to protect biodiversity

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DEVOTES
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Development of innovative tools for understanding marine biodiversity and assessing good environmental status

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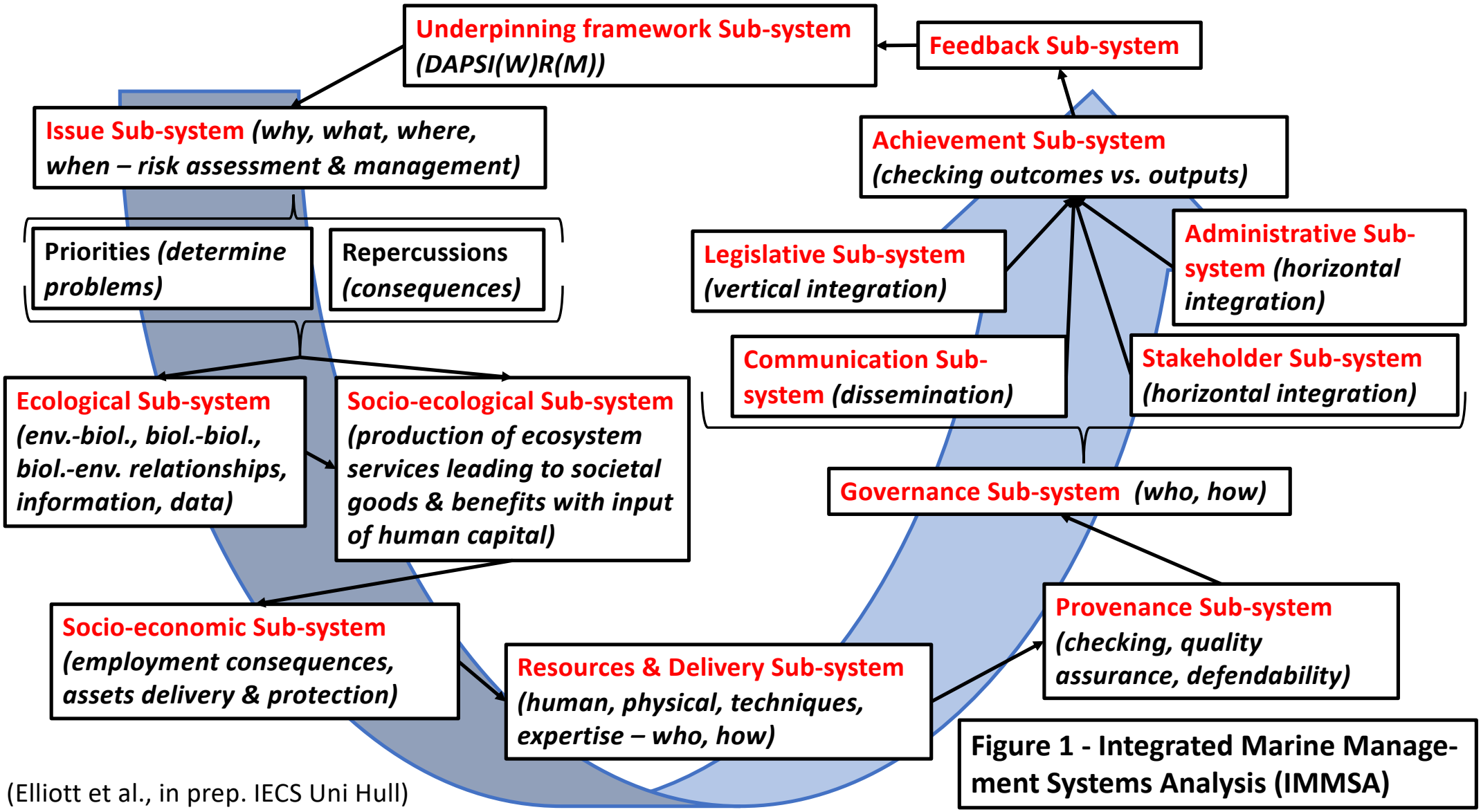
What is systems analysis and why do we need it for the marine environment?

"Systems change is an intentional process designed to alter the status quo by shifting the function or structure of an identified system with purposeful interventions. It is a journey which can require a radical change in people's attitudes as well as in the ways people work. Systems change aims to bring about lasting change by altering underlying structures and supporting mechanisms which make the system operate in a particular way. These can include policies, routines, relationships, resources, power structures and values."

Possible mapping approaches of the system to represent system elements and connections, e.g.:

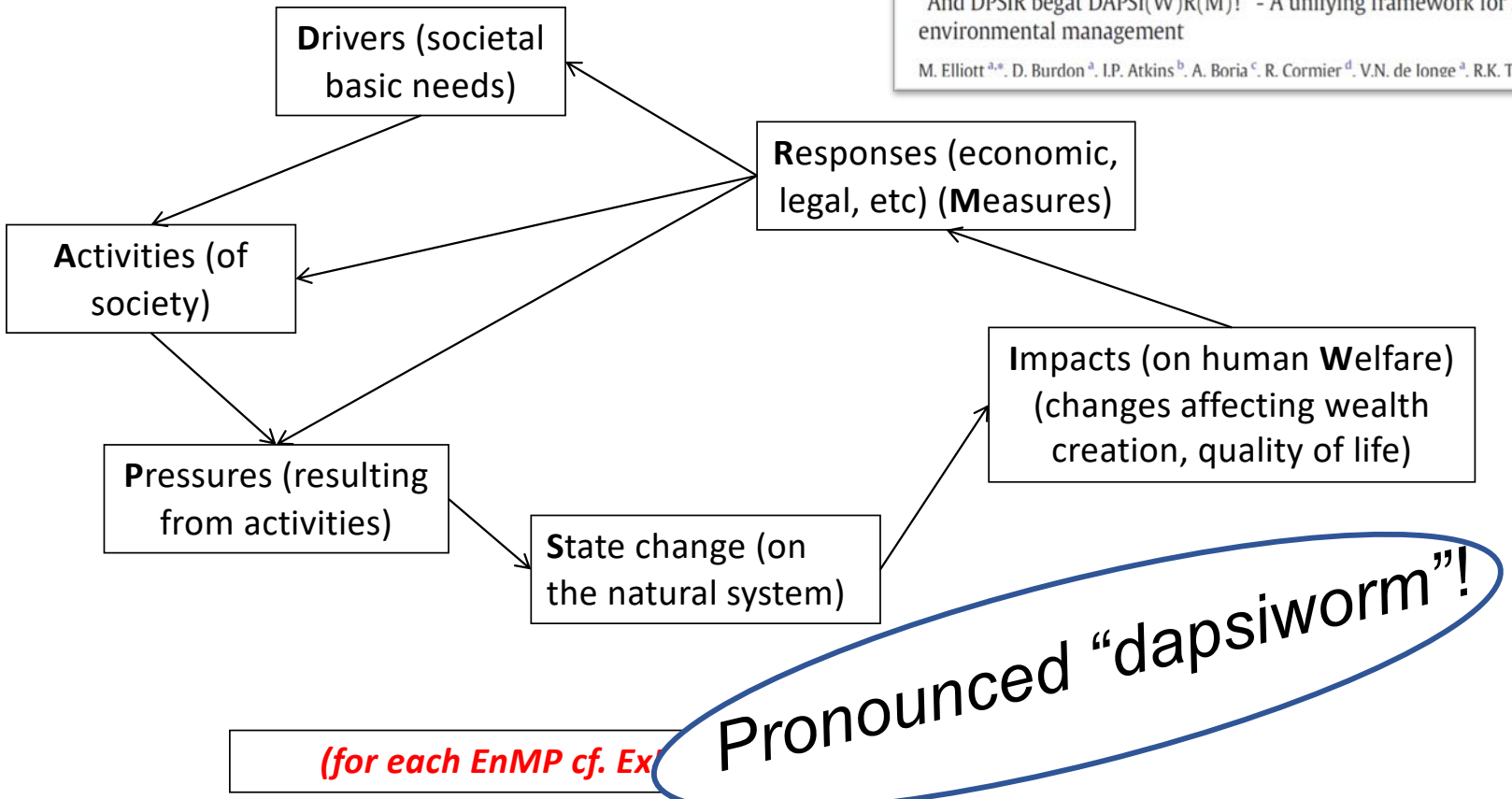
- Actor maps - which individuals and/or organizations are key players in the space and how they are connected
- Mind maps - highlight various trends in the external environment that influence issues
- Issue maps - the political, social, or economic issues affecting a given geography or constituency (often used by advocacy groups)
- Causal-loop diagrams – interrogating the feedback loops (positive and negative) that lead to system behaviour or functioning



(Elliott et al., in prep. IECS Uni Hull)

Figure 1 - Integrated Marine Management Systems Analysis (IMMSA)

Underpinning framework Sub-system *(DAPSI(W)R(M))*



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Issue Sub-system *(why, what, where, when – risk assessment & management)*

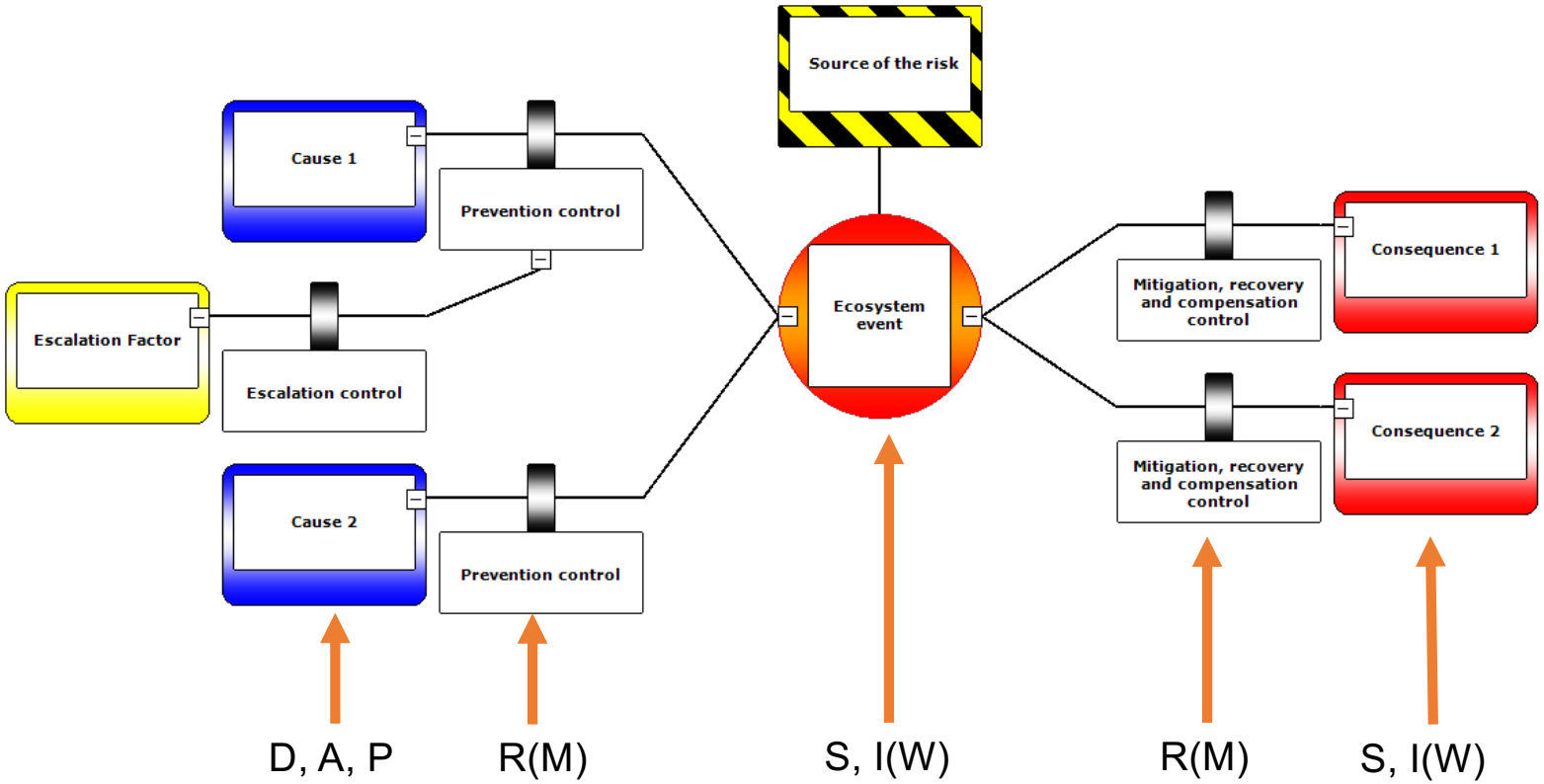
Priorities *(determine problems)*

Repercussions *(consequences)*

this is vision-related and includes activities emanating both inside the sea-area to be managed (endogenic pressures where causes and consequences are managed), and outside (exogenic pressures where only consequences can be managed);

to identify the causes of the problems (the risks and hazards typology) and it requires an ability to prioritise challenges but also know the repercussions of natural and anthropogenic changes.

Bow-Tie Analysis linked to **DAPSI(W)R(M)** Framework for Risk Assessment and Risk Management (**D**rivers, **A**ctivities, **P**ressures (as mechanisms of change), **S**tate change (on the natural system), **I**mpact (on human **W**elfare), **R**esponses (using **M**easures based on 10-tenets – econ., tech, ecol., legal, admin, cult., polit., moral, comm., social aspects)



Stakeholder consultation – to determine causes and consequences and to agree the responses throughout the sequence

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Ecological Sub-system

Anthropogenic distortions

Physico-chemical attributes

Fundamental niche

Anthropogenic distortions

biol.-env. links

env.-biol. links

Community functional attributes

biol.-biol. links

Community structural attributes

Anthropogenic distortions

Anthropogenic distortions

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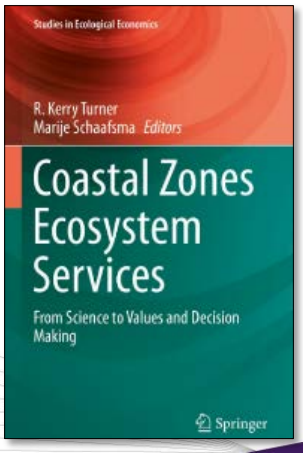
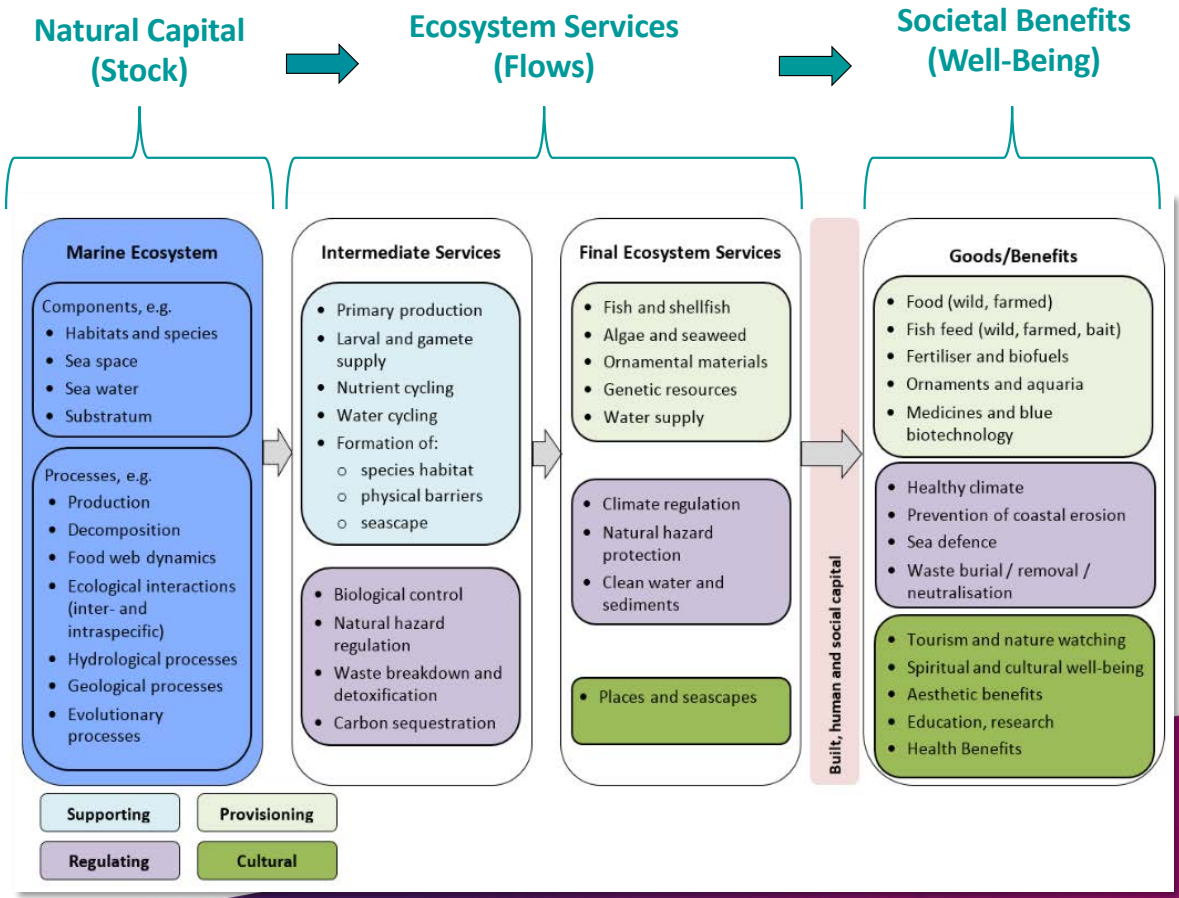
Socio-ecological Sub-system *(production of ecosystem services leading to societal goods and benefits with input of human capital)*

– considers producing ecosystem services from ecological functioning to deliver societal goods and benefits (economic repercussions), after inputting human complementary assets and capital (natural, human, built, economic?).





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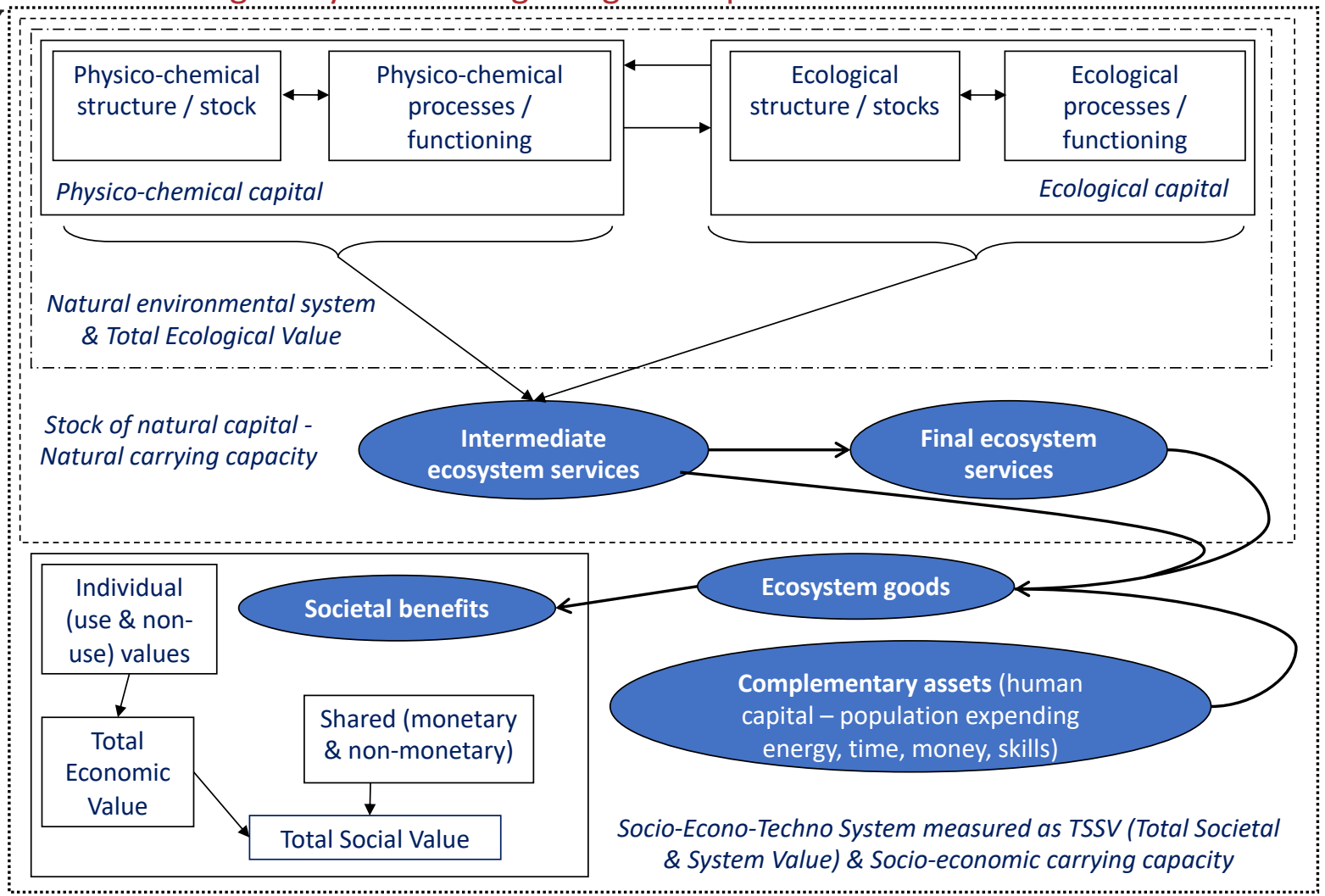
Socio-Ecological System - Integrating Concepts:



[ME/JPA/DB (UoH) & RKT (UEA) Coastal zone ecosystem services HG v9]

(Elliott et al., 2017, Mar. Poll. Bull.)

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Socio-economic Sub-system *(employment consequences, assets delivery & protection)*

– considers which of the different groups of stakeholders benefit from the management of ecosystem services and societal goods and benefits; how are the drivers (basic human needs) translated into economic products and how the societal assets are delivered and protected; Blue Growth repercussions.

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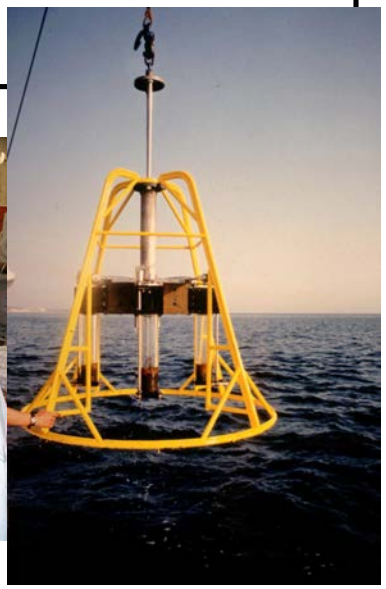
Resources & Delivery Sub-system *(human, physical, techniques, expertise – who, how)*

consider who does what and how do they do it, requiring adequate personnel (training, expertise, techniques) and physical facilities (technologies, equipment).



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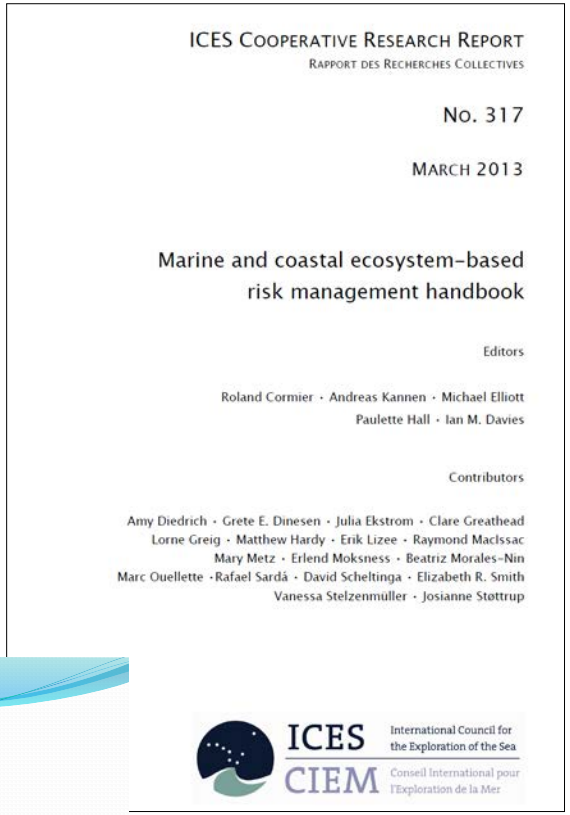
Provenance Sub-system *(checking, quality assurance, defendability)*

underpinned by fit-for-purpose science (*need-to-know* vs *nice-to-know*);
focus on aims (why), objectives (what/how) and hypothesis generating and testing (to indicate success);
ensure a defendable knowledge-evidence base (*science-for-policy* and *policy-for-science*) of data;
data conversion to information and knowledge, and models for prediction (include traditional knowledge (indigenous knowledge),
but also citizen science as generator of knowledge (apps for biodiversity, alien species, pollution or litter tracking).


ICES Cooperative Research Report
Rapport des Recherches Collectives

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Marine and coastal ecosystem-based risk management handbook

Editors

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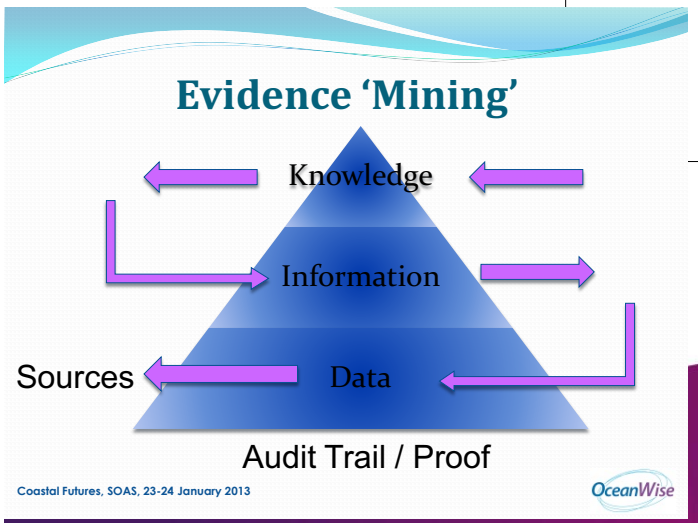
ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer



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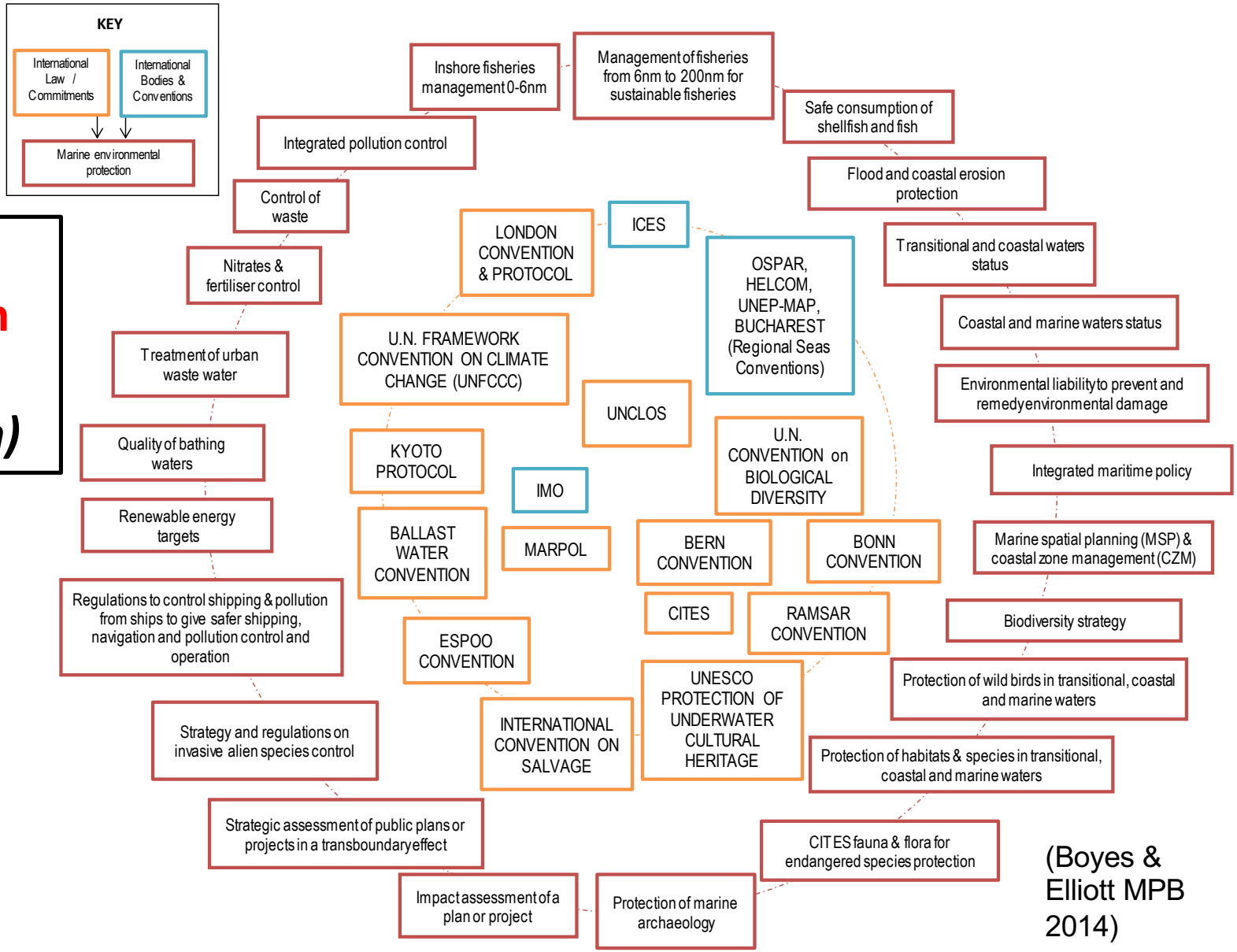
Governance Sub-system *(who, how)*

incorporating policies and politics plus **the Legislative Sub-system,** with vertical integration from local to global, and **the Administrative Sub-system,** by horizontal integration of the management organogram to accomplish the vision.

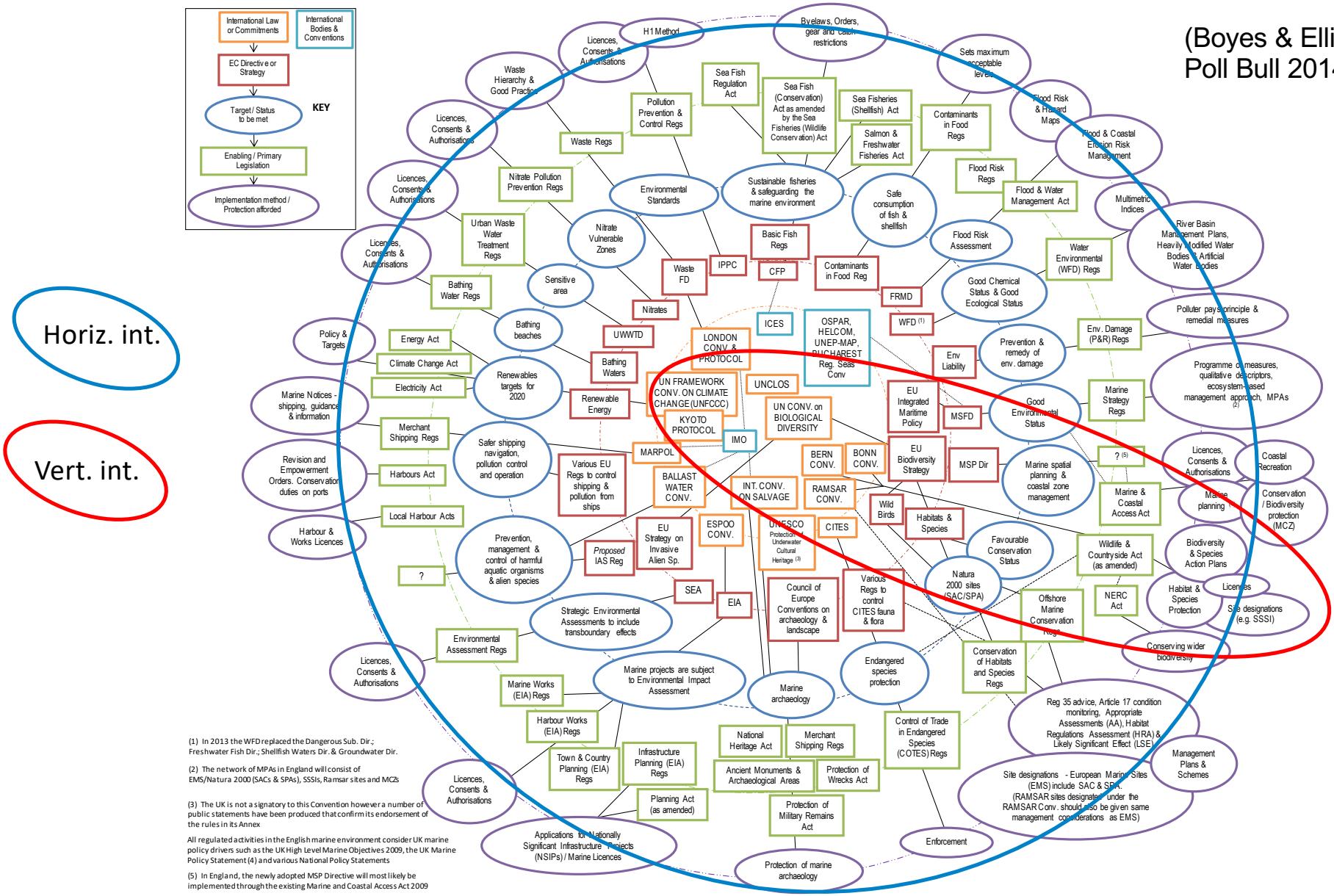
adopting internationally recognised principles which together comprise ***The Ecosystem Approach***:

- ecologically sustainable development
- inter-generational equity
- the precautionary principle
- conservation of biological diversity and ecological integrity
- ecological valuation
- economic valuation of environmental factors
- the 'damager debt' / 'polluter pays' principle
- waste minimisation, and
- public participation - the role of individuals and ethics.

Legislative Sub-system *(vertical integration)*



(Boyes & Elliott MPB 2014)



(Boyes & Elliott, Mar Poll Bull 2014)

(1) In 2013 the WFD replaced the Dangerous Sub. Dir.; Freshwater Fish Dir.; Shellfish Waters Dir. & Groundwater Dir.

(2) The network of MPAs in England will consist of EMS/Natura 2000 (SACs & SPAs), SSSIs, Ramsar sites and MCZs

(3) The UK is not a signatory to this Convention however a number of public statements have been produced that confirm its endorsement of the rules in its Annex

All regulated activities in the English marine environment consider UK marine policy drivers such as the UK High Level Marine Objectives 2009, the UK Marine Policy Statement (4) and various National Policy Statements

(5) In England, the newly adopted MSP Directive will most likely be implemented through the existing Marine and Coastal Access Act 2009

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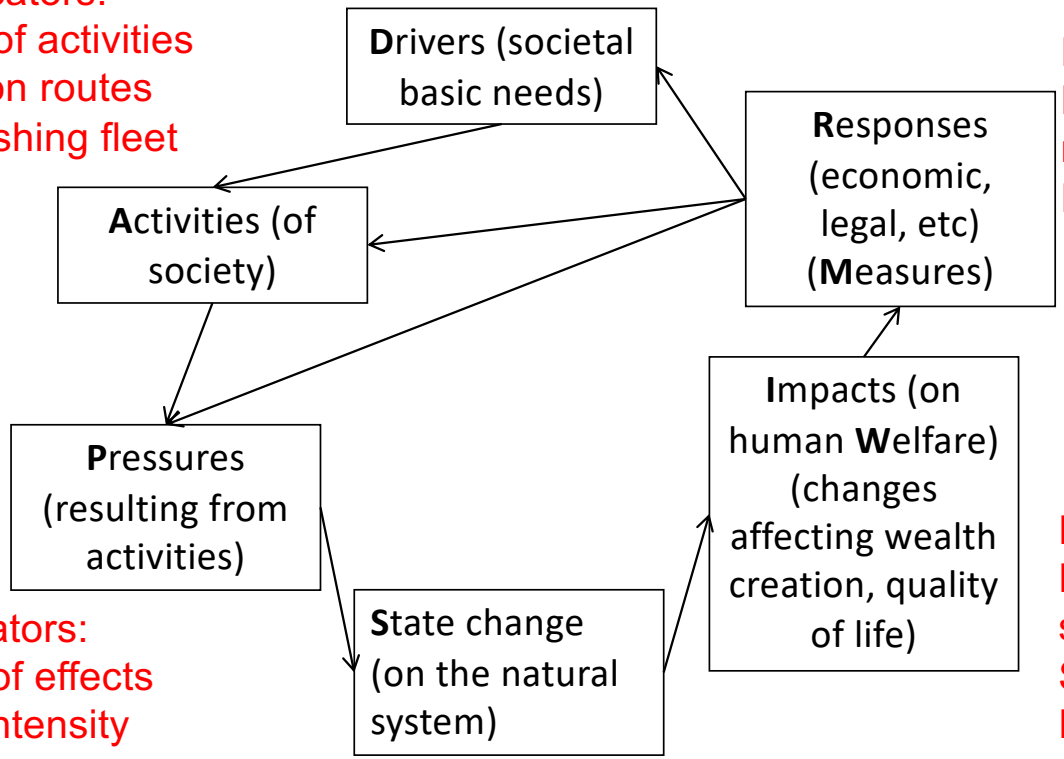
Achievement Sub-system *(checking outcomes vs. outputs)*

Indicator-based DAPSI(W)R(M) framework



E.g. Indicators:
Number of activities
Navigation routes
Size of fishing fleet

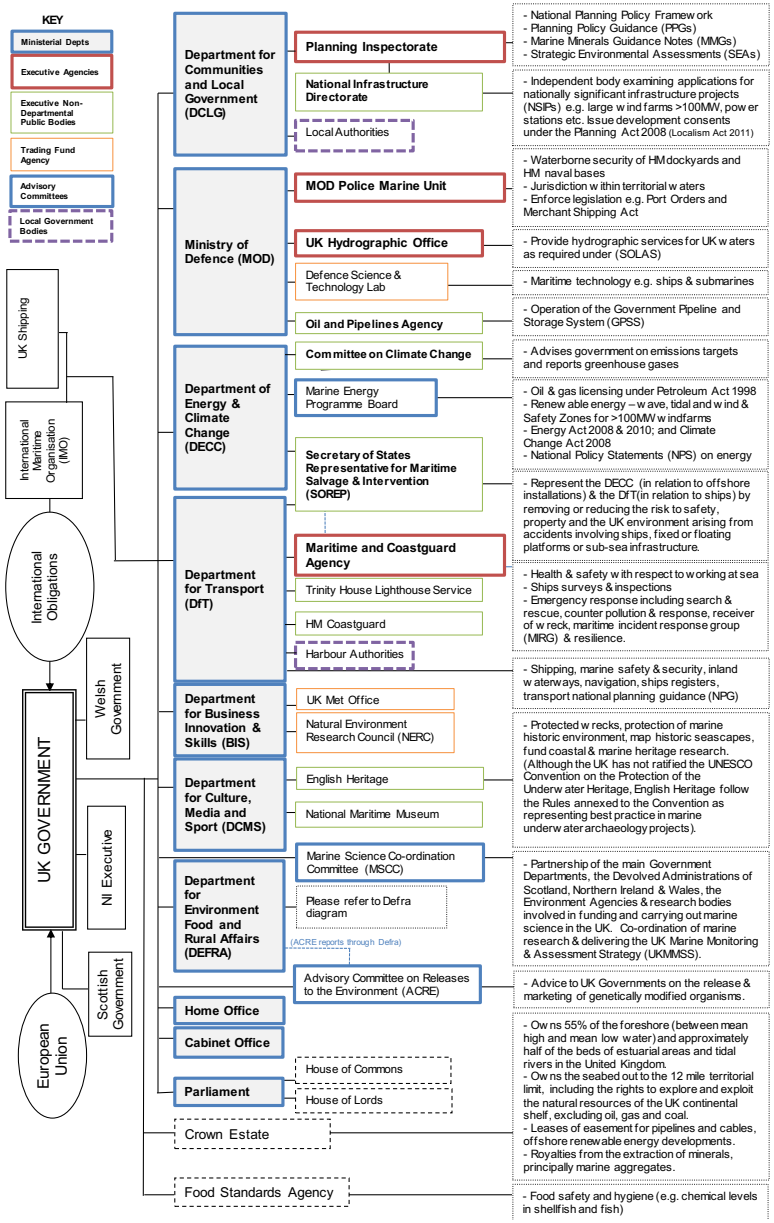
E.g. Indicators:
Number of regulations
Economic costs
10-tenets values

E.g. Indicators:
Footprint of effects
Stressor intensity

E.g. Indicators:
Natural health status
Population levels
Community structure

E.g. Indicators:
Ecosystem service
Societal benefits
Human health status

(NB - DEVOTES indicators catalogue – 500 indices!)



Administrative Sub-system *(horizontal integration)*

Marine Pollution Bulletin 86 (2014) 39–47

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Viewpoint

Marine legislation – The ultimate 'horrendogram': International law, European directives & national implementation

Suzanne J. Boyes *, Michael Elliott

Marine Policy 51 (2015) 57–65

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

The excessive complexity of national marine governance systems – Has this decreased in England since the introduction of the Marine and Coastal Access Act 2009?

Suzanne J. Boyes *[,1], Michael Elliott [1]

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Stakeholder Sub-system *(horizontal integration)*

Stakeholder-orientated Research Questions (from Newton & Elliott 2016)
1) What are the definitions of interested parties stakeholders and social actors?
2) Who are the interested parties and stakeholders?
3) What types of stakeholders are there?
4) What are the roles of each type?
5) Why are stakeholders important in participatory processes?
6) What influence do/should they have in marine management?
7) Are all stakeholders equal?
8) What are the difficulties and conflicts?
9) How should interested parties be involved?
10) What examples have worked?
11) How can we improve stakeholder participation?

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Stakeholder Typology (from Newton and Elliott 2016)

- The **‘*inputters*’** (of pollution, infrastructure, sediment, etc) – those creating the pressures in the sea.
- The **‘*extractors*’** (of fish, water, space) – also causing the pressures.
- The **‘*regulators*’**, those statutory bodies with a legislative competency regulating the above and supported by administrative bodies and many legal instruments.
- The **‘*beneficiaries*’**, most if not all of society, who take or receive advantage of those uses and materials provided by the seas or even who get advantage by reducing their costs due to putting wastes into the seas.
- The **‘*affectees*’**, a large group of stakeholders that are affected, possibly adversely, by those using and managing the seas.
- The **‘*influencers*’**, those politicians, non-governmental organisations, media, academics and educators who direct the nature of marine use.

(from Newton and Elliott 2016)

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Communication Sub-system *(dissemination)*

Together with the Stakeholder Sub-system, this requires horizontal integration and informed dissemination across the stakeholder typology (of formal and informal actors), including conflict resolution.
It enables complementarity and stakeholders should be included in all aspects, including feedback loops.
Communication using academic, peer-reviewed information, grey literature, public but unpublished reports
Open access vs subscription-based literature

Who?	Main usual source of information	Amount of information usually produced and used
General public	News bulletins (TV, radio); newspaper headlines, social media, tweets, soundbites, 'pub talk!'	2 minutes attention span, 140 character tweets
Undergraduate and graduate MSc/MA students	Text books, lecture notes, web sites, Wikipedia	Synoptic syntheses
PhD students and early career scientists	Books, reviews, web sites, abstracts, compendia, Wikipedia, journal articles	Detailed syntheses
Experienced natural scientists	International journal, peer-reviewed articles, some monographs	10-300 pp
Experienced social scientists	International journal, peer-reviewed articles, monographs, books	10-300 pp
Consultants	Consultant reports, government documents, unpublished reports	200 pp
Policy implementers	Government & agency reports, commissioned consultant reports	<50 pp
Policy makers	Government briefings, commissioned briefings, policy briefs	<2 pp
World leaders (e.g. POTUS)	Tweets, soundbites!	140 characters, sentences

(Elliott et al., 2017, Mar. Poll. Bull.)

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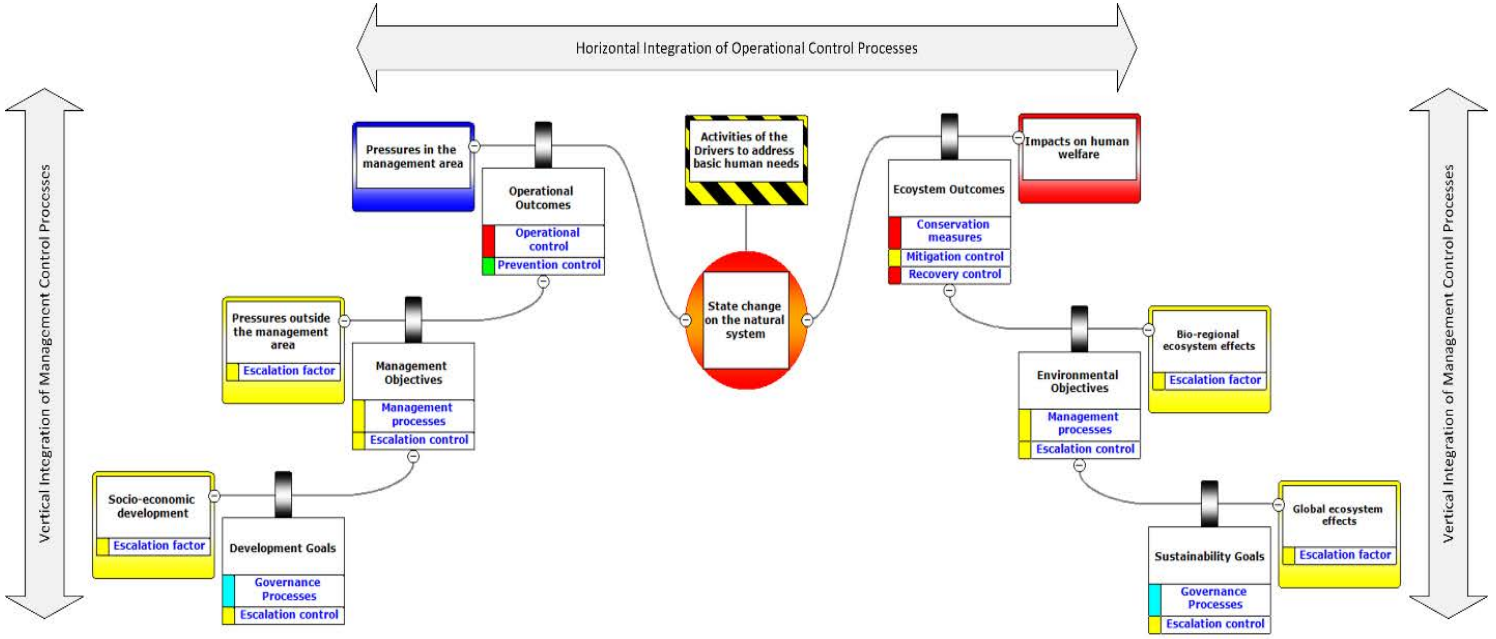
Indicating the success of societal Responses to Drivers, Activities and Pressures to stop State changes and Impacts on human Welfare;
focus on risk (and opportunity) assessment and management;
link to SMART indicators;
determine monitoring link to indicators and management.

Feedback Sub-system




Science of the Total Environment 648 (2019) 293–305

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

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Putting on a bow-tie to sort out who does what and why in the complex arena of marine policy and management

Roland Cormier [a,*], Michael Elliott [b], Jake Rice [c]

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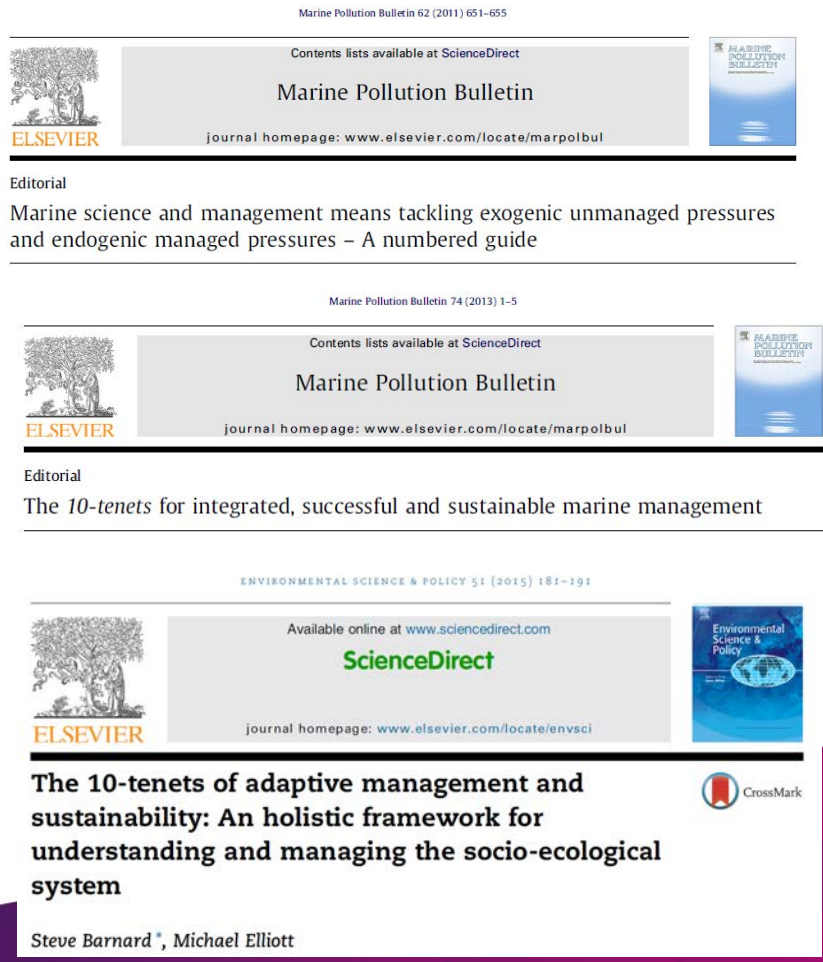
The 10 tenets for societal marine management responses:

To be successful, management measures or responses to changes resulting from human activities should be:

- Ecologically sustainable
- Technologically feasible
- Economically viable
- Socially desirable/tolerable
- Legally permissible
- Administratively achievable
- Politically expedient
- Ethically defensible (morally correct)
- Culturally inclusive
- Effectively communicable

(cf. PESTLE)



Marine Pollution Bulletin 62 (2011) 651–655

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Editorial

Marine science and management means tackling exogenic unmanaged pressures and endogenic managed pressures – A numbered guide

Marine Pollution Bulletin 74 (2013) 1–5

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Editorial

The *10-tenets* for integrated, successful and sustainable marine management

ENVIRONMENTAL SCIENCE & POLICY 51 (2015) 181–191

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/envsci

The 10-tenets of adaptive management and sustainability: An holistic framework for understanding and managing the socio-ecological system

*Steve Barnard *, Michael Elliott*

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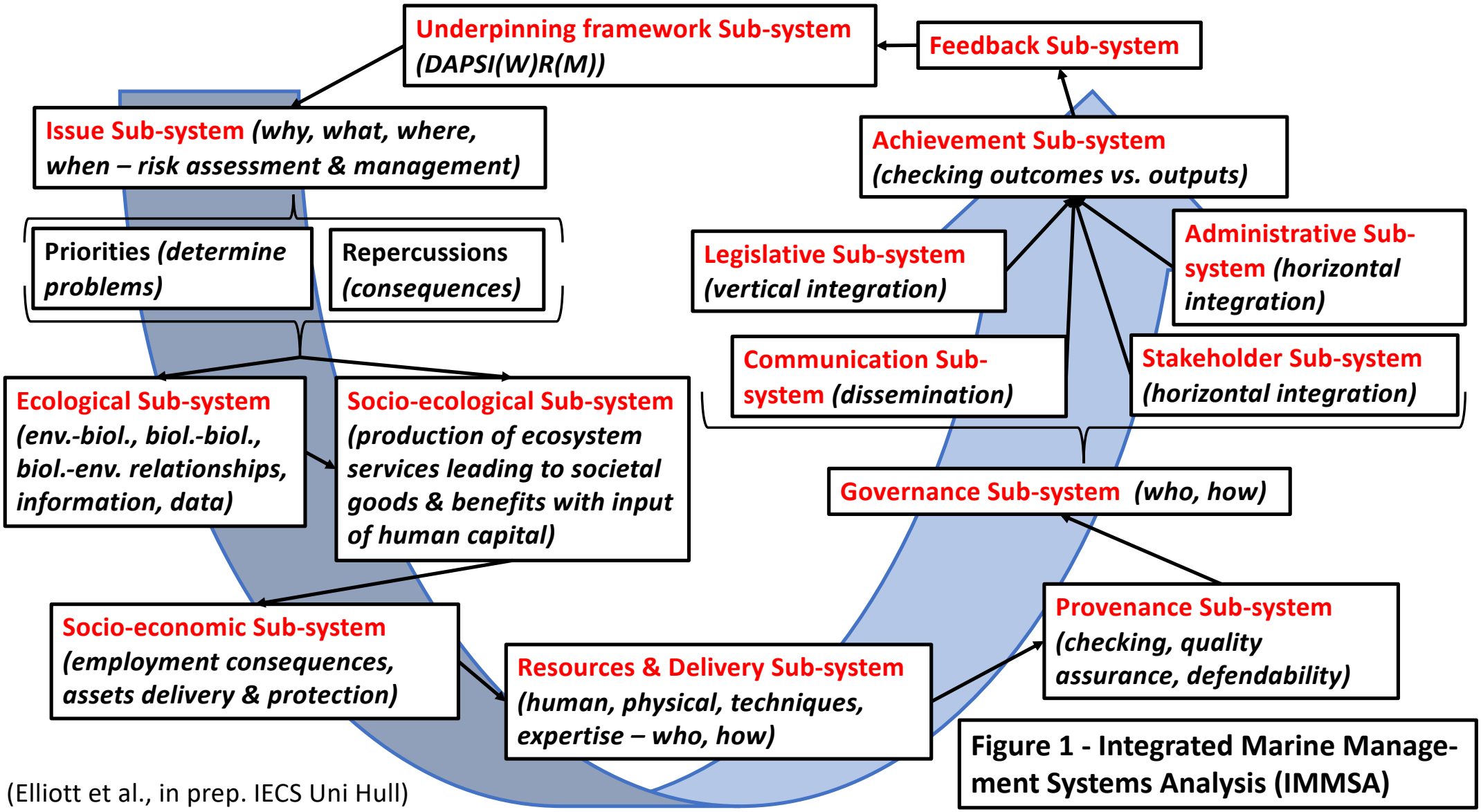
Recipe Leading to Integrated Marine Management

- Need to understand how our activities lead to which pressures
- Need to understand which pressures are within and outside our control
- Need to understand ecological structure and functioning
- Need to understand what state changes on the natural system occur from those pressures
- Lead to describing the impact on human welfare as effects on Ecosystem services and Societal benefits
- Lead to defining the appropriate responses as management measures
- Require implementation of governance (policies, politics, administration and legislation)
- Within a multiuser system requiring resolution of conflicts amongst users
- Communicate by working with stakeholders



(Elliott et al., in prep. IECS Uni Hull)

Figure 1 - Integrated Marine Management Systems Analysis (IMMSA)

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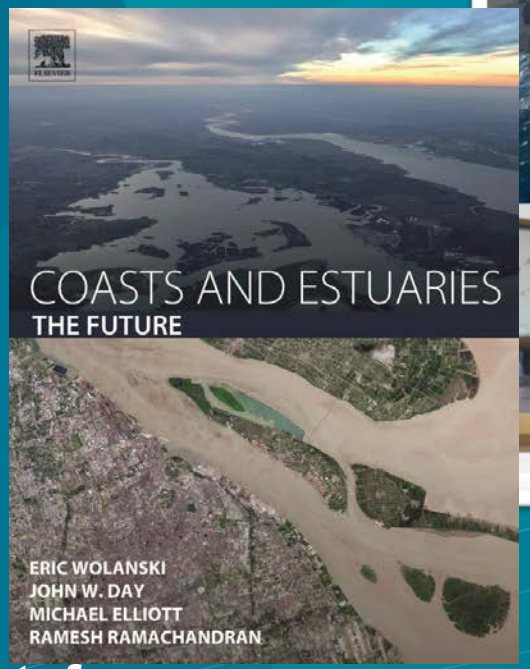

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