The Challenge of Implementing Marine Sustainable Development: Integrating Socio-Economic Values in Interdisciplinary Approaches

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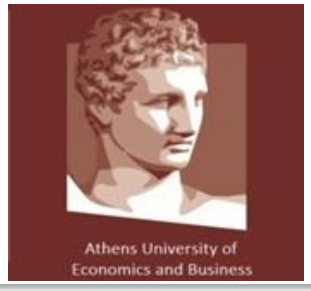

Sustainable development: organizing principle for meeting human development goals while at the same time sustaining the ability of natural systems to provide the natural resources and ecosystem services upon which the economy and society depend.

Desired result: state of society where living conditions and resource use continue to meet human needs without undermining the integrity and stability of the natural system.

Sustainable development can be classified as development that meet the needs of the present without compromising the ability of future generations to do the same.

A global network of universities, research and innovation centres, civil society organizations, businesses, policymaking and political institutions, to support the science driven implementation of the Sustainable Development Goals (SDGs)

What is the United Nations Sustainable Development Solutions Network – UN SDSN?

- SDSN was launched in 2012 by UN Secretary General Ban-Ki Moon
- In order to mobilize global scientific and technological expertise
- To promote practical problem solving for sustainable development

SDSN-Global, Earth Institute, Columbia University
SDSN-Global Director, Prof. Jeffrey Sachs

SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS

SDSN Global

- SDSN Climate Change Work: The Paris Agreement on CC, Deep Decarbonization Pathways, Low Carbon Technology Partnership Initiative

- SDG Academy: platform high-quality mass online education in the field of sustainable development, 1 million students enrolled.

- SDSN Thematic Networks: The World in 2050; Forests, Oceans, Biodiversity, and Ecosystem Services; Redefining the Role of Business for Sustainable Development

- Solution Initiatives promote new technologies, business models, institutional mechanisms, policies and combinations thereof that can dramatically accelerate progress towards sustainable development.

ICRE8
www.icre8.eu

International Centre for Research on the Environment and the Economy (ICRE8)

www.icre8.eu

National and Kapodistrian University of Athens
PESD

University of Athens Political Economy of Sustainable Development Lab (PESD)

http://pesd.econ.uoa.gr

Website: www.unsdsn.gr

SDSN GREECE

Co-Chairs
Prof. Phoebe Koundouri
Prof. Andreas Papandreou

Leadership Council
Business, Politicians, NGOs, Policy Making

Youth Section

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Hosting Institutions

SDSN Greece
Cross-Cutting Themes & Thematic Priorities

CROSS-CUTTING THEMES

Natural Capital Valuation: Sustainable Investment Allocation

Climate Change: Mitigation and Adaptation Policies

Sustainable Development in Times of Crisis

THEMATIC PRIORITIES

Sustainable Shipping and Marine Resources

Sustainable Energy and Energy Security

Sustainable Water-Food-Energy Nexus

Sustainable Tourism and Biodiversity

Education and Training Courses in Sustainable Development

Is "Sustainable Development" something new?

Physiocrats (18th century), Malthus (19th century), etc...

The Tragedy of the Commons, Garrett Hardin

Science 13 Dec 1968: Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons.

70's Sustainability on Political Agenda

1972: United Nations Environmental Program (UNEP)
1980: World Conservation Strategy
1983: World Commission on Environment and Development (WCED)
1987: Our Common Future
Etc...

2000: Millennium Development Goals
2015: Sustainable Development Goals, Agenda 2030

Cluster *of research entities:*

- ***ICRE8****, private not for profit Research Center*

- ***ReSEES/AUEB****: Athens University of Economics and Business, Research on Socio-Economic and Environmental Sustainability (ReSEES) Laboratory*

- ***PESD/NKUA:*** *National and Kapodistrian University of Athens, Political Economy of Sustainable Development Laboratory*

- ***SDSN-Greece:*** *United Nations Sustainable Development Solutions Network*

- ***ATHENA****, government Research Center,*

with a strong commitment to research related to Economics, Environment, Energy, (Eco-)Innovation and Sustainability, with an exceptional record in attracting research funding, achieving successful completion of influential projects with explicit policy interventions, and producing numerous academic and popular publications.

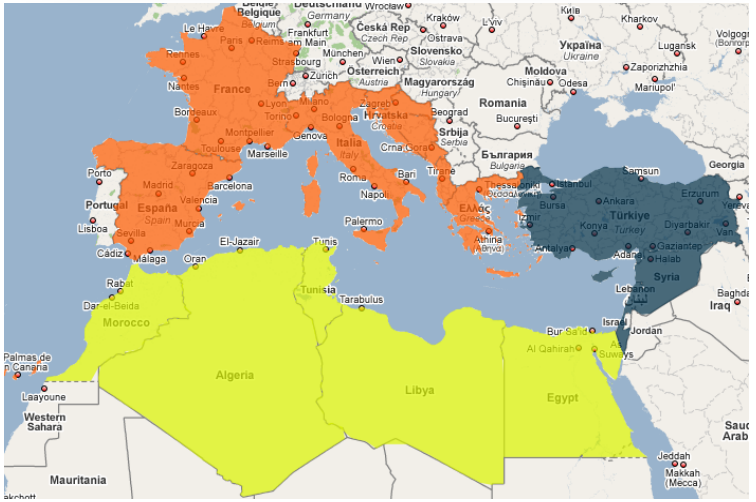
SDSN Map of Finished & Ongoing Projects

- **€100+ million of research funding from:** European Commission: DG RTD (FP4,5,6,7, H2020), DG MARE, DG ENV, DG ENER, International Organizations: World Bank, OECD, EBRD, WHO, FAO, UN, Governments in all **5** continents
- **1000+ peer-reviewed research papers & books**

Contextualizing the SDGs for the Mediterranean Region:

Regional priorities for the Mediterranean: How do they translate to SDGs?

1. Ensuring sustainable development in marine and coastal areas
2. Promoting resource management, food production and food security through sustainable forms of rural development
3. Planning and managing sustainable Mediterranean cities
4. Addressing climate change as a priority issue for the Mediterranean
5. Transition towards a green and blue economy
6. Improving governance in support of sustainable development

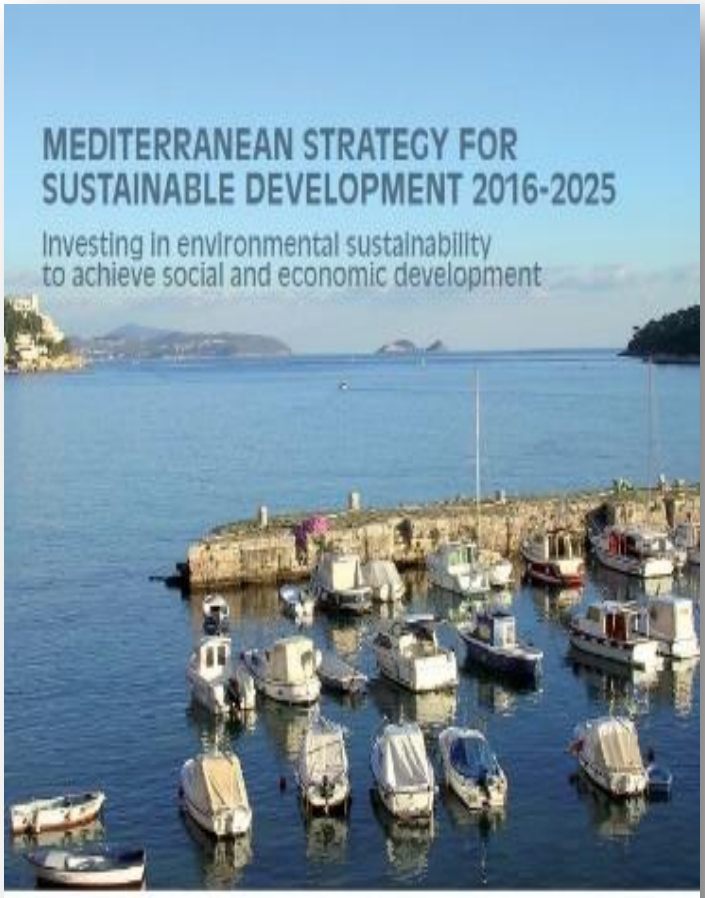


Regional strategies for sustainable development

Strategic Plans for the Region

Mediterranean Strategy for Sustainable Development (MSSD)

- Under the auspices of UNEP-MAP.
- A strategic guiding document for all stakeholders and partners to translate the 2030 Agenda at the regional, sub-regional and national levels.
- An adaptation of international commitments to regional conditions, in the context of the 2030 Agenda and its SDGs.



UNEP

Where do the Mediterranean countries stand relative to the SDGs?

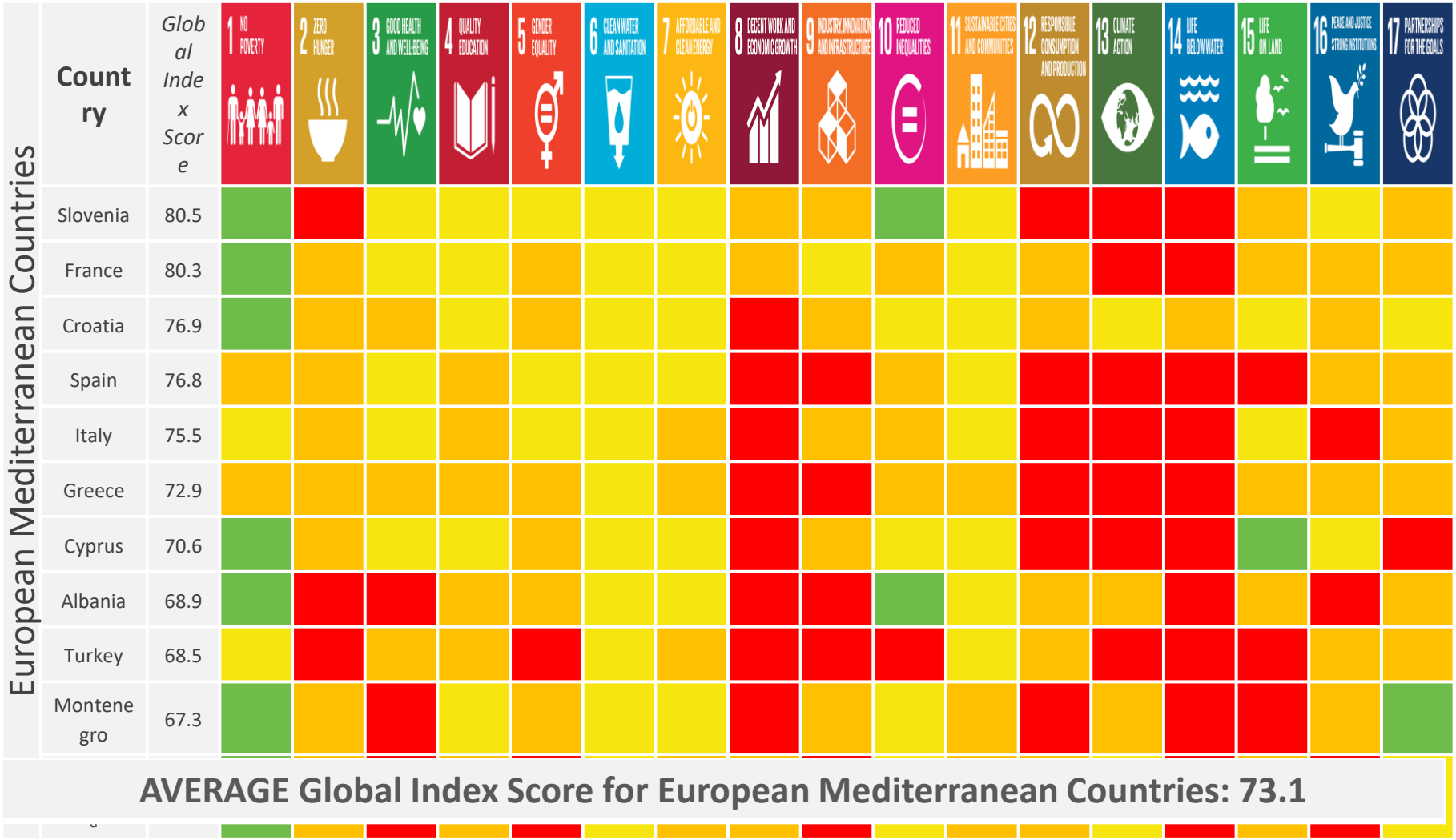
- 2017 SDG Indicator Dashboard and report.

- The report generates “rough grading” for all countries to draw attention to the most urgent SDG related challenges facing each country for each SDG.

Where do the Mediterranean countries stand relative to the SDGs?

Country	2017 Global SDG Index Score	Country	2017 Global SDG Index Score
Czech Republic	81.9	Cyprus	70.6
Slovenia	80.5	Israel	70.1
France	80.3	Albania	68.9
Hungary	78.0	Russia	68.9
Belarus	77.1	Algeria	68.8
Croatia	76.9	Tunisia	68.7
Slovakia	76.9	Turkey	68.5
Spain	76.8	Montenegro	67.3
Poland	75.8	Morocco	66.7
Italy	75.5	Jordan	66.0
Moldova	74.2	Bosnia & Herzegovina	65.5
Romania	74.1	Lebanon	64.9
Greece	**72.9**	Egypt	64.9
Ukraine	72.7	Syria	58.1
Bulgaria	72.5	Iraq	56.6

European – Mediterranean Countries 2017 SDG Index Score



Source: Sachs, J., Schmidt-Traub, G., Kroll, C., Durand-Delacre, D. and Teksoz, K. (2017): SDG Index and Dashboards Report 2017. New York: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN)

A sea of shared challenges and opportunities

Jobs

Value

Sustainability

Blue Economy

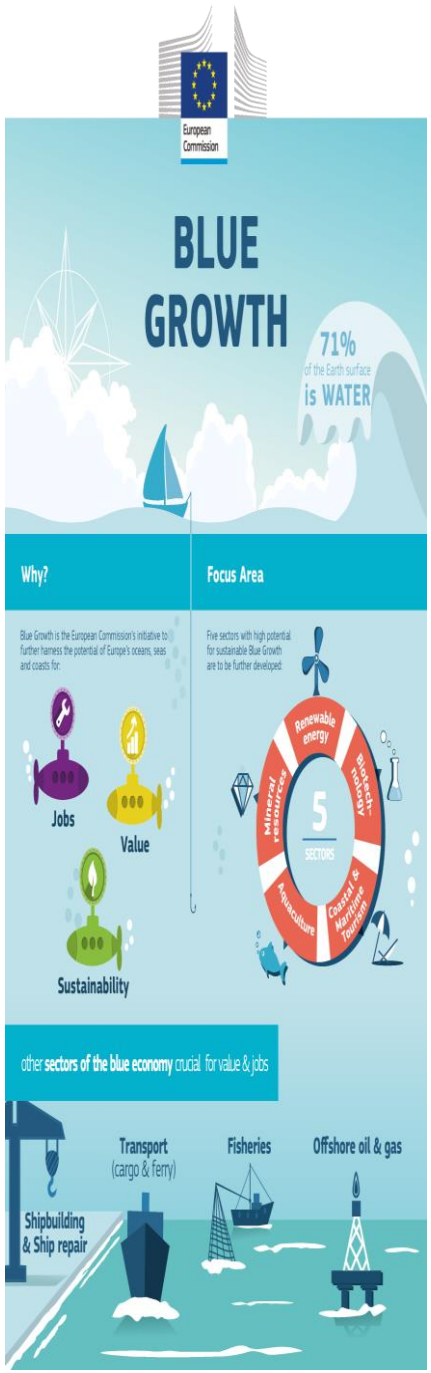
SDG 14

Over three billion people depend on marine and coastal biodiversity for their livelihoods.

Today we are seeing 30 percent of the world's fish stocks overexploited, 26 percent rise in ocean acidification, marine pollution.

The SDGs aim to **sustainably manage** and **protect** marine and coastal ecosystems from **pollution**, as well as address the **impacts of ocean acidification**.

Enhancing conservation and the sustainable use of ocean-based resources through international law will also help mitigate some of the challenges facing our oceans.



EU MARITIME AFFAIRS

Blue Growth is the long term strategy to support sustainable growth in the marine and maritime sectors as a whole.

The 'blue' economy represents roughly **5.4 million jobs** and generates a gross added value of almost **€500 billion a year**

How?

1. Develop sectors that have a high potential for sustainable jobs and growth, such as: aquaculture, coastal tourism, ocean energy

2. Essential components to provide knowledge, legal certainty and security in the blue economy: marine knowledge, maritime spatial planning, integrated maritime surveillance

3. Sea basin strategies to ensure tailor-made measures and to foster cooperation between countries: Adriatic and Ionian Seas, Arctic Ocean, Atlantic Ocean, Baltic Sea, Black Sea, Mediterranean Sea, North Sea

Maritime spatial planning

European MSP Platform

Maritime spatial planning (MSP) works across borders and sectors to ensure human activities at sea take place in an **efficient, safe and sustainable way**.

What are the benefits of maritime spatial planning?

- **Reduce conflicts**
- **Encourage investment**
- **Increase cross-border cooperation**
- **Protect the environment**

2021: Deadline for the establishment of maritime spatial plans

Marine Spatial Planning (MSP) is a process for analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives.

Marine Spatial Planning can also be thought of as a means on implementing ecosystem-based management

…an integrated approach to management that considers the entire ecosystem, including humans.

*The goal of ecosystem-based management is to **maintain an ecosystem in a healthy, productive, and resilient condition**, so that it can provide the services humans want and need.*

Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors.

Central Concept:

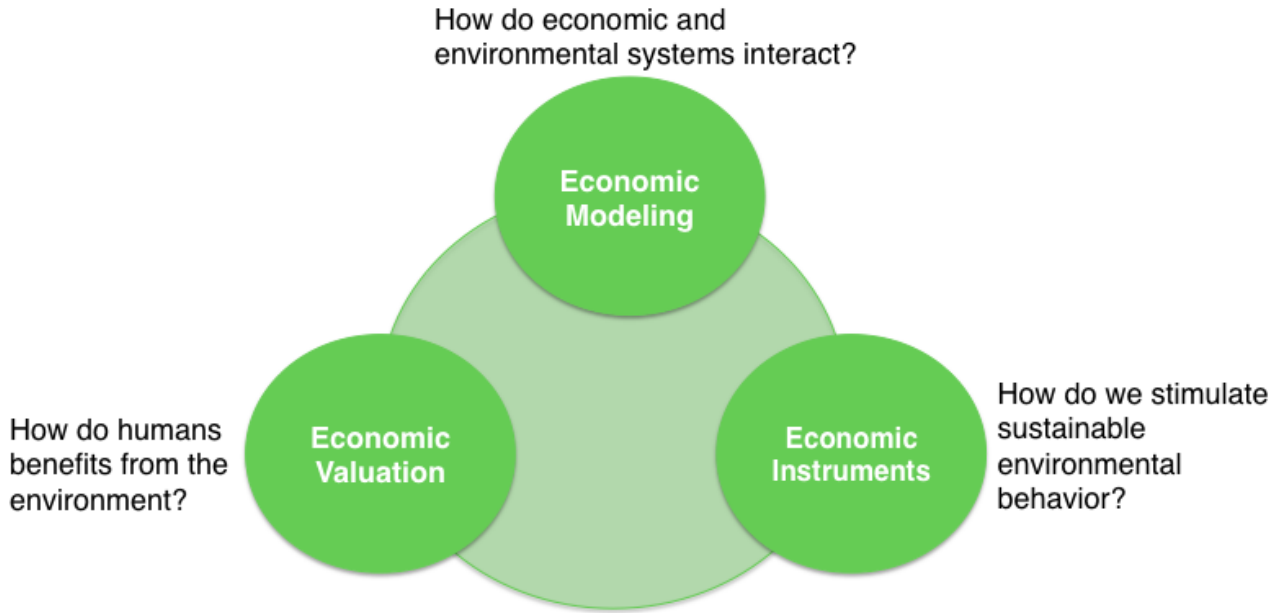
*Achieving **Natural Resources, Economic, Social Sustainability** by developing **scientific and methodologically sound approaches** to recognizing, demonstrating and capturing the **Total Economic Value** of natural resources and other public goods important for social welfare, integrating them in sustainable **management instruments and policy making**, while recognizing the **interdisciplinary** nature of the challenge.*

AN INTRODUCTION TO THE NON-EXPERT

Economics?

Allocation of scarce resources across people, over time & space in a way that social welfare is maximized.

Natural Resources, Environmental and Energy Economics?



Research Lab on Socio-Economic and Environmental Sustainability (ReSEES)

Stages of Interdisciplinary Analysis

MODELS ON INTERACTION

- Nature
- Society
- Economy
- Including CC & SE scenarios

EMPIRICAL APPLICATION of MODELS, FUTURE SIMULATION

- Quantitative & Qualitative Results
- Decision Criteria (CBA)
- Management and Policy Recommendations

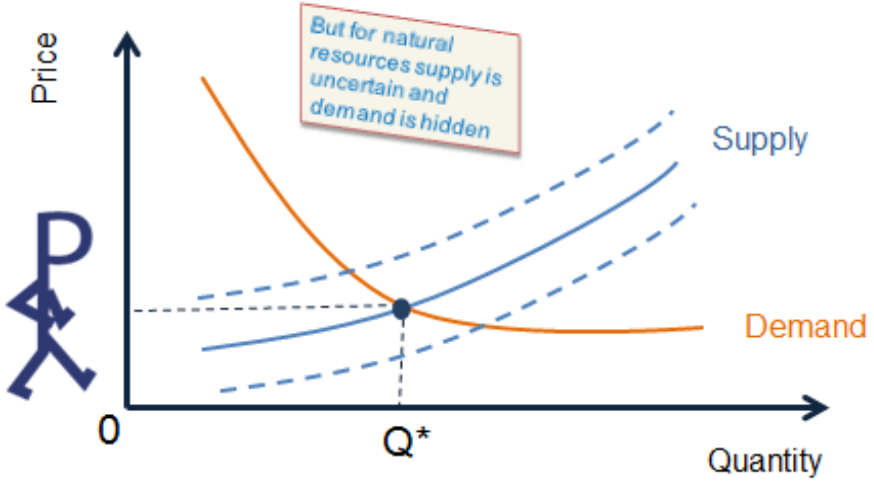
CHARACTERIZATION

- Natural Resources,
- Socio-Economic
- Institutional
- Stakeholders

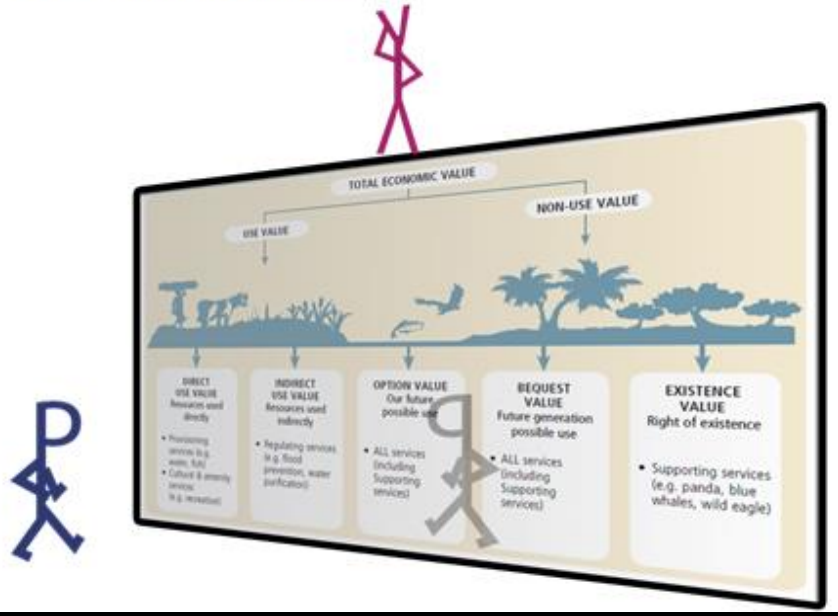
SOLUTIONS & INNOVATION / Stakeholders Adoption and Diffusion

- Socio-Economic Instruments
- Infrastructural Investments
- Nature-Based Solutions
- Technological Innovation
- Social Innovation

Market Interaction Makes Value Explicit



Price should mirror Value



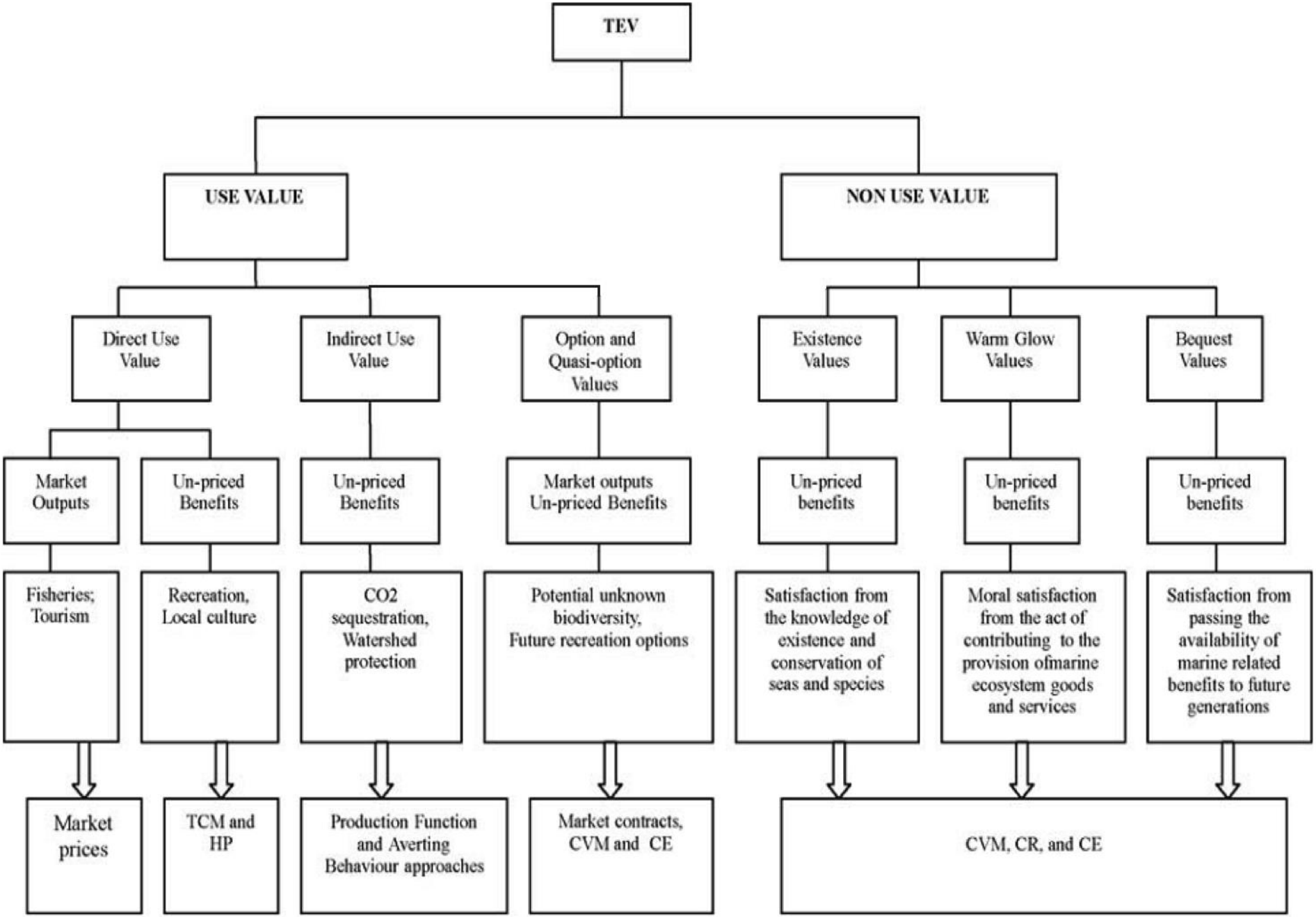
We need for EACH

- Resource $_{(r)}$
- Individual $_{(i)}$
- Space $_{(s)}$
- Time $_{(t)}$ from today till ∞

If You Can't Measure It, You Can't Improve It

(William Thomson, Lord Kelvin)

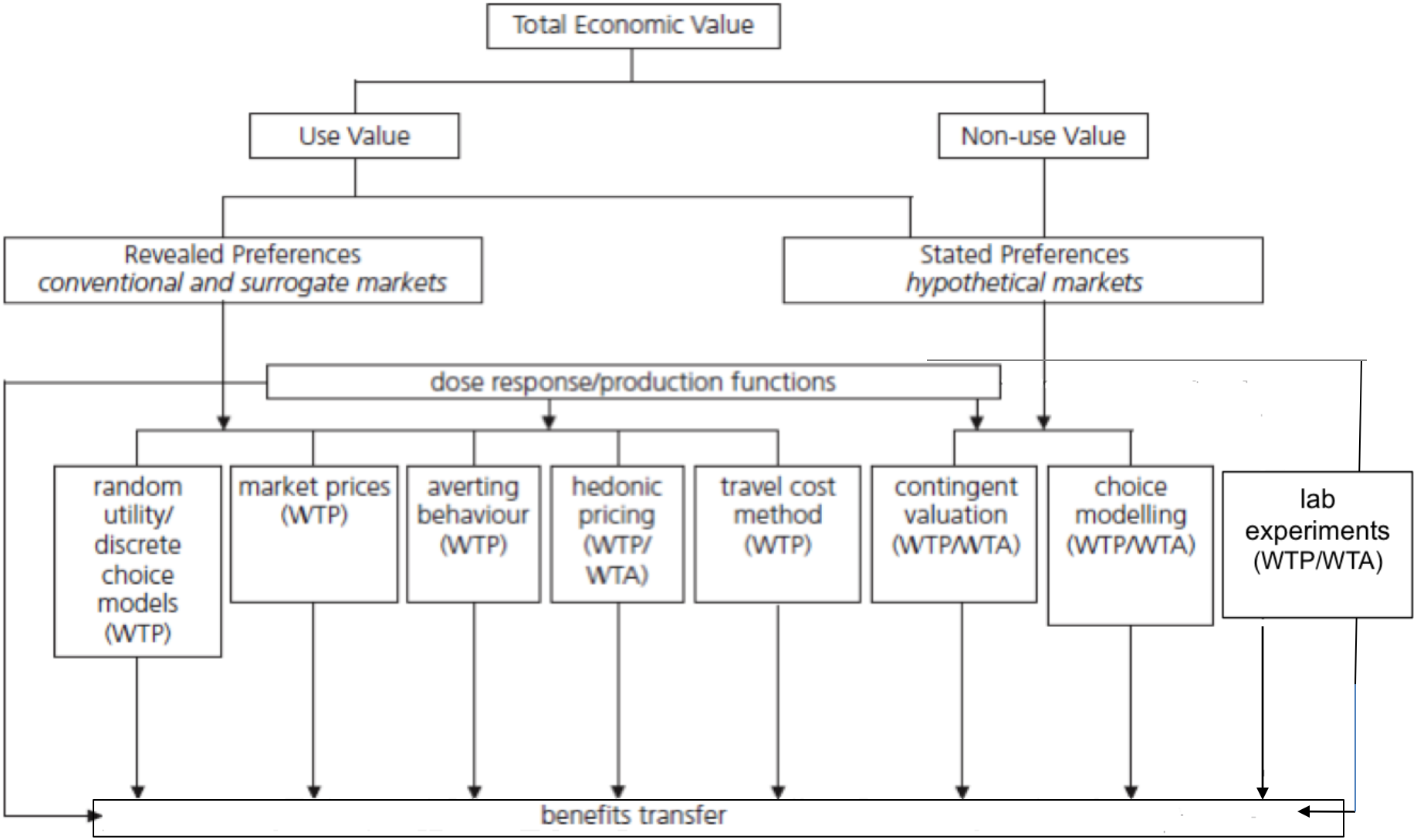
TEV Example: Marine Resources



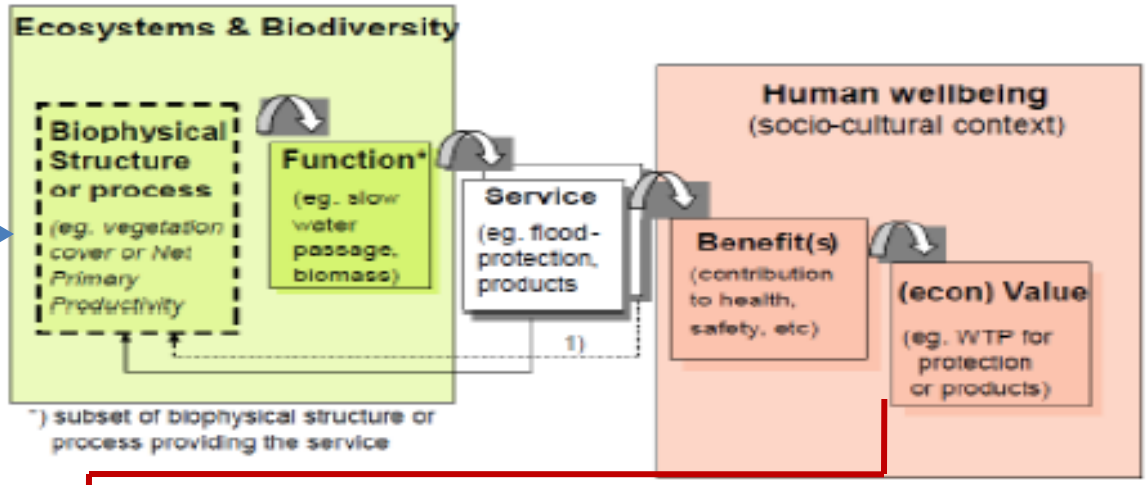
Beaches have value as ecosystems.
Sandy beaches provide many ecosystem services:

- sediment storage and transport
- wave dissipation and associated buffering against extreme weather events
- dynamic response to sea level rise
- breakdown of organic materials and pollutants
- water filtration
- nutrient mineralization and recycling
- storage of water in dune aquifers and groundwater discharge through beaches
- maintenance of biodiversity and genetic resources
- providing a nursery area for juvenile fishes
- nesting sites or rookeries for turtles, shorebirds, and pinnipeds
- prey for birds and other terrestrial wildlife
- scenic vistas and recreational opportunities
- functional links between terrestrial and marine environments, etc.

While physical and recreational aspects of sandy beaches are important, management decisions will never be optimal for society without also considering the total economic value of sandy beaches.



- TEV: systematic tool for considering full range of impacts on human welfare.
- TEV: reflects the preferences of individuals.
- Preferences can be studied and estimated by stated & revealed preference methods .
- TEV: essential for resource allocation and policy making.



TEV
ES-related Goods & Services

USE & OPTION

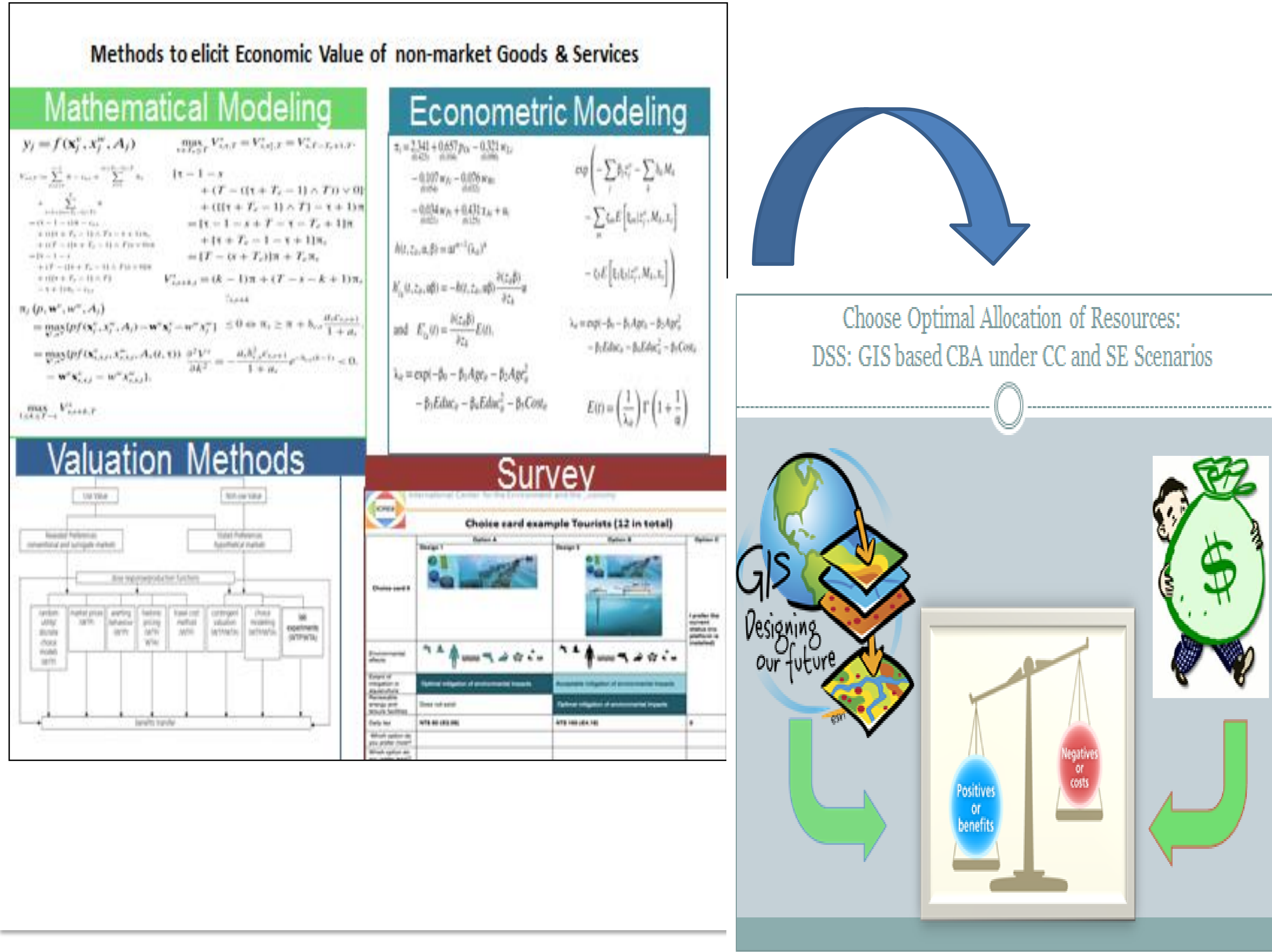
- **Fisheries-Aquaculture** — Production Analysis
- **Shipping** — Demand Analysis
- **Energy Production** — Value Transfer
- **Research-Education** — Contingent Valuation
- **Tourism-Recreation** — Choice Experiment

PASSIVE

- **Existence Value** — Choice Experiment
- **Bequest Value** — Choice Experiment
- **Warm Glow** — Lab Experiment
- **Altruistic** — Lap Experiment

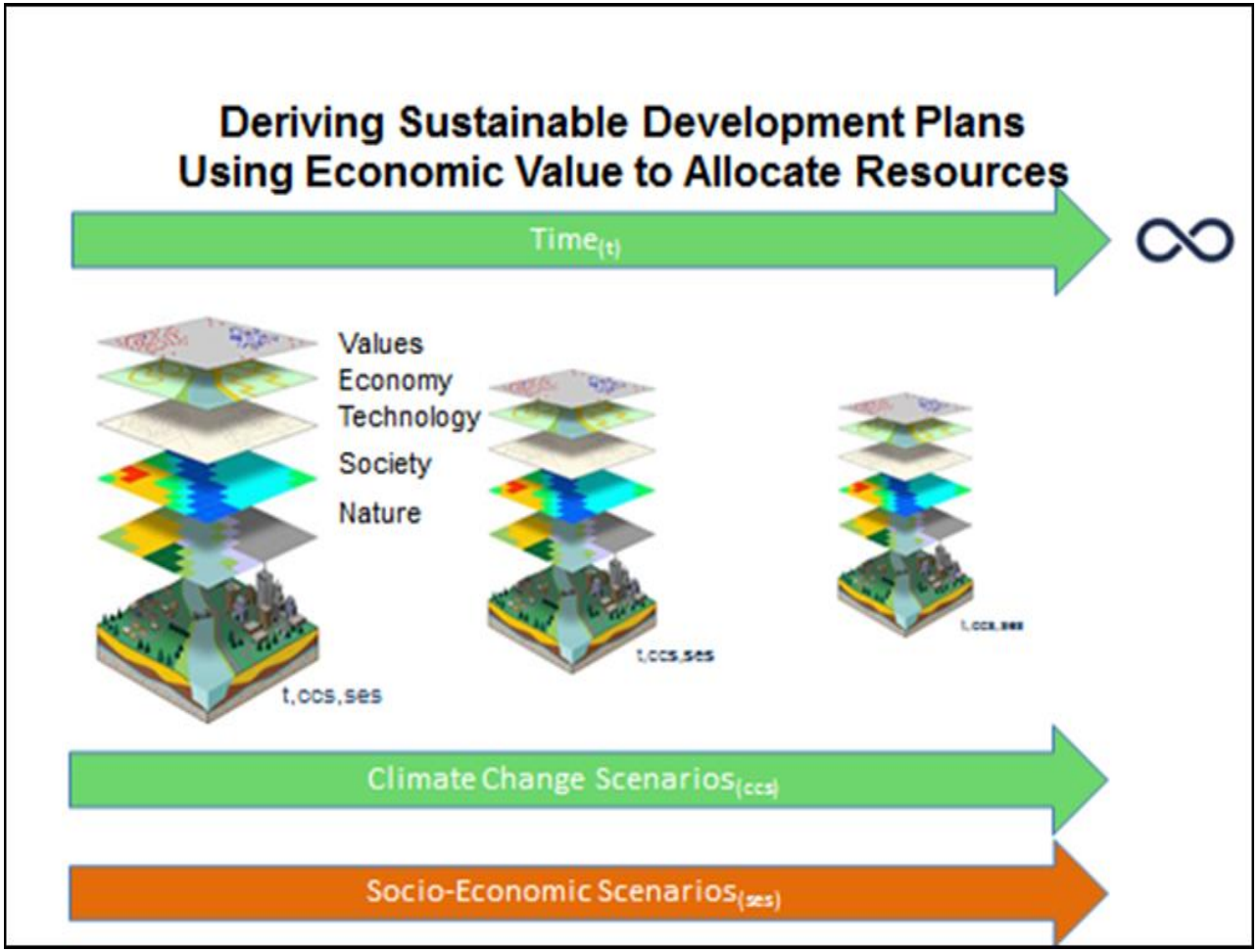
DSS: GIS based CBA for different CC & SE scenarios

Institutional + Policy Analysis



Methods to elicit Economic Value of non-market Goods & Services
Mathematical Modeling
Econometric Modeling
Valuation Methods
Survey
Choice card example Tourists (12 in total)
Choose Optimal Allocation of Resources:
DSS: GIS based CBA under CC and SE Scenarios
GIS
Designing our future
Positives or benefits
Negatives or costs
$

Implementing Social Welfare Increasing Sustainable Solutions



Nature Based Solutions

Infrastructural Solutions

Socio-Economic Tools

Pricing
Tradable permits
Quotas
Taxes/subsidies
Charges
Direct Controls
Educational/Awareness Campaigns
Voluntary Agreements
Legal Instruments
Investments

Athens University of Economics and Business

Research Lab on Socio-Economic and Environmental Sustainability (ReSEES)

ICRE8
www.icre8.eu

Our Books

www.icre8.eu

1) Natural Capital Valuation: Sustainable Investment Allocation

Indicative Projects

MERMAID

AQUASTRESS

BlueBRIDGE

REFRESH

GENESIS
groundwater and dependent ecosystems

The ARID Cluster

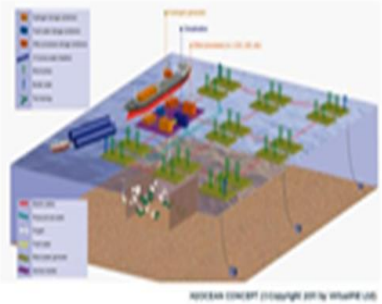
TROPOS

Sustainable Energy and Resource Management

OCEANS of TOMORROW, EC-DG Research-FP6; Budget: 20,000,000

Development of a wind- wave power open-sea platform equipped for hydrogen generation with support for multiple users of energy

http://www.h2ocean-project.eu/



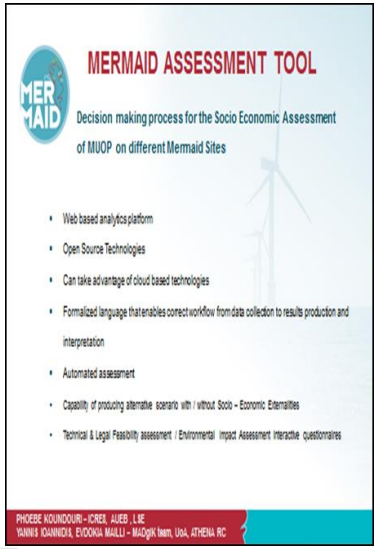
Innovative multi-purpose offshore platforms: planning, design and operation

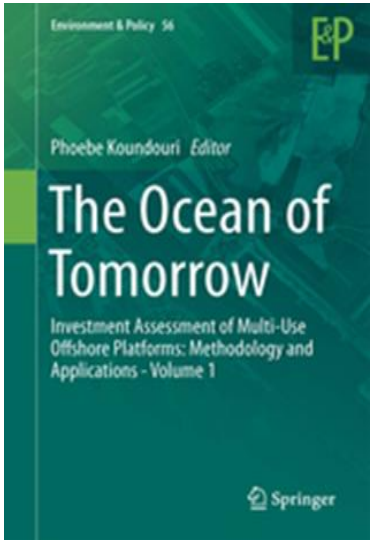
http://www.mermaidproject.eu/

Modular multi-use deep water offshore platform harnessing and servicing Mediterranean, subtropical and tropical marine resources

http://www.troposplatform.eu/

Innovative Multi-purpose offshore platforms: planning, design & operation





Sustainable Energy and Resource Management

The BlueBRIDGE Project –

Addressing the Blue Societal Challenge
H2020. Budget: 10,000,000 euro

Building Research environments fostering Innovation, Decision Making, Governance and Education to support Blue Growth

2) Climate Change: Mitigation and Adaptation Policies

Indicative Projects

DECISION MAKING UNDER UNCERTAINTY:
ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS
ΕΙΔΙΚΟΣ ΛΟΓΑΡΙΑΣΜΟΣ ΚΟΝΔΥΛΙΩΝ ΕΡΕΥΝΑΣ
THE EXAMPLE OF CLIMATE CHANGE

THESEUS

MSP Cyprus

GLOBAL IQ
IMPACT QUANTIFICATION OF GLOBAL CHANGES

GLOBAQUA

BRIGAID

Innovations and Management for Sustainable Development

BRIGAID: BRIdging the **GA**p for **I**nnovations in Disaster resilience
http://brigaid.eu/

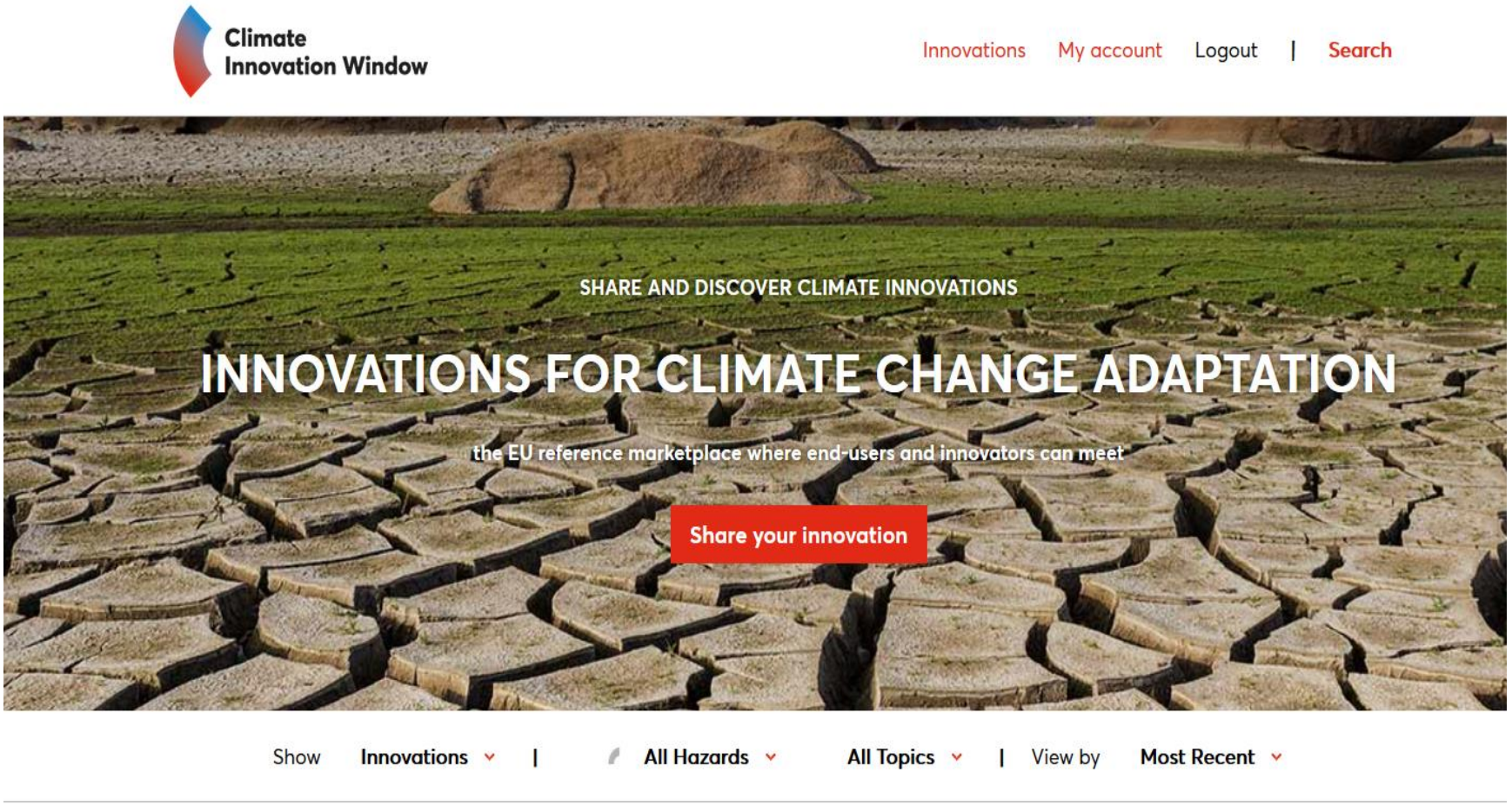
BRIGAID

Innovations and Management for Sustainable Development

Aim: To effectively bridge the gap between innovators and end-users in resilience to floods, droughts and extreme weather

Climate Innovation Window : Interactive Platform

Interactive medium between innovators and stakeholders



http://www.theseusproject.eu/

Innovative technologies for safer European coasts in a changing climate

European Commission

FP7, THEME 6 - Environment, including climate

Budget: (6,530,000 €)

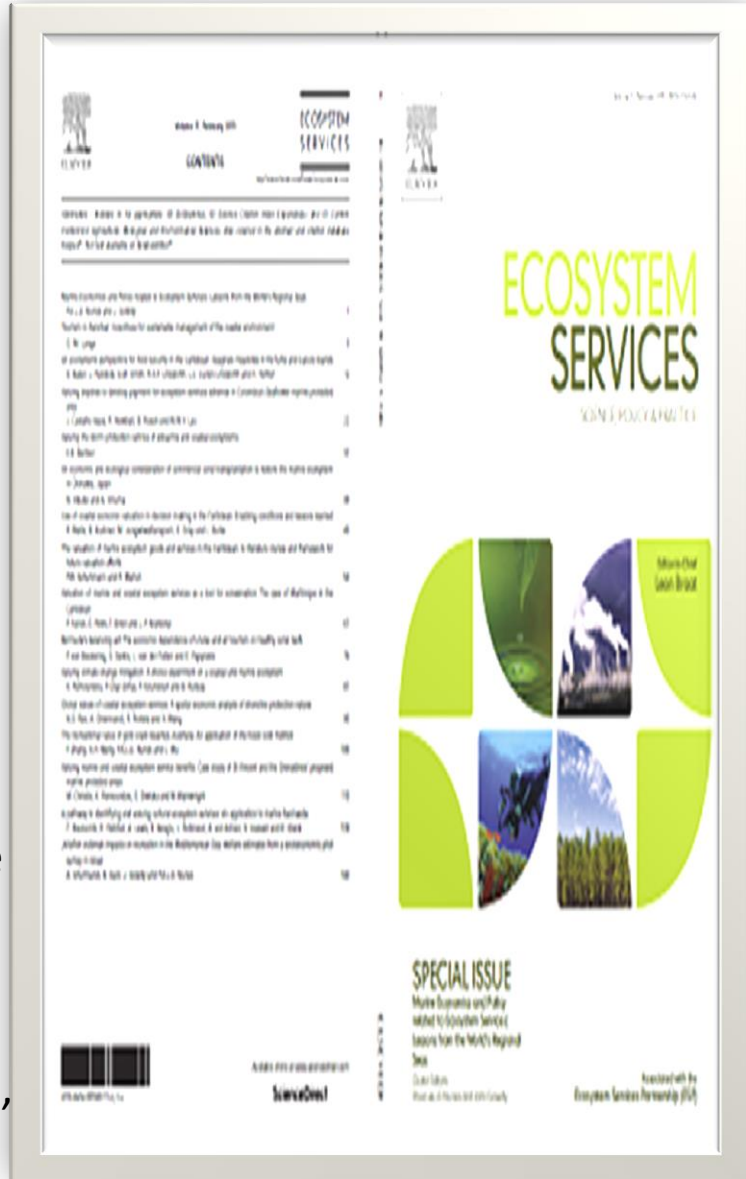
The Economic Valuation of Climate Change Effects on Coastal Ecosystems: A Choice Experiment

THESEUS largest Integrated Project within coastal risk assessment and mitigation funded by the European Commission

The project develops a systematic approach to deliver both a low-risk coast for human use and healthy coastal habitats for evolving coastal zones.

Won an award from CIRIA, a non-profit organisation that links science with the construction industry: Trialled artificial rockpools as a biodiversity enhancement in a granite breakwater. The rockpools have proven a great success, increasing the species diversity of the manmade habitat and supporting species of conservation importance. They are also equally diverse and productive as natural rockpools.

At a time when hard coastal defences are proliferating around our coasts in response to rising and stormier seas, interventions such as this are becoming essential.



3) Sustainable Development in Times of Crisis

Indicative Projects

SESAME

simra
Social Innovation in Marginalised Rural Areas

DAFNE

RECONNECT
Interreg
Balkan-Mediterranean

SMIRES
Science and Management of Intermittent Rivers and Ephemeral Streams

aqua librium

CIGESMED

simra
Social Innovation in Marginalised Rural Areas

Horizon 2020

http://www.simra-h2020.eu/

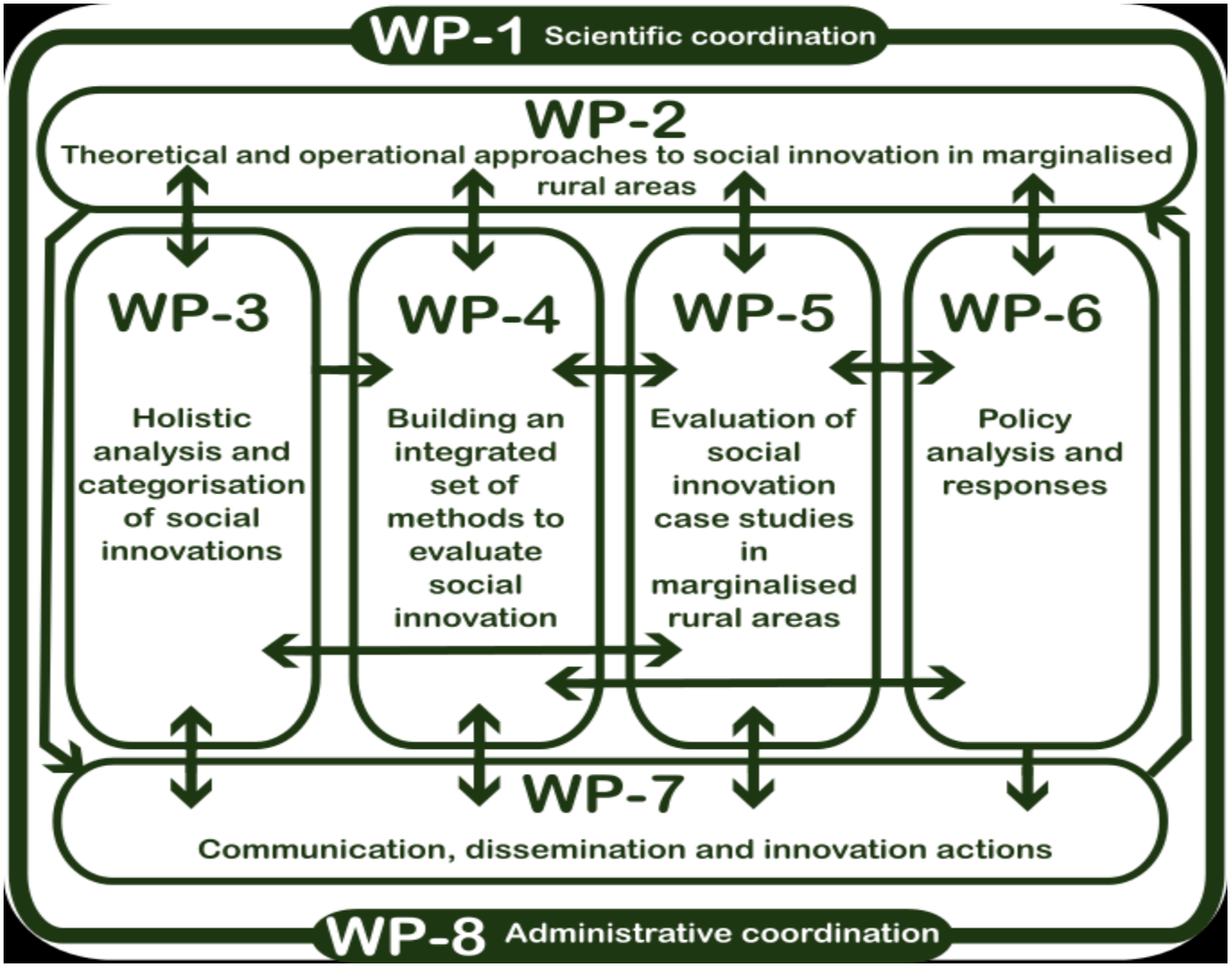
- 4-year project (2016-20)
- 26 partners
- Funded by the European Union (Horizon 2020)
- € 5,9m

- Advance understanding of social innovation and innovative governance in:
  - Agriculture
  - Forestry
  - Rural Development

- Boost them in marginalized rural areas across Europe and around the Mediterranean, including non-EU countries

simra
Social Innovation in Marginalised Rural Areas

simra
Social Innovation in Marginalised Rural Areas



Innovations and Management for Sustainable Development

The Value of Distant Benefits

&

Long-Term Discount Rates

- *Humanity has the ability to make development sustainable: to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs. WCED, 1987*

- *There is something awkward about discounting benefits that arise a century hence. For even at a modest discount rate, no investment will look worthwhile.*

The Economist, 1991

FUNDED BY VARIOUS GOVERNMENTS: UK, FRANCE, USA, NORWAY, SWEDEN, HOLLAND

FUNDED BY THE WORLD BANK FOR CYPRUS, MOLDOVA, UKRAINE

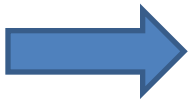
Innovations and Management for Sustainable Development

CBA - Ramsey Formula extended for Risk & Uncertainty

(papers by Dasgupta, Gollier, Koundouri, Weitzman and others)

In an Uncertain Environment persistent shocks on:

- ✓ the growth rate of consumption
- ✓ short-term interest rates



DDR

Estimate Theory Consistent DDR trajectory

- *Using Historical Data*
- *Without Structural Model*
- *Using univariate time series regime switching models*

DDR for higher PV of Long-Run effects!

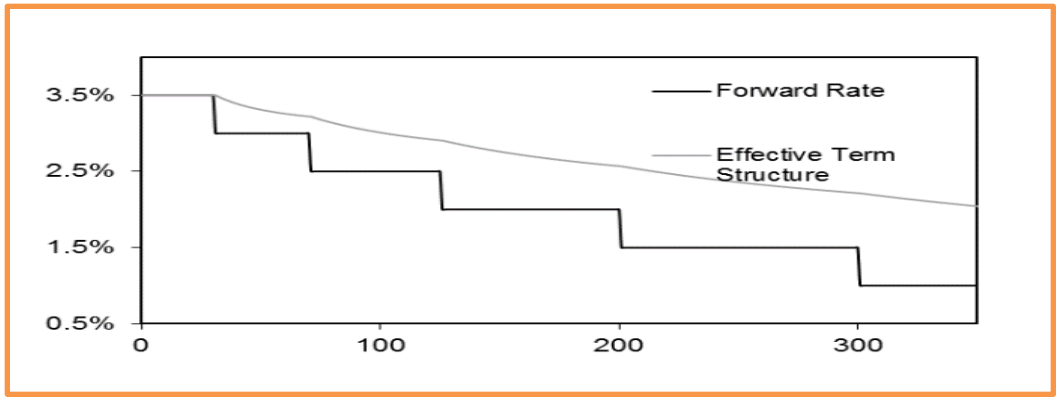
Example: *Climate Change Mitigation*

DDR implies double social cost of CO2 emissions

Innovations and Management for Sustainable Development

RECOMMENDED SCHEDULE OF DISCOUNT RATES PROVIDED

Adopted in:
UK, USA, France, Norway, Etc.



Country	Method	SDR%	LR (T>40) SDR Declining?	Risk & Uncertainty
EU Area	SRTP	3	Declining	sensitivity scenario analysis monte carlo simulations
Sweden	SRTP	3.28- 3.5	Mentioned Not adopted	
Moldova	SRTP/SOC	4,63+9 (RP)	Declining	
Norway	SRTP/SOC	2.5+ 1.5(RP)	Declining	
Cyprus	SRTP/SOC	2.5+ 1.5(RP)	Declining	Sensitivity Analysis
Ukraine	SRTP/SOC	5+ 7(RP)	Declining	Sensitivity Analysis

Ongoing Marine Projects
Below List of Ongoing

- **THESEUS**: Innovative technologies for safer European coasts in a changing climate (FP7)
- **OCEANS OF TOMORROW**: Multi-Use Offshore Platforms for Sustainable Blue Growth (FP7)
- **BLUEBRIDGE**: Building Research environments fostering Innovation, Decision making, Governance and Education to support Blue growth (H2020)
- **RECONNECT**: Regional cooperation for the transnational ecosystem sustainable development (INTERREG)
- **MARINE SPATIAL PLANNING** (Ministry of Env, Govt of Cyprus)
- **FISH ON A CHIP**: Innovative Technologies at the Service of the Aquaculture, Fisheries & Research Sectors (H2020)
- **COASTAL:** Collaborative Sea Integration Platform (H2020)
- **BLUEGREENGOV:** Blue-green integrated governance tools for growth (H2020)

Education and Training

International, Regional, National Conferences, Workshops, Training Seminars & Research, Policy, Business Events

www.eaere-conferences.org/2017

ICRE8
International Centre for Research
on the Environment & the Economy

www.icre8.eu | Local Organiser

Scientific and Policy Events

EAERE 23 in Numbers

- ✓ **1200** members from 80 countries
- ✓ **2000** submissions
- ✓ **700** peer-reviewed papers presented
- ✓ **10** Policy Sessions
- ✓ **9** Thematic Sessions
- ✓ **38** posters
- ✓ **800** registered participants
- ✓ **274** referees

European Association of Environmental and Resource Economists

- ✓**9** sponsors
- ✓**10** exhibitors
- ✓More than **60.000 euros** attracted from sponsorships and exhibitors
- ✓More than **30** volunteers

RDA FISHERIES & ACQUACULTURE Datathon

ICRE8 Workshop
19 June 2017
Athens, Greece

BlueBRIDGE receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 675680

RDA/BB FISHERIES & ACQUACULTURE Datathon

To fuel new thinking in the holistic analysis of satellite, environmental, biological and socio economic data and the interactions between fisheries, aquaculture and the marine spatial planning.

Copernicus, EMODnet, BlueBRIDGE, FAO, Eurostat, Natura2000 are among the relevant datasets that will be made available

ADVANCED POLICY WORKSHOP IN SUSTAINABILITY AND RESOURCE VALUATION

28 June 2017
Athens, Greece

Under the auspices of

SDSN GREECE

ORGANIZERS

Political Economy of Sustainable Development Lab (PESD),
Department of Economics, National and Kapodistrian University of Athens
in collaboration with
Athens University of Economics and Business and
International Centre for Research on the Environment and the Economy (ICRE8)

5th GLOBAQUA Training Course

Economics of Sustainable Water Management in accordance to the Water Framework Directive, the Millennium Ecosystems Assessment & Sustainable Development Goals of the UN Agenda 2030

19-20 February 2018

Athens, Greece

Under the auspices of

SDSN GREECE

GLOBAQUA

Coordinator

The course is coordinated by Phoebe Koundouri, Professor of Economics and Econometrics, Athens University of Economics and Business (School of Economics) and London School of Economics (CCCEP), Scientific Director of ICRE8, SDSN-Greece chair.

National and Kapodistrian University of Athens PESD

ICRE8

Open-Access to Scientific Information

www.openaire.eu

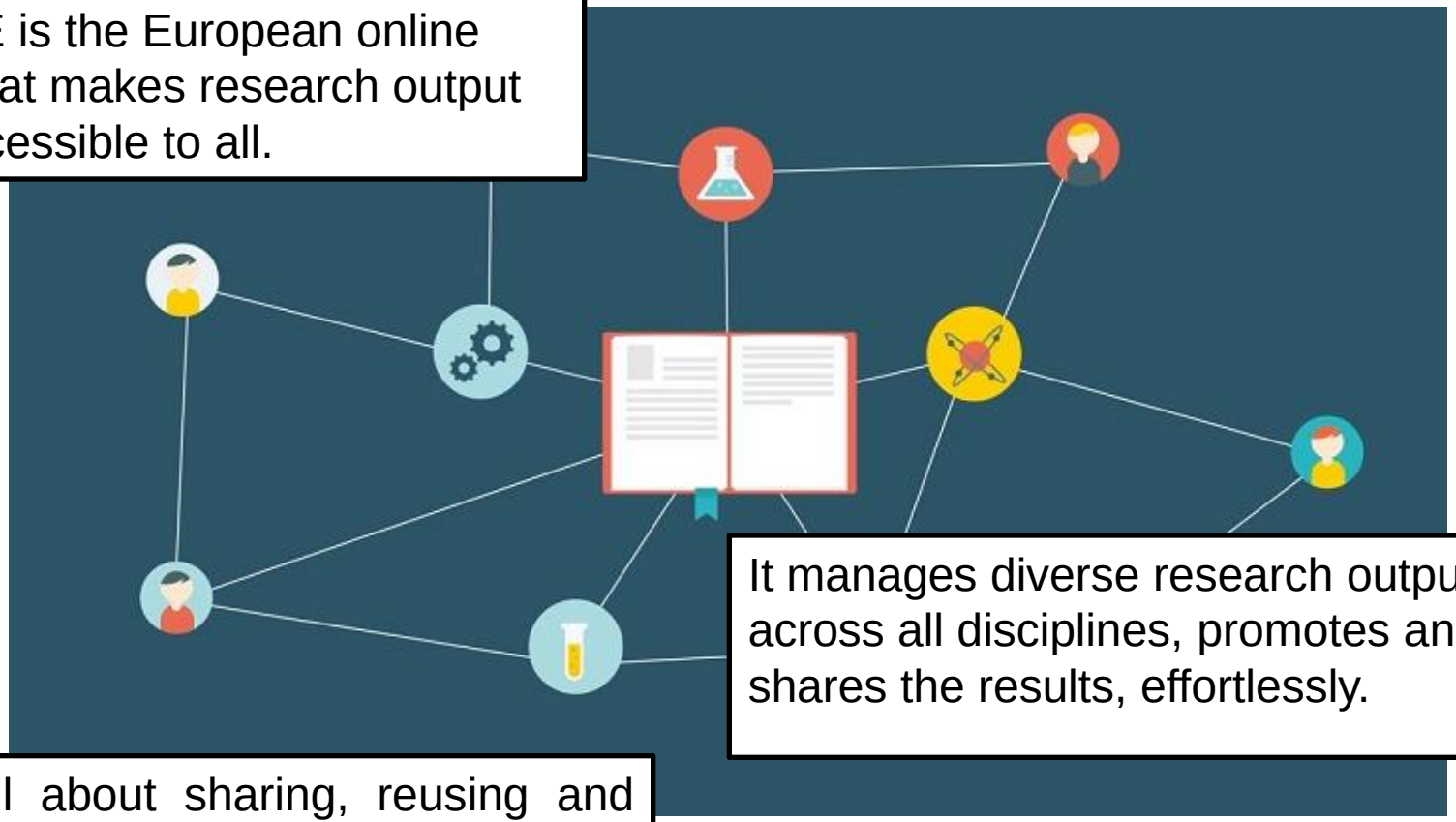
EC-DG Research-FP6

Budget: 12,000,000

Open Access evolution in Europe

http://vimeo.com/openaire/2014

OpenAIRE is the European online network that makes research output openly accessible to all.



It manages diverse research outputs across all disciplines, promotes and shares the results, effortlessly.

It is all about sharing, reusing and linking research information.

Coordination OpenAIRE Connect

- Funded by the European Union (Horizon 2020)
- ~ € 2m
- Provide technological and social bridges
- Deliver services enabling uniform exchange of research artefacts
  - Literature
  - Data
  - Methods
  - with semantic links between them and
  - across research communities and content providers in scientific communication
- Introduce and implement the concept of Open Science as a Service (OSaaS)

CASE STUDY: SDSN Greece

- Official website: www.unsdsn.gr

- Mapping of Greek universities and research centers
  - ✓ >50 public and private universities
  - ✓ 18 research centers
  - ✓ NGO's

- Collaboration with critical strategic partners:
  - ✓ Ministry of the Environment
  - ✓ Greek Universities and Research Centers
  - ✓ Athens Resilient Office, Municipality of Athens
  - ✓ WWF, Greece
  - ✓ Foundation for Economic and Industrial Research
  - ✓ Hellenic Federation of Enterprices
  - ✓ Etc.

SDSN GREECE e-library

Our Vision

An SDG E-library for Greece

An Open Science directory of all past **20 years** completed and ongoing research publications, data and related models relevant to the 17 SDGs

A data source towards the implementation of the SDGs

immediate & long-term benefits to:

research communities research organizations

funders, industry and… society

Literature

- ✓ Journal articles (OA and non-OA)
- ✓ White papers
- ✓ Pre-prints

Datasets

- ✓ Databases (SDG Indices, economic data, geophysical data, GIS data)
- ✓ Files

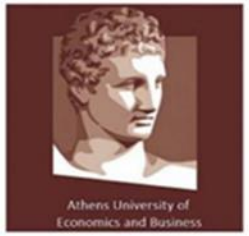
Projects

- ✓ Greek coordinators
- ✓ Greek partners
- ✓ Greek area as a case study

SDSN GREECE e-library

We're growing…

- ✓ SDG Open Science directory for Greece
- ✓ SDG Open Science directory for SDSN-Mediterrenean
- ✓ **SDG Open Science directory for the global SDSN**



Research Lab on
Socio-Economic
and Environmental
Sustainability
(ReSEES)

SDSN
GREECE
www.unsdsn.gr

ICRE8

National and Kapodistrian University of Athens
PESD

Hosting Institutions

AQUASTRESS

REFRESH

SMIRES
Science and Management of Intermittent Rivers and Ephemeral Streams

BRIGAID

SESAME

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