Earth Observation for Energy & Mining

International trends & developments

Earth observation applications

Business development

Capacity building

0. Introduction

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HCP international:
consulting, marketing of earth observation

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project for promotion & capacity building of earth observation applications

Sequence:

- General assessment of the state-of-the-art of earth observation
- Major trends and developments in the application field
- Description of earth observation solutions
- Assessment of market potential for earth observation solutions and marketing instruments
- Capacity building for successful application of earth observation solutions

Earth Observation helps you:

save money

save lives

save the environment

Earth observation applications

- On the verge of reaching new user communities
- These new user communities need to be involved
- Weakest link / last mile aspects are important
- Marketing needed: promotion & capacity building

Life cycle of products & services

Initialization

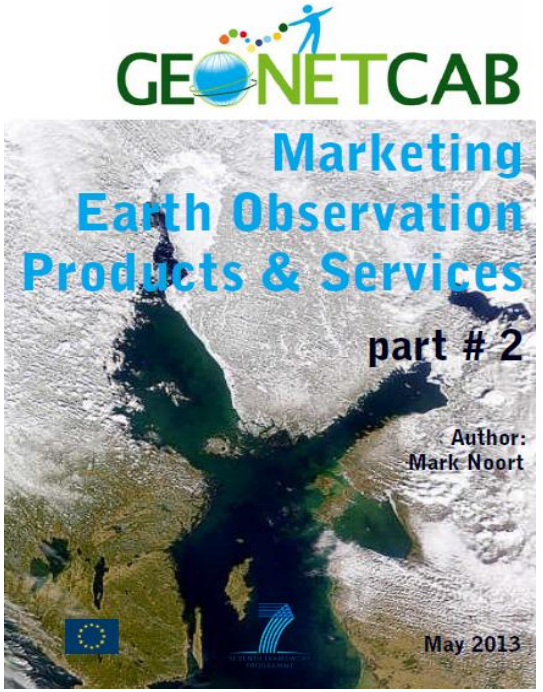
System analysis & design

Rapid prototyping

System development

Implementation

Post-implementation



Scope

Energy resources:
anything that can be used as a source of energy

Energy:
property of objects, transferable among them via fundamental interactions, which can be converted in form but not created or destroyed

Mining can be described as:
the extraction of valuable minerals or other geological materials from the earth, which are of economic interest to the miner

Climate aspects are dealt with more in detail in the climate toolkit, hydropower aspects are also covered in the water management toolkit, environmental impact of mining and energy resources relates to subjects dealt with in the environmental management toolkit.

Assessment of business & funding opportunities

- Categories of environmental management products & services
- Life cycle phase of product or service
- Regional context, level of technological & economic development
- Optimum marketing mix

1. International trends & developments in energy & mining

Issues & trends in energy & mining

- Increased attention for **renewable energy** and **new energy sources** (including biofuel)
- Increased attention for **energy saving,** more **efficient use of resources** and **recycling**
- Search for new **mining deposits** (including rare earths) and **transport chains**
- Increased attention for **environmental aspects of mining**
- Anticipation on the possible effects of **climate change**
  -> in climate toolkit

Drivers

- Increasing demand for energy and mining products (growing population, increasing urbanization, growing economy);
- Adaptation to climate change: changing trends, increasing variability, greater extremes and large inter-annual variations in climate parameters are expected;
- Possible depletion of fossil fuels and mining deposits;
- Concerns about vulnerability of nuclear energy to disasters;
- Negative environmental impact of mining and extraction of fossil fuels.

Renewable energy & new energy sources

- Renewable energy sources: **solar** energy, **wind** energy (onshore, land-based and offshore), **bioenergy, hydropower, geothermal** energy;
- **Electricity generation** from **renewable** energy is i**ncreasing**;
- Employed to **improve energy security** and **encourage economic development** (less dependency on fossil fuels);
- **Less impact** on **climate** and **environment** than fossil fuels;
- **Efficiency, storage and cost-effectiveness need to be improved**.

More information:

Renewable energy projects handbook (WEC; 2004)
overview of renewable energy options, potential and main features of each type of renewable energy + political and financial considerations, project checklist and a description of the environmental credits acquisition process

Global Energy Information System www.worldenergy.org
case studies on renewable energy from different countries

Promise of renewables (CSIS; 2012)
commentary on trends, developments, problems: renewable is more expensive than fossil, but investment is growing

More information solar energy:

Solar energy perspectives (IEA; 2011)
comprehensive overview: if you want use solar energy, start here!

Renewable energy essentials: Solar heating and cooling (IEA; 2012) *short overview of markets and potential*

Renewable energy essentials: Concentrating solar thermal power (IEA; 2009) *short overview of markets and potential*

Technology roadmap: Solar photovoltaic energy (IEA; 2010)
plan for future action, based on current and anticipated trends

Technology roadmap: Solar heating & cooling (IEA; 2009)
plan for future action, based on current and anticipated trends

More information wind energy:

Technology roadmap: Wind energy (IEA; 2009)
plan for future action, based on current and anticipated trends and stressing the importance of standards for resource assessment, sharing of wind resource data and improving wind forecasting accuracy

Renewable energy essentials: Wind (IEA; 2008)
short overview of markets and potential

More information bioenergy:

Biofuels: policies, standards and technologies (WEC; 2010)
overview of the current state of affairs, including sustainability criteria

Good practice guidelines: Bioenergy project development & biomass supply (IEA; 2007)
guide towards a sustainable and profitable approach

More information hydropower & geothermal:

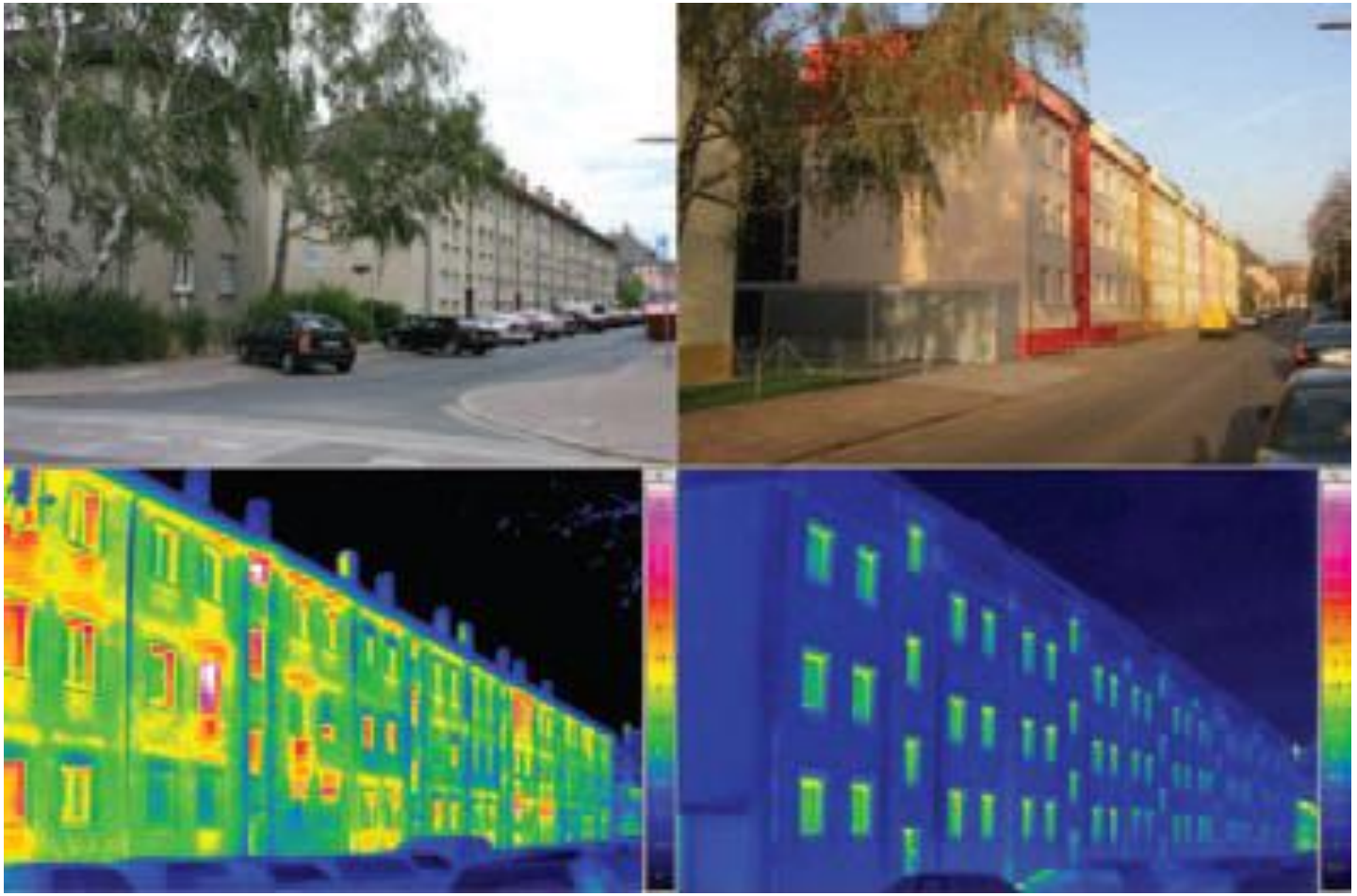
Renewable energy essentials: Hydropower (IEA; 2010)
short overview of markets and potentials

Renewable energy essentials: Geothermal (IEA; 2010)
short overview of markets and potentials

Energy saving

- Energy efficiency supports different **goals**: **energy security**, adaptation to and mitigation of the effects of **climate change**, **economic development**;
- A significant proportion of the **energy efficiency improvement potential is not realised**, mainly because of market barriers;
- **Policy** options:
  a) address **contract design** to ensure end-users face energy prices,
  b) **regulate** the level of energy efficiency in appliances and buildings,
  c) improve **access to information** about energy efficiency performances.

Example



Frankfurt refurbishment using passive housing technology.
Top photos: the building before and after refurbishment. Bottom images: infrared visualization of the heat losses before and after the refurbishment (Source: Passive House Institute Darmstadt)

More information:

Mind the gap: Energy efficiency (IEA; 2007)
comprehensive discussion of barriers and solutions with respect to achieving energy efficiency, based on agency theory

Technology roadmap: Energy-efficient buildings (IEA; 2011)
graphic visualization of roadmap and targets

Mining deposits & transport chains

- **Increasing demand** for raw materials;
- Trends towards **securing strategic flow of resources** and independent supply (national / regional interest);
- Increased **sophistication of exploration**, enabling mining in **environmentally sensitive areas**, such as the arctic and tropical forests;
- Concerns about **health, safety** (and income) **risks**;
- More attention for **stakeholder participation**, poverty effects and sustainability, environmental, climate aspects.

More information:

Trends in the mining and metals industry (ICMM; 2012)
overview of trends, main deposits and mining's contribution to sustainable development

Measurement, reporting and verification and the mining and metals industry (ICMM; 2011)
description of MRV for climate change and sustainable mining

Approaches to understanding development outcomes from mining (ICMM; 2013)
best practices description and overview and assessment of different valuation tools and methods and their feasibility for measuring the impact of mining on social and economic development

Environmental aspects of mining

- More attention for **preventing environmental pollution** during all phases of the mining cycle;
- More attention for **disaster prevention** and **risk management**;
- More emphasis on **corporate social responsibility** (CSR);
- More priority for **sustainable use of inputs** for the mining process;
- More regulation (and enforcement) on **handling of mining waste**.

More information:

Report on socio-economic indicators, drivers and best practice across the chosen sites (IMPACTMIN; 2010)

Report on the study of mining and society and its implications (IMPACTMIN; 2011)

Indicators (EO-MINERS; 2012) on:

D : air quality and other nuisances

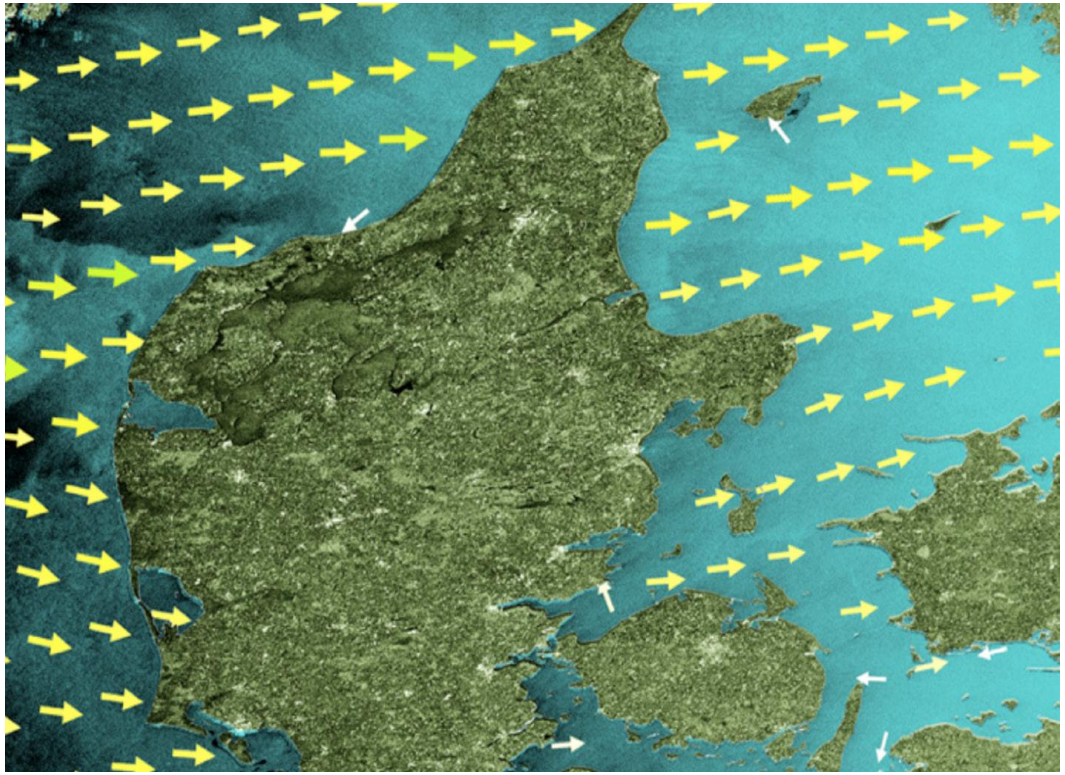
E : water quality

G : geotechnical hazards and accidents

H : industrial and other accidents

2. Earth observation applications

Earth observation for energy & mining



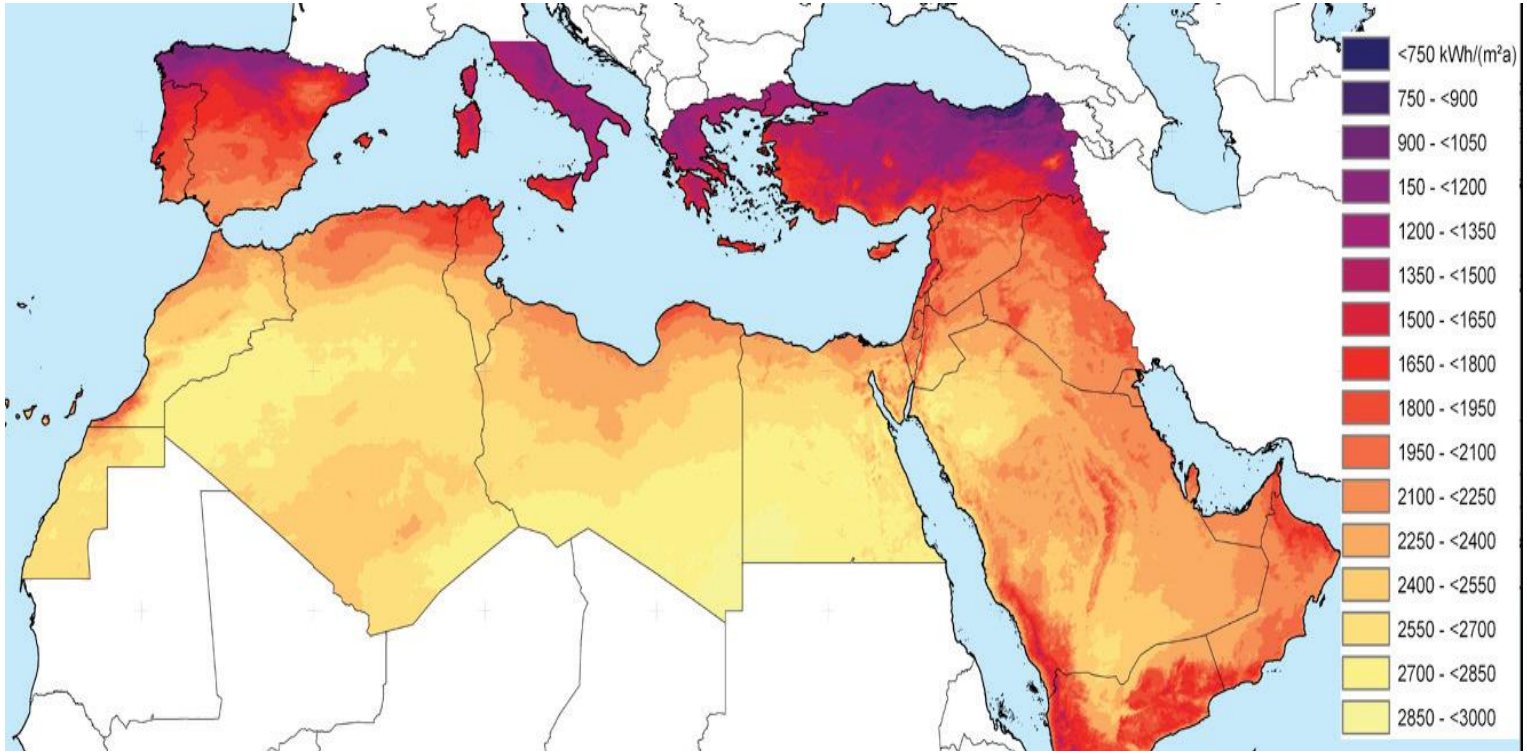
This coloured Envisat ASAR radar image, which is normally black and white, shows the wind fields over the North Sea around Denmark and northern Germany in September 2009. Speed values range from 0–32 km per second. Wind speeds and directions are indicated by the size and colour of the arrows.

(Source: EEA & ESA)

Earth observation contribution

- **Resource assessment** and **exploration support** for **renewable energy**
- **Resource assessment** and **exploration support** for **mining** and **fossil fuel extraction**
- **Pipeline monitoring**
- Optimization of biofuel production
  (see agriculture toolkit)
- Effect of **climate change** on energy requirements (and vice versa)
  (see climate toolkit)
- **Urban heat islands** and **sustainable building design**
  (see urban management, land administration and SDI toolkit)

Example renewable energy



Energy resource map: Annual solar irradiance in the Mediterranean region (kWh/m2). (Source: DLR)

Renewable energy

- Earth observation provides data on irradiation, cloud cover, wind velocity, wind direction, wind shear, air temperature, relative humidity, topography/elevation, surface roughness, wave height, etc.
- Data series are available for historical and statistical analysis and analysis of whole regions
- Cost estimate: renewable energy resource assessment 2 – 10 € / km^2
- Main challenges: cost, capacity, business model.

Examples:

Space-based environmental information for solar energy industries (ENVISOLAR; 2007) www.envisolar.com
brochure with overview of services and examples, including services for investment decisions, plant management, utilities, time-series services for science and consulting and a description of the PV-calculator tool

MESoR *(management and exploitation of solar energy knowledge)*
www.mesor.net *continued at* www.webservice-energy.org/

Description of solar resource products, summary of benchmarking results and examples of use (MESoR; 2009)
overview of and comparison (benchmarking) of different methods for measuring irradiation + 20 use cases

Needs for new solar radiation services to faster deploy the market for solar energy applications and optimize grid integration (MESoR; 2009)
recommendations for improvements in observations and forecasts

More examples (2):

RETScreen international (Natural Resources Canada)
brochure on RETScreen initiative www.retscreen.net

Clean energy projects, RETScreen engineering & cases textbook (RETScreen; 2005)
description of clean energy decision-making software; uses worldwide database of NASA satellite-derived meteorological data (NASA surface meteorology and solar energy dataset (SSE)) from a ten-year period (1983 – 1993)

Solar energy data for developing countries (GEO-ECP; 2007)
short description of, and links to, SSE, Helioclim and SODA

More examples (3):

Results of solar resource assessments in the UNEP/SWERA project (Renné; 2005)
article with summary of the results in the 13 SWERA countries

Global atlas for solar and wind energy end-user needs assessment (Caner; 2012)
presentation of the end-user assessment for SWERA products (policy-makers, developers, NGOs/universities, global modelling community). SWERA is used as first data source (to identify high-potential areas), but is not enough for decision-making. More capacity building needed.

Solar and wind energy resource assessment (GEF; 2011)
success story with summary of SWERA achievements

Highlighting Earth's solar resources from space (Copernicus: 2013) *brochure on earth observation for solar energy*

More examples (4):

Enhancing information for renewable energy technology deployment in Brazil, China, and South Africa (UNEP, 2011) *description of resource assessment for solar and wind energy in the three countries + comparison between the countries*

Terminal evaluation of UNEP GEF project solar and wind *evaluation report of the SWERA project with lessons learned and recommendations (establishment of a knowledge network)*

User manual for SWERA: designing renewable resource assessment projects and using assessment products (UNEP) *user manual for SWERA and related products + guidance on where to find information*

More examples (5):

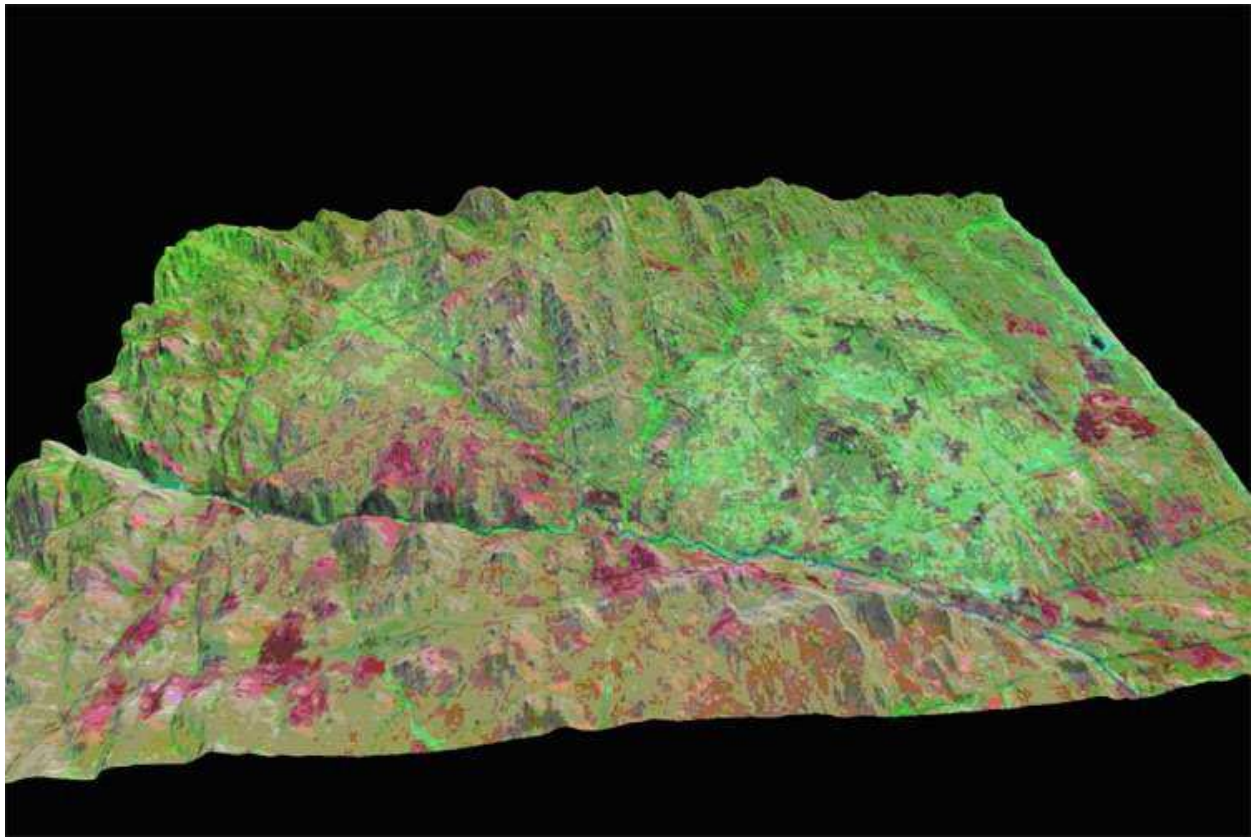
Satellite based services for the wind industry (Furevik; 2005)
article describing the use of EO data for wind farms (wind measurements over the ocean, wave statistics, tidal heights and currents, terrain roughness, orography)

Wind energy forecasting (Brower; 2011)
presentation with escription of forecasting systems, models, time horizons and forecast performance + recommendations to improve wind forecasting in the United States

Assessment of wind resources and annual energy production of wind farms (Hasager; 2012)
presentation on the use of earth observation for WAsP (wind atlas analysis and application programme) in Denmark

Space supports Europe's energy future (Copernicus: 2013)
brochure on earth observation for wind energy

Example mining and fossil fuel extraction



Landsat ETM+ satellite image of the Catanda carbonatite massif (Angola) superimposed on DEM

(Source: AEGOS project)

Mining and fossil fuel extraction

- Earth observation is used for geological mapping (exploring of new mineral deposits), optimal planning of seismic surveys and monitoring of the impact of mining and fossil fuel extraction (land use change, air quality, soil quality, water quality, presence of roads, indicators of socio-economic effects, risk management, site rehabilitation)
- Earth observation can be applied in remote areas and access to data is not restricted
- Cost estimate: geological mapping 2 – 16 k€ for an area of 20 x 20 km, habitat / impact assessment 20 – 25 k€ per mining operation, geotechnical assessment 10 – 15 k€ per mining operation, mine waste monitoring 10 – 50 k€ / year
- Main challenges: cost, complexity, capacity.

Examples:

Review of spin-off projects based on AEGOS, preparation of a road map for AEGOS test beds (AEGOS; 2011)
description of 8 geological mapping initiatives in Africa

The spatial data infrastructure for georesources in Africa (Urvois, AEGOS; 2013) *overview presentation of the AEGOS initiative*

ERS in oil and gas industry (Earth from Space; 2011)
special issue dedicated to GIS and remote sensing for oil and gas by the Russian company Scanex

Satellite monitoring of the diamond field in the Archangelsk Region (Earth from Space; 2013)
article on earth observation for environmental impact of diamond mining by the Russian company Scanex

More examples:

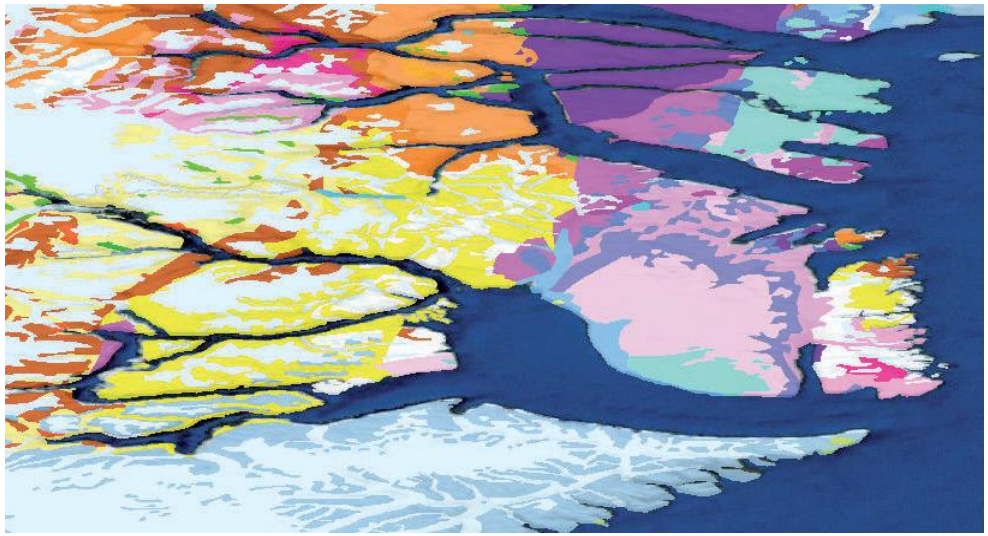
Report on the limitations and potentials of satellite EO data (IMPACTMIN; 2010)
assessment of the feasibility of different earth observation sensors and techniques for monitoring the environmental impact of mining

Indicators and earth observation products for the assessment of the extractive industry environmental and societal impacts (EO-MINERS; 2013)
report series on earth observation and the impact of mining with case studies in South Africa, Czech Republic and Kyrgyzstan

Earth observation and what it can tell us about the impacts of mining (EO-MINERS)
leaflet summarising the contribution of earth observation to monitoring the impact of mining

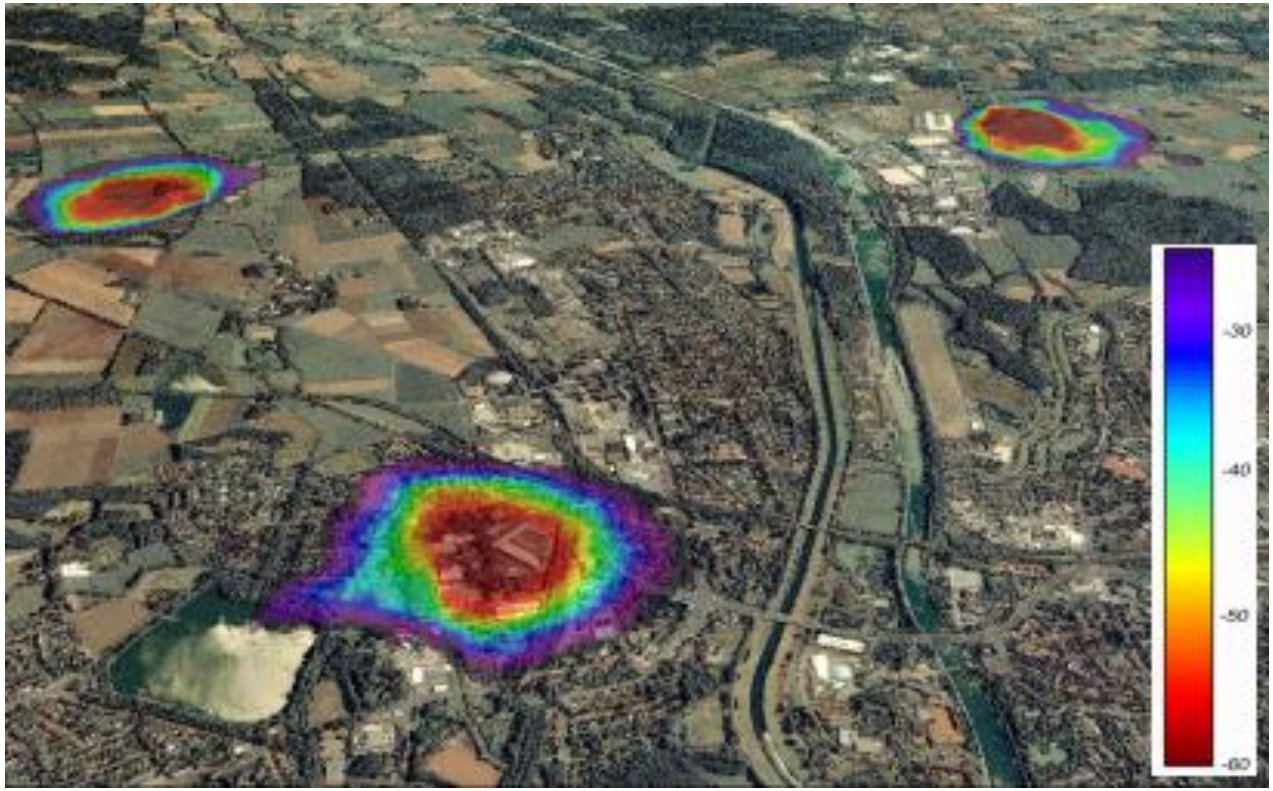
One Geology:

Geological maps for more than 70 countries
including information on geothermal showcases in Australia and France, and the digital energy map of the UK
www.onegeology.org



Initiatives, such as AEGOS, One Geology, IMPACTMIN, EO-MINERS and EnerGEO also support energy resources assessment!

Example pipeline monitoring



Ground monitoring and route planning service

(Source: PIPEMON project)

Pipeline monitoring

- Earth observation enables remote monitoring, with increased frequency and accuracy, reduced need for on-site inspections, early detection of stresses and leaks, encroachment monitoring and enhanced network performance and safety, route planning and ground motion monitoring
- Cost estimate: on case-by-case basis
- Main challenges: cost, cost-benefit, protection of sensitive data.

Examples:

Oil and gas spill and pipeline condition assessment using remote sensing (EPA)
overview of methodologies for pipeline monitoring in the US

Pipeline monitoring service (PIPEMON; 2006)
service portfolio specifications

Ground motion monitoring service (PIPEMON; 2005)
leaflet

Growth potential for earth observation

- **Resource assessment and monitoring for renewable energy, especially wind and solar**.
  Main clients: governments, energy companies.
- **Resource assessment and monitoring for mining and fossil fuel extraction, including environmental impact**.
  Main clients: governments, mining companies, energy companies, NGOs.

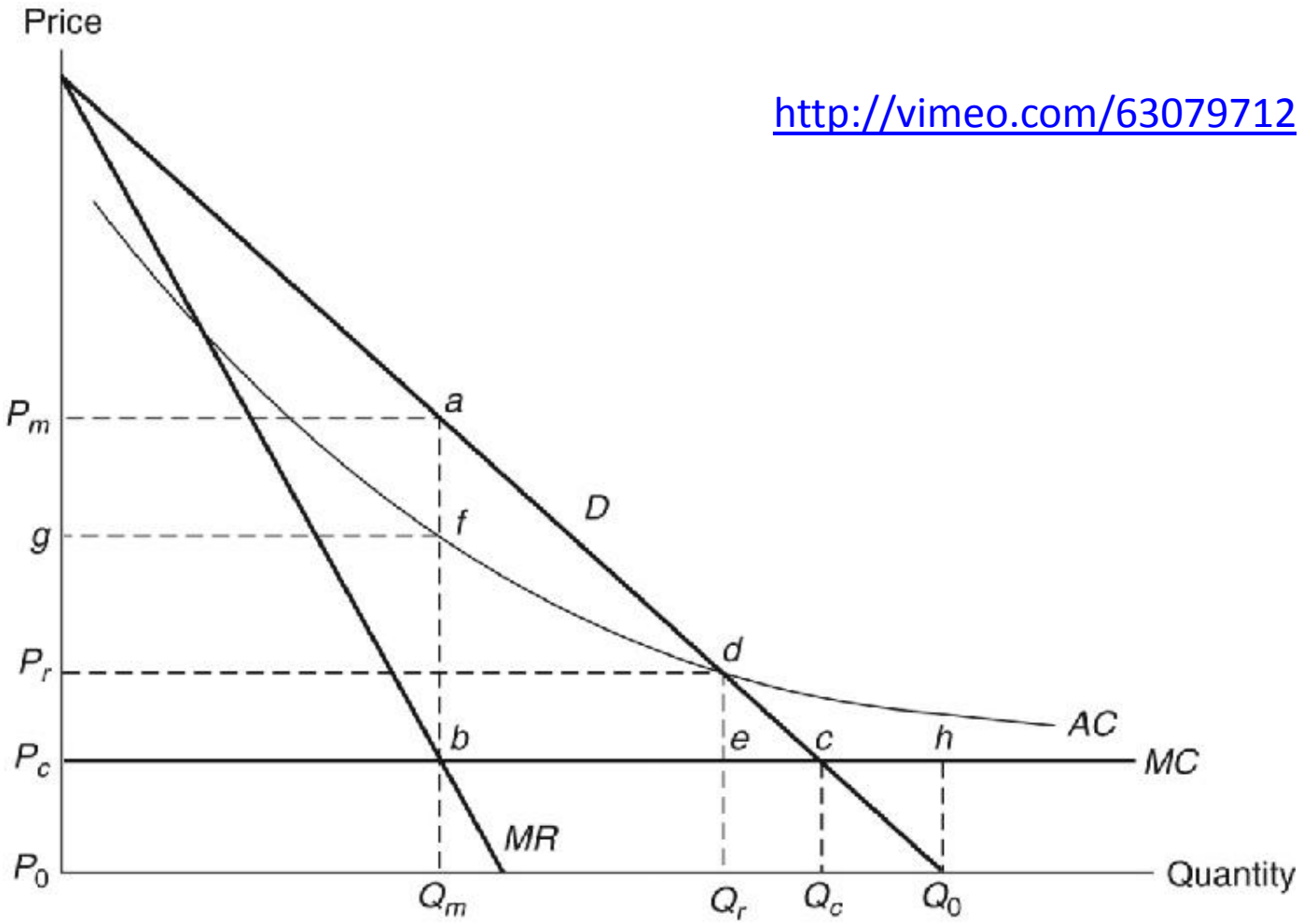
3. Business development

Why is marketing / promotion of earth observation needed?

- Public sector information (PSI)
- Externalities (environmental accounting & payment for ecosystem services)
- Global datasets, open access, data sharing, compatibility (GEO)

If public sector information is made available free-of-charge, demand will increase and, in the end, government revenue also, as companies will derive income from value-added products and services, and consequently pay more taxes (see figures in following slides).

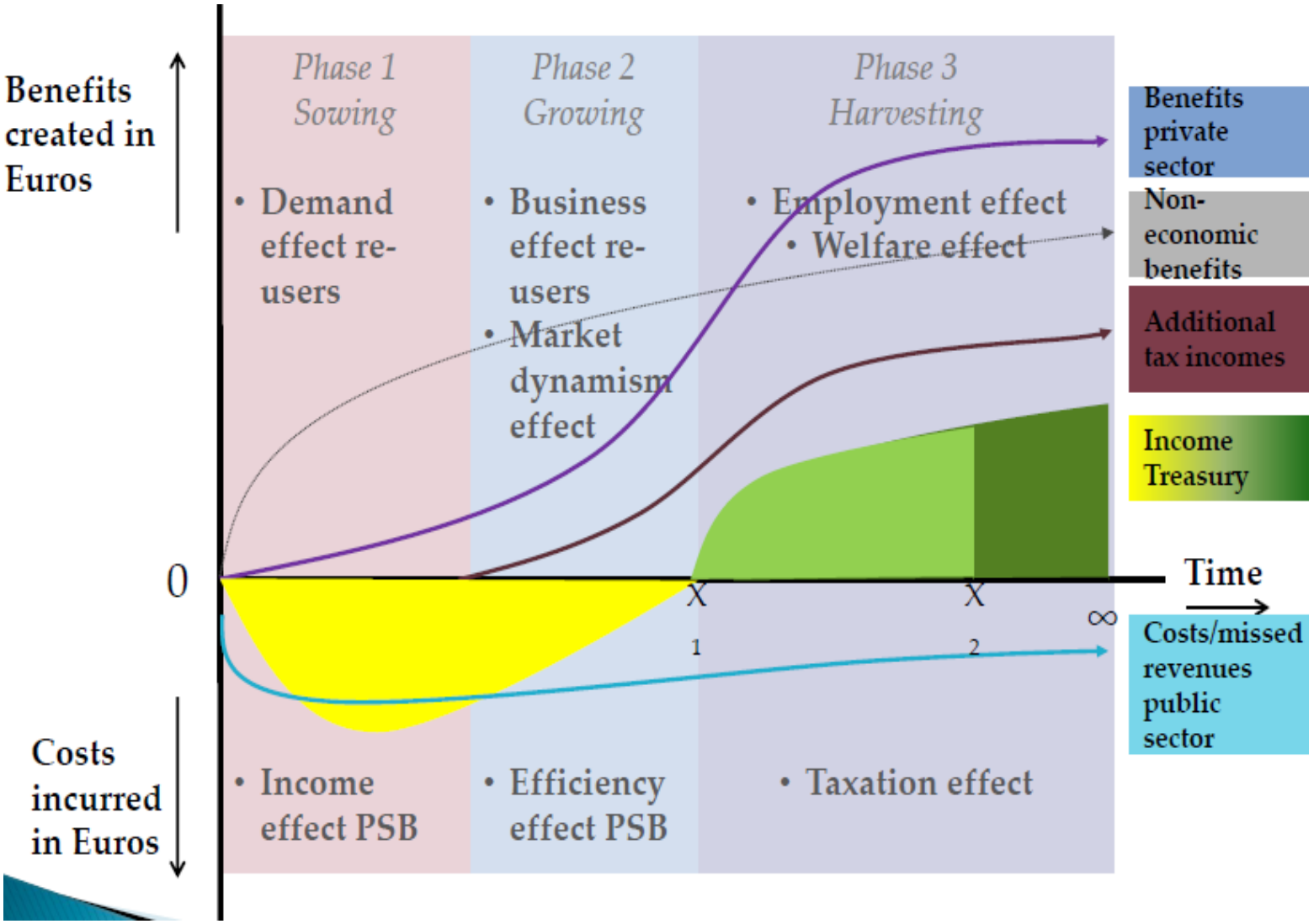
Supply & Demand Public Sector Information



http://vimeo.com/63079712

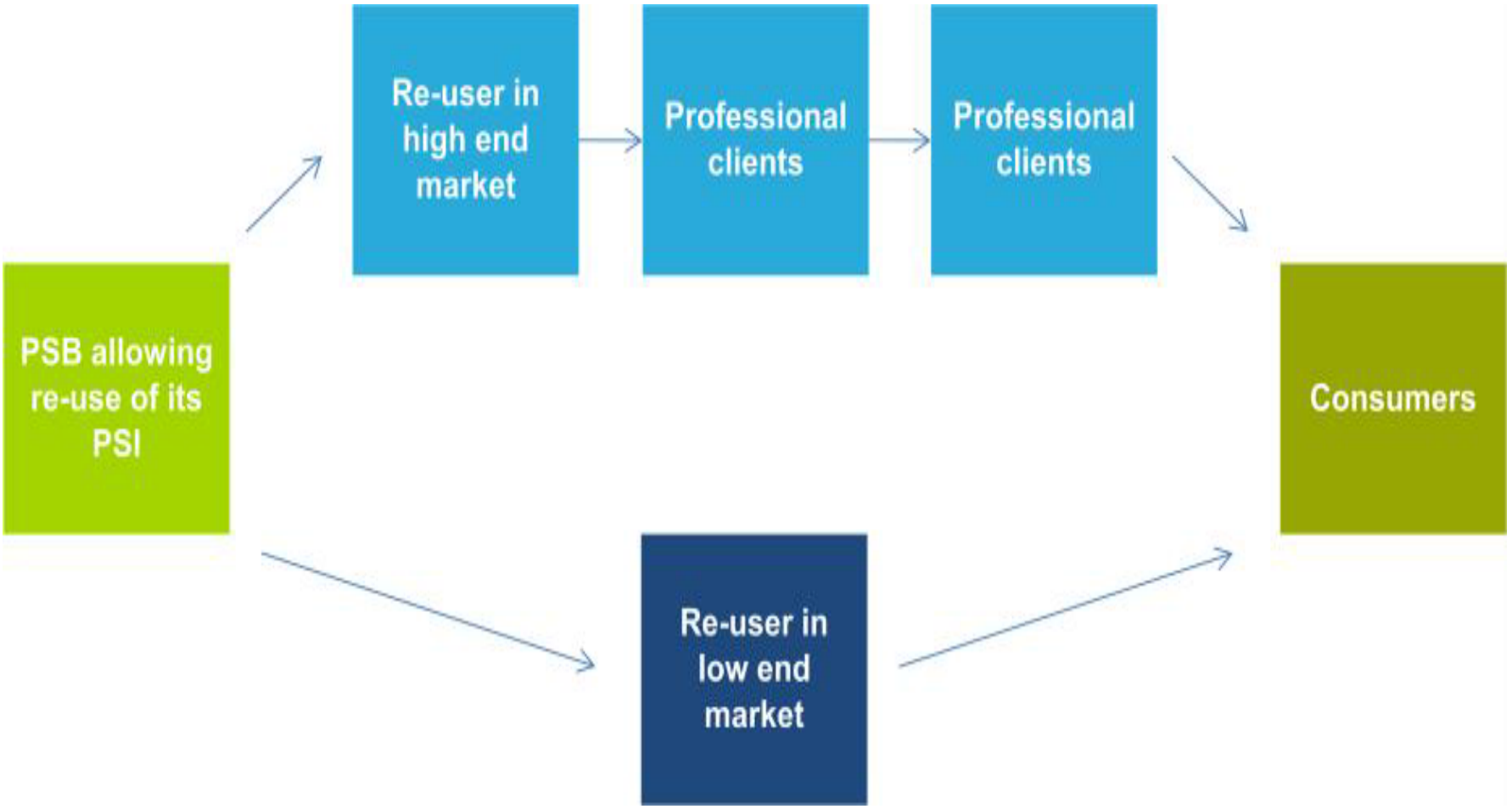
Source: About GMES and data: geese and golden eggs (Sawyer, de Vries 2012)

Cost-benefit Public Sector Information



Source: About GMES and data: geese and golden eggs (Sawyer, de Vries 2012)

Re-use of Public Sector Information

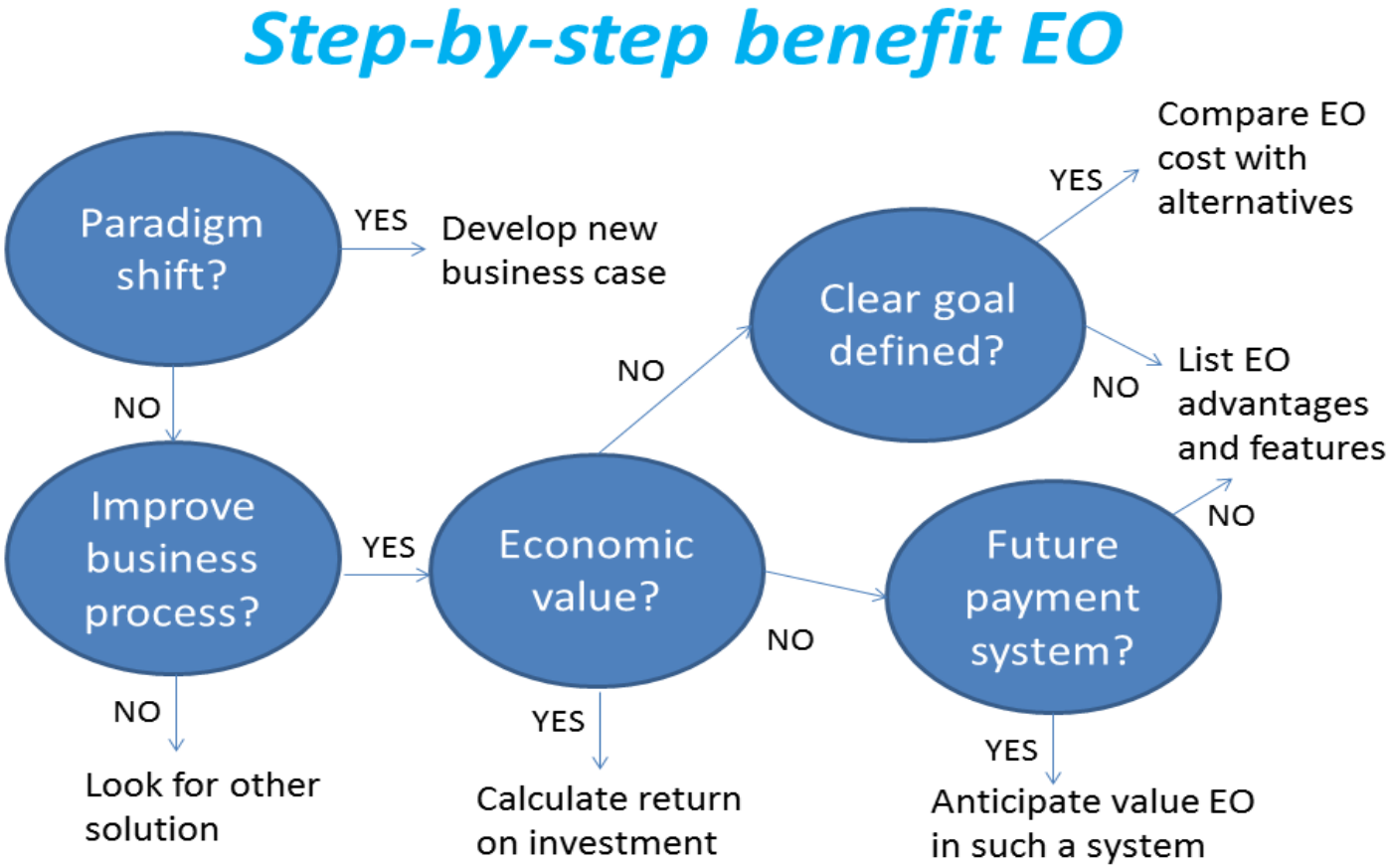


Source: About GMES and data: geese and golden eggs (Sawyer, de Vries 2012)

Most earth observation applications deal with so-called externalities, such as impact on the environment.
It is difficult to capture these in terms of conventional cost-benefit models.

To tackle this, the following framework for analysis of earth observation applications is developed:

Framework for analysis



Step-by-step analysis of the benefits of earth observation (source: GEONetCab, 2013)

Key questions

- Does the new application cause a paradigm shift?
- Is the current business or organization process improved?
- Does the application provide economic value that can be quantified?
- Is a clear measurable goal defined to which the earth observation application contributes?
- Is a future payment scheme or other economic mechanism foreseen in which the earth observation application fits?

Assessment of geospatial solutions

Rating of **characteristics** of geospatial solutions:

- fit-for-purpose
- comparative advantage
- complexity to user / ease- of-use
- elegance
- cost-benefit,
- sustainability
- resilience
- reproduction capacity / flexibility
- acceptance
- level of knowledge transfer required
- ethics, transparency, public accountability, objectivity & impartiality

Rating of **business environment**:

- **Willingness to pay** (by clients)
- **Embedding** (in organizational processes)
- **Openness** (transparency and ease of doing business, access to markets)
- **Institutions** (is the institutional environment conducive to doing business, acceptance of new solutions?)

Fit-for-purpose

An important, but often forgotten requirement:
Does the product or service do what it is supposed to do to solve a certain problem?

In other words: is it really a solution or just an attempt towards a solution?

- Quantitative: not applicable
- Qualitative (on scale of 1 to 5): based on description of what the EO solution actually does

Comparative advantage

What it does significantly better than other solutions to the same problem.

For earth observation usually the comparative advantages of greater accuracy, better resolution in time and space, comprehensive overview of large areas and near real-time information provision are mentioned as comparative advantages.

- Quantitative: calculation of degree in which the EO solution is better than alternatives
- Qualitative (on scale of 1 to 5): based on listing of comparative advantages

Complexity (to user) / ease-of-use

At all levels in the value chain the users (professionals and end-users) are able to work with the product or service.

- Quantitative: not applicable
- Qualitative (on scale of 1 to 5): based on user testimonials and user surveys

Elegance

Once you get the idea behind this product or service, you want to be part of the community that uses it.

This sense of belonging facilitates the formation of user groups that provide valuable feedback.

- Quantitative: none, or it should be the size of the user community
- Qualitative (on scale of 1 to 5): based on user testimonials and user surveys

Cost-benefit

The cost-benefit of the product or service is quantified and sufficiently attractive, also in the long-term.

- Quantitative: cost-benefit calculation
- Qualitative (on scale of 1 to 5): based on quantitative assessment

Sustainability

The product or service can be delivered when it is needed.
There is a long-term perspective that guarantees delivery.

Sustainability concerns the following aspects:

- ✓ Long-term data availability
- ✓ Availability of finance/funds to provide the solution continuously for present and future use
- ✓ Long-term institutional / governmental interest and support
- ✓ Long-term user interest for a solution that addresses real needs

- Quantitative: not applicable
- Qualitative (on scale of 1 to 5): based on sensitivity analysis of the EO solution

Resilience

In case of extremes or breakdown in the value chain, the product or service can still be delivered at an acceptable level. Alternatives (plan B) are available (and developed).

- Quantitative: cost-benefit calculation of plan B
- Qualitative (on scale of 1 to 5): based on risk analysis of the EO solution

Reproduction capacity / flexibility

The product or service can be easily applied or adapted for use in another region or another situation, while still providing the solution without (too much) extra cost.

- Quantitative: calculation of reproduction costs for application in other regions or situations; measurement of spreading of actual use
- Qualitative (on scale of 1 to 5): based on quantitative assessment and description of EO solution

Acceptance

The users intuitively get what the product or service is about and are interested. They accept it as a solution to their problem.

- Quantitative: none, or survey results about acceptance. After introduction of the solution: number of clients and/or users
- Qualitative (on scale of 1 to 5): based on user testimonials and user surveys

Level of knowledge transfer required

The training requirements for professionals and other users along the value chain are clear and associated costs and efforts are acceptable.

- Quantitative: cost and time required to get the users at the desired knowledge and skill level
- Qualitative (on scale of 1 to 5): based on knowledge transfer plans and evaluation of training activities

Ethics, transparency, public accountability, objectivity & impartiality

Application of Earth observation increases the level of objectivity and impartiality in decision-making processes, including conflict resolution. The application improves transparency and public accountability. It raises no ethical issues or if it does, as in the case of privacy concerns, these are resolved in a satisfactory way for all parties concerned.

- Quantitative: not applicable
- Qualitative (on scale of 1 to 5): based on user testimonials and user surveys

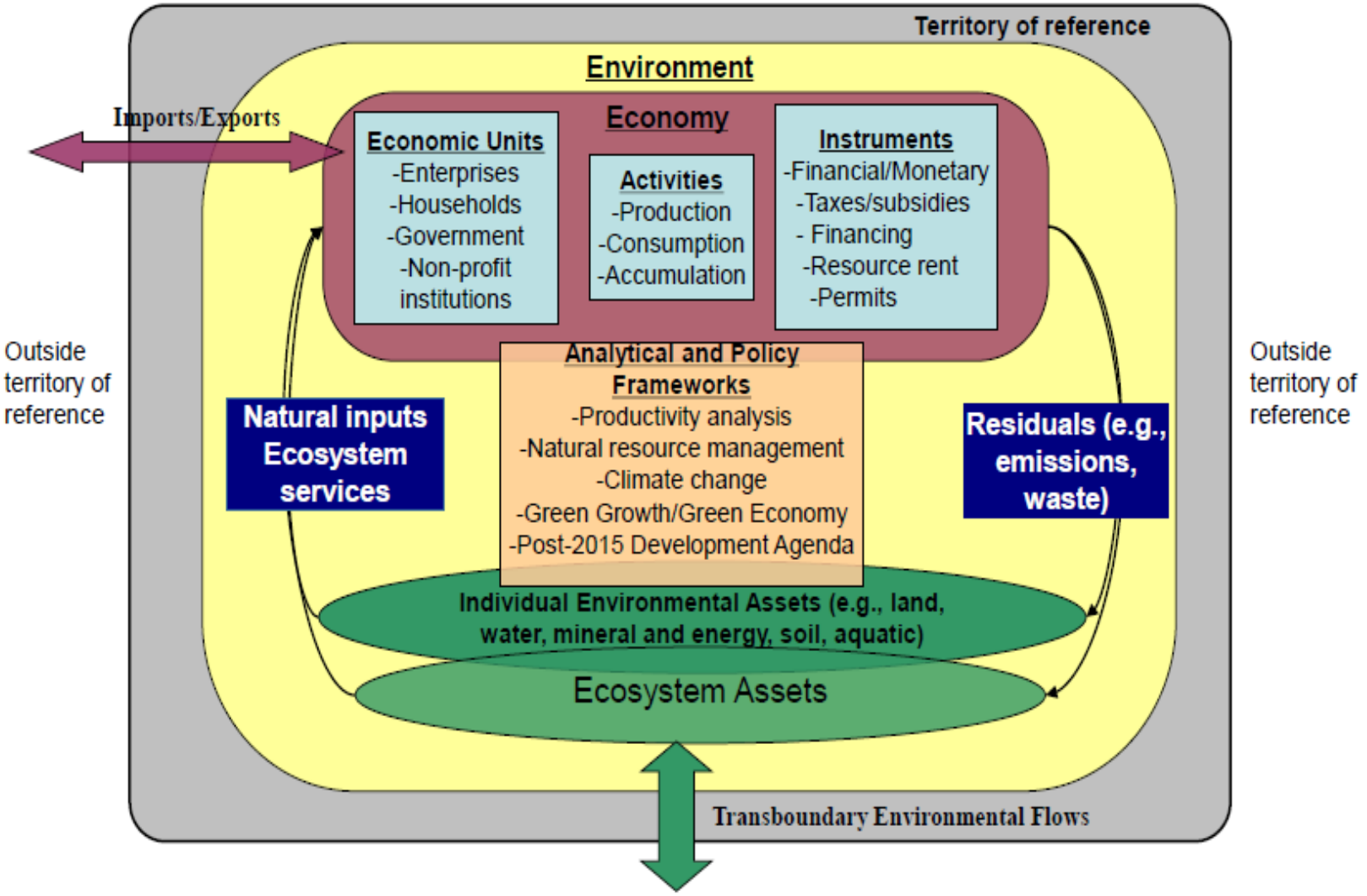
Several attempts have been made to introduce environmental accounting and to enlarge the sphere of the conventional economy to include and quantify impact on ecosystems.

The following slides give some examples:

Environmental accounting & payment for ecosystem services

- **SEEA:**
  System of Environmental-Economic Accounts
  (EC, FAO, IMF, OECD, UN, WB)
- **WAVES:**
  Wealth Accounting and the Valuation of Ecosystem Services (global partnership, led by World Bank)
- **TEEB:**
  The Economics of Ecosystems and Biodiversity
  (group led by UNEP)

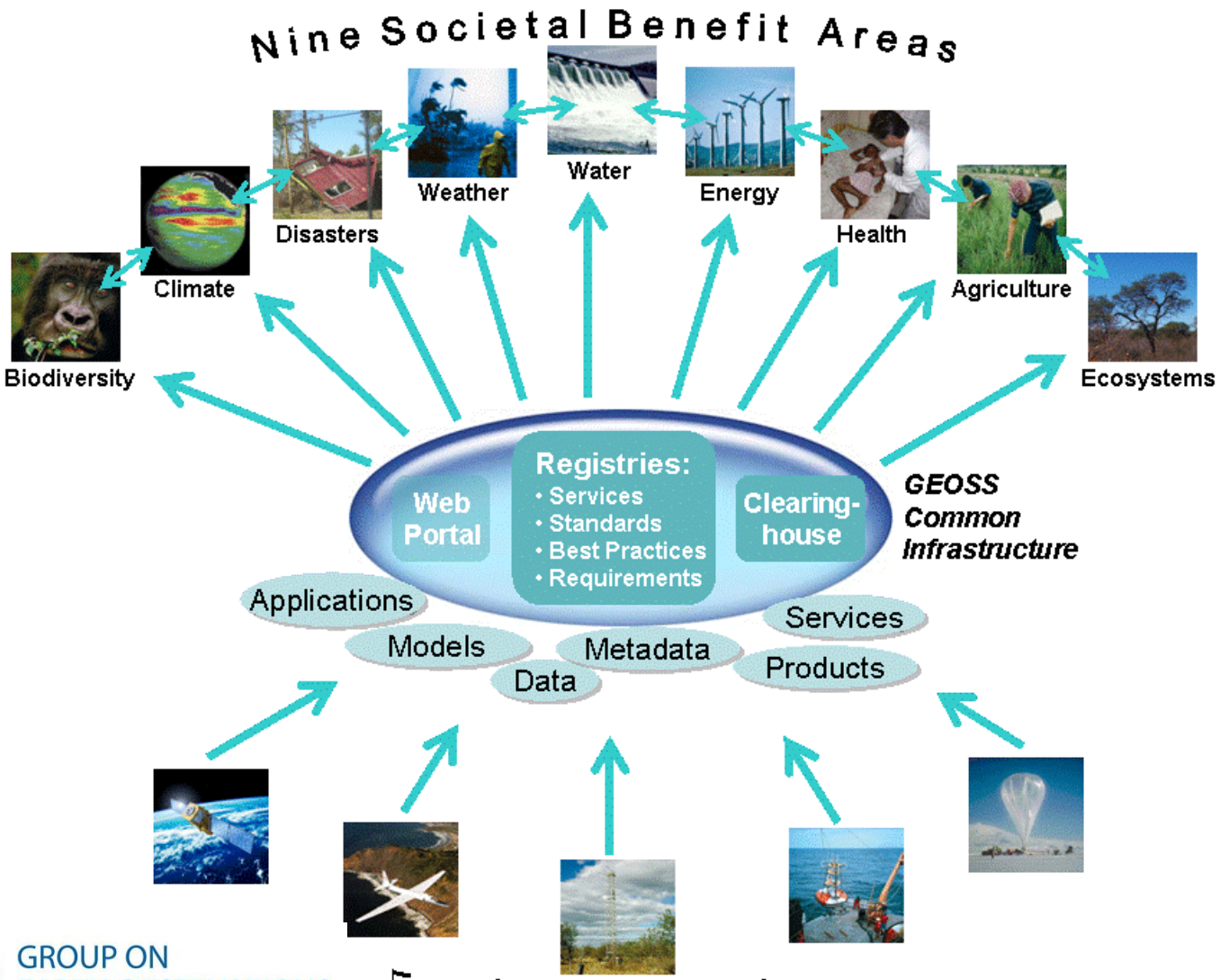
SEEA Conceptual Framework



Source: SEEA conceptual framework report (EC, FAO, IMF, OECD, UN, WB 2012)

For earth observation the work of the Group on Earth Observations (GEO) is essential to achieve the goal of a Global Earth Observations System of Systems (GEOSS), resulting in the shared GEO common infrastructure (GCI):

Group on Earth Observations



GROUP ON EARTH OBSERVATIONS

Marketing elements

- Customer value propositions
- Crossing the technology chasm
- Creating shared value
- Promotion tools

Customer value propositions capture the unique value of a product or services as perceived and appreciated by the customer.

Interestingly, they can differ completely from the features that the provider considers most important:

Customer Value Propositions

VALUE PROPOSITION	ALL BENEFITS	FAVOURABLE POINTS OF DIFFERENCE	RESONATING FOCUS
Consists of:	All benefits customers receive from a market offering	All favourable points of difference a market offering has relative to the next best alternative	The one or two points of difference whose improvement will deliver the greatest value to the customer
Answers the customer question:	"Why should our firm purchase your offering?"	"Why should our firm purchase your offering instead of your competitor's?"	"What is *most* worthwhile for our firm to keep in mind about your offering?"
Requires:	Knowledge of own market offering	Knowledge of own market offering and next best alternative	Knowledge of how own marketing offering delivers value to customers, compared with next best alternative
Has the potential pitfall:	Benefit assertion	Value presumption	Requires customer value research

Source: Customer value propositions in business markets (HBR 2006)

Buyer behaviour & motivation

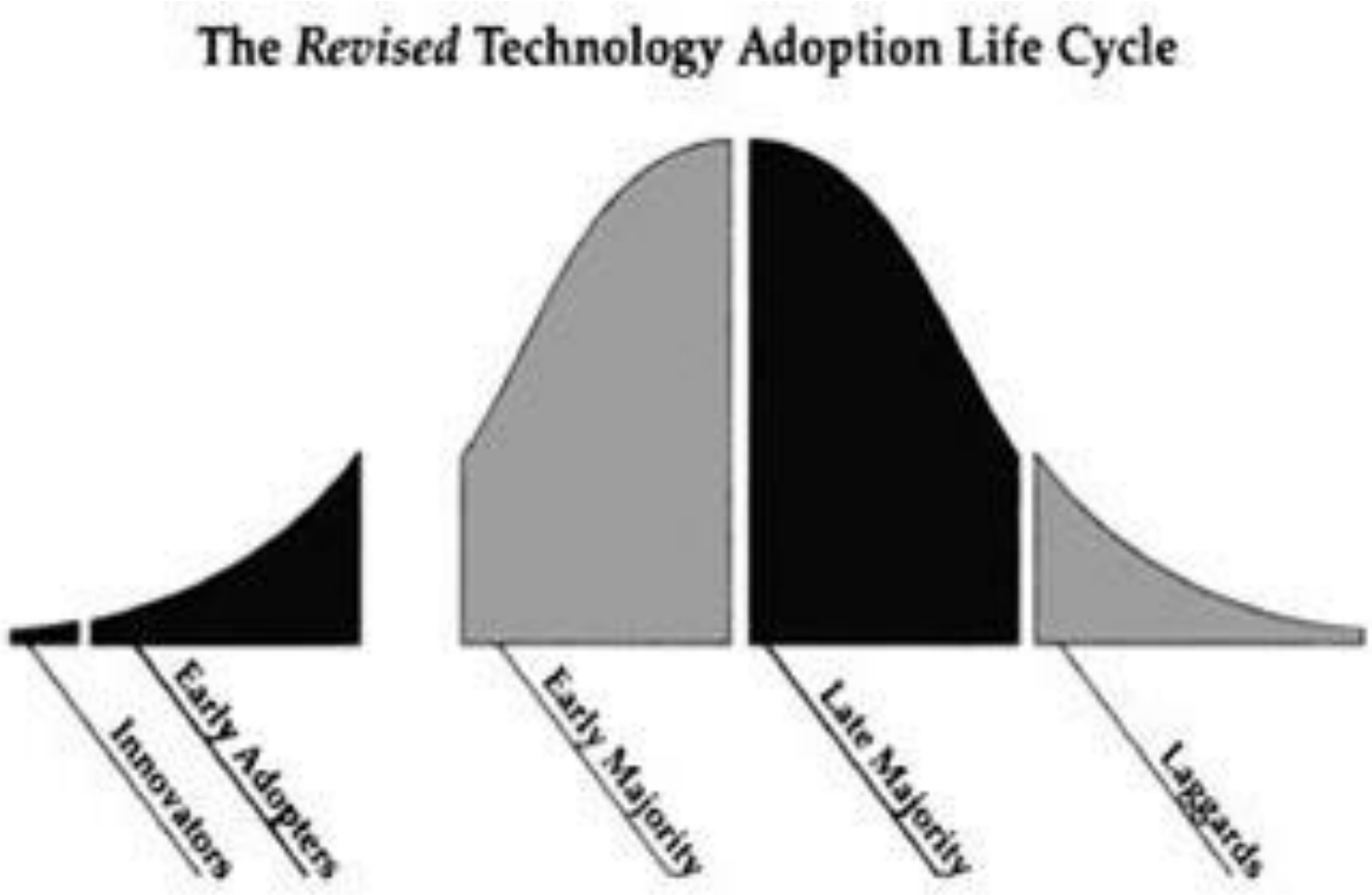
Type	Buyer behaviour	Motivation
Transactional sales	Intrinsic value buyers: “keep it cheap and easy to do business”	Understands the product Perceives it as substitutable Cost focus Resents time ‘wasted’ with sales people
Consultative sales	Extrinsic value buyers: “I don’t know the answer: help me analyse and solve the issue	Focus on how the product is used Interested in solutions and applications Values advice and help Needs the sales person

Source: Rethinking the sales force (Rackham, de Vincentis 1999)

Even when customer value propositions are well captured and formulated, introduction of solutions that involve new technology will have to overcome some hurdles.

This is called “crossing the technology chasm”:

Crossing the technology chasm



Source: Crossing the chasm (Moore 1991)

Crossing the technology chasm

- Most clients of EO products and services belong to the early and late majority,
- They are pragmatists and are not prepared or willing to take substantial risk: the solution should work and be reliable.
- Once convinced, the pragmatists will be long-term clients.

Source: Crossing the chasm (Moore 1991)

More information:

Creating & delivering your value proposition
– managing customer experience for profit
(Barnes, Blake, Pinder; 2009)

Customer value propositions in business markets
(Anderson, Narus, van Rossum [Harvard Business Review]**; 2006)**

Rethinking the sales force:
refining selling to create and capture customer value
(Rackham, de Vicentis; 1999)

Crossing the chasm
– marketing and selling high-tech products to mainstream customers
(Moore; 1991)

Creating shared value is a key element of successful implementation of earth observation solutions.

To achieve this, in most cases earth observation applications have to be integrated into more general (business or organizational) processes:

Create shared value

Involves cooperation between:

- **Public sector**
- **Private sector**
- **Social sector**

Opportunity for earth observation (integrated) solutions:

- Integrate EO in general business / organizational process
- Integrate different EO (and GIS and navigation) functionalities

Based on all considerations dealt with in the previous slides, there are some practical approaches that can be applied in combination to promote earth observation applications:

Tools for earth observation marketing:

- Success stories (in non-technical language, feasible, replication capacity, sustainable)
- Marketing toolkits (international trends, earth observation examples, references)
- Pilot projects, innovation funds, quick-wins (demonstration that EO actually works)
- Promotion outside EO community (fairs, seminars, lunch-bag meetings, magazines)
- Resource facilities for reference and capacity building (distributed, but connected, in different languages)

Source: Marketing earth observation products and services (Noort 2013)

Business elements

Business elements:

- **Proposal writing**
- **Business procedures**

Proposal writing is an art in itself.

During the GEONetCab and EOPOWER projects templates have been developed for writing successful proposals:

Proposal outline

1. Introduction / relevance
2. Objective(s)
3. Activities
4. Output
5. Management & evaluation
6. Risk assessment
7. Time schedule
8. Budget

   Annexes

(more detailed version in separate document,
see www.eopower.eu or www.hcpinternational.com)

Other guides that may be useful:

- Civicus: writing a funding proposal
- Michigan State University: guide for writing a funding proposal
- ESRI: writing a competitive GRANT application
- REC: project proposal writing

If you run a company, compete for assignments and manage projects, a structured approach towards responsibilities, tasks, implementation and documentation is needed.

The following business procedures may be helpful:

Business procedures

1. On acquisition
2. On offers
3. On negotiation
4. On contracts
5. On project management
6. On travel & deployment
7. On deficiencies & complaints
8. On internal organization
9. On finance

(more detailed version in separate document,
see www.eopower.eu or www.hcpinternational.com)

Again:

- **SHARED PROBLEM**
- **SHARED LANGUAGE**
- **SHARED SOLUTION**

4. Capacity Building

General

Marketing is promotion + capacity building.

Especially for the introduction of new technologies capacity building is important at all levels.

Capacity building is the instrument to increase self-sufficiency and make solutions work.

General references for capacity building, open data and success stories

GEO Portal: www.earthobservations.org

Capacity building resource facility www.eopower.eu
compilation of tutorials, references, open-source software, etc.

Satellites going local: *share good practice* **(Eurisy handbooks)**
www.eurisy.org

Earth observation for green growth (ESA, 2013)

General references for capacity building, open data (2)

Bringing GEOSS services into practice:
how to use data from the GEO portal and how to provide input
www.envirogrids.net

Science education through earth observation for high schools:
basic tutorials on all kind of subjects
www.seos-project.eu

Copernicus briefs:
information on satellite applications for different topics
www.copernicus.eu/pages-secondaires/publications/copernicus-briefs/

Capacity building resources for energy & mining (1):

MESoR training seminar on solar radiation services
presentations from the MESoR training seminar + use cases
See also MESoR user handbook & RETScreen engineering textbook

AEGOS Inventory of available curricula of training centers and practices
overview of IT, data management, GIS, RS and web applications courses (Europe, Africa, distance)and thermal infrared

AEGOS Concept note about the needs in capacity building and training
overview of competencies required to work with the AEGOS data infrastructure and the existing gaps in Africa

Capacity building resources for energy & mining (2):

EnerGEO knowledge portal

http://energeo.researchstudio.at/energeo/catalog/main/home.page

communicates and brokers information for a global assessment of the current and future impact on the environment and ecosystems from the energy domains connecting experts and casual users across businesses

Clean energy projects, RETScreen engineering & cases textbook

description of clean energy decision-making software; uses worldwide database of NASA satellite-derived meteorological data (NASA surface meteorology and solar energy dataset (SSE)) from a ten-year period (1983 – 1993)

Capacity building resources for energy & mining (3):

EO-MINERS
http://www.eo-miners.eu/additional_material/am_introduction.htm
factsheets, indicators, leaflets and reports on earth observation and mining

ENDORSE (energy downstream services) www.endorse-fp7.eu
reports on renewable energy and energy saving

IMPACTMIN http://impactmin.geonardo.com
e-training on new methods and a toolset for impact monitoring of mining operations using earth observation and in-situ data

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