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# A European Perspective on Digital Earth

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# Introduction

- Position Paper “Toward Next Generation Digital Earth”, 2008
- Digital Earth Session at ISRSE33, Stresa, May 2009
- Digital Earth 6<sup>th</sup> Symposium, Beijing
  - ISDE EC members met to discuss how to strengthen European contribution
- JRC Meeting, January 2010, Ispra “European View on DE”

International Journal of Spatial Data Infrastructures Research, 2008, Vol. 3, 146-167.

*Editorial*

## **Next-Generation Digital Earth\***

A position paper from the Vespucci Initiative for the Advancement of Geographic Information Science

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### **Abstract**

This position paper is the outcome of a joint reflection by a group of international geographic and environmental scientists from government, industry, and academia brought together by the Vespucci Initiative for the Advancement of Geographic Information Science, and the Joint Research Centre of the European

## Meeting “European View on DE” (JRC, 14 January 2010)

- **Scope**

- Better understand the DE vision
- Identify key priorities from a European Perspective
- Identify actions to raise awareness of DE in Europe
- Streamline European contribution to DE

- **Participants**

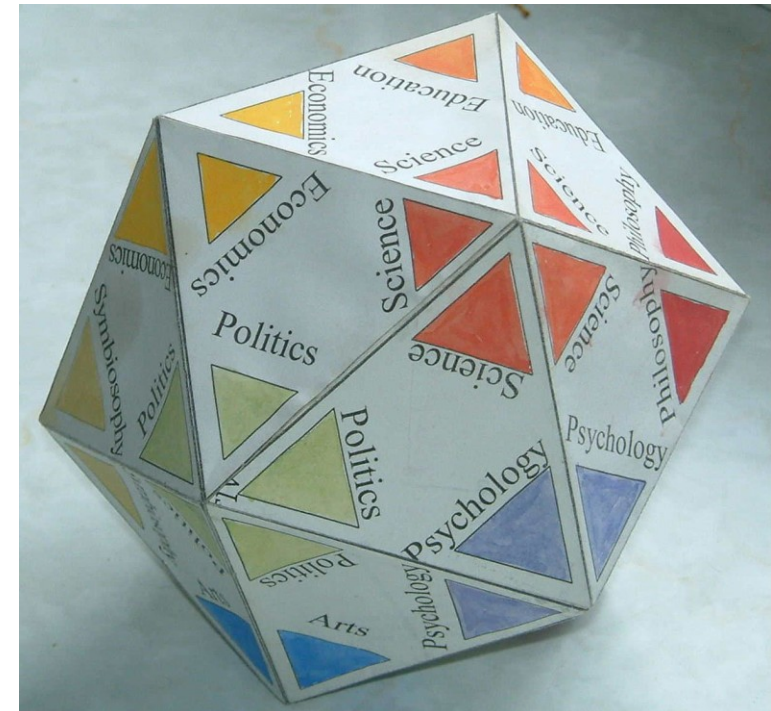
- **Annoni**, Craglia , De Longueville, **Ehlers**, Georgiadou, Giacomelli, **Konecny**, Luraschi, Ostlaender, **Remetey-Fülöpp**, **Rhind**, Smits, Schade
  - Joint Research Centre, University of Osnabrueck, Institute for Geoinformatics and Remote Sensing, University of Twente, Faculty for Geo-information Sciences and Earth Observation, Critigen Consulting, Masaryk University, Department of Geography, Hungarian Association for Geo-information, Portsmouth Hospitals NHS Trust

## Introduction (1/2)

- Al Gore vision of DE articulated by 1998
- ISDE very successful in promoting DE through Symposia, Summits and IJDE
- Developments such as Digital Asia , Virtual Australia , and the establishment of CEODE indicate the vibrancy of the DE concept in Asia
- Key role by the private sector (e.g. Google, Microsoft,..) in making the concepts of DE familiar to hundreds of millions of users
- In Europe, relevant developments are taking place at multiple levels (INSPIRE, GMES, eGov, Digital Agenda for Europe, Europe 2020,..)

## Introduction (2/2)

- Notwithstanding these important developments, the benefits of DE technologies have not yet properly exploited
- **There has been a lack of holistic thinking about what benefits Digital Earth can offer and how best to exploit DE and extend it – the ‘why’ rather than the ‘what’**



## DE Vision – a SWOT analysis - STRENGTHS

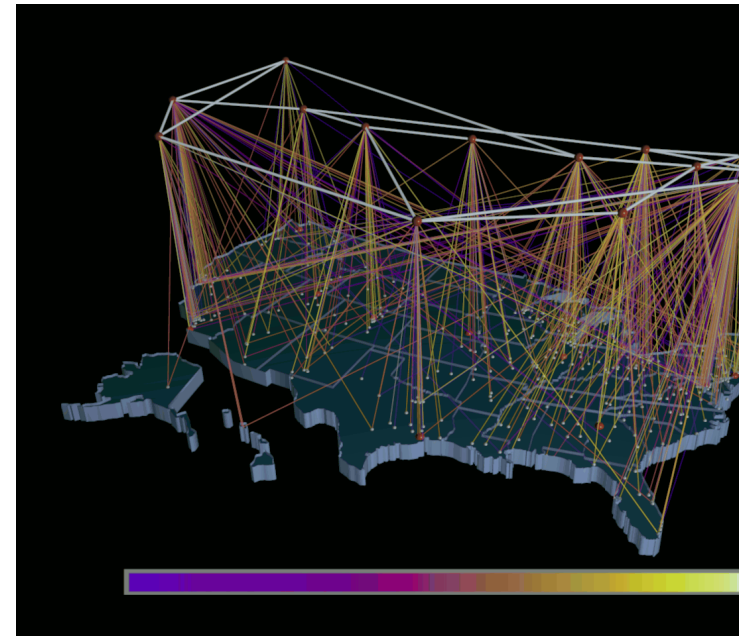
- DE is a very useful metaphor
- DE displays some of the characteristics of “magic concepts”
- DE has a global dimension, inclusive of multiple applications and themes
- DE has a strong political backing since the beginning
- DE has a strong technological component
- DE provides a flexible framework to adapt to evolving technologies



Magic Tricycle - Car Design News™ 2008

## DE Vision – a SWOT analysis – WEAKNESSES (1/2)

- DE encapsulates many different concepts
  - e.g. information system, infrastructure to visualise and access geo-information, a virtual model of the Earth (or parts of it), an approach to explore the Earth system...
- The DE Vision has
  - Ambiguities on its nature: political, vs. academic, vs. a technological initiative
  - Ambiguities on main target audience: policy-makers and planners vs. scientific community or the general public
  - Unclear research focus, which may reduce interest in the scientific community
- DE has uneven visibility in different regions of the world



National Center for Supercomputing Applications  
University of Illinois

## DE Vision – a SWOT analysis – WEAKNESSES (2/2)

- Unclear relationships and added value of DE in relation to other initiatives such as GEOSS, SDIs, Eye on Earth,...
- Original DE vision does not properly reflect recent changes society including
  - major role of the private sector (Google, Microsoft), and
  - emergence of social networks (Facebook) at the global level
- Because of the uncertainties above, it is difficult to communicate clearly what DE is, and how it will be put into practice
- This difficulty in communicating the concept makes harder to consolidate links and collaborations with other initiatives and to develop a DE community with active members from different disciplines

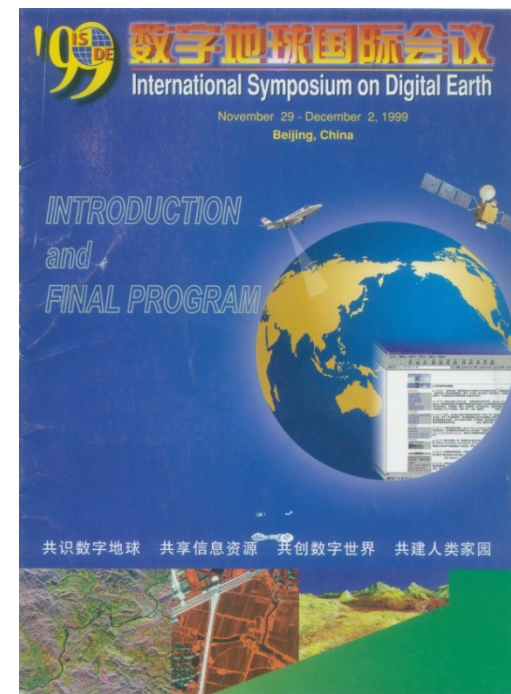


GROUP ON  
EARTH OBSERVATIONS



## DE Vision – a SWOT analysis –OPPORTUNITIES (1/2)

- The increased availability of digital content from public, private sectors and citizens supports the vision of DE
- Developments in technology and policy foster increased data access and sharing
- ISDE with 10 years of history, strong political backing, and the support of the Chinese Academy of Science provide a sustainable platform for achieving the vision
- Increasing profile of DE within the scientific community through symposia and the inclusion of the IJDE in the scientific citation index
- Increasing recognition of the need to build bridges across different related initiatives, as witnessed by the membership of the ISDE in GEO
- Multiple research and government funding opportunities available to develop components and applications of DE



## DE Vision – a SWOT analysis – OPPORTUNITIES (2/2)

- Profiling DE as a central vision space where ‘Geo-Imagineers’ can think out-of-the-box:
  - where they can extend and modify the vision of DE by incorporating innovative ideas and edge-cutting technologies, combining disciplines, and
  - ultimately feeding new ideas and requirements into research projects and more practically oriented initiatives



## DE Vision – a SWOT analysis - THREATS

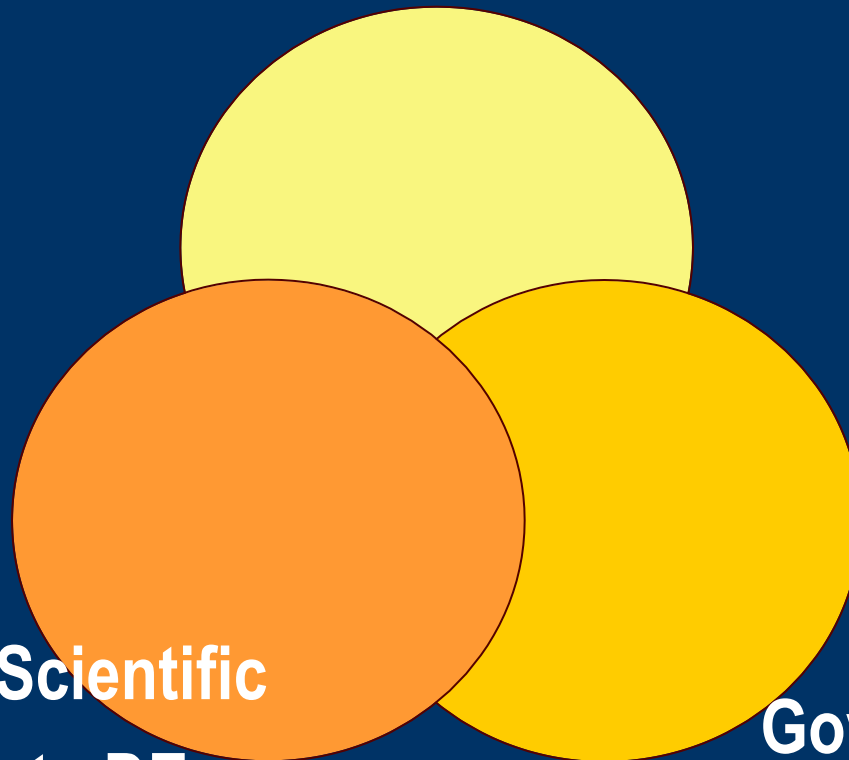
- No shared ownership over the vision of DE
- Existing leaderships do not always recognize the importance and power of the DE vision as a mechanism to advance the realisation of DE
- Initiatives are sometimes competing for resources rather than exploiting synergies



- Private sector's own vision and interpretation of DE, and the resources at its disposal, may overshadow and make irrelevant governmental or academic efforts in this area
- Because the success of the private sector's mass market applications, the need for research and development in the area of DE may become less evident to the funders of public sector research programmes

## Topics of European Interest

**Citizens' Involvement in the  
Development and Use of DE**



**Integration of Scientific  
Research into DE**

**Governance**

## Citizens' Involvement in the Development and Use of DE

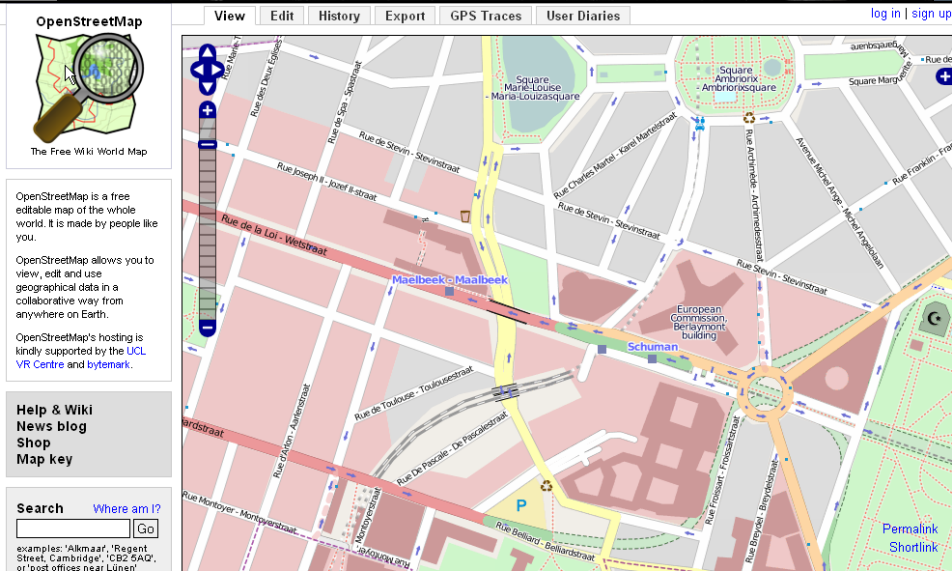
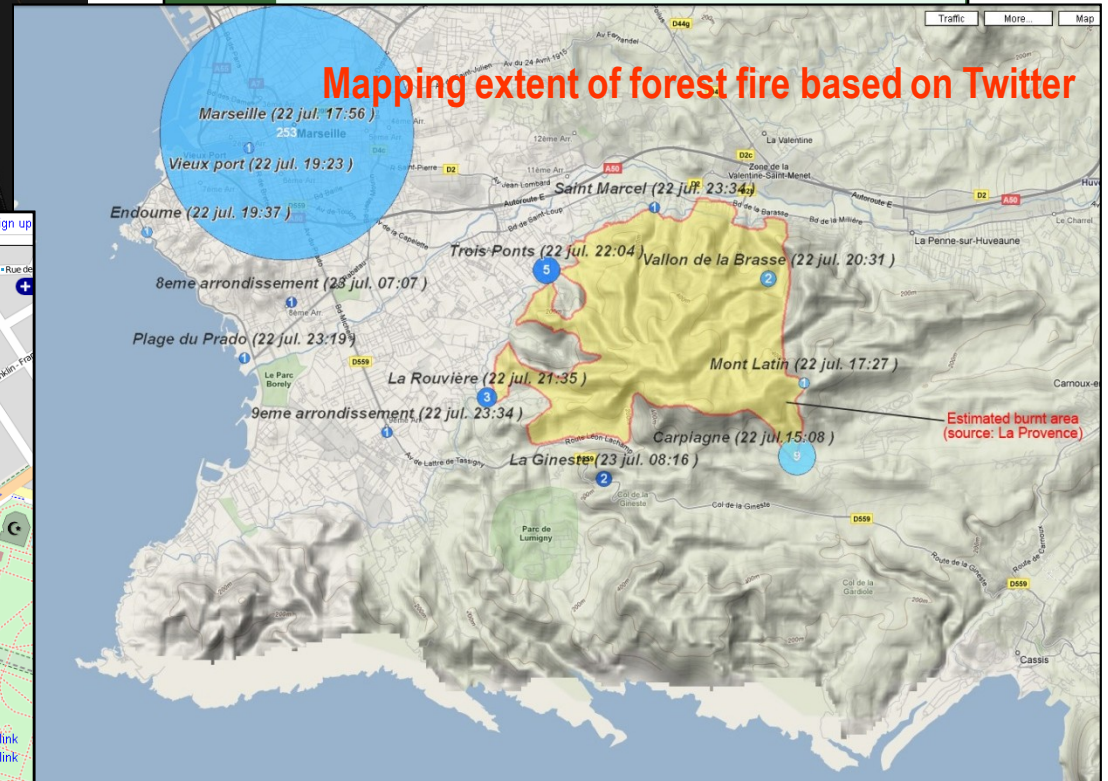
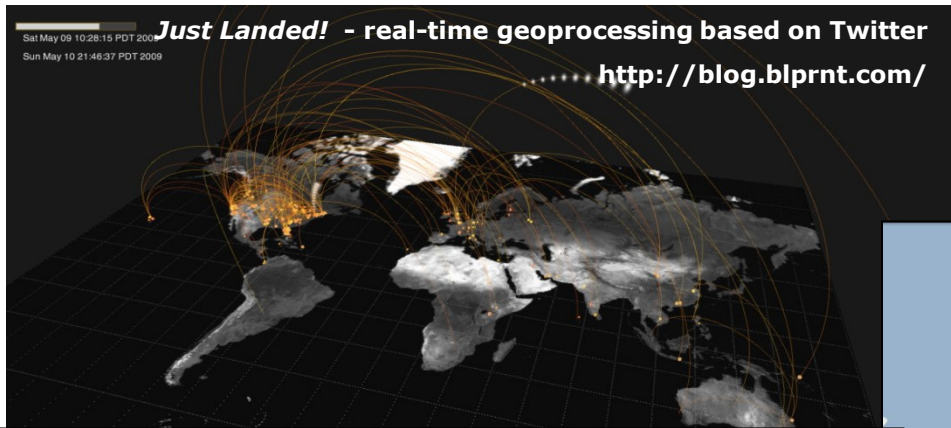
- DE involves multiple stakeholders. While the roles of environmental and social scientists, technologists, and decision-makers are widely acknowledged, those of individual citizens have yet to be articulated
- we suggest giving priority to the following three:
  1. ***contribution of individuals as providers of data***
  2. ***role of individuals as users of DE***
  3. ***impacts of DE on individuals and society at large***



## ***Contribution of individuals as providers of data***

- several examples, relevant for a variety of applications, two main classes:
  1. those in which individual provide data through an agreed, and validated methodological framework and
  2. those in which information voluntarily provided by individuals is analysed after the event with different methodologies to control for quality and fitness for purpose
    - Such methods could include the use of editors as in the case of Wikipedia, data mining and clustering techniques, ..

# Citizens as Providers of Voluntary Geographic and Environmental Data

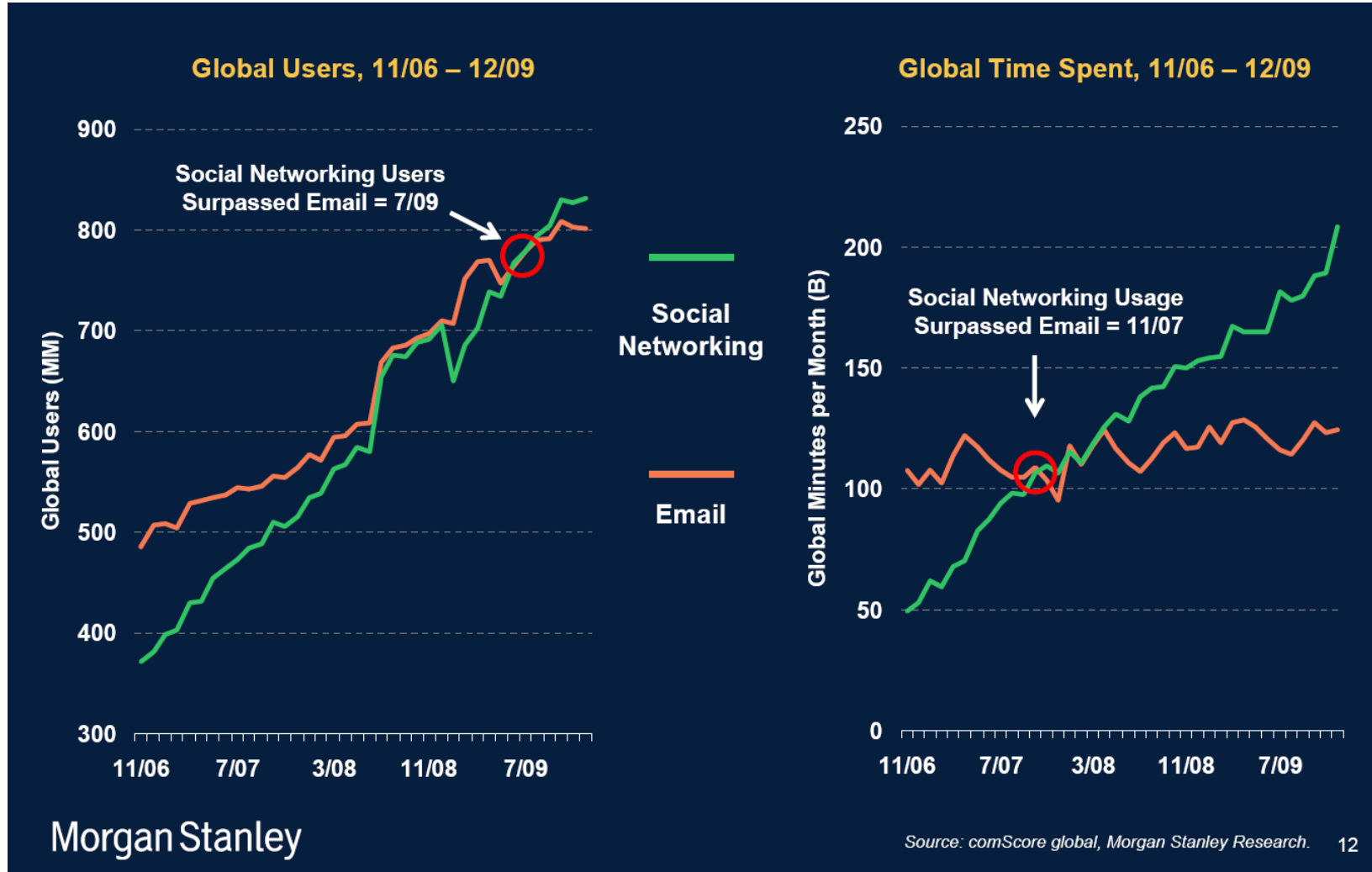


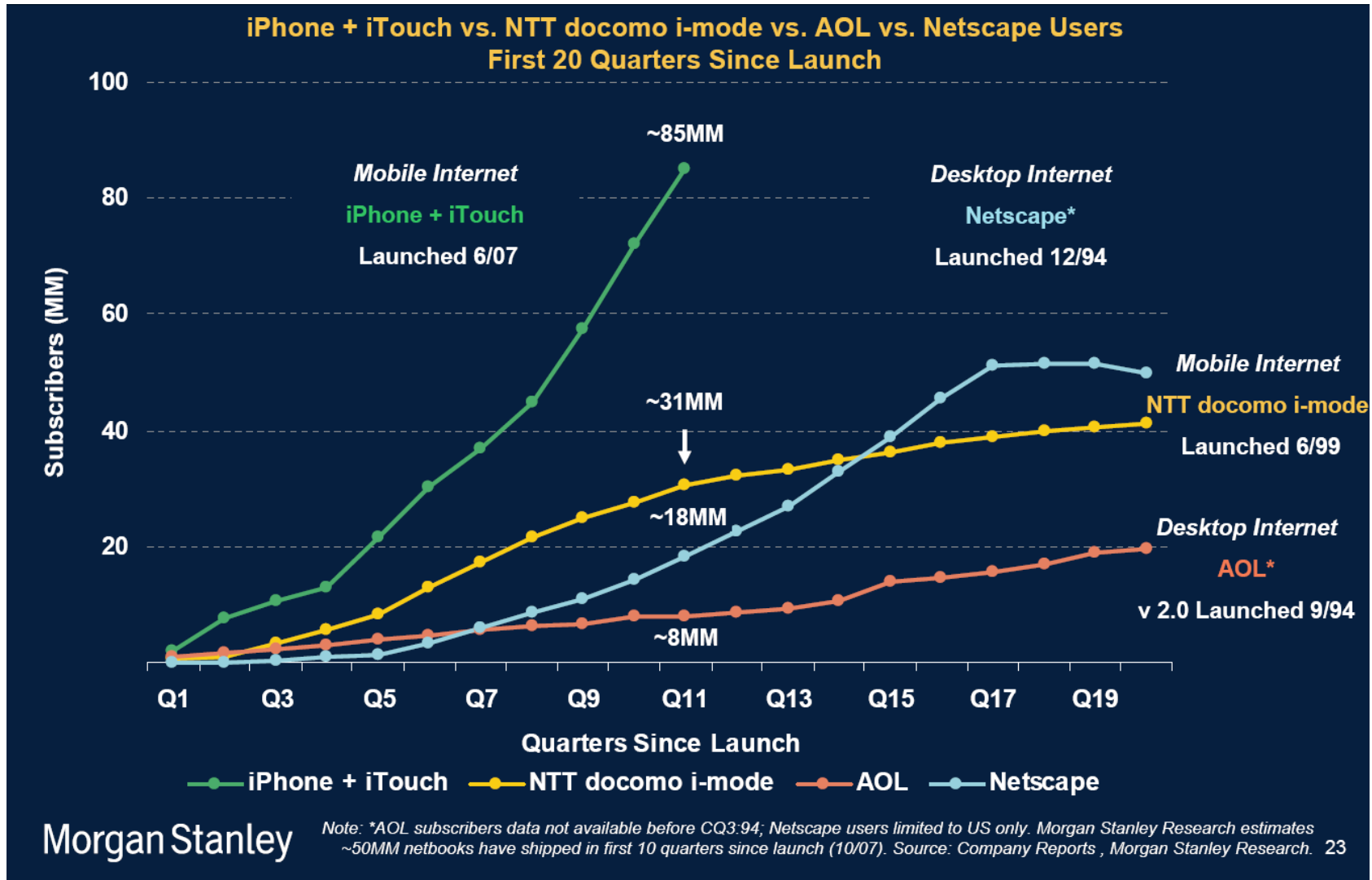
## *The role of individuals as users of DE*

- important to consider issues of usability, relevance, format, i.e. different ways in which DE can become the instrument of choice to access information about the Earth physical and social phenomena as suggested in the original vision in 1998



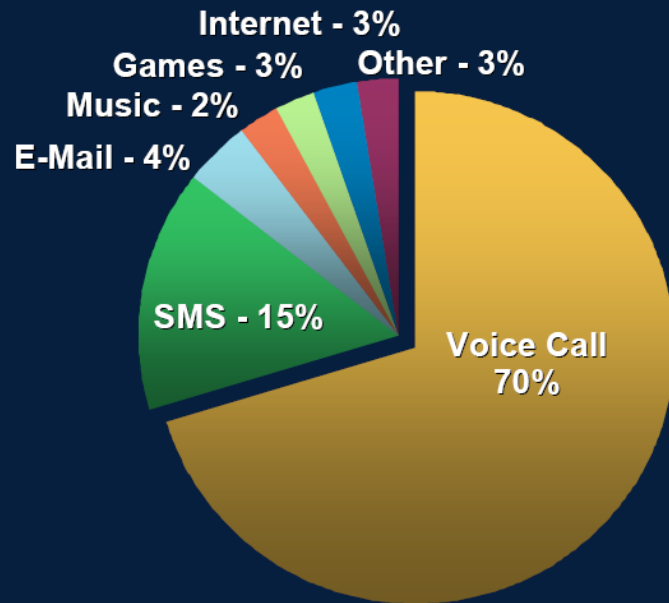




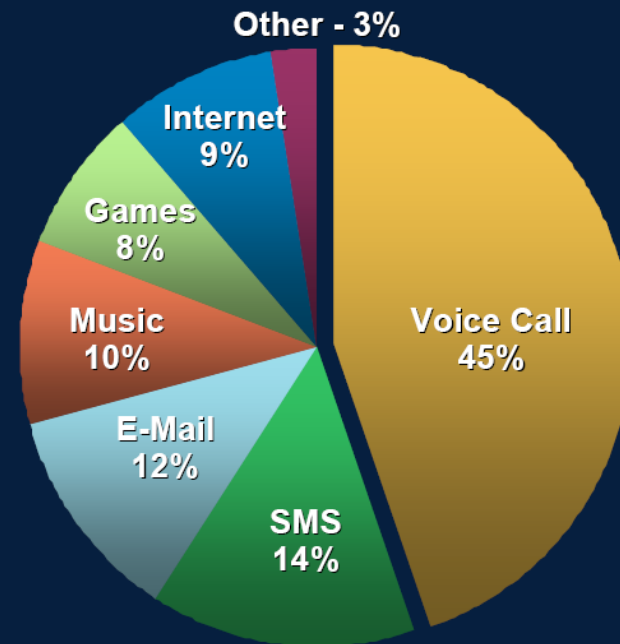


## Daily Usage Breakdown, % of Time Spent on Each Activity

**Average US Cell Phone User  
40 Minutes Per Day**



**iPhone User  
60 Minutes Per Day**



*Note: CTIA estimates average voice call time per day is 27 minutes, assuming 70% of total time spent is on voice call, per iSuppli, total average time spent on cell phone is approx. 40 minutes per day. iPhone time spent per day is our estimates. Source: iSuppli ConsumerTrak survey, 10/08, Morgan Stanley Research.*

**Morgan Stanley**

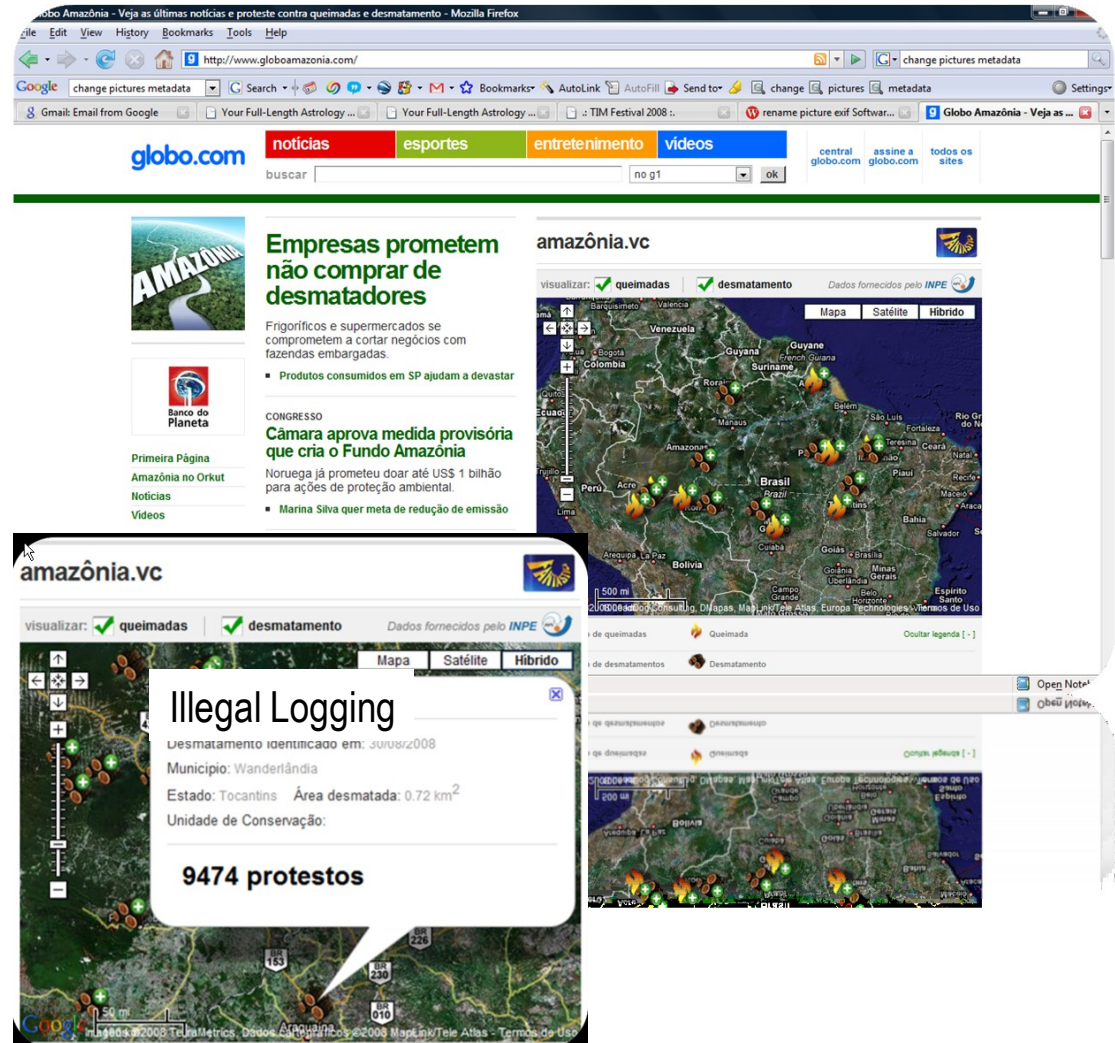
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## The impacts of DE on individuals and society at large

- research and ethical issues on
  - privacy and confidentiality, openness and transparency versus security considerations
  - measurement of social, economic and environmental costs and benefits of the deployment of DE on society including
    - democratic accountability of the action of government
    - increased trust in science through better understanding and participation in scientific processes

## Social impact: greater participation and accountability

- Globo Amazonia launched by TV Globo in Brazil in Sept. 08
- Interactive site with satellite data provided by INPE to report illegal logging and clearing fires.
- 41 million reports in 3 months
- Political impact through back up of TV network



The screenshot displays the website 'globo.com' with a navigation bar for 'notícias', 'esportes', 'entretenimento', and 'videos'. The main content area features several news items:

- Empresas prometem não comprar de desmatadores**: Frigoríficos e supermercados se comprometem a cortar negócios com fazendas embargadas.
  - Produtos consumidos em SP ajudam a devastar
- Câmara aprova medida provisória que cria o Fundo Amazônia**: Noruega já prometeu doar até US\$ 1 bilhão para ações de proteção ambiental.
  - Marina Silva quer meta de redução de emissão

Below the news, there is a section for 'amazônia.vc' which includes a satellite map of the Amazon region. The map shows various markers for 'queimadas' (fires) and 'desmatamento' (deforestation). A pop-up window titled 'Illegal Logging' provides details for a specific deforestation event:

- Desmatamento identificado em:** 30952008
- Município:** Wanderlândia
- Estado:** Tocantins **Área desmatada:** 0.72 km<sup>2</sup>
- Unidade de Conservação:**

At the bottom of the pop-up, it states '9474 protestos'.

## Integration of Scientific Research into DE (1/2)

Two perspectives are important and must be clearly integrated in DE:

1. framework for undertaking the research necessary to achieve DE
2. contribution of DE to science (see for example 1999 Beijing Declaration



**INTEGRATION**

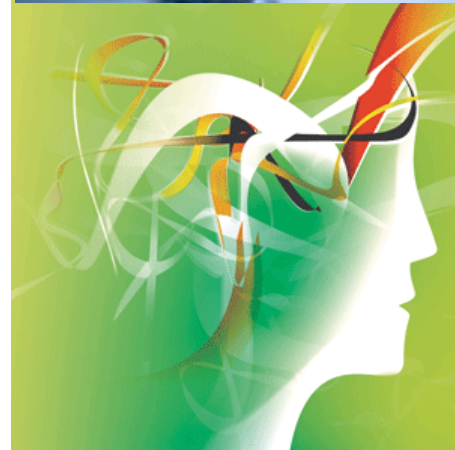
Just because you can, doesn't mean you should.

by supporting the **integration of environmental and social sciences models** at multiple scales addressing issues such as global change, climate change, land use change and environmental degradation, sea level rises, natural resource depletion, and the impacts of these phenomena on society and the economy at global, continental, and local levels.

## Integration of Scientific Research into DE (2/2)

### *European perspective*

- Important role of DE in representing and understanding cultural heritage (including multi-lingual aspects)
  - **Information integration** (multi source and heterogeneous, multi-disciplinary, multi-temporal, multi-scale, multi-media, and multi-lingual);
  - **space-time analysis and modelling**
  - **Intelligent descriptions** (automatic, user driven) of data, services, processes, models, searching and filtering;
  - **visualisation of abstract concepts in space**
  - **computational infrastructures** to implement the vision of DE and
  - **trust, reputation and quality models** for contributed information and services



## Governance (1/3)

governance is crucial for future development of DE

- **need to build connections and synergies** with the many related developments at national, continental, and global levels
  - *e.g. GEOSS, the United Nations activities on Global Geographic Information Management, the Earth System Governance Project of the International Human Dimensions Programme on Global Environmental Change, etc..*
- **need to work with the private sector to exploit the platforms and technologies currently available** and utilised by hundreds of million of users, **and to involve the public** in the development of DE.





## Governance (2/3)

### *European perspective*

- stronger integration of DE with INSPIRE, GMES, and SEIS, as well as GEOSS.
- other initiatives need to be monitored and exploited:
  - e.g. Digital Cities, European Institute of Innovation & Technology, funding opportunities available under the Framework Research and Development programme of the EU,..
- all of these initiatives must be targeted to address the innovation and sustainable growth challenges identified in the **Europe2020** Communication which for example also earmarks a **Digital Agenda for Europe** as one of its flagship initiatives.

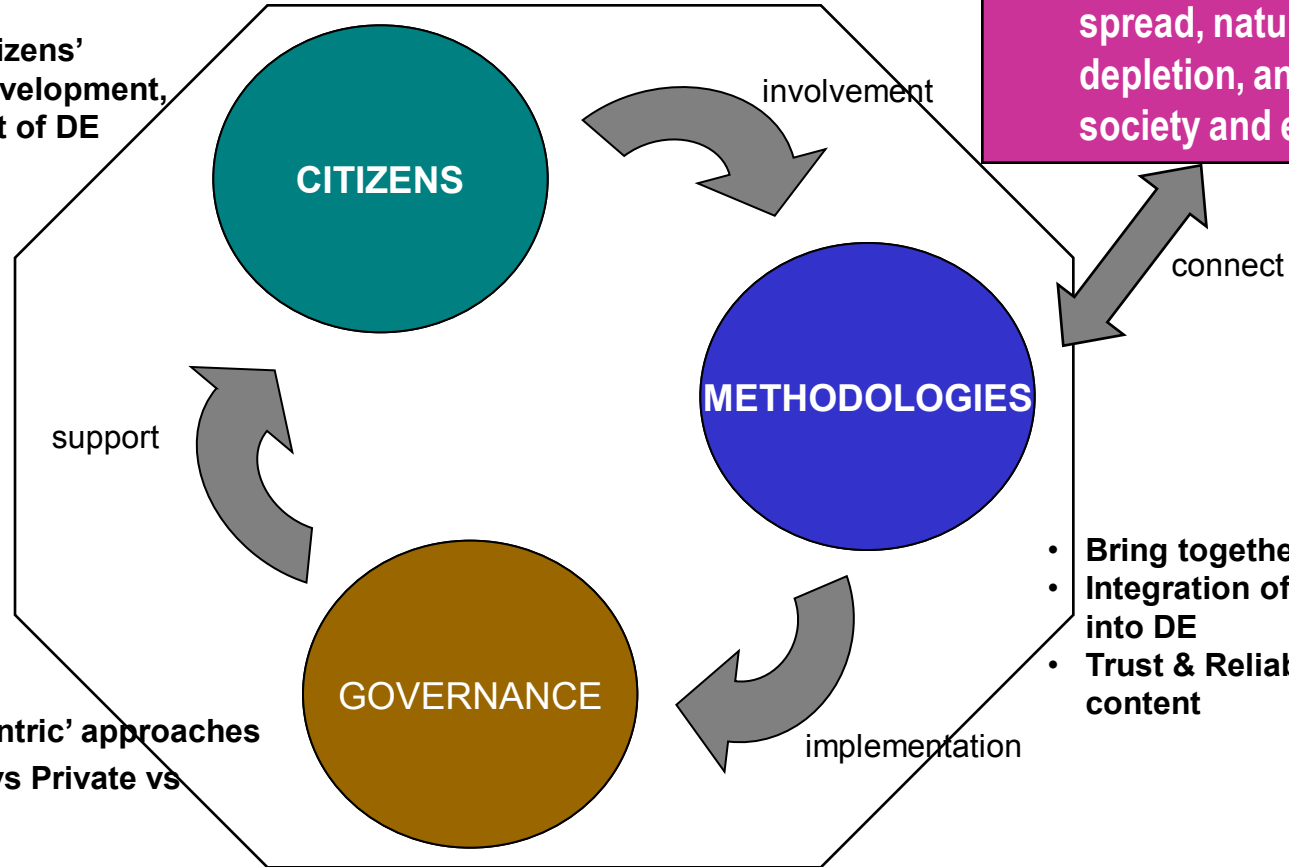
## Governance (3/3) *European perspective*

***Embedding DE as a driver for science but also for innovation and growth will make it possible to flourish in Europe and contribute more strongly to the global objectives of the ISDE***



# European Perspective

The role of private citizens' involvement in the development, use, and management of DE



global change and climate change, land-use change, sea level rise, environmental degradation, urban spread, natural resource depletion, and their impacts on society and economy

- **Distributed' vs. 'centric' approaches**
- **Multifacet: Public vs Private vs Citizens**
- **Multilevel**
- **Link to innovation and growth**

- **Bring together methods and tools**
- **Integration of scientific research into DE**
- **Trust & Reliability in information content**

# The Way Forward (initial actions)

1. To develop a more structured European research agenda and implementation mechanism e.g. through the establishment of a European Digital Earth research Network (**EDEN**).



2. Establish a European Special Interest Group (SIG) and coordinate better the European effort and sustain organisational activities

## European Digital Earth research Network (EDEN) (1/2)

- **Federate a number of research laboratories** in Europe doing research on DE and related topics
- Open a European **DE “building site”** by linking through interoperability arrangements the various heterogeneous components already existing (e.g. SDIs) taking advantage of
  - the INSPIRE implementation,
  - digital and virtual cities already in development in Europe,
  - digital landscapes, museums and libraries, and virtual cultural artefacts (e.g. the Acropolis), ...
- **In this way synergies, opportunities, and gaps become more evident and the “building Site” itself becomes the virtual laboratory in which to address the research priorities identified;**

## European Digital Earth research Network (EDEN) (2/2)

- Link to related activities at the global level (US, China, etc.);
- Provide greater visibility to the research effort
- **Undertake regular technology watch and market evaluation** in collaboration with the private sector to assess the potential impact of DE research on innovation and competitiveness at the European level
  - **ISDE Position Papers & Recommendations**

## European Special Interest Group (SIG)

- Provide a forum for monitoring relevant initiatives and help identify and channel research funding;
- Provide the base from which to establish linkages to relevant initiatives
- Jointly organise with these communities thematic events and workshops
  - to advance research on applied DE in Europe and raise awareness of the opportunities of DE for these communities;
- Contribute to raising awareness of DE by launching pilot projects and competitions (awards) and joint initiatives with other organisations (e.g. OpenStreetMap, the Electronic Cultural Atlas initiative), and the private sector (e.g. Google, Microsoft);
- Support activities to foster cross-fertilisation between DE and the ISDE with other pertinent activities such as GEOSS.



# European Proposals

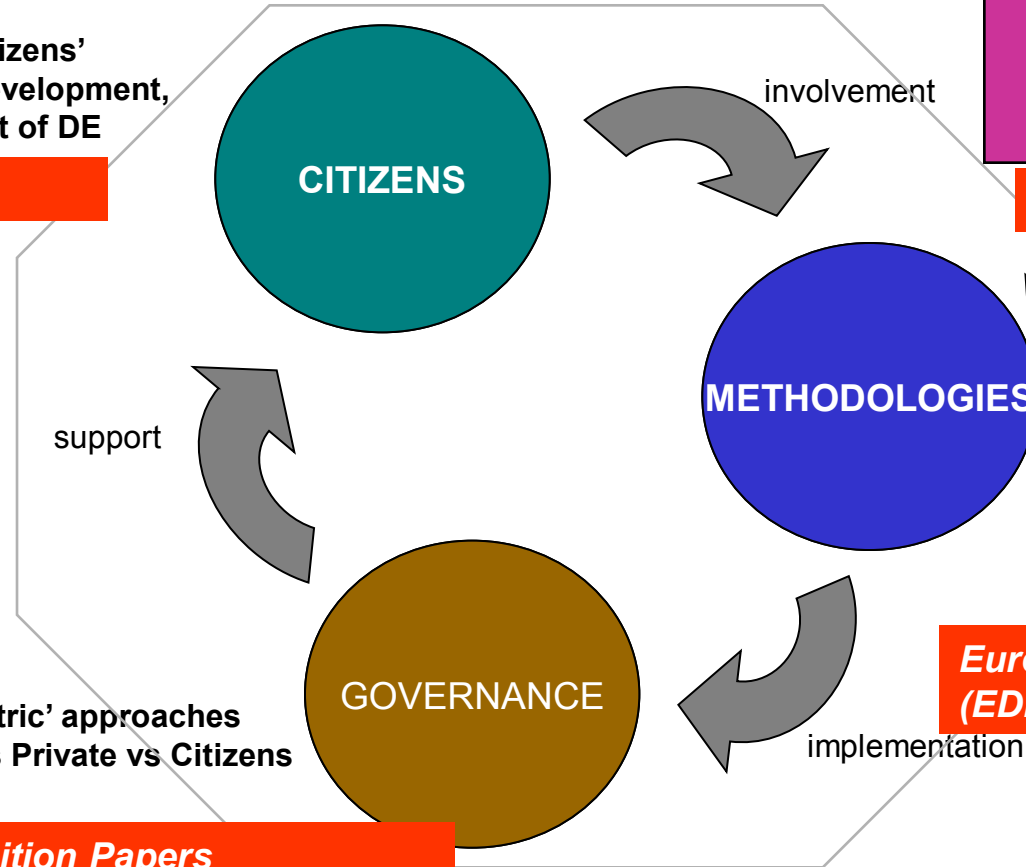
The role of private citizens' involvement in the development, use, and management of DE

*Pilots and Events*

- Distributed' vs. 'centric' approaches
- Multifacet: Public vs Private vs Citizens
- Multilevel

- *Research & Position Papers*
- *European Special Interest Group*

*European DE research Network (EDEN)– socio-economic component*



global change and climate change, land-use change, sea level rise, environmental degradation, urban spread, natural resource depletion, and their impacts on society and economy

*Joint conferences and workshops*

connect

- Bring together methods and tools
- Integration of scientific research into DE
- Trust & Reliability in information content

*Pilots & Projects*

*European DE research Network (EDEN)– technological component*



## Conclusions

- There is a clear need to refresh the DE vision
- The new vision should be able to adapt to regional diversities and priorities
- Awareness raising and Operations are the keys for enlarging ISDE community
- Need to further discuss and engage ISDE community

## Some questions for Today Round Table

- Which additional structures are needed to reinforce ISDE?
  - IJDE (done) ,
  - EDEN vs IDEN? ,
  - ESIG vs ad hoc wgs? , ...
- Which ISDE products/services ?
  - ISDE Newsletters (done),
  - Position Papers?,
  - DE Research Agenda?, ..
- Which links should be prioritised, how to connect and contribute?
- Are the identified priorities/solutions for Europe appropriate?



Thank you