

# Global Earth Observation - Benefit Estimation: Now, Next and Emerging



Assessing the economic, social and environmental benefits of the GEO domains

## International cooperation on Earth Observation in the course of GEOSS An evaluation based on game theoretic and economic concepts.

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### Introduction

Growing environmental concern has fueled the discussion about the establishment of an international institutional arrangement for cooperation on Earth observation. **The Global Earth Observation System of Systems (GEOSS)** comes as a timely solution. However, the implementation of GEOSS faces challenges; some of them are related to the fact that contribution to GEOSS is voluntary and GEOSS bears properties of a **public good**, whose provision is usually corrupted by “**free riding**”.

### Objectives

- Identifying challenges in managing and implementing GEOSS as a public good.
- Examining how these problems are discussed in economic and game theoretical literature.
- Examining problems concerning the user integration of GEOSS.

### PROBLEM STATEMENT

#### GEOSS as a public good:

- ❖ GEOSS shall be made accessible freely or at a very low cost
- ❖ Earth Observation is the basis for improved environmental policy making. Improved environment is non-rival and no-exclusive

### LEADING QUESTIONS

1. If contribution to GEOSS is voluntary, what are the consequences for the provision of GEOSS?
2. What could be the implications of insufficient information exchange between GEOSS participants?
3. How can technological/data standards emerge in a self-organizing process and in the absence of a binding data sharing agreement.
4. What are the considerations when integrating private providers to GEOSS?

### 1. VOLUNTARY PARTICIPATION

Contribution to GEOSS is non-binding and inconsequential. GEOSS tasks are self-organizing and self-financing.

Economic and Game Theoretic concepts imply:

- ❖ Socially optimal size for an agreement to provide a public good is full cooperation.
- ❖ Without an external coordinating institution the number of providers is small.
- ❖ Fraction of members to an agreement decreases with the number of affected countries (D'Aspremont et al., 1983<sup>1</sup>).
- ❖ Tradeoff between breadth and depths of an agreement: the larger the potential gains to cooperation, the larger the benefits of free-riding (Barrett, 1994).
- ❖ To induce cooperation an external institution can strategically frame a situation such that cooperation is mutually desirable.

### 2. ASYMMETRICALLY DISTRIBUTED INFORMATION

To induce cooperation a coordinating institution needs full information about the participants, which is not always the case.

Economic and Game Theoretic concepts imply:

- ❖ Asymmetrically distributed information lead to
  - adverse selection: each agent's ability is known only to himself and does not reveal it.
  - moral hazard: post-contractual, self-interested misbehaviour when effort is not observable.
- ❖ Informational asymmetries can lead to the collapse of a market (Akerlof, 1970), or to a lower outcome in situations of cooperation.
- ❖ External monitoring institutions, such as the Monitoring & Evaluation task in GEO, can have a positive effect on information disclosure (When private information is only revealed to competitive fellows, it can be used strategically against the agent, whereas when third parties are present this is not likely to occur (Ayra and Mittendorf, 2005).

### 3. STANDARD SETTING AND THE ROLE OF A TECHNOLOGICAL LEADER

GEOSS is a 'system of systems' where technical standardization and interoperability of the components has to be ensured: how can standards emerge in a self-organizing process?

Economic and Game Theoretic concepts imply:

- ❖ Interoperability and data compatibility yield network effects and increased benefits (direct network effects, indirect network effects).
- ❖ Benefits increase when the size of the network increases
- ❖ Agents often delay the private provision to a network. Pioneering entry results in immediate losses until other agents join the network (Bliss and Nalebuff, 1984 or Melissas, 2005).
- ❖ Agents fear to be stranded with a technology or standard which no one else uses. They rather have a suboptimal standard in a network than an optimal standard alone (Choi, 1997).

### 4. PUBLIC-PRIVATE PARTNERSHIPS

A formalized relationship between the private sector and GEOSS still has to be developed, but the commercial sector can play an important role in the future of GEOSS.

- ❖ Provision of a public good requires different inputs: possibility for partnerships to exploit the comparative advantage in production, and relative project valuation (Besely and Ghatak, 1999).
- ❖ Private sector is usually motivated by profits and might give insufficient weight to quality or safety issues (Levinson et al., 2006).

### USER INTEGRATION

- User integration should not only focus on how the end-users can access GEOSS, but also on how users can be integrated in the process of designing and implementing GEOSS.
- Strengthen visibility of GEOSS in the general public.
- Is the GEO Web portal sufficient to address all users? Could the integration of social scientists as a bridge between natural scientists and users help?

### CONCLUSION

**Game theoretic and economic concepts offer explanations for possible trends and scenarios concerning the provision of a public good:**

- **The provision of a public good demands an external institution as coordinator. The GEO secretariat might fulfill this role by providing guidance for the GEOSS components, establishing a framework for cooperation, and fostering political approval for the tasks.**
- **Similarly, optimal standard setting and achieving interoperability can be jeopardized without guidance of an external institution.**
- **Asymmetrically distributed information and insufficient communication might be a major barrier to the establishment of GEOSS. An external institutions could focus on setting incentives to foster revelation of information and communication.**

<sup>1</sup> Full reference list provided in proceedings

Visit the GEO-BENE web site at [www.geo-bene.eu](http://www.geo-bene.eu)



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