



FP7 Project Nr 265124

Project start date: 01 Sep 2010

Acronym: **EGIDA**

Project title: **Coordinating Earth and Environmental cross-disciplinary projects to promote GEOS**

Theme: ENV.2010.4.1.1-1

Theme title: Supporting the integration of European and international R&D programmes in GEO

D4.8 The EGIDA Methodology - Final version

Title	D4.8 The EGIDA Methodology - Final version
Creator	CNR
Creation date	16/05/2012
Date of last revision	16/01/2013
Subject	Description of the EGIDA Methodology
Status	<input type="checkbox"/> Draft <input checked="" type="checkbox"/> Final
Publisher	EGIDA WP4
Type	Text
Description	
Contributor	Paolo Mazzetti, Stefano Nativi
Format	DOC
Source	
Rights	<input type="checkbox"/> Restricted <input checked="" type="checkbox"/> Public Deliverable_4.8_v1.0.docx
Language	En
Relation	WP4 – T4.1, T4.2, T4.3, T4.4, WP2, WP3
Coverage	Not applicable

These are Dublin Core metadata elements. See for more details and examples <http://www.dublincore.org/>



Executive Summary

The definition of a general methodology for a sustainable contribution to GEO/GEOSS through the implementation of a System-of-System (re-) engineering process is one of the objectives of the EGIDA Project in order to consolidate the results of the actions carried out in support of the GEO Science and Technology Committee (STC) Road Map.

This EGIDA METHODOLOGY must be based on several sources including GEO activities and documents, activities of the EGIDA project in support of the GEO STC Road Map, lessons learned from the initiatives and projects already contributing, in different ways, to the building of advanced infrastructures as direct or indirect part to GEO/GEOSS.

The objective of this deliverable is to describe the EGIDA METHODOLOGY and how it has been revised after its assessment phase.

The design of the EGIDA METHODOLOGY included several steps:

a) an operational definition of the EGIDA METHODOLOGY:

The EGIDA METHODOLOGY is a general methodological approach for implementing a (re-) engineering process of the S&T national infrastructures and systems, which can be adopted by national/regional S&T communities, for a sustainable contribution to the GEOSS and relevant European initiatives based on a SoS approach, through the mobilization of resources made available from the participation in national, European and international initiatives and projects.

b) the identification of the target audience for the EGIDA METHODOLOGY:

- National/regional S&T communities
- European Programmes aiming to put in practice services related to the EO (e.g. GMES).



EGIDA, Coordinating Earth and Environmental cross-disciplinary projects to promote GEOSS

FP7 Project nr 265124

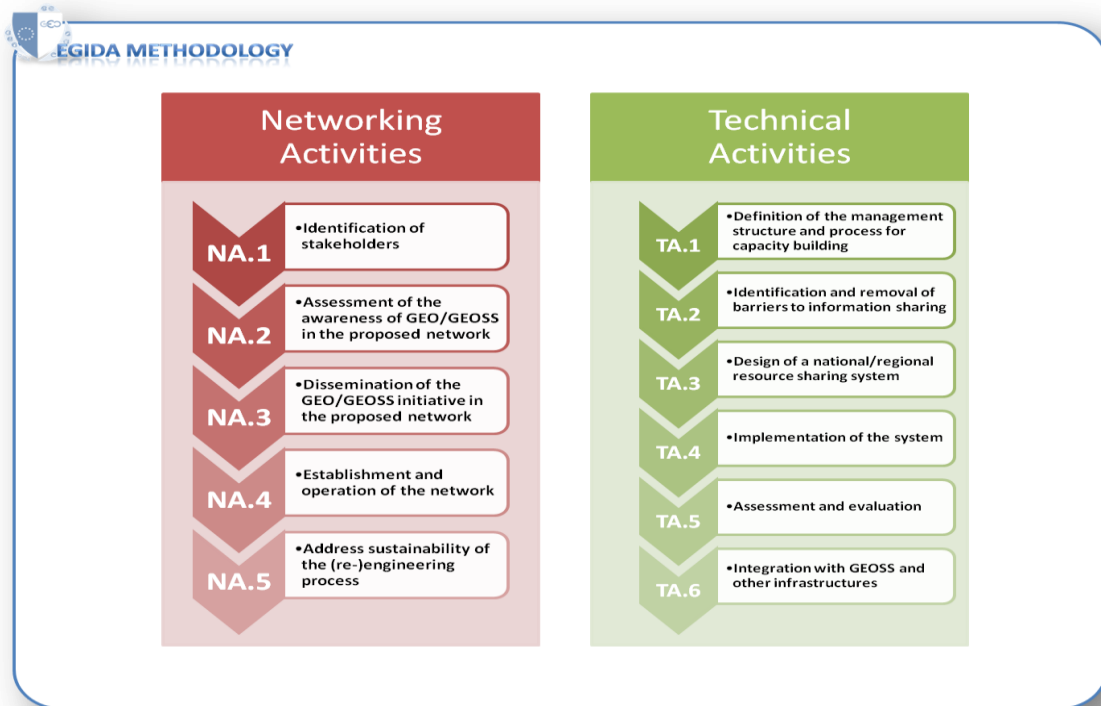
- Funding agencies which would like: a) to provide guidelines for projects aiming to contribute to the GEOSS and other supranational SoSs; b) to assess results of funded projects.

c) the identification of typical scenarios for the application of the EGIDA METHODOLOGY:

- Regional/National Scenario
- European Commission Framework Programme Scenario
- National GEO Scenario

Basing on these design activities the EGIDA METHODOLOGY is defined as a set of two activities running in parallel:

- Networking Activities: to identify and address the relevant S&T community (-ies) and actors (Community Engagement);
- Technical Activities: to guide the infrastructure development and align it with the GEO/GEOSS interoperability principles (Capacity Building);



Activities and actions of the EGIDA METHODOLOGY

For each activity several actions and sub-actions are defined. For each action and sub-action, practices and guidelines derived from the design phase are proposed.

The EGIDA METHODOLOGY has been evaluated and assessed through its application to five different use-cases. The outcomes of the transfer process, along with feedbacks from presentations and discussion allowed to revise the first version of the EGIDA Methodology and to publish the current final version herewith presented.



Table of Contents

EXECUTIVE SUMMARY	2
ACRONYMS AND ABBREVIATIONS	6
1 INTRODUCTION	7
2 RATIONALE.....	8
3 GENERAL OBJECTIVE	10
4 DEFINITION	10
5 TARGETS OF THE EGIDA METHODOLOGY	12
5.1. THE ROLE OF GEO NATIONAL COORDINATION GROUPS.....	12
6 OPERATIONAL OBJECTIVE AND STRUCTURE	12
7 METHODOLOGICAL APPROACH.....	13
8 SCENARIOS.....	13
9 THE EGIDA METHODOLOGY	15
9.1. NETWORKING ACTIVITIES	16
9.2. TECHNICAL ACTIVITIES	33
10 GENERAL REFERENCES.....	60



Acronyms and Abbreviations

Abbreviation	Name
EC	European Commission
EU	European Union
FP7	Seventh Framework Programme
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GMES	Global Monitoring for Environment and Security
INSPIRE	Infrastructure for Spatial Information in Europe
MS	Member State
SDI	Spatial Data Infrastructure
SEIS	Shared Environmental Information System
WP	Work Package
T	Task
ST-09-01	GEO Task ST-09-01: Catalyzing Research and Development (R&D) Funding for GEOSS
ST-09-02	GEO Task ST-09-02: Promoting Awareness and Benefits of GEO



1 Introduction

The objective of this deliverable is to describe a general methodological approach, namely the EGIDA METHODOLOGY, which can be adopted by national/regional Science and Technology (S&T) communities, for a sustainable contribution to the GEOSS through the mobilization of resources made available from the participation in national, European and international initiatives and projects.

The EGIDA METHODOLOGY consolidates the activities of the EGIDA Project in support of the GEO Science and Technology Committee (GEO STC) with particular focus on the implementation of the STC Roadmap, for re-use.

The EGIDA METHODOLOGY is structured as a set of practices and guidelines for activities and actions to be carried out in the context of on-going projects on resource sharing in order to provide a sustainable contribution to GEO/GEOSS and other relevant international initiatives (such as INSPIRE/SEIS and GMES in Europe).

The proposed actions and related guidelines are derived by several information sources including GEO documents, activities in the EGIDA project in support of the implementation of the GEO Science and Technology Committee (STC) Roadmap, relevant experiences in EC-funded projects. This document describes the final version of the EGIDA METHODOLOGY after the assessment of the first version through its transfer in five use cases [EGIDA-D4.7].

The EGIDA METHODOLOGY is described providing suggestions and guidelines for specific actions dedicated to capacity building and community engagement derived in the design phase. Specific points are supported or clarified with statement enclosed in grey boxes. These supporting statements are derived by existing national/regional initiatives. Initiatives explicitly related to GEO/GEOSS are usually not referred since they are already aligned to the top-down actions defined by GEO. Their contribution is then included with the direct contribution from GEO documents used in the design of the EGIDA METHODOLOGY.



2 Rationale

The need of a general methodology addressing the contribution to GEOSS stems from the existence of two different and possibly complementary approaches to the building of GEOSS that should be harmonized to overcome the respective limitations:

- a) A top-down approach from GEO: the GEO provides a general framework for building the GEOSS, e.g. at a general level through the GEO Work Plan, and specifically through the Committees'/Boards' activities (such as the GEO STC Roadmap) and the task actions. However, due to its voluntary-based nature, GEO does not directly fund its activities and must leverage members' efforts for the implementation. This limits the effectiveness of the GEOSS building especially introducing gaps from countries where either GEOSS awareness, capacities or resource mobilization is for any reason limited (e.g. in developing or small countries).
- b) A bottom-up approach from on-going initiatives on Earth Observation: there are several on-going and planned initiatives funded in the context of supranational, national and regional projects (often involving developing countries) which contribute or might contribute to the GEOSS implementation. However they are often lacking of an overarching approach beyond the scope of the single project.

An integration and coordination of these two different approaches would then provide more effective and efficient contributions to build the GEOSS. The idea behind the definition of the EGIDA METHODOLOGY is that taking into account the commonalities between the different supranational, national and regional projects it would be possible to define a general methodology for better directing the efforts towards a sustainable contribution to GEOSS.

The same problem is commonly present in other European and global initiatives for the implementation of data sharing Systems-of-Systems (SoSs). Therefore the EGIDA



METHODOLOGY also addresses this other SoSs initiatives (that actually are often part of a more general contribution to GEOSS, as for European INSPIRE and GMES initiatives). It is however important to consider, besides the commonalities, also the differences between these initiatives. For example, the implementation of INSPIRE, as a Directive of the European Commission, mandatory for national environmental information, is enforced by national regulations. Therefore, in this case, the top-down approach is obviously stronger than in the GEOSS case. Anyway the need of harmonizing on-going projects is still important, especially where the application of the INSPIRE specifications is not mandatory but could result beneficial. This is the case of research organization which although having no obligation in the INSPIRE Directive, could be important users and providers for the INSPIRE infrastructure.



Figure 1 - Top-down and bottom-up actions contributing to the building of GEOSS



3 General Objective

With the above in mind, the main objective of the EGIDA METHODOLOGY is to provide a general methodology for the coordination of the top-down actions from the GEO, and the bottom-up actions from on-going initiatives, in the view of a sustainable contribution to the GEOSS. In this process, depending on the interest of the involved communities, other relevant initiatives should be considered as INSPIRE and GMES in Europe. The EGIDA METHODOLOGY aims to a more effective mobilization of existing resources (from on-going national and regional projects), providing guidelines to align the on-going and planned national/regional actions with the GEOSS objectives.

It is noteworthy that currently the EGIDA Methodology focuses on *how* to provide a contribution to GEO/GEOSS objectives and not on *why* this contribution should be provided.

4 Definition

As explained above, the EGIDA METHODOLOGY aims to provide a general methodology for leveraging efforts made in the context of supranational, national and regional projects for an effective contribution to GEOSS and the most relevant European initiatives on data sharing, with particular reference to INSPIRE and GMES. However a precise definition of the EGIDA METHODOLOGY is necessary in order to delimit the boundaries of its contribution.

The EGIDA METHODOLOGY is defined as:



The EGIDA METHODOLOGY is a general methodological approach for implementing a (re-) engineering process of the S&T national infrastructures and systems, which can be adopted by national/regional S&T communities, for a sustainable contribution to the GEOSS and relevant European initiatives based on a SoS approach, through the mobilization of resources made available from the participation in national, European and international initiatives and projects.

Within this new definition several key words are introduced:

- “general methodological approach” means that the EGIDA METHODOLOGY builds on the commonalities that can be found between typical situations where activities carried out in the context of regional and national initiatives might be aligned with the capacity building principles of international SoSs initiatives;
- “(re-) engineering” means that the EGIDA METHODOLOGY is based on a process of re-organization of the existing systems and planning of new ones;
- “sustainable” means that the aim of the EGIDA METHODOLOGY is to provide guidelines for a contribution to the most important European and global Systems-of-Systems (SoSs) which is not limited to the scope and duration of the projects providing funds for the specific activities;
- “national/regional” recognizes the importance of the national and regional levels in the contribution to GEOSS and other SoSs. While the scope of these initiatives may be, and it usually is, supranational, the implementation of its components is generally performed at national/regional level for several reasons (funding, legislation, etc.);
- “contribute” means that the EGIDA METHODOLOGY has the specific objective of helping the contribution to the European and global SoS initiatives with particular reference to GEOSS.



5 Targets of the EGIDA METHODOLOGY

The definition highlights that the EGIDA METHODOLOGY is proposed for adoption of *national/regional S&T communities* working in the context of *national, European and international initiatives and projects*. Therefore several targets may be identified.

- National/regional S&T communities and actors which would like to build a sustainable contribution to the GEOSS and other supranational SoSs through resources available from on-going initiatives and projects. These communities and actors are the direct target of the EGIDA METHODOLOGY, those that are supposed to implement the proposed guidelines.
- European Programmes that aim to replicate or put in practice services related to the EO data sharing (e.g. GMES). These programmes are indirect targets. They may benefit from the EGIDA METHODOLOGY in the implementation phase where the contribution to the planned system(s) should be mainly provided by local S/T communities.
- Funding agencies which would like: a) to provide guidelines for projects aiming to contribute to the GEOSS and other supranational SoSs; b) to assess results of funded projects.

5.1. The role of GEO national coordination groups

In order to address the direct targets of the EGIDA METHODOLOGY, that are the regional/national S&T Communities, different approaches are possible. They will be detailed as part of the EGIDA METHODOLOGY itself. However it is important to anticipate that the GEO national coordination groups (National GEOs) may play a specific role. Indeed, through dedicated internal Task Forces or Working Groups, the National GEOs could coordinate the actions proposed in the EGIDA METHODOLOGY supporting its implementation ad sustainability.

6 Operational objective and structure

The operational objective of the EGIDA METHODOLOGY is to provide an action plan and related guidelines that can be followed by the national/regional S&T Communities and



actors for an effective and efficient mobilization of resources provided by planned and on-going projects.

7 Methodological Approach

The EGIDA METHODOLOGY recognizes that many resources (personnel, equipments, services, etc.) which contribute or may contribute to the development of GEOSS components, come from projects funded in the context of supranational, regional and national initiatives. Therefore the methodological approach followed by the EGIDA METHODOLOGY consists in applying the System-of-Systems (SoS) philosophy to the Capacity Building actions, that is, to build on existing national/regional programmes and initiatives, collocating them in the GEO/GEOSS context. In this view the EGIDA METHODOLOGY aims to supplement, and not supplant, the national/regional projects and initiatives objectives, by introducing the GEO/GEOSS priorities in the actions related to Capacity Building.

The EGIDA METHODOLOGY includes two types of actions:

- **Networking Activity:** to identify and address the relevant Science and Technology community (-ies) and actors;
- **Technical Activity:** to guide the infrastructure development and align it with the GEO/GEOSS interoperability principles;

8 Scenarios

The EGIDA METHODOLOGY is defined basing on a small set of common abstract scenarios:

- S1) **Regional/National Initiative Scenario:** A national project aimed to deploy a national/regional infrastructure for sharing information relevant for GEO/GEOSS. Project partners may adopt the EGIDA METHODOLOGY for an effective and efficient mobilization of resources, in order to design and develop the infrastructure making it a sustainable contribution to GEO/GEOSS.



EGIDA, Coordinating Earth and Environmental cross-disciplinary projects to promote GEOSS

FP7 Project nr 265124

- S2) European Commission Framework Programme Scenario: A multi-national project (e.g. funded in the context of the European FP) as part of its operational objectives, must deploy an infrastructure for sharing information relevant for GEO/GEOSS. Project partners may adopt the EGIDA METHODOLOGY for an effective and efficient mobilization of resources, in order to design and develop the infrastructure making it a contribution to GEO/GEOSS.
- S3) National GEO Scenario: Central groups have been established to coordinate efforts on capacity building at national/regional level taking into account the relevant supranational and global initiatives. Each coordination group can adopt the EGIDA METHODOLOGY for implementing capacity building actions.

9 The EGIDA METHODOLOGY

The EGIDA METHODOLOGY includes two types of activities (Figure 2):

- Networking Activities: to identify and address the relevant Science and Technology community (-ies) and actors;
- Technical Activities: to guide the infrastructure development and align it with the GEO/GEOSS interoperability principles;

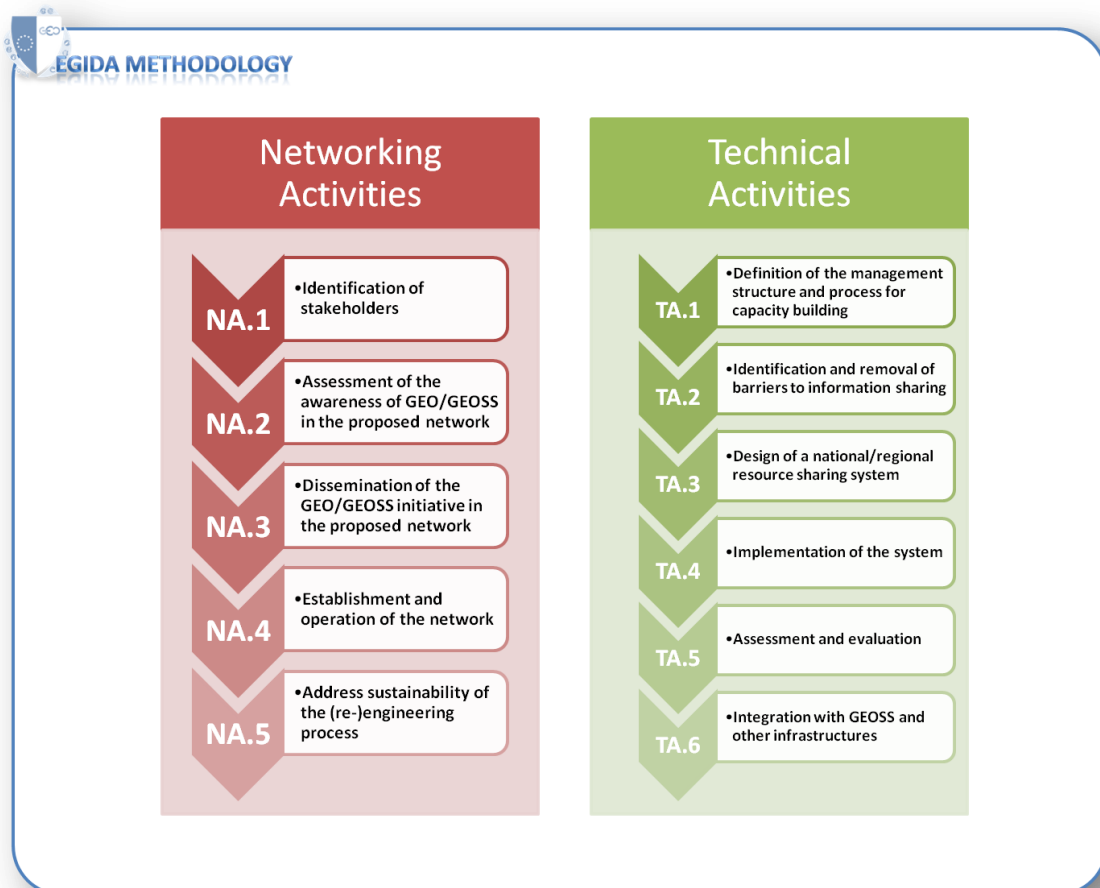


Figure 2 The overall structure of the EGIDA METHODOLOGY

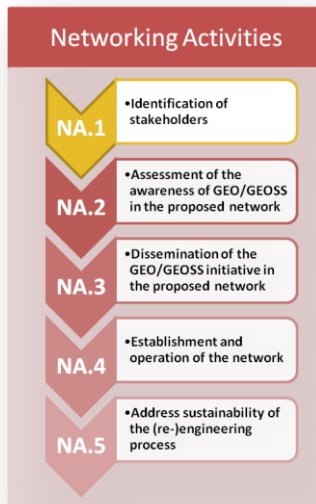


9.1. Networking Activities

The objective of Networking activities is to identify and address the relevant Science and Technology community (-ies) and actors. Specific actions should be carried out in order to establish a wide stakeholders network supporting a common information framework for a sustainable contribution to the GEOSS.

All different stakeholders should be considered:

- information providers: community members that might potentially provide the information content to the observation infrastructure (data, models, etc.).
- technology providers: community members that might potentially provide the required technology to build, manage, and enhance the infrastructure.
- intermediate users: community members who might potentially use the infrastructure to deliver resources to other (intermediate or final) users. For example intermediate users may be developers of value-added services based on the resource published through the planned observation infrastructure. They are users by the infrastructure point-of-view, and providers by the final users' point-of-view.
- end users: community members that might potentially use the resources published through the infrastructure by providers and intermediate users, for different objectives. These include policy and decision makers, citizens, and also industries for business applications.
- advisors: community members who may provide advice through their expertise.



NA.1 Identification of stakeholders

NA.1a Definition of the stakeholders profile

In order to achieve sustainability it is important to involve all the relevant stakeholders. The identification of relevant stakeholders is then a fundamental step. Depending on the activity characteristics the stakeholders profile can be defined according to several aspects: typology, role and scope.

Stakeholders typology can vary:

- **Research:** Public and private research organization may provide knowledge and expertise on thematic and transversal domains. In particular the thematic research (i.e. on scientific domains like those included in SBAs) organizations cover the Science segment of the stakeholder communities, playing a fundamental role as users for the definition of the user requirements, and end-to-end applications in the GEOSS view. They are also important as resource providers (data, sensors, models) and having several of them on board may assure a large amount of valuable resources available through the observation infrastructure. Transversal research organizations may provide relevant expertise on information science and technology in order to keep the planned infrastructure (sensors, information services, etc.) aligned with the state-of-the-art.
- **Industry:** enterprises can play a fundamental role as stakeholders in the Technology segment. They can be the end users of shared resources, exploiting the infrastructure for building new business opportunities. This could help to establish a virtuous circle with enterprises providing new requirements for starting or expanding businesses, and on the other hand providing funds for a sustainable management of the infrastructure (licensing for



commercial exploitation of resource, including fees, should be investigated). Enterprises may also act as proxies towards the real end user, as it often happens for Public Administrations. A specific attention should be paid to enterprises active in the Earth Observation: EO sensors developers, observation systems owners, services developers. Finally IT enterprises may also have a role in the development of the infrastructure.

- **Public Administrations:** Public Administrations are another important piece for the stakeholders network. They are both users and providers. As users they act on behalf of the citizenship and can provide relevant requirements. As providers they produce and share resources at different levels: from observation networks to value-added services. They are also often subjected to special regulations and legislation imposing specific requirements to the infrastructure. This is particularly true in Europe, where the INSPIRE Directive (and SEIS Communication) gives a fundamental role to Public Administrations for geospatial data sharing.
- **Citizens:** Citizens, possibly together in communities and organizations, are end-users of the infrastructure. Recently citizens have been also recognized as providers. Through user-friendly Web 2.0 technologies the so-called citizen scientists may provide observations collected through home stations or mobile devices (e.g. photo and videos). These innovative processes in Earth observation are often referred to as *crowdsourcing*, *Volunteered Geographic Information (VGI)* and *Citizen Science*. Citizens can also be developers of new applications (e.g. mobile apps) based on resources provided through the infrastructure.
- **Standardization organizations:** In building a System-of-Systems component, standardization as a means for interoperability is a key factor, both internally and towards the other components of the higher-level SoSs (e.g. GEOSS or INSPIRE infrastructure). Therefore the involvement of national/regional and international standardization organizations is an important issue. This should be a two-way process. On one side the realization of a System-of-Systems component for data sharing may raise awareness on the interoperability standards providing contribution in the standardization organization working groups. On the



other hand, in several cases there are specific national/regional regulations on standards that the SoS component must adopt.

- **Advisors:** In order to achieve a more effective and efficient liaison with the relevant European and global initiatives, it is useful to consider national/regional experts involved in those initiatives (e.g. members of GEO Committees, leaders/participants in the GEO tasks, or INSPIRE working groups, etc.). Advisors may be structured in an Advisory Panel or Board, or they may be contacted separately on specific issues.
- **Other relevant programmes and initiatives at national and international level:** liaison and coordination with on-going initiatives at different level (e.g. UNEP, GMES, FP Projects, etc.) is a valuable resource for effective mobilization of resources, and avoiding of duplication of efforts.

Stakeholders may cover different roles such as:

- (Intermediate and end) Users: they can use the outcomes of the initiative (services, data, etc.) as end users, or as developers of value-added services;
- Resource Providers: they can provide resources (data, services, etc.)
- Technology Providers: they can provide tools and expertise for capacity building and sustainability
- Advisors: they can provide advice on specific issues (e.g. relationships with global initiatives, expertise on selected themes)

They can provide contribution for achieving different objectives:

- Priority setting
- User Requirements identification and refinement
- Assessment and validation through the running of pilot projects and case studies
- Consultation on specific issues (e.g. interoperability)
- Exploitation
- Sustainability



NA.1b Collection of candidate stakeholders

Once the stakeholders profile has been defined, candidate stakeholders can be collected. The process should actually be a living process with new candidate stakeholders that can be identified lately when the re-engineering process is already on-going.

It is useful to consider for each stakeholder how it might be addressed and engaged in the initiative. In particular it should be considered if stakeholders have to be addressed individually or collectively. Established Community-of-Practice in the scientific research areas, industrial forums, project consortia are examples of organizations that may act as proxies towards individual stakeholders, also providing some added value due to the already existing cooperation between participants.

Guideline NA.1b.1

The identification of stakeholders can be based on several different actions.

- a. Study the national legal framework; national legislation regulating the development, organization and management of spatial data infrastructure, which gives some basic information on the organization and the main key players in SDI development in the country, e.g. who has the mandate to coordinate the elaboration of the SDI.
- b. Study the national research and development funding system: information on terms and conditions for funding research and development activities in the country can give information on potential stakeholders.
- c. Mobilize project groups, professional and technical associations in search for potential stakeholders and partners – potential organizations and networks can be national and European project partnerships, national and European technology platforms and initiatives, centres of excellence etc.
- d. Information sources for identification of stakeholders vary from country to country, therefore it is recommended to study the national approach to the building of NSDI. For European countries, the national EC INSPIRE – State of Play Reports are a valuable source of information on the status and the key entry points to the NSDI. Nevertheless, these reports



can still be incomplete in particular in countries where a thematic spatial data is fragmented and to a great extent produced by private companies and/or physical persons.

- e. Explore the national participation in European projects relevant to GEO and other European and international data sharing initiatives.



In the context of the EGIDA pan-European use-case “Air Quality for Health” an analysis have been carried out in order to identify key stakeholders and initiatives highlighting previous involvement in GEOSS (to derive lessons learned) and potential for increased involvement. The resulting 25 relevant initiatives have been classified thematically: Air Quality monitoring, Atmospheric composition monitoring (not Air Quality focus), Health issues, IT and communication.



The FP7 Project ENVIROFI prepared a survey on an internal Wiki site to collect information about possible stakeholders. The survey asked for basic information about the candidate stakeholders, and their possible role in the project.

Guideline NA.1b.2


When the Stakeholders Network refers basically to a well-defined scientific community, the corresponding GEO Community of Practice (CoP) may be contacted, if existing, or a new one can be created. The GEO Web Site reports information about existing CoPs



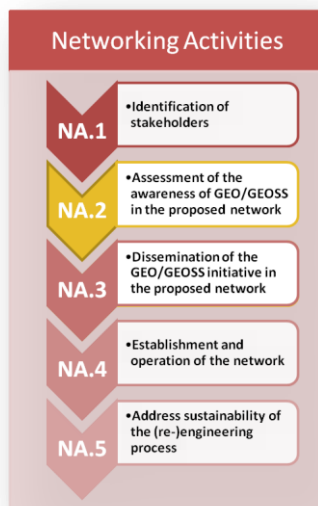
(<http://www.earthobservations.org/cop.shtml>) including the guidelines for proposing new CoPs¹.

Guideline NA.1b.3

The participation in and, in particular, the organization of workshops, conferences and thematic discussions is an important opportunity for building and operating the Stakeholders Network.

 The FP7 project EuroGEOSS (European approach to GEOSS) organized a final conference on the theme "Advancing the vision for GEOSS" [<http://www.eurogeoss.eu/conferences/Pages/2012.aspx>] inviting participants active in European and international projects and programmes related to GEO. The EGIDA use-cases reported that it was a valuable opportunity to establish liaisons with stakeholders, and to be informed about other on-going initiatives.

¹ http://www.earthobservations.org/documents/cop/20101019_cop_process_and_guidelines.doc



NA.2 Assessment of the awareness of GEO/GEOSS in the proposed network

While some stakeholders may have a deep knowledge of initiatives on resource sharing like GEO/GEOSS, INSPIRE, GMES, others may not. For different reasons, advisors (participating in tasks and working groups), standardization organizations (having liaison with most of this initiatives), and Public Administrations (e.g. for compliance with the INSPIRE Directive) are usually aware of at least some of the relevant initiatives on data sharing. On the other side, in particular the research and industrial members which are important

potential providers and users, usually do not have any specific need of knowing those initiatives, since in many cases they are not required to. An important step is then to assess the awareness of the most relevant European and global initiatives on data sharing, namely GEO/GEOSS, INSPIRE, GMES in the stakeholder network.

Guideline NA.2.1

The assessment can be performed in parallel with the identification of candidate stakeholders through questionnaires, interviews and informal talks during meetings and conferences.

Guideline NA.2.2

The first meetings and workshops are good opportunities to both assess awareness and disseminate (see NA.3) GEO/GEOSS and related initiatives in the Stakeholders Network.

Guideline NA.2.3

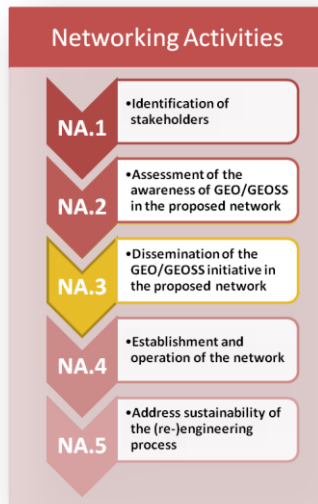


EGIDA, Coordinating Earth and Environmental cross-disciplinary projects to promote GEOSS

FP7 Project nr 265124

During the assessment process it is important to clarify the level of awareness. Sometimes the lack of awareness of GEO/GEOSS depends on a more general lack of awareness on data sharing and interoperability issues. Sometimes instead the Stakeholder Network is aware of data sharing and interoperability issues but it has not any or full knowledge of GEO and GEOSS.

In the first case it is important to verify that the Stakeholders Network includes people and organizations interested and skilled in Information Technology. If the Stakeholders Network only includes scientists or decision-makers, the lack of awareness on data sharing and interoperability issues may depend actually in lack of interest or skills in the IT domain. If the Stakeholders Network does not include this category of expertise provider they should be identified and invited to join (see NA.1). If an expertise on interoperability is not available then it can be built in NA.3/TA.2 joint actions such as dedicated workshops.



NA.3 Dissemination of the GEO/GEOSS initiative in the proposed network

After the assessment phase, specific actions for dissemination may be designed and carried out. These actions aim to focus candidate stakeholders on their contribution to the establishment of a resource sharing infrastructure as a component of larger SoSs.

Guideline NA.3.1

Dissemination should be focused on the topics where awareness actually needs to be raised. Sometimes the limited awareness about GEO/GEOSS is actually the consequence of a limited awareness on the general topic of resource interoperability. Where necessary specific actions should be taken in order to:

- raise awareness on the importance of resource sharing;
- raise awareness on initiatives addressing resource sharing in terms of resource interoperability, policies, etc.;
- raise awareness on specific relevant initiatives including GEO/GEOSS;

Guideline NA.3.2

GEO/GEOSS should be presented as an opportunity in different directions, for example supporting better decision-making, enhancing research through easier resource sharing, reducing information collection costs and opening new frontiers for business through the development of value added services.



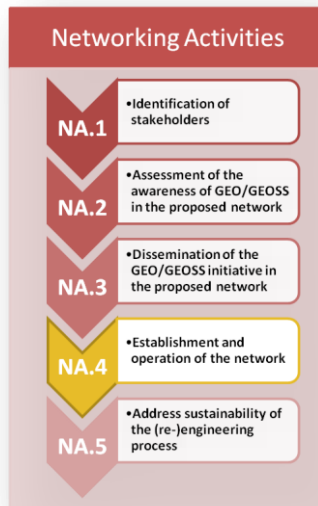
Guideline NA.3.3

Compelling examples that show GEOSS at work for Science and Technology are a valuable mean to demonstrate the feasibility and added value of participation in GEOSS. The GEOSS Portfolio for Science and Technology (http://www.geotasks.org/geoss_portfolio/) provides access to examples of GEOSS at work in the nine SBAs and cross-cutting areas. Other examples of information sharing systems relevant for the geographical region and themes addressed by the initiative may be relevant.

Guideline NA.3.4

Another possible approach that has demonstrated successful in many cases is to postpone the dissemination of GEO/GEOSS after the initial technical activities. After the establishment (or re-engineering) of the infrastructure it is possible to use the core services implemented (e.g. discovery and view services) as a basis for demonstrating the added value of GEOSS.

The same considerations are valid for other initiatives as INSPIRE or GMES in Europe. Demonstration examples might also include economic assessments aiming to show that cost saving can be oriented to other important initiatives and actions.



NA.4 Establishment and operation of the network

Once the candidate stakeholders are collected, and awareness and interest is raised, the stakeholders network may be setup and operated.

Guideline NA.4.1

Depending on the desired scope and objective, the Stakeholder Network can be structured formally (through legal agreements) or informally (e.g. as a group of interest, or a forum). The level of collaboration may vary for different stakeholders. In some cases a full partnership may be defined, in other cases a Memorandum of Understanding may be considered sufficient.



GIIDA *GIIDA, as an initiative internal to the CNR (National Research Council of Italy), needed no specific agreement to include the research component. The initiative was promoted at the level of Department of Earth and Environment, and the Institutes interested in the initiative simply appointed their representatives. Other research components were also included without any formal agreement, just on the basis of joint research groups. In some cases existing agreement were exploited, as in the case of relationships with the European Grid Initiative (EGI) through the*



Italian Grid Initiative that CNR is part of. Relationships with the Public Administrations where partly informal through the links provided by GIIDA members already working with them. A formal agreement (a MoU) was instead defined with ISPRA to establish a deeper collaboration aiming to perform interoperability tests between GIIDA infrastructure and SINAnet. Members of the coordination team were active in standardization bodies and GEO/GEOSS, INSPIRE, GMES so no other specific link was considered necessary.

Guideline NA.4.2

Personal communication proved to be the most efficient in the first phases of the networking process, in particular in activities of identification of stakeholders and motivating them to participate in the network, getting them involved.

Guideline NA4.3

The operation of the Stakeholders Network should be tailored to the objectives of the underlying initiative. The Stakeholder Network can provide relevant inputs throughout all the initiative lifecycle through:

- Priority setting
- User Requirements identification and refinement
- Assessment and validation through the running of pilot projects and case studies
- Consultation on specific issues (e.g. interoperability)
- Exploitation
- Sustainability

Guideline NA4.3

Different means for addressing stakeholders may be considered:

- Mailing lists and newsletters
- Social networks
- Visits



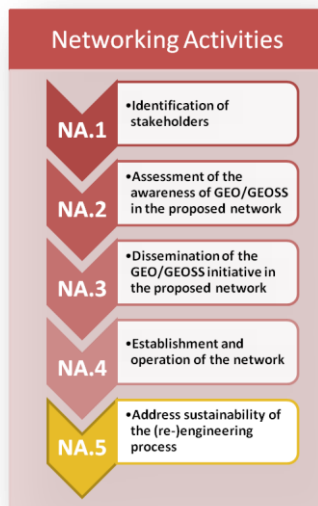
- Workshops and consultation meetings



The project ENPI-SEIS (European Neighborhood and Partnership Instrument) for the EEA has already overtaken the inception phase and accomplished country visits, for the establishing of the baseline for the development of the Shared Environmental Information Systems in the ENPI South Countries (South: Algeria; Egypt; Israel; Jordan; Lebanon; Morocco; Palestinian Authority; Syria and Tunisia. East: Armenia; Azerbaijan; Belarus; Georgia; Moldova; Russian Federation and Ukraine).

Guideline NA.4.3

When the addressed national/regional initiative covers a region where there is already an existing, although informal, stakeholders network, it is easier and more efficient to resort on it. One organization, or individual expert, may act as a contact point towards other stakeholders exploiting existing personal or institutional relationships.



NA.5 Address sustainability of the (re-)engineering process

Addressing sustainability of the (re-)engineering process and consequently of its contribution to GEOSS and other SoSs initiatives, requires the analysis and removal of the barriers that could hamper it. Barriers may be of different nature: legal, financial and technical. Moreover a long-vision coordination action is required.

Guideline NA5.1

The creation and operation of a national/regional central coordination point like the national GEO secretariats could be a first step towards organising a sustainable GEOSS contribution, which especially means supporting the search for funding.

Guideline NA5.2

Where possible, include in the Stakeholder Network, members that can help to address the sustainability of the process having interest in the wider context, including liaisons with international initiatives and projects, Communities of Practice, funding agencies, decision and policy makers.

Guideline NA5.3

Assuming that technical barriers are removed carrying out the Technical Activities proposed in the EGIDA METHODOLOGY, the financial barriers are the most relevant for a sustainable process. They are often cited as the main obstacle towards the implementation and continuation of a (re-)engineering process. In the National GEO Scenario, the establishment of a central coordination body often does not include direct funds for implementation. In the National/Regional Scenario funds generally cover only



the investment for the initial implementation of the (re-)engineering process. In the European Commission Framework Programme Scenario, funds only partially cover the (re-)engineering process and only for the duration of the project.

The EGIDA Project has analyzed financial issues by the European funding agencies point-of-view in the Deliverable D3.6 "Framework concept for European funding agencies" [EGIDA-D3.6].

Funding of the (re-)engineering process and its sustainability can be addressed at different level:

National level: "The research and innovation policy systems of various countries will vary a lot. The countries have a different historical and cultural background, various capabilities in terms of research and education, different industrial structures and trajectories, and different approaches to welfare and social policies. The political culture may also differ, which leads to different approaches as regards collaboration and governance, as well how struggles for power and influence play out. Indeed, there is a lot of variation inside the national systems as regards "belief systems" – i.e. coherent narratives about how the world is and should be – and policy practice." [EGIDA-D3.6]. Therefore it is difficult, if not impossible, to provide general guidelines. However some general considerations can be carried out. The national research is planned and financed by *ministries*, but often the decisive policy-making level is not necessarily an individual ministry, but a *council*, and they act through *funding and implementing organisations*, agencies, or even dedicated ministerial departments. *Policy Advisors, stakeholder organizations and NGOs* can play an important role in influencing policy-makers. At a higher level all this stakeholders should be involved in the initiative to influence funding decisions. *Private companies* that fund or perform R&D or another important target, since they can provide resources in terms either of direct funding or assigning personnel to relevant tasks in the (re-)engineering process. Finally *research performers*, e.g. Universities and Public research institutes, may provide personnel active on projects and initiatives that can provide contribution to the (re-)engineering process.



EGIDA, Coordinating Earth and Environmental cross-disciplinary projects to promote GEOSS

FP7 Project nr 265124

Supranational level: At supranational level there are usually funding opportunities. In Europe, the European Inventory of Research and Innovation Policy Measures gives an example of different funding instruments. The sustainability of a (re-)engineering process aiming to the sustainability of GEOSS contribution can benefit from the fact that there is an on-going effort to establish explicit linkages between research and development programmes funded by GEO Members and Participating Organizations and GEOSS. For example, already in several calls of the European Commission Seventh Framework Programme these links take the form of requiring explanations of how projects to be funded will interface with GEOSS and ensuring that demonstrating significant relevance for GEOSS. In some cases the link is even stricter requiring for a direct contribution to the GEOSS Tasks.

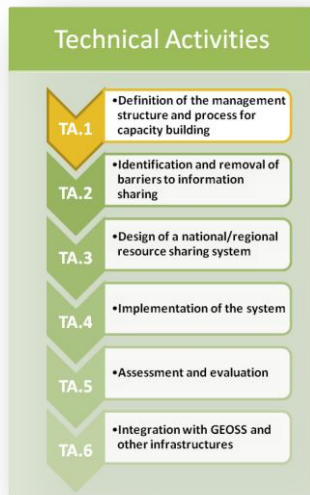


9.2. Technical Activities

The objective of the Technical Activities is to guide the (re-)engineering process implementing a System-of-Systems approach, and aligning the resulting system with the GEO/GEOSS interoperability principles (e.g. GCI approach, Data sharing principles, Capacity Building principles).



The project ENPI-SEIS, aiming to improve environmental monitoring and data and information sharing by gradually extending the SEIS principles to the European neighbourhood, recognized, that the vast array of already collected environmental data and information should be organised in a coherent and integrated "system of systems" for environment information based on access, sharing and interoperability.



TA.1 Definition of the management structure and process for capacity building

TA.1a Central coordination

The design and deployment of an infrastructure is a complex process requiring a central coordination. The central coordination helps to achieve a combination of bottom-up approach and top-down approach that appears effective for addressing several issues.



On the matter of a) catalysing resources, b) standardisation of procedures and c) data and information harmonisation, during the EGIDA workshops, it was highlighted by the participants that the most proficient cases are characterised by a combined top-down and bottom-up approaches. As well as the bottom-up contribution to GEOSS, national or regional top-down activity can be led by a voluntary approach (e.g. Italian GEO implementation). [EGIDA-D3.4]

UK EOF

UK-EOF is an initiative with a strong top-down component. The elements of the UK-EOF include:

EACH PARTNER - ensuring internal and external arrangements are in place to work with and progress the strategy and its deliverables.



A CENTRAL COORDINATING SECRETARIAT - providing programme management, communication between, and facilitation of the work packages.

A HIGH LEVEL BOARD owning the uk-eof. this will consist of strategic policymakers and funders able to facilitate change at the top of organisations and across government, provide resources and policy direction and respond to the potential implications of work package outputs on financial mechanisms and data policy. The ERF main board will undertake this role.

A MANAGEMENT GROUP directing the delivery of the framework and transferring the outcomes to each partner organization.

OBSERVATION CLUSTERS ensuring greater integration of existing evidence collection and co-ordination initiatives and assessments.

DATA AND INFORMATION facilitating the sharing of knowledge and data.

AD HOC GROUPS OR WORKSHOPS facilitating work streams where necessary.

Depending on the characteristics of the initiative for capacity building different solutions are possible.

Guideline TA.1a.1

For the Regional/National Scenario (S1) and National GEO Scenario (S3) a management group for the entire initiative is usually already present. Therefore is a specific task of this management group to establish a technical working group or task force in charge of the technical activities. These initiatives are often focused on capacity building, in particular in the National GEO scenario, therefore there are usually no problems of resources allocation and expertise. In case of necessity, stakeholders network members and advisors can assist or even be full members of the technical task force.

Guideline TA.1a.2

The EC FP Project Scenario (S2) is somewhat different and more complex. As the analysis carried out in the EGIDA Project highlighted, in these projects the capacity



building activities are often part of a wider objective. Sometimes one or more work packages are dedicated to the capacity building, but in other cases, the technical activities are scattered in several work packages making difficult to coordinate them, at least at the extent required for an effective contribution to GEOSS. Moreover in these cases, projects are focused on different objectives (e.g. scientific research) and the expertise in interoperability issues, and resources allocated to the capacity building tasks are limited. Last but not least, the activities needed for the implementation of the EGIDA METHODOLOGY should not have negative impact on the specific objectives of the project. In this case the coordination with other relevant FP projects is usually a valuable mean for an effective mobilization of resources, with re-use of outcomes which is welcome by the EC as the funding agency.

T1.b Definition of Thematic Working Groups

The definition of Thematic Working Groups is an effective mean for implementing an efficient resource sharing infrastructure.

Regional initiatives and National GEO initiatives are often multi-disciplinary being focused more on a operational objective (e.g. to enable services for one or more PAs, engage communities, provide contributions to overarching initiatives, etc.) than on a specific domain. In this case the definition of Thematic WGs is useful in order to handle the specificity of the different domains in the design phase (use-cases, user requirements, existing and gap analysis, Community-of-Practice specifications, etc.).

FP projects are more commonly mono-disciplinary, especially when they are funded on actions dedicated to specific research themes (e.g. air pollution, ocean, land monitoring on Environment Theme, or geohazards on Space theme, etc.). In this case one Thematic working group can be sufficient, but the stakeholder network may help to better reach out the referred community. Some FP projects, more focused on capacity building or enhancement, usually consider different thematic groups building them already in the proposal phase, with specific WPs. This seems a good strategy for a correct allocation of resources and efforts for the analysis phase where users need to be involved.



Guideline TA.1b.1

Thematic Working Groups may be defined basing on different taxonomies such as the GEOSS SBAs, the INSPIRE Themes, or they may be simply defined taking into account the objectives of the initiative carried out.



The FP7 project EuroGEOSS (European approach to GEOSS) studied solutions for enabling multidisciplinary applications in the GEOSS infrastructure. Three WPs were specifically dedicated to interaction with disciplinary domains: Forestry, Drought and Biodiversity.



The FP7 project GeoWOW (GEOSS interoperability for Weather, Ocean and Water) is continuing the EuroGEOSS work adopting the same approach dedicating specific WPs to the Weather, Ocean and Water domains.



The FP7 project ENVIROFI (The Environmental Observation Web and its Service Applications within the Future Internet), one of eight usage areas projects within the public-private partnership programme on the Internet of the Future (FI-PPP), in the same way, dedicates three WPs to user scenarios on Biodiversity, Atmospheric and Marine applications.



GIIDA

At the beginning of its activities the GIIDA project launched a Call for Proposals to identify possible contribution to the GIIDA infrastructure from different CNR Institutes. Basing on the analysis of the collected proposals, six Thematic Area were defined: Biodiversity, Climate change, Air quality, Soil/water quality, Hydrogeological hazards, Marine resources. Additionally one Transversal Area dedicated to “Joint Infrastructures between research and Public Administration” was defined. For each Area a coordinator and a vice-coordinator were appointed.

TA.1c Identification of relevant transversal areas/themes

Besides the Thematic areas, there are usually transversal areas that may need to be specifically addressed for their relevance in the initiative. These transversal areas are often related to technological issues but they easily touch different subjects requiring the contribution of Thematic WGs (e.g. definition of ontologies) and advisors (e.g. security and data policy).

Guideline TA.1c.1

The coordination group should identify the most relevant transversal areas and define which of them require the creation of a specific WG or task force including initiative’s participants and external members from the stakeholders network. Examples of typical transversal themes are:

- Semantics and Ontologies
- Environmental Models representation and chaining
- Data Policy
- Security

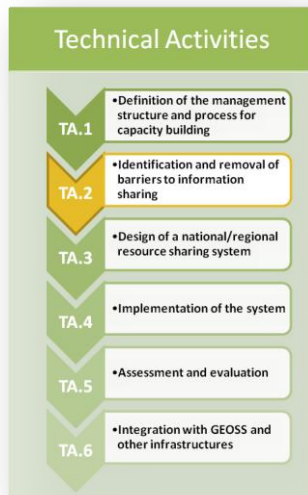


- High Performance and High Throughput Computing (including Grid and Cloud technologies)

The Transversal WGs do not need to be identified at the beginning of the initiative activities since most of them are usually not evident for participants until they acquire importance after the initial Technology Activities. The only transversal theme that appears to be useful to address since the very beginning of the Technical Activities is that related to Data Policy.

Guideline TA.1c.2

A Data Policy WG is generally useful for carrying out the activities on Data Sharing. The Data Policy WG should comprise members from the relevant stakeholders (scientists, data providers, data users, IT experts).



TA.2 Identification and removal of barriers to information sharing

In order to achieve an effective and sustainable contribution to GEOSS and other SoS initiatives, it is important to identify possible barriers to the information sharing by the candidate participants. Behavioral, political, legal, technical issues or other reasons may obstacle information sharing. Identification is a first step in order to define means for barriers removal.

Behavioral reasons relate to the will of participants who may have low or no attitude to resource sharing, depending not on some sort of constraint (which would make this barriers fall in other categories) but simply on habits. It may happen, for example, with research centers that did not have necessity to share resources yet. The removal of behavioral reasons may leverage the opportunities opened by information sharing (funding opportunities, access to others' information, etc.). It should be considered that after the removal of behavioral barriers, others may appear (e.g. technical, legal, etc.).



IDE-UNIVERS was a research project aimed at creating a thematic Spatial Data Infrastructure (SDI) to encourage access, exchange and interoperability of the huge quantity of information with a geographic reference produced by Universities and Research Centers within their projects and activities. It identified two main obstacles to information sharing: a) To motivate the actors to contribute in the project. It was solved by showing them that by contributing in the project creating the thematic SDI, their work would gain visibility; and b) the cost and effort to set up services. It was solved by using open source solutions and supporting people with courses and a helpdesk.



Political and legal barriers are related not to the will, but to the possibility of sharing. It is well known that a great amount of information cannot be shared due to political or legal reasons. There are sensitive data for privacy, security and safety reasons, some resources have a dual usage (civil and military), others are subject to complex Intellectually Property Rights (IPRs) for different actors involved (data owners, data providers, data users, service providers, etc.). Political and legal barriers are usually removed with a clear data policy.

Technical barriers are related not to the will or possibility to share resources, but to the capability to do it. Some participants may be willing and authorized to share resources but are not able to do it. Obviously technical barriers are removed through the availability of technical expertise and tools. These include the establishment of technical Task Forces, and training activities for individual capacity building such as workshops, summer schools, web lectures, etc.

Economical and financial barriers are also related to the capability to share information. They can be removed through identification of funding sources, and efficient mobilization of resources from parallel relevant activities (see also N5 action).



During the interoperability tests between SINAnet and GIIDA some criticalities emerged:

- Reticence by some partners to adopt new tools for data and information sharing (Response: seminars have been held to promote the benefits from data sharing).*
- Being a volunteer approach (no funds), the re-engineering process has to be conducted with in-kind resources (Response: full ITC support provided by CNR and SINAnet to the partners involved).*



- *Even if CNR and SINAnet fully supported the re-engineering process, not all the partners involved were capable to accomplish interoperability. Lack of competences arisen to implement and maintain the system (Response: Meeting has been held for know-how transfer).*
- *Lacks on communication between different actors, e.g. systems analysts and data and information providers*



EGIDA activities suggested that promoting synergies between the conducted activities and GEOSS (Drag effect) could be the primary step to strengthen the national (and sub-national) participation in GEOSS. [EGIDA-D3.4]

Guideline TA.2.1

The existence and nature of obstacles to data sharing can be discovered and analyzed through surveys and interviews. Members of the Stakeholders Network can provide information about behavioral, legal, technical and financial barriers to data sharing.

Guideline TA.2.2

The analysis of similar initiatives at local, national, regional and global level can provide direct and indirect suggestions on possible barriers. Past and on-going projects and programmes can be analyzed to investigate whether and to what extent they reached their own objectives in data sharing, which are the reason of failures (if any).

Guideline TA.2.3

Each emerging barrier must be analyzed in depth to correctly identify it. Some misunderstanding may happen, thus hindering the removal. For example if respondents say that they are not willing to share data. But a deeper investigation may suggest that they have this attitude because of policy concerns, or because it would require too much



effort. In this case what appeared to be a behavioral barrier would actually be a legal or a financial barrier, respectively. In another case a service might not be provided with the usual tools, but if a different more expensive software tool would enable the service provision, this should not be considered as a technical barrier, but as an economical one (or legal if the limitation in using the expensive tool is not in its cost, but in its license, e.g. not being free and open-source).

Guideline TA.2.4

Behavioral barriers can be removed clearly showing the benefits of data sharing. Benefits should be tailored to the audience. For example if behavioral barriers are encountered in science communities, the benefits of data sharing (including open data) of research data in terms of new research and funding opportunities should be highlighted.

Guideline TA.2.5

Legal barriers can be removed showing that common concerns about policies exists since a long time, and therefore several policies and license agreement already address most issues. Typical concerns about policies such as embargo period for scientific publications, data acknowledgment and citation, terms of use acceptance, disclaimer, etc. are already considered. The only problem here is to define a correct policy which is covered by action TA.4d.

Guideline TA.2.6

Financial and economical barriers can be removed through the identification of funding opportunities, or through the mobilization of resources. Action NA.5 addresses the identification of funds at different levels, however there might exist on-going projects already addressing the building and population of a data sharing infrastructure. They may have unused resources that might be mobilized to remove the financial and economical barriers.

Guideline TA.2.7

Whenever the acquisition of software is perceived as an economical barrier to the (re-)engineering process, the wide availability of free and open-source tools in the geospatial



domain should be considered as an important resource. More generally the on-going initiatives on re-use of software can help to a better mobilization of resources coming from different projects and initiatives.

Guideline TA.2.8

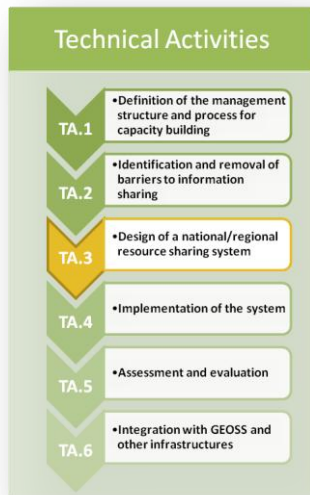
Technical barriers can usually be removed easily once they are correctly identified. If the barrier consists of general lack of expertise on interoperability issues, experts may be contacted and added to the specific WGs. Seminars, webinars, lectures, and workshops are means for providing the lacking technical expertise.

Guideline TA.2.9

Although most common data sharing technical requirements in terms of functionalities and performances are currently supported by technologies (tools and specifications) some advanced functionality might still require research and development (e.g. model interoperability and chaining, large datasets management, etc.). In such case technical WG can address the problem analyzing on-going initiatives in the domain, and, where possible, carrying out the necessary R&D activities. If no solution is available the provision of the advanced functionality should be post-poned and a general rescheduling is required to the coordination WG.

Guideline TA.2.10

Sometimes technical barriers arise during or after the (re-)engineering process for lack of communication between IT and interoperability experts, and users. User manuals, training sessions, tutorials and seminars are important for make users able to fully exploit the infrastructure.



TA.3 Design of a national/regional resource sharing systems

TA.3a identifying existing systems/sub-systems

A first step towards the definition of a system as a component of wider SoSs, is an analysis of the available resources that could be part of it: data, services, full infrastructures.

Guideline TA.3a.1

A survey can be conducted in the Stakeholders Network to identify existing resources. The survey can include

identification of existing resources and requirements.

Guideline TA.3a.2

An analysis of on-going initiatives at different levels (local, national, global) can provide information on existing resources. This analysis can consider both existing resources and identified gaps (see TA.3.b).

UK EOF *An interesting and useful practice was furnished by UK-EOF programme, where cataloguing pasts and currents activities at national level drove to the statement of needs and gap analysis. By this initiative it has been possible for UK to optimise both resources and researchers contributions [EGIDA-D3.4].*

This step is also useful to identify the inner structure of the proposed infrastructure. For small-range initiatives all the contribution may be provided through a single infrastructure for resource sharing which is then linked to wider systems like GEOSS or INSPIRE. For greater initiatives collecting heterogeneous contributions from different



participants and thematic groups, it could be useful and valuable to structure the infrastructure as a SoS in itself, which is in turn a component of the wider SoSs. In this case it is important to define the level of each sub-component which may be at local, national or regional level. In some cases a sub-local level is needed or useful.

TA.3b performing a gap analysis on existing infrastructures

After the existing analysis it is possible to perform a gap analysis to identify which components or resources are missing. Specific actions may be carried out to fill the identified gaps. For example other initiatives (e.g. FP projects) may provide the missing information.

Guideline TA.3b.1

Matching the requirements with the existing resources, the gaps can be identified. A prioritization of gaps is useful to direct the following capacity building actions.

TA.3c identifying available components/tools

Guideline TA.3c.1

A survey of the existing tools and components is an important step to speed up the deployment of the infrastructure and for an effective mobilization of resources. Existing infrastructures may provide relevant inputs in terms of architectural approaches, technological solutions and components.

TA.3d design the (re-)engineering process

Guideline TA.3d.1

The infrastructure should be conceived as a System-of Systems to build on the existing and protecting previous investments. The System-of-Systems Engineering (SOSE) approach is adopted in the main international initiatives on data sharing including GEOSS.

Guideline TA.3d.2

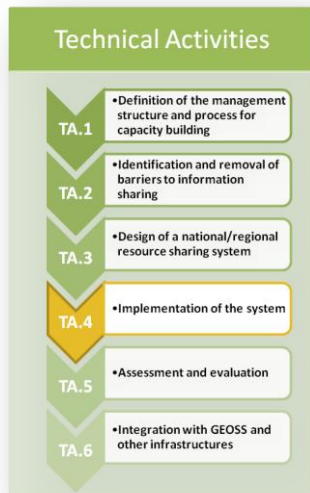
The "quick-win" approach is useful to help both the capacity building and networking action. A "quick-win" may be defined as *an action that requires minimal effort and*



EGIDA, Coordinating Earth and Environmental cross-disciplinary projects to promote GEOSS

FP7 Project nr 265124

produces major results. A quick-win may be for example the publication of a database which is almost ready (all metadata available, adoption of standard data encoding, etc.) but that was never published before. The result of a quick-win may be used for networking activities such as the dissemination of GEO/GEOSS or other initiatives to the Stakeholder Network, and for technical activities for example as a successful story for removing behavioral barriers. The achievement of quick-wins may follow the same approach described in TA.4 for the overall system.



TA.4 Implementation of the system

The implementation of the infrastructure should follow some steps. The order of the different steps depends on several reasons, such as the maturity level of sub-systems, availability of resources, etc. However, by a general point-of-view, the following steps may be considered a typical roadmap towards the implementation of the infrastructure.

TA.4a Deployment of a portal

A first step towards the implementation of the infrastructure is the deployment of a portal. It is designed as the point of access to the shared resources. Other points of access (e.g. specialized clients) can be provided later depending on the necessity. The portal should provide the basic information about the addressed initiative, and information about the past, on-going and future steps. It can be part of a more general portal (e.g. an institutional web-site). Depending on the future steps on the implementation of the data sharing system, it will be complemented with a geo-portal for discovery, evaluation, access and use of the shared resources.

TA.4b Deployment of a catalog service

The second step towards the deployment of the infrastructure is usually the deployment of a catalog service. There are many reasons for this choice:

- a) There are several implementation of standard catalog services available (e.g. OGC CSW). This removes any technical barriers on the service provision side.
- b) There are several standard metadata models and profiles available enabling at least the data discovery. This removes technical barriers on the data description side.
- c) Participants usually do not express objection on metadata sharing. This removes any political/legal barrier.



- d) The availability of a catalog accessible to external users helps to gain visibility of the infrastructure and of single participants. This is an opportunity also for funding, and it is a driving force towards a deeper information sharing.



The need to centralise the metadata indexing arose frequently during the workshop, first to discover resources at national level and, secondly, as an intermediate step toward GEOSS to provide the harmonised national contribution. The National INSPIRE Directive implementation can help to supply this need on the basis of the mandatory creation of environmental Metadata across Europe. [EGIDA-D3.4]

The deployment of a catalogue service requires several steps.

Guideline TA.4b.1

It is necessary to agree on the interfaces, metadata models and encodings supported in the infrastructure. The GEOSS specifications on Architecture and Data Management, and, where relevant the INSPIRE Implementing Rules and Technical Guidelines, provide the basis to facilitate the interoperability respectively with the GEOSS Common Infrastructure and the INSPIRE infrastructure. By a technical point-of-view ISO standards (e.g. ISO 19115/19115-2 for geographic information and ISO 19119 for services) provide a strong baseline for the description of data and services. Existing profiles (e.g. the INSPIRE profile) can be adopted, or extended to define new profiles where required.

As for metadata models and encodings, the adopted catalogue interface(s) must be defined. The OGC Catalogue Service for Web (CSW), ISO profile, is the better choice for making easy the interoperability with GEO/GEOSS and INSPIRE. Other specifications are commonly adopted as de-facto standards such as OpenSearch and related extensions.



Guideline TA.4b.2

While standards for metadata are quite widespread nowadays, it is however important to consider also possible specifications from the relevant Communities-of-Practice (CoP). In fact it is common that well-established CoPs have already developed metadata models and encodings. In order to effectively catalogue the existing datasets already described using this metadata models and encodings, it is often convenient support them in the growing infrastructure. This approach allows avoiding any re-encoding metadata which is an expensive and often unfeasible process.

As for metadata model and encodings, some CoPs have defined their own service interfaces (e.g. GBIF in the biodiversity domain).

Guideline TA.4b.3

If the adopted metadata models and encodings are not unique, a problem of internal interoperability arises. This issue can be addressed through a mediation approach using dedicated components to mediate between the internal supported models and encodings and the metadata model and encoding provided outside (e.g. towards the GCI).

An interesting solution has been widely tested in the context of many different projects and it is currently adopted in the GEOSS Common Infrastructure with the GEO Data and Access Broker (DAB). This solution is based on a brokering architecture where one or more dedicated components, the Brokers, are in charge of mediation. This approach facilitates the connection of existing catalogues and inventories without any major action on the metadata descriptions, according to a re-use approach. It also helps to lower entry barriers for both providers and users who do not have to make major changes in their own system since interoperability is in charge of the Brokers.

Guideline TA.4b.4

It is noteworthy that current widespread metadata profiles still do not fully support two very important sets of information: data citation and data policy.

Concerning data citation, presently *"GEOSS is lacking a data citation standard. This is symptomatic of the entire field of geo-spatial data, with few exceptions. A wide variety of organizations and projects support the concept of data citation (e.g., IPY, PANGAEA, NASA DAACS, USGS, NOAA National Data Centers), however no standard has emerged."*



[EGIDA-3.1]. While it is not possible to provide the citation information according to a standard is however convenient to consider and possibly include them in the metadata profile. This would avoid the need of adding new metadata (concerning information that could be lost) whenever a standard will be established. The International Polar Year (IPY) guidelines can provide suggestions (*"It is recommended that the implementation of the GEOSS Citation Standard should proceed along the following lines: 1. Use IPY data citation Guidelines to implement a first version of the GEOSS Citation Standard. [...]"*) [EGIDA-3.1]).

Concerning data policy, well-established profiles usually provide very basic information. For instance the INSPIRE profile accommodates information on "Constraints related to access and use" in the ISO 19115 model, using `accessConstraints` (for limitations on public access; e.g. sensitive data) and `useLimitation` (for conditions applying to access and use; e.g. fees) metadata fields [INSPIRE-M-TG]. The value is "free text" which is suitable for human-to-machine interaction, but not for machine-to-machine interaction as required to build complex services.

Guideline TA.4b.5

Another issue concerns the internal catalogue architecture. Three approaches are possible: a) central catalogue, where a single catalogue instance provide information about all the available resources; b) federated catalogues, where multiple catalogue instances are federated with a central component acting as the single-point-of-access, by the adoption of a common federated interface (same protocols and metadata models); c) brokered catalogues, where multiple catalogue (and inventory) instances are interconnected with a central component acting as the single-point-of-access, by mediation of different interfaces (protocols and metadata models). The first solution is simpler, but less scalable. It can be efficiently adopted whenever the infrastructure will not scale up much. It fits well to the scenario of a small infrastructure which must be deployed very soon starting from scratch, without any need of connecting existing catalogs and inventories. This may be the case of a much focused project (e.g. an FP project) needing an information sharing infrastructure.



When the requirements are more complex, a federated solution seems more appealing. Existing catalogues and inventories may be easily connected. Also resources not yet catalogued may be provided by local catalogues instead of a central one. The decision on how many catalogues should be deployed and which information they should collect depends on the characteristics of the guiding initiative. Each Thematic Area may have its own catalogue facilitating thematic grouping of resources. Or each workgroup may have its own catalogue facilitating the management.

Similarly to federated catalogues, brokered catalogues connect different information sources, but adding more flexibility by not imposing any common federated model, thus allowing to discover also resources published by different systems. It basically replicates the GEOSS approach at a lower level building the system as a System-of-Systems itself. Obviously mixed solutions are possible, with some resource descriptions served by local catalogues, and other directly served by a central catalogue (e.g. for small workgroups which do not want to manage a catalogue instance).

TA.4c Deployment of view services

A third step usually carried out simultaneously with the deployment of the catalogue service, is the provision of a view service. This may be as simple as a portrayal service in order to have a look to the available data in the catalogue, or a more advanced one as a full viewing service providing subsetting and possibly tiling, supporting a first visual evaluation of datasets. The reasons in favor of an early deployment of a viewing service are similar to those for the catalogue service:

- a) There are several implementations of standard viewing services available (e.g. OGC WMS). This removes any technical barriers on the service provision side.
- b) There are several clients and APIs able to access the standard viewing services (e.g. Google Maps APIs, OpenLayers APIs). This removes technical barriers on the client side.



c) Participants usually do not express objection on data viewing. This removes the majority of political/legal barrier. (However there is some cases where images should be partly masked for policy or security reasons.)

d) The availability of a data viewing to external users helps to gain visibility of the infrastructure and of single participants. This is an opportunity also for funding, and it is a driving force towards a deeper information sharing.

TA.4d Definition of a Data Policy

The definition of a data (and service) policy can be quite a complex task. It is necessary to start this activity as soon as possible because the lack of a clear data policy is a common barrier towards the next steps in the deployment of the infrastructure, in particular, the deployment of access services. In fact it is known that *"some institutions refuse to share their data, either because of a restriction on these particular data, or because of the absence of a policy relating to provision of data altogether. Even in the situation where a data policy exists, it may not have been ideally elaborated, i.e. in such a way that people apply it by consent and not by constraint. The data policy should be initiated with a clear understanding of why for example, some people and institutions are reluctant to share their data."* [SDI-AFRICA]

The data policy should consider the different use-cases identified.

Guideline TA.4d.1

The proposed data policy should at least consider:

- The GEO Data Sharing Principles and outcomes of the GEO Data Sharing Task Force including the GEO Data Sharing Action Plan²
- In Europe, especially for FP Projects, the outcomes of the INSPIRE Data and Service Sharing activities³, specifically including:
 - INSPIRE Regulation on INSPIRE Data and Service Sharing;

² http://www.earthobservations.org/geoss_dsp.shtml

³ <http://inspire.jrc.ec.europa.eu/index.cfm/pageid/62>



- Guidance on the 'Regulation on access to spatial data sets and services of the Member States by Community institutions and bodies under harmonised conditions'
- Good practice in data and service sharing.
- National legislation of participants
- Specific regulation for thematic areas, coming from international bodies or communities-of-practices

Guideline TA.4d.2

The Guidance on the 'Regulation on access to spatial data sets and services of the Member States by Community institutions and bodies under harmonised conditions' provides relevant suggestions and License templates (INSPIRE Basic License and Specific License) that can be useful in general, also outside the European context.



One of the elements of the eContentPlus project OneGeology-Europe was the development of a Code of Practice on access and licensing for the participating geological surveys. This Code of Practice provided guidelines for implementing an access policy that is adaptable to the circumstances and national requirements of the geological surveys, and at the same time user-friendly for interested data users. The access policy contained practical and organizational measures and model licences.

TA.4e Deployment of access services

The deployment of access services is a fundamental step towards the implementation of a resource sharing infrastructure. The definition of a data policy is usually considered a requirement for enabling data sharing. Once the data policy is clear, the deployment of access services is straightforward. There exist several implementations of both standard and community-of-practice access services.



Guideline TA.4e.1

It is necessary to agree on the interfaces, data models and encodings supported in the infrastructure. The GEOSS specifications on Architecture and Data Management, and, where relevant the INSPIRE Implementing Rules and Technical Guidelines, provide the basis to facilitate the interoperability respectively with the GEOSS Common Infrastructure and the INSPIRE infrastructure. By a technical point-of-view many different data models and encodings (OGC O&M, netCDF, HDF, Grib, etc.) have been defined and are de-jure or de-facto standards in the geospatial domain supporting different use-cases.

As for data models and encodings, the adopted access interface(s) must be defined. The OGC Web Coverage Service (WCS), OGC Web Feature Service (WFS), OGC Sensor Observation Service (SOS) are common choices in the geospatial domain.

Guideline TA.4e.2

While standards for data models and formats are quite widespread nowadays, it is however important to consider also possible specifications from the relevant Communities-of-Practice (CoP).

Guideline TA.4e.3

If the adopted access interfaces, data models and encodings are not unique, a problem of internal interoperability arises. This issue can be addressed through a mediation approach using dedicated components to mediate between the internal supported models and encodings and the data model and encoding provided outside (e.g. towards the GCI). An interesting solution has been widely tested in the context of many different projects and it is currently adopted in the GEOSS Common Infrastructure with the GEO Data and Access Broker (DAB). This solution is based on a brokering architecture where one or more dedicated components, the Brokers, are in charge of mediation. An access broker can access heterogeneous data access and transformation services, harmonizing them to provide datasets on a Common Environment (same resolution, Coordinate Reference System, geographical coverage, data format, etc.). This approach facilitates the connection of existing access services without any major action on the data, according to a re-use approach. It also helps to lower entry barriers for both providers and users who



do not have to make major changes in their own system since interoperability is in charge of the Brokers.

TA.4f Deployment of advanced services

Advanced services are value-added services that may enrich the infrastructure. They may include:

- Resource publishing system: advanced services to help providers to easily publish resources;
- Mediation services: advanced services for mediating between heterogeneous resources differing for metadata/data model or service interface;
- Semantic discovery and annotation: advanced services for enriching discovery through semantic augmentation (multilingual support, gazetteers, ontologies, natural language queries, etc.); advanced services to provide resource annotations by users;
- Model chaining: advanced services supporting discovery and chaining of environmental models;

TA.4g Documentation

The system should be documented at different levels.

Guideline TA.4g.1

A general communication about the system capabilities should be provided through the portal (see TA.4.1) and also through the usual communication channels by the Stakeholders Network.

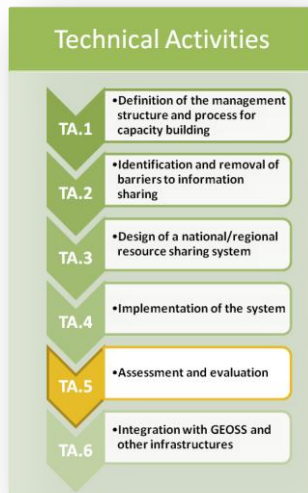
Guideline TA.4g.2

Technical documentation (user's manual, developer's manual, etc.) should be prepared to make possible the use and extension of the system. Training session can be organized for users.



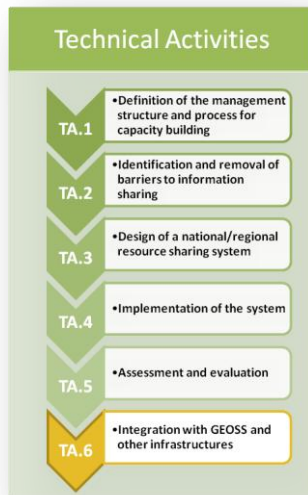
EGIDA, Coordinating Earth and Environmental cross-disciplinary projects to promote GEOSS

FP7 Project nr 265124



TA.5 Assessment and Evaluation

The deployed infrastructure may be tested and validated through the definition of pilot projects and case studies. Relevant stakeholders may play a fundamental role in this stage. A failure in the assessment and evaluation may require to cycle over the TA.4 "Implementation of the system" subactivities.



TA.6 Integration with GEOSS and other infrastructures

Once the infrastructure has been put in place, evaluated and assessed, it can be considered as a candidate contribution for wider SoSs such as GEOSS, INSPIRE/SEIS, etc.

Guideline TA.6.1

Interoperability tests should be carried out in order to verify the compliance with the specification of the addressed SoS. A failure in the interoperability tests may require to cycle over the TA.4 "Implementation of

the system" sub-activities.

Guideline TA.6.2

Once the system is validated and interoperability tests have been run successfully, the implemented system can be connected with other infrastructure to be part of a wider SoS. Depending on the related specification, component registration can be carried out. Concerning GEOSS, the "Register your Resources" section in the GEO Portal (http://www.geoportal.org/web/guest/geo_home) provide instructions on the process for registering resources.



10 General References

[EC-CATALOGUE]

European Commission - Directorate General for Research and Innovation - Environment Directorate, "Catalogue of EU funded projects in Environmental research - 2007-2011 FP7 - Theme 6 – Environment (including climate change) Preliminary", 2011

[EGIDA-D3.1]

EGIDA Consortium, "D3.1 Proposal for a GEOSS citation standard", 2011

[EGIDA-D3.3]

EGIDA Consortium, "D3.3 Master plan for scientific sessions focusing on the GEOSS to S&T relationship", 2011

[EGIDA-D3.4]

EGIDA Consortium, "D3.4 Process for the identification of examples showing GEOSS at work and analysis of national cases for the identification of practices, commonalities and needs for further replication", 2011.

[EGIDA-D3.6]

EGIDA Consortium, "D.3.6 Framework concept for European funding agencies", 2011.

[EGIDA-D4.1]

EGIDA Consortium, "D4.1 Analysis of initiatives relevant for the GEOSS S&T objectives", 2011.

[EGIDA-D4.2]

EGIDA Consortium, "D4.2 The EGIDA Methodology", 2011.

[EGIDA-D4.3-HSP]



EGIDA Consortium, "D4.3 Report on EGIDA Methodology Transfer Use-case: Mediterranean hot-spot pollution", 2012.

[EGIDA-D4.4-MED]

EGIDA Consortium, "D4.4 Report on EGIDA Methodology Transfer Use-case: Mediterranean region", 2012.

[EGIDA-D4.5-AQH]

EGIDA Consortium, "D4.5 Report on EGIDA Methodology Transfer Use-case: Pan-European Air Quality for Health", 2012.

[EGIDA-D4.6]

EGIDA Consortium, "D4.6 Workshops Reports and Recommendations", 2012.

[EGIDA-D4.7]

EGIDA Consortium, "D4.7 Assessment of the EGIDA Methodology", 2012.

[EGIDA-D4.9-SLV]

EGIDA Consortium, "D4.9 Report on EGIDA Methodology Transfer Use-case: Slovenia", 2012.

[EGIDA-DOW]

EGIDA Consortium, "Grant agreement for: Coordination and support action - Annex I - 'Description of Work'", 2010.

[GEO-CB]

Group on Earth Observations, "GEO Capacity Building Strategy". Document 13, As Accepted at GEO-III, 2007.

[GEO-ST]



EGIDA, Coordinating Earth and Environmental cross-disciplinary projects to promote GEOSS

FP7 Project nr 265124

Group on Earth Observations, "GEOSS Strategic Targets", Document 12(Rev1), As accepted at GEO-VI, 2010.

[INSPIRE-M-TG]

Drafting Team Metadata and European Commission Joint Research Centre, "INSPIRE Metadata Implementing Rules: Technical Guidelines based on EN ISO 19115 and EN ISO 19119", 2010

[SDI-AFRICA]

Geoinformation Team, Economic Commission for Africa, "SDI Africa: an Implementation Guide", 2004, available at: <http://geoinfo.uneca.org/sdiafrica/default1.htm>