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D4.2 The EGIDA Methodology

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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 designed.

The design of the EGIDA METHODOLOGY includes 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).

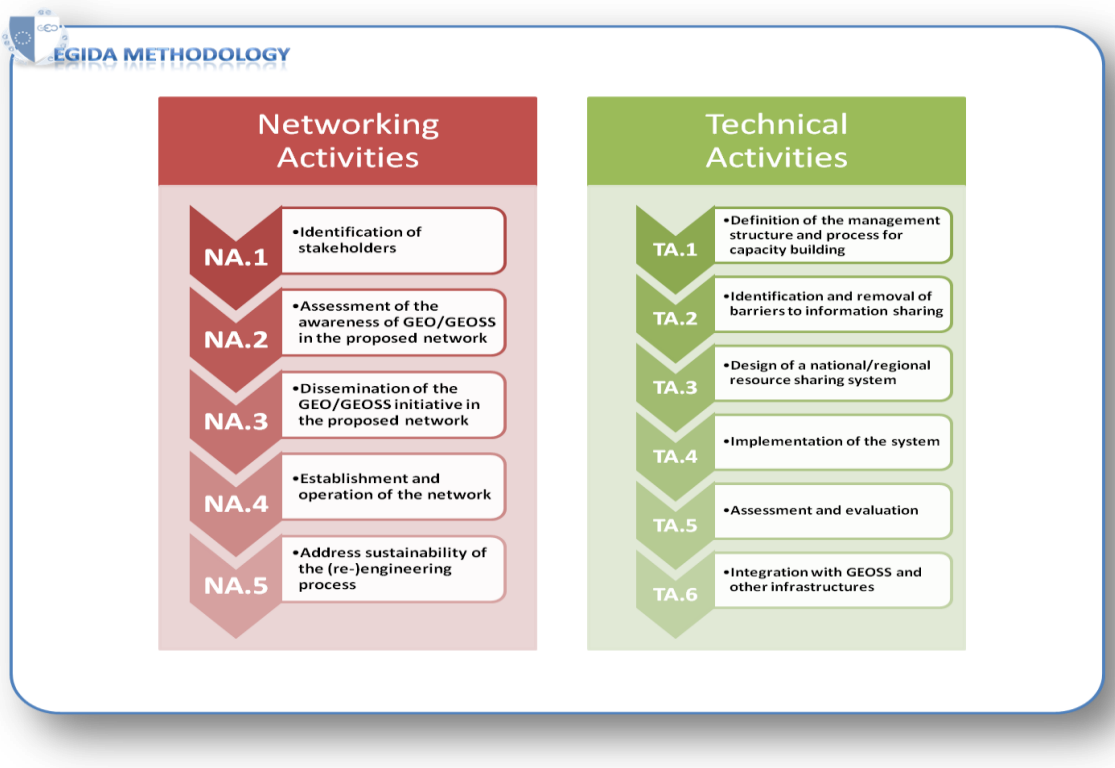
- Funding agencies which would like: a) to provide guidelines for projects aiming to contribute to the GEOSS and other supranational SoSs; b) to assess results of funded projects.

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:

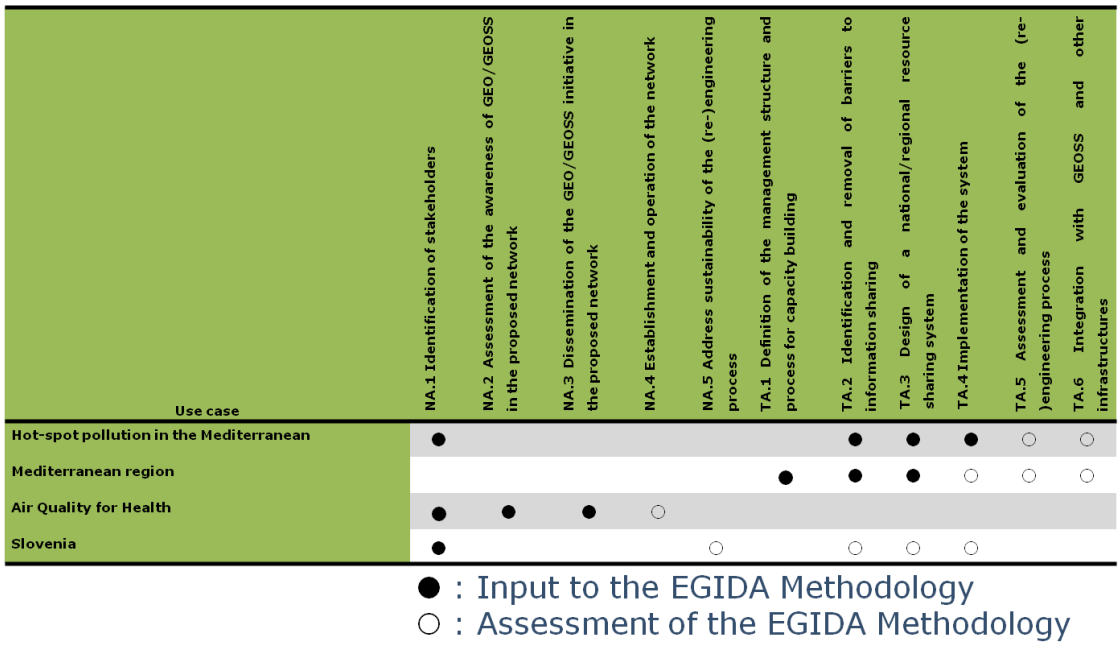
- Networking Activities: to identify and address the relevant S&T community (-ies) and actors (Community Engagement);
- Technical Activities: to guide the infrastructure development and align it with the GEO/GEOSS interoperability principles (Capacity Building);



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 will be evaluated and assessed during the EGIDA Project through four use-cases. The use cases, based on-going projects and initiatives, have provided input in the design phase and in the following phases will assess different aspects of the EGIDA METHODOLOGY.



EGIDA Use-Cases contribution to the design and assessment of the EGIDA METHODOLOGY (preliminary plan)

The present version of the EGIDA Methodology should be considered as a draft since relevant contributions coming from on-going future activities in the EGIDA Projects need to be included.

In particular the three main expected contributions for the final version of the EGIDA Methodology are: a) the EGIDA deliverables descrbing he activities in support to the STC Roadmap ; b) suggestions from the GEO STC, EGIDA Advisory Board and EGIDA Stakeholders Network ; c) feedback from the evaluation and assessment activties in the EGIDA use-case.

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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.

The document describes, in chapters 2-11, the design of the EGIDA METHODOLOGY; chapter 12 is specifically dedicated to the resulting EGIDA METHODOLOGY. It 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 contribute 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: indeed, 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' 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: indeed 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 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 their 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 have no obligation in the INSPIRE Directive, but they 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. Depending on the outcomes of EGIDA activities in support to the STC Roadmap, feedbacks from the EGIDA use-cases, and suggestions from the EGIDA Advisory Board and Stakeholders Network, the final version of the EGIDA Methodology might address the motivations for a contribution to GEO/GEOSS.

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.

As stated in the EGIDA Description of Work (DoW)

> *"the EGIDA Methodology will describe a sustainable approach for implementing a (re-) engineering process for the S&T national infrastructures and systems (e.g. observatories, data systems, processing services, modelling systems, etc.) and contribute to the GEO System of Systems (SoS) and to the other relevant European initiative based on a SoS approach (e.g. INSPIRE, GMES, SEIS)."*
>
> *[EGIDA-DOW]*

The activities carried out during the first year of the EGIDA Project helped to refine the definition, pointing out, for example, the importance of the methodology target (i.e. national/regional S&T communities), the funding sources (i.e. national, European and international initiatives and projects), and different levels of participation (in particular regional and sub-national).
The final operational definition of the EGIDA METHODOLOGY is then expressed as follows:

> *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" recognizes the importance of the national level 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 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 new 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 (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.

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 Methdology 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 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.

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 Design of the EGIDA METHODOLOGY

The EGIDA METHODOLOGY is based on several sources (Figure 2):

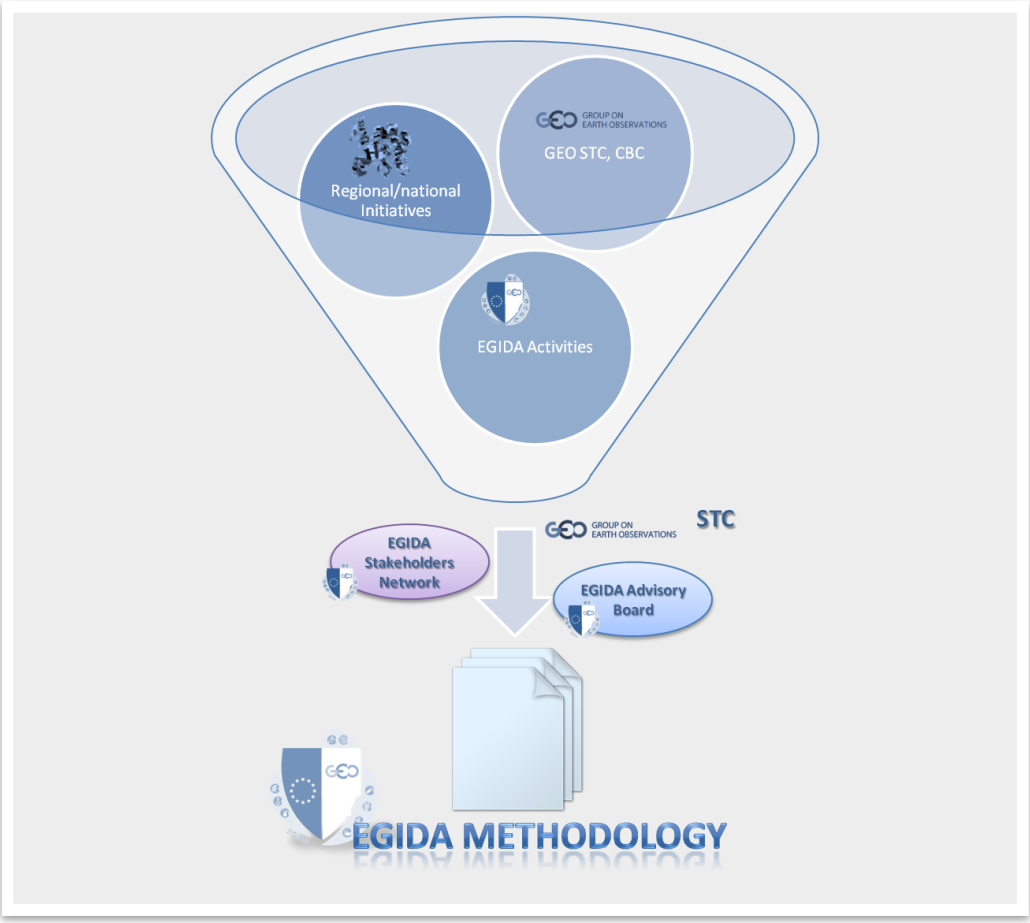

Figure 2 Schematic process for the design of the EGIDA METHODOLOGY

9.1. GEO Activities

GEO activities are obviously a fundamental source for the definition of the EGIDA METHODOLOGY. More specifically the GEO Capacity Building Strategy and the GEO Science and Technology Roadmap are the main inputs.

9.1.1. GEO Capacity Building Strategy

The GEO Capacity Building Strategy is detailed in the Document 13 accepted at GEO-III [GEO CB]. The guiding principles listed in the document are rooted in the capacity building elements of documents and fora developed by GEO as well as GEO Members and Participating Organizations that have existing Earth observation capacity building initiatives. The following are the guiding principles that confirm GEO's commitment to sustainable actions in responding to user needs:

a) Build on existing efforts and best practices;
b) Focus on user needs;
c) Foster collaboration and partnership, especially with and between developing countries, at the local, national, regional and global level, and within and between GEO societal benefit and transverse areas;
d) Concentrate on end-to-end Earth observation needs in each of GEO's societal benefit areas, including user requirements; data access, collection, archiving and analysis; and product development and exchange;
e) Enhance the sustainability of existing and future Earth observation capacity building efforts by building awareness amongst decision makers in developing countries; and
f) Facilitate the development of comprehensive, sustainable capacity building efforts that address infrastructure

9.1.2. GEO Science and Technology Roadmap

The GEO Science and Technology Committee has defined a roadmap to identify and motivate the path and it has decided to pursue to achieve its objectives.
It includes a set of activities grouped under two headings:

1) Actively engaging and incorporating science and technology participants in the development of GEOSS

a) Revolving scientific review of each Work Plan, starting with the current work plan for 2009-2011 on grounds of scientific and technological soundness and completeness against the outstanding questions and challenges in each of the SBAs
b) Implement review indicators in the GEO Work Plan reporting to ensure that activities in individual GEO Tasks and Sub-Tasks meet the applicable scientific and technological standards
c) Assess the requirement for continuity and long-term monitoring by Earth observation systems of essential data from GEOSS components
d) Ensuring state-of-the-art technology in the GEOSS Common Infrastructure (GCI) and Observation Infrastructures.
e) Responding to S&T needs and priorities in Earth observation for GEOSS.

2) Creating incentives and promoting GEO in the S&T communities
   a) Getting GEO/GEOSS better acknowledged in the scientific community.
   b) Establishing a "GEO label" to recognise the scientific relevance, quality, acceptance and societal needs for activities in support of GEOSS.
   c) Building awareness of GEO and GEOSS in the different S&T communities, within the scope of the GEOSS development.
   d) Showing GEOSS at work with a set of compelling examples showing how GEOSS serves the S&T communities in their work.
   e) Enhancing registration of scientific data sets as an important indicator for potential contributors from the science communities in assessing the relevance of GEOSS for their work.
   f) Identify key commercial partners, which could contribute to GEOSS and also benefit from improved observational means, products and services and might therefore support certain S&T development.
   g) Catalyze research and developing funding to help engaging the S&T communities in the implementation of the GEOSS.

9.2. EGIDA activities in support of the GEO STC Roadmap

The EGIDA Project aims to prepare a sustainable process promoting coordination of activities carried out by: the GEO Science & Technology (S&T) Committee; S&T national and European initiatives; and other S&T Communities. This is done by supporting broader implementation and effectiveness of the GEOSS S&T Roadmap and the GEOSS mission through coherent and interoperable networking of National and European projects, and international initiatives. To achieve these objectives EGIDA dedicates specific WPs to support the implementation of the STC Roadmap:

- WP2 "Support of GEO Task ST-09-01" includes activities aiming to:
  - T2.1 Assess the requirements for continuity and long-term monitoring
  - T2.2 Respond to S&T needs and priorities
- WP2 "Support of GEO Task ST-09-02" includes activities aiming to:
  - T3.1 Get GEO/GEOSS better acknowledged
  - T3.2 Establish a "GEO label"
  - T3.3 Interface with S&T communities
  - T3.4 Show GEOSS at work
  - T3.5 Enhance registration of scientific data sets
  - T3.6 Catalyze research and development resources

The outcomes of the EGIDA activities in these two WPs are included in the definition of the EGIDA METHODOLOGY. The relevant deliverables are:

- D2.1 Methodology and process for the evaluation of the relevance of specific
- observation infrastructure
- D2.2 Continuity indicator for GEOSS components
- D2.3 Continuity database
- D2.4 Availability test report

- D2.5 Framework for sustained operation
- D2.6 STC Web applications
- **D3.1 Proposal for a GEOSS citation standard**
- D3.2 Proposal for a GEO Label
- **D3.3 Master plan for scientific sessions focusing on the GEOSS to S&T relationship**
- **D3.4 Process for the identification of examples showing GEOSS at work**
- D3.5 Survey on datasets available from the European S&T Community
- **D3.6 Framework concept for European funding agencies**

In bold the deliverables available at the moment of writing the present document. They were considered for the design of the first version of the EGIDA METHODOLOGY. For the others, where a draft was available it was considered as a preliminary input. The outcomes from deliverables available lately in the project will be included in the final version of the EGIDA METHODOLOGY.

9.3. Analysis of national and European initiatives

Another important source of information for the design of the EGIDA METHODOLOGY was the analysis of on-going initiatives carried out in the context of the EGIDA Project (WP4 EGIDA METHODOLOGY and Use-Cases). In particular: a) the Workshop on National Use-cases organized by ISPRA for the EGIDA Project and held in Rome on April 2010, whose outcomes were summarize in the EGIDA deliverable D3.4; and b) the analysis on national use-cases and FP7 Projects reported in the EGIDA deliverable D4.1.
Particular attention has been paid to three initiatives discussed in the workshop in Rome that have demonstrated specific focus on GEO/GEOSS contribution also defining an integrated and coordinated approach towards the contribution to GEO/GEOSS and towards other relevant initiatives on information sharing.

- UK EOF The UK-Environmental Observation Framework (UK-EOF) strives to change the way the UK perceives, values, archives and uses information from observation activities by working across public departments and agencies, the voluntary sector, industry and academia. The UK-EOF will be a self contained 5 year programme of Living With Environmental Change (LWEC), funded by the major sponsors of environmental observations in the UK and delivered via a series of workstreams.

- GIIDA GIIDA is a interdepartmental project of the National Research Council of Italy coordinated by the Department of Earth and Environment (CNR-DTA) which targets the definition and development of a shared multidisciplinary infrastructure for the management, processing and analysis of environmental data. It is composed of work groups related to air quality, seas and marine resources, natural and anthropic risk, climate change, water and soil quality, biodiversity and combined infrastructures between Research Institutes and Public Administrations.

- SINAnet SINAnet is the Environmental Information and Monitoring System and represents the EIOnet National Focal Point (NFP) the EEA in Italy. NFP is in charge of cooperation with the EEA and the NRCs (National Reference Centers) and organises national coordination of activities related to the EEA strategy. Data and information of European relevance are managed to support the business processes of the European Environmental Information System and building on a shared information infrastructure to create national repositories (REPORTNET). Through SINAnet, ISPRA act as Coordination Structure for INSPIRE implementation to support the National Contact Point (Ministry for Environment, Land and Sea).

GIIDA and SINAnet also cooperate in building a SoS at national level. This is an example of the results of a (re-)engineering process, in order to build a system of systems (SoS)

conceived for a coordinated and sustainable contribution to the GEOSS. Indeed, ISPRA and CNR-DTA, as part of a coordination effort, underwent a re-engineering of their GIIDA and SINAnet systems in order to build a common infrastructure based on the GEOSS principles (SoS approach, interoperability through standardization) and GCI provisions (best practices, standards, components) supporting multi-disciplinary use-scenarios for both research and government applications requiring access to EO resources. The infrastructure is also conceived as an effective and sustainable contribution to the GEOSS.

10 Structure

The EGIDA METHODOLOGY is structured as a set of activities, actions and sub-actions for capacity building and community engagement. For each action and sub-action, good practices and guidelines derived from the identified sources are provided.

11 Assessment of the EGIDA METHODOLOGY

The EGIDA METHODOLOGY will be assessed through a set of use-cases.

UC 1. "*Hot-spot pollution in the Mediterranean*" will focus on a thematic and regional context. It will assess the EGIDA METHODOLOGY in the typical context of a FP7 project (KnowSeas).

UC 2. "*Mediterranean region*" will assess the EGIDA METHODOLOGY on a multithematic regional context. It will focus on partnership, infrastructures, products and services involving developing countries (namely southern Mediterranean Countries).

UC 3. "*Air Quality for Health*" will focus on a pan-European thematic context.

UC 4. "*Slovenia*" will focus on a multi-thematic national context, helping to assess the EGIDA METHODOLOGY taking into account the specificity of small countries (namely Slovenia).

The use-cases are based on ongoing activities running in parallel with the EGIDA project. Depending on their status, scheduling and characteristics they provide different contributions to the EGIDA METHODOLOGY. The activities already carried out have provided

inputs in the design of the EGIDA METHODOLOGY, while future activities will help to assess specific aspects of the EGIDA METHODOLOGY (Figure 3).

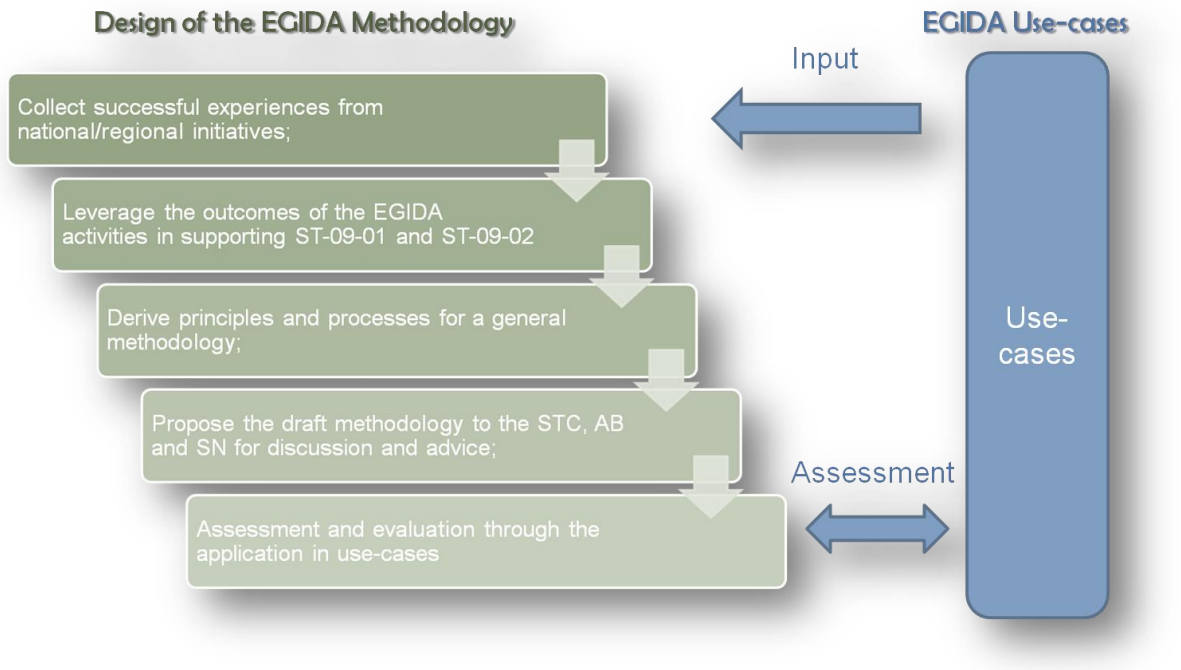

Figure 3 - EGIDA Use-cases contributions to the design of the EGIDA METHODOLOGY

Each use-case will apply the EGIDA METHODOLOGY to specific actions to be carried out and will provide a feedback to improve the EGIDA METHODOLOGY (Figure 4)

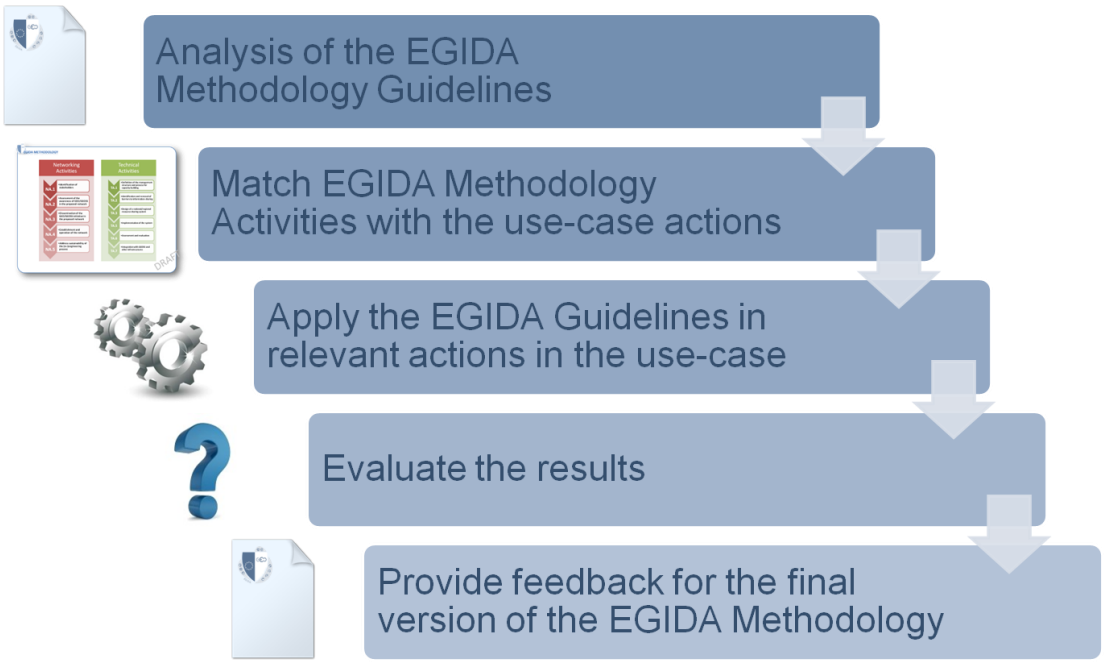

Figure 4 - EGIDA METHODOLOGY assessment plan for the EGIDA Use-cases

The following table (Figure 5) summarizes the contributions from the different use-cases, taking into account the provided inputs and a preliminary plan for assessment actions:

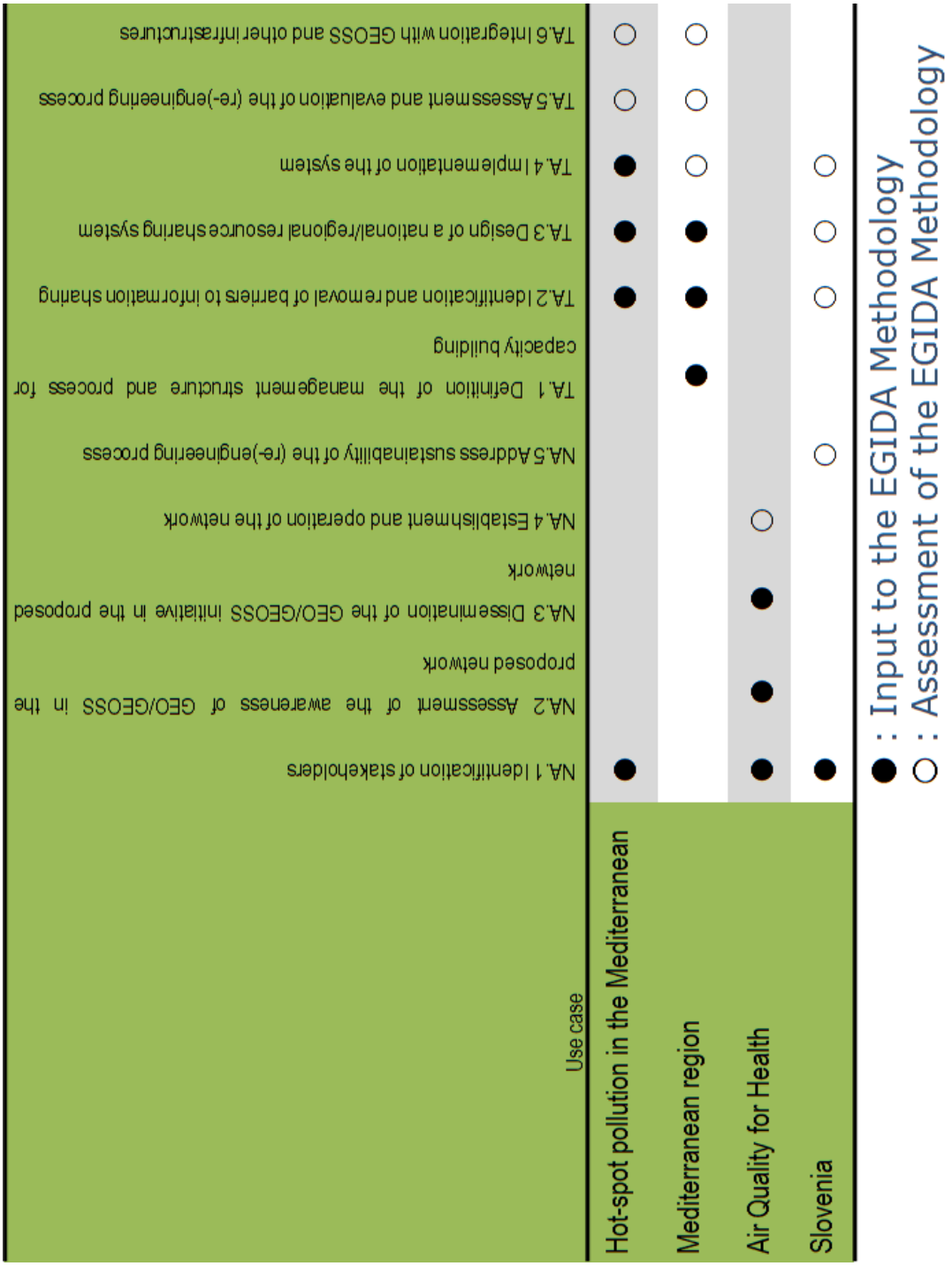

Figure 5 - EGIDA Use-cases contribution to the design and assessment of the EGIDA Methodology (preliminary plan)

12 The EGIDA METHODOLOGY

The EGIDA METHODOLOGY includes two types of activities (Figure 6):

- 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;

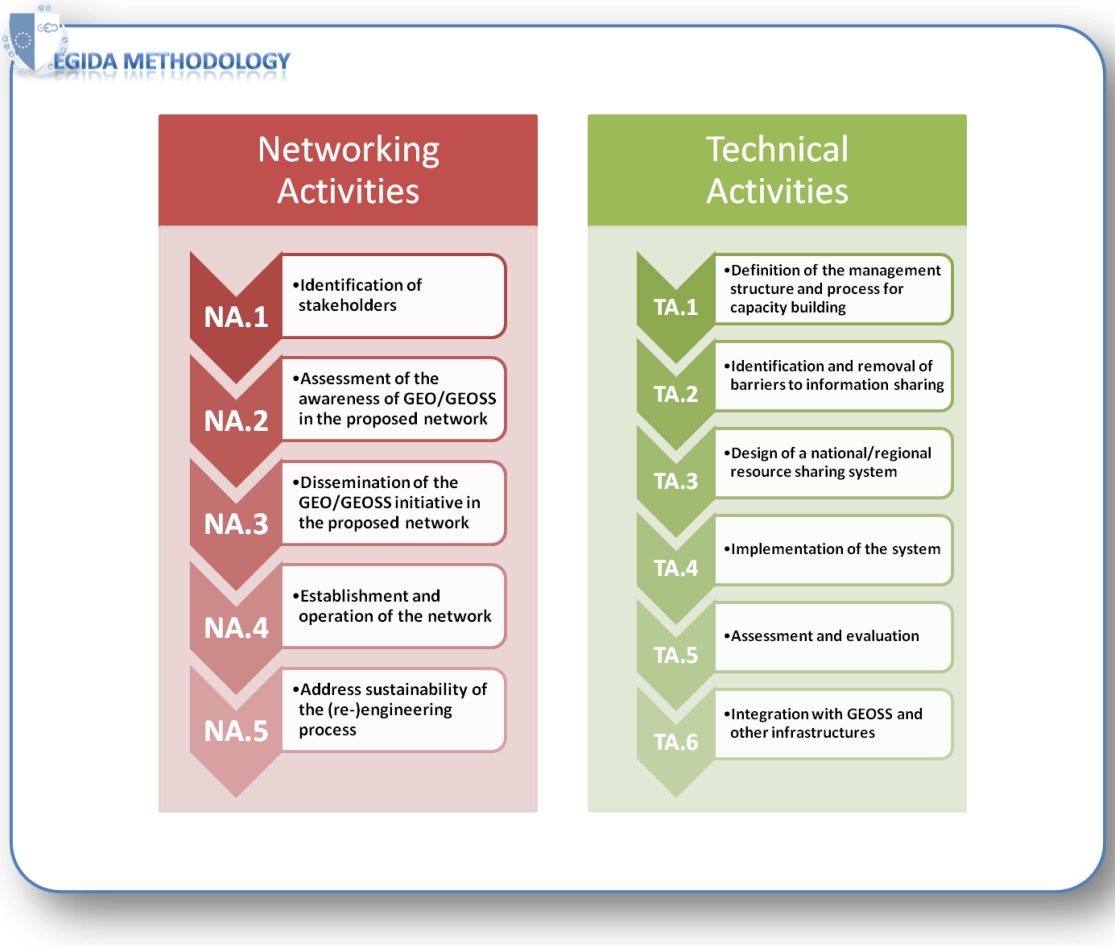

Figure 6 The overall structure of the EGIDA METHODOLOGY

12.1. 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.
- final 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 final 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 final 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 fora, 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.

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. Initially it was proposed only to the project participants and it is planned to extend it outside the Consortium, in the following phases. The survey asked for basic information about the candidate stakeholders, and their possible role in the project.

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.
The assessment can be performed in parallel with the identification of candidate stakeholders for example through surveys.

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. This actions aim to focus candidate stakeholders on the contribution to the establishment of a resource sharing infrastructure as a component of larger SoSs. This should be presented as an opportunity on different direction, 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.
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.geo-tasks.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.
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 aimed to show that cost saving can be oriented to more important initiative.

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 created. Depending on the desired scope and objective, this 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.

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

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) fo 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).

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. Assuming that technical barriers are removed carrying out the Technical

Activities proposed in the EGIDA METHODOLOGY, the financial barriers are the most relevant. 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 draft Deliverable D3.6 "Framework concept for European funding agencies".
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.

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.

12.2. 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).

In the project ENPI-SEIS 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 workshop 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 ERFF 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. 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.

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. Thematic Working Groups may be based 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.

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.

The FP7 project EuroGEOSS (European approach to GEOSS) studies solutions for enabling multidisciplinary applications in the GEOSS infrastructure. Three WPs are 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 Ins titutes. 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). 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. A Data Policy WG is generally useful for carrying out the activities on Data Sharing.

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: seminaries has 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 where 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, eg. systems analysts and data and information providers

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]

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.

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.

TA.3c identifying available components/tools

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 identification of "quick-wins"

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 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 SoS component.

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 remove 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 :

Metadata profile definition : It is necessary to agree on the 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. 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 to avoid any re-encoding metadata which is an expensive and often unfeasible process.
If the adopted metadata models and encodings are not unique, a problem of internal interoperability arise. 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 tested in the FP7 project EuroGEOSS, and in the GEOSS Architecture Implementation Pilots task. This solution adopts a brokering architecture where one or more dedicated components, the Brokers, are in charge of mediation. This approach facilitate the connection of existing catalogues and inventories without any major action on the metadata descriptions, according to a re-use approach.

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.

Catalogue distribution design: Another issue concerns the internal catalogue architecture. Two approaches are possible: a) central catalogue, where a single catalogue instance provide information about all the available resources; b) federated catalogues, where multiple catalogue (and inventory) instances are federated with a central component acting as the single-point-of-access. 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 must be deployed very soon starting from scratch, without any need of connecting existing catalogs and inventories. This may be the case

of a very 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. 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).

Catalogue interface definition: 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. Anyway, as for metadata model and encodings, some CoPs have defined their own service interfaces (e.g. GBIF in the biodiversity domain).
Whenever multiple interfaces are internally supported, adaption of interfaces is required in order to expose a standard interface to the outside world. The brokering approach, briefly described above, address this issue adapting different service interfaces.

TA.4c Deployment of view services

A third step usually carried out simultaneously with the deployment of the catalog 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 implementation of standard viewing services available (e.g. OGC WMS). This remove 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 There are some cases where images should be partly masked for policy, 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.

The proposed data policy should at least consider:

- GEO Data Sharing Principles and outcomes of the GEO Data Sharing Task Force
- In Europe, especially for FP Projects:

- INSPIRE Regulation on INSPIRE Data and Service Sharing;
- 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.

  The Guidance provides relevant suggestions and License templates that can be useful in general, also outside of the European context.

- Specific regulation for thematic areas, coming from international bodies or communities-of-practices

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 implementation of both standard and community-of-practice access services.

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.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.

Interoperability tests may 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" subactivities.

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.

13 General References

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