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Strategic view for the sustainability of ENEON after the end of the project

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Acronyms

CEOS	Committee on Earth Observation Satellites
DAB	Discovery and Access Broker
EARSC	European Association of Remote Sensing Companies
EC	European Commission
ECV	Essential Climate Variables
EEA	European Environment Agency
ENEON	European Network of Earth Observation Networks
EO	Earth Observation
EOV	Essential Ocean Variables
EV	Essential Variables
GISC	GMES *in-situ* Coordination Project
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GCOS	Global Climate Observing System
GMES	Global Monitoring for Environment and Security
NMM	Network Metadata Model
OGC	Open Geospatial Consortium
SBA	Societal Benefit Area
SDG	Societal Development Goals
UNEP	United Nations
VOS	Voluntary Observing Ship
WMO	World Meteorological Organization

Executive Summary

Many in situ networks in Europe collect valuable Earth observation data, with both European and global relevance. Nevertheless, there are still gaps in coverage and datasets, and difficulties in maintaining sensors and infrastructures. Furthermore, a lack of collaboration and coordination between different communities hinders a full exploitation of observation data and information for scientific, policy and societal applications. To respond to these needs the concept of a European Network of Earth Observation Networks (ENEON) as a common framework and facilitator for in situ European networks have emerged in the frame of the ConnectinGEO project.

The objective of this deliverable is to analyse and propose different options for the establishment of a self-sustaining ENEON after the end of the ConnectinGEO Project. Different aspects of the possible ENEON organization structure are here explained.
The ultimate vision is to have all European in situ Earth observation networks (for different domains/themes) integrated and harmonized so that gaps in the availability of observation data are closed, redundancies are reduced, cost savings are realised, and full operational continuity of observation data collection and management is ensured.

The optimal structure for ENEON proposed here is a formal organization, needed to have recognition and claim funding, but with a light secretariat behind (to avoid a bureaucratic and slow body) embedded/hosted in an existing project or organization(s). A minimum level of financial resources, from a mixture of public and project funding, would be needed to operate such a secretariat. The rationale for public funding is because ENEON will be in the interest of the whole EU Earth observation community, with implications also for societal and sustainable development.

Different organizations, with relevance to the ENEON objectives, were considered as potential ENEON hosts, including: EEA (European Environment Agency), GEO (Group of Earth Observations), IIASA (International Institute for Applied Systems Analysis), CREAF or similar institutions.

In conclusion, the ConnectinGEO consortium recommends to the EC to support the ENEON continuation through the following three complementary and sequential instruments:

1. ERA-PLANET provides support to ENEON – short and near-term action.
2. EC prepares a specific topic to develop ENEON as part of the next H2020 calls for proposals – medium-term action.
3. EC considers the inclusion of a new EIP to support in situ (as non-satellite) Earth observations – long-term action.

Introduction

ENEON[1] is a *common* network of in situ Earth observation (EO) networks which shall provide an integrated and harmonized perspective on observation resources, helping to reduce redundancies and detect gaps in the European EO arena. Its final aim is to derive policies and actions to address complex societal challenges. The idea and characteristics of ENEON have evolved from the ConnectinGEO project, but there is a need to continue the work on ENEON in a sustained manner beyond the duration of the project. The ultimate vision is to have all European in situ Earth observation networks (for different domains/themes) integrated and harmonized so that:

- gaps in the availability of observation data are closed,
- redundancies are reduced,
- cost savings are realised, and
- full operational continuity of observation data collection and management is ensured.

With the heterogeneous landscape of in situ networks operating in Europe and the numerous gaps in EO data, the European Commission (EC) together with the Group on Earth Observations (GEO) have proposed that an organization such as ENEON could be established to provide Europe's in situ networks with a common framework. Numerous in situ networks operate across Europe underpinning European Earth observation. However, only a short list of research and operational data infrastructures share a common structure under the name of ENVRI and, in general, in situ networks are not yet supported by a common framework for building a European in situ EO infrastructure. The ENEON framework will aid the in situ community in terms of:

- identifying gaps and setting priorities,
- recommending infrastructure and interoperability standards,
- agreeing on common data policy principles, and
- ensuring sustainability.

ENEON has started to map existing networks to the Sustainable Development Goals (SDG), Societal Benefit Areas (SBA) and Essential Variables (EV), demonstrating the crucial role of in situ observations. Furthermore, ENEON is linking heterogeneous in situ networks with the intention to present a unified voice to the EC, GEO, the Committee on Earth Observation Satellites (CEOS), the European Association of Remote Sensing Companies (EARSC), Copernicus, and the wider community.

This deliverable presents the strategic view for the sustainability of ENEON following the completion of the ConnectinGEO project in January 2017. It builds upon the Deliverable 3.4 *Report on observations, measurements and gaps in observation systems reported by the communities* (IIASA, 2016).

[1] ENEON - European Network of Earth Observation Networks. For more details, see http://eneon.net/.

Rationale

Many in situ networks in Europe collect valuable Earth observation data, and European institutions are involved in numerous global networks. Nevertheless, there are still gaps (http://www.connectingeo.net/gaps) in EO networks as well as datasets and problems persist in maintaining current sensor and data infrastructures. This limits a scientist's ability to obtain a clear integrated picture of the status and changes on the planet and for providing the right guidance to decision makers.

Furthermore, a lack of cross-domain collaboration and coordination in the interaction between Earth observation communities, policy and decision makers hinders a fully integrated exploitation of observation data for societal applications. ENEON aims to strengthen coordination and collaboration between in situ EO networks, eventually leading to the development, generation, publication and dissemination of (new) products to better serve growing societal needs for environmental intelligence.

Coordination of in situ Earth Observation activities is a daunting task. Even a cursory attempt to map the in situ networks operating on a European level shows that this is a large, incomplete and complex environment. Nonetheless, some degree of global domain-specific coordination is in place for many in situ observational topics and SBAs, along with continental, national and regional cross-domain efforts. Examples for the global coordination of in situ observation activities include, but are not limited to, GEO BON (Biodiversity Observation Network), GCOS (Global Climate Observing System), GGOS (Global Geodetic Observing System), POGO (Partnership for Observation of the Global Oceans) and the former GTOS (Global Terrestrial Observing System). Actually, some of these global coordination efforts rely on European funding (e.g. GEO BON is relying on EU-BON for Europe) with additional participation by more fine grained thematic networks and initiatives (e.g. GEO BON participates in the Freshwater Information Platform (FIP) and Global Biodiversity Information Facility (GBIF)). To make the situation more complex, new networks appear from time to time while others become inactive. Hence, ENEON has the commitment to maintain and enrich the graph inventory shown partially in Figure 1 (http://www.eneon.net/graph/index.htm).

Objective

The main objective of this report is to analyse and propose different options for the establishment of a self-sustaining ENEON after the end of the ConnectinGEO Project in January 2017. Different aspects of the possible ENEON organization structure were considered over the course of the ConnectinGEO Project, including its role, structure, legal status, funding sources, etc., and are explained further below.

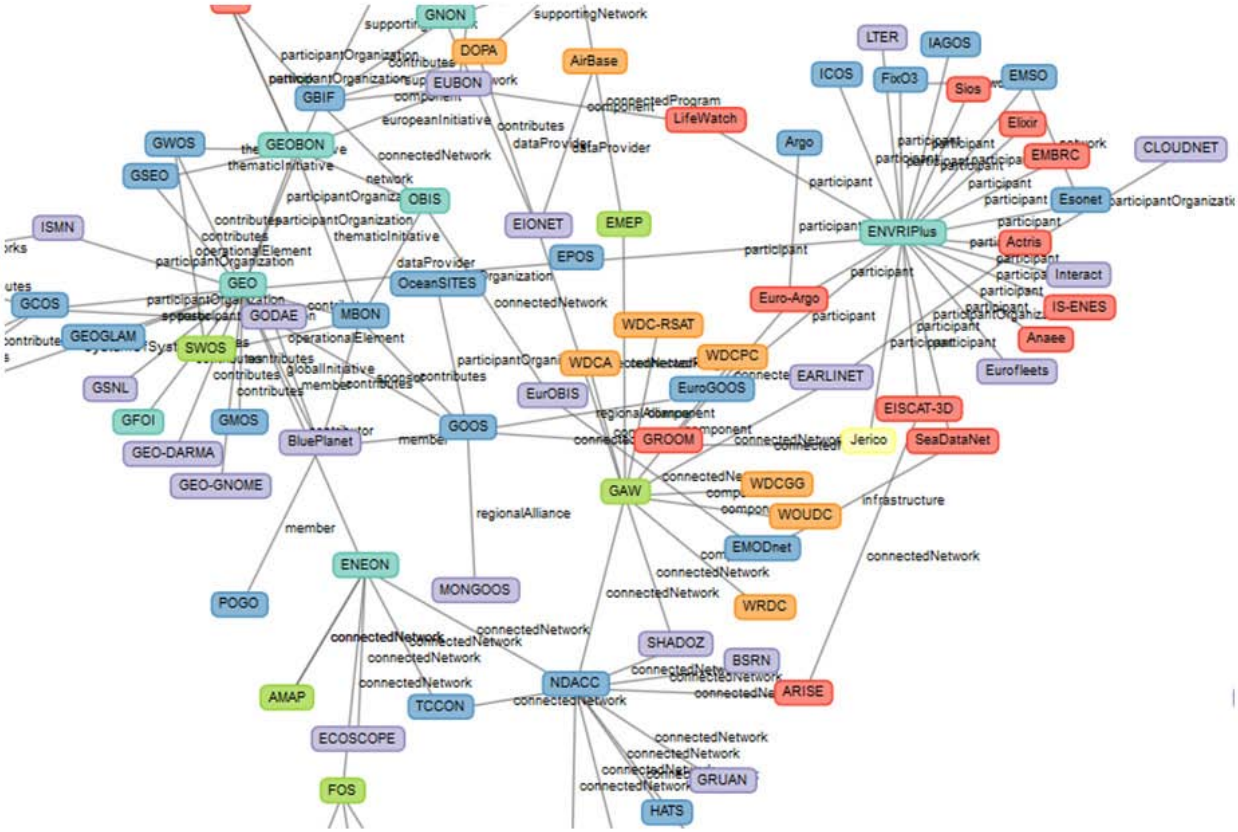

Figure 1: Extract of a graph showing European in situ networks and their connectivity (see http://www.eneon.net/graph).

ENEON Role

Different possibilities concerning the role of ENEON were discussed during the ConnectinGEO Project. Firstly, ENEON needs to be a facilitating entity to coordinate European networks. In doing so, ENEON shall organize working groups and meetings, where appropriate, on different topics of relevance to the European networks. In its facilitating role, ENEON representatives could jointly participate on behalf of the different networks (and their needs) in international fora. Thus, it would not be necessary for each single network to follow all issues/discussions and to send their own representatives to all potentially relevant events. Instead, they could provide the ENEON secretariat with their requirements, agree on common positions, and designate an ENEON person to represent their needs. This will ensure a significant added value for the individual networks, as ENEON would be able to represent their needs and issues with a higher weight. Moreover, observation networks often have difficulties to enter into a dialogue with policy makers and to secure funding, so that ENEON could play an important supporting role in facilitating this process.

To improve coordination, interaction and discussion, ConnectinGEO has started a pilot to establish a virtual platform (representing the scientific community): the ENEON Commons portal. ENEON Common shall serve as a platform where:

- in situ observation networks are introduced, exposed and made discoverable,
- users (e.g. scientists) can search for and request data for interdisciplinary problems,
- users can establish contacts with those networks that may deliver needed data,
- participants can informally share information, etc.

Figure 2 provides an impression of the ENEON Commons prototype. This screenshot shows an exemplary description of a network description. Further functionality of the prototype comprises for example the submission of issues/requests for data needed for answering certain (scientific) questions (Figure 3).

Figure 2: Screenshot of the ENEON Commons Portal Prototype - Network Description.

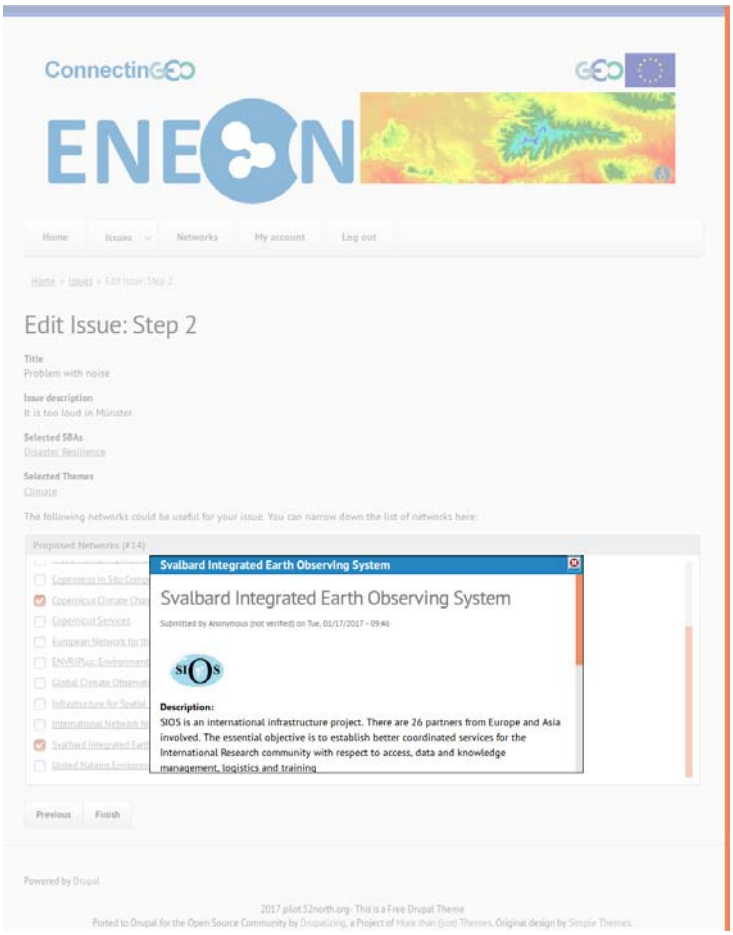

Figure 3: Screenshot of the ENEON Commons Portal Prototype - Issue Creation.

ENEON will work on a variety of issues that are relevant for the networks (both members and non-members), prioritizing activities based on consensus from the networks. Annex 3 defines the concept for the ENEON Commons in more detail.

ENEON Structure

The optimal structure was considered to be a formal organization, needed to have recognition and claim funding, but with a light secretariat behind (to avoid a bureaucratic and slow body). A small secretariat is indeed envisaged as sufficient to run ENEON, especially if the core of its activities is related to coordinating data and networks, and organizing and participating in relevant events. That secretariat could be composed by a small flexible group of people that can grow or shrink as needed, and that need to perform the following functions:

- scientific coordination,
- secretarial,
- communication, and
- maintenance of the IT infrastructure.

This new secretariat can be composed of either a self-standing entity or be part of an existing organization. At an organizational level, different options were considered

including a pure virtual organization or an organization managed by regular face-to-face events. The option that considers only regular face-to-face events was discarded due to the cost associated to time and travel. The option of a purely virtual organization and to rely only on voluntary work was discarded, because of the risk of not reaching the necessary level of commitment, both in terms of funding and working efforts. In the end we consider that only a correct balance between an organization supported by a secretariat that organizes a limited number of meetings (mainly virtually run) combined by an online collaborative environment that serves both to network members and network users alike will function effectively, resulting in the *ENEON Commons* Web portal.

The work of ENEON will be organized in committees and working groups that will mainly meet virtually, work in the ENEON Commons and be coordinated by the ENEON secretariat. They will also meet face-to-face in the steering assembly events. There will be an Executive Board that will be mainly run by the ENEON secretariat. A foreseen Senior Advisory Panel will be formed and invoked by the ENEON secretariat as the ENEON evolves. A schema of the structure is shown in Figure 4. The main activities identified by ConnectinGEO members which ENEON should conduct during the first two years of existence are detailed in Annex 2.

The process to establish a new legal entity, even if small and simple, can take a long time and be costly, and we cannot risk undermining the effectiveness of ENEON by losing this momentum because of administrative steps and searching for funding. The easier and quicker option is to have a light secretariat embedded/hosted in an existing project or organization(s) as discussed in the next section.

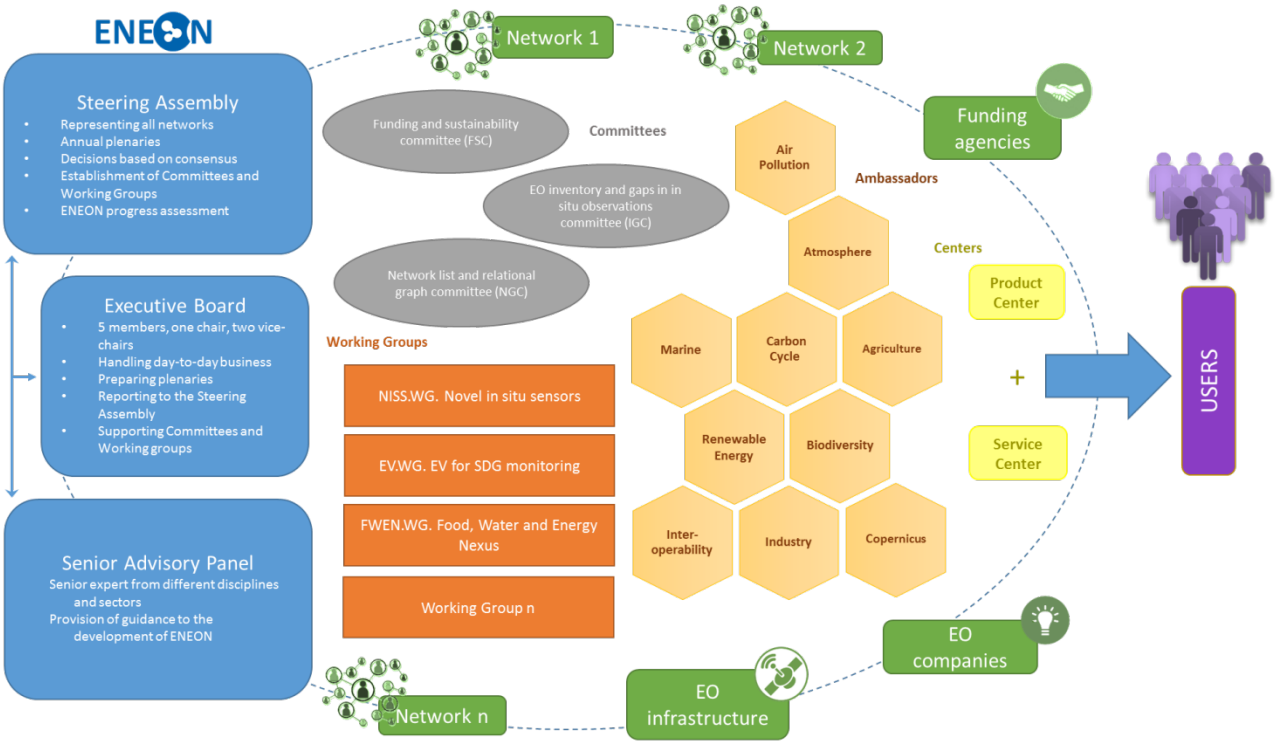

Figure 4: Overview of the ENEON Organization Structure

ENEON Host

Different organizations (possibly already registered as GEO Participating Organizations - PO) with relevance to the ENEON objectives, were considered as potential ENEON hosts, including (in alphabetical order):

- GEO (Group of Earth Observations): ENEON could start as a new GEO Initiative, moving from Europe as a model to be applied to other regions, globally. Hosting the ENEON under GEO in some context seems like the ideal long-term solution, in particular considering the establishment of the in situ foundational task (formerly known as GD-06).
- IIASA (International Institute for Applied Systems Analysis), CREAF or similar institutions could also be potential candidates to host an ENEON, possible in the near to medium-term.
- ENEON could also be hosted in the framework of a project, with one potential candidate being the ERA-PLANET programme, running for the next four years.

An alternative could be to set up a joint group of organizations and institutions supporting ENEON with a rotating secretariat, which moves from one body to another after a certain time frame. However, there is the risk to lose continuity, while we need to secure ENEON in the long-term.

Conceptually, in the framework of GEO – but not only, it would be important and useful to replicate something like the CEOS model for in situ networks. However, for in situ networks this will be a very challenging task to achieve, due to the increased diversity, higher number of players and funding constraints compared to the satellite community.

Funding opportunities

The following opportunities were reviewed by ConnectinGEO and are listed as follows:

- Public/Private funding: either EU or country level, foundations, etc. Funding not project-based.
- Project funding: projects can be an additional source of funding, but cannot be relied upon for the core funding. EU H2020 funding was used to launch the initial phase of ENEON as part of the ConnectinGEO project.
- Membership contributions: the members should be willing to pay for the ENEON which is designed to benefit them, albeit once a minimum level of functionality has been reached.
- Market: only once the ENEON is established, and products, services etc. are available in an operational mode, a business model based in charging fees for products or services can be realized.

A mixture of public and project funding seems to be the most logical option for the near future, considering that ENEON will be in the interest of the EU Earth observation community. A minimum level of funding would be needed to operate the ENEON secretariat in the terms proposed above.

Next steps: interim solutions

All the above options require further discussion, modification and agreement to develop into action, which will obviously take time. The ConnectinGEO consortium has started the process and will still voluntarily lead its continuation into the first period following the completion of the ConnectinGEO Project. Nevertheless, interim solutions are needed to further develop the ENEON concept and the sustainability options proposed here and then take the decision about its concrete continuation. Suggested interim solutions are:

- ERA-PLANET: some of the ConnectinGEO partners are part of the ERA-PLANET initiative. Some budget could be specifically dedicated to prepare a sustainability plan for ENEON.
- European Project (e.g. H2020): the European Commission could launch a call for proposals within a topic specifically dedicated to establish ENEON, following a similar model like the preparatory phase of the ESFRI Roadmap. In the Annex 1 we present a proposed text for a topic in such a call.
- GEO Initiative: as said above, GEO could set up the framework where voluntary work will be carried out to establish an operational ENEON and raise funding. This new GEO initiative would start from Europe as a model to be applied to other regions and become global.

Conclusions

At the ConnectinGEO week in Laxenburg, Austria in October 2016, the ConnectinGEO consortium approved by unanimous consent a recommendation to the EC to support the ENEON continuation through the following three complementary and sequential instruments:

4. ERA-PLANET provides support to ENEON - short and near-term action.
5. EC prepares a specific topic to develop ENEON as part of the next H2020 calls for proposals - medium term action.
6. EC considers the inclusion of a new EIP to support *in situ* (as non-satellite) Earth observations - long-term action.

References

IIASA (2016): D3.4 Report on observations, measurements and gaps in observation systems reported by the communities. Online: http://connectingeo.net/Docs/SubmittedDeliverables/D3_4_ReportOnObservations.pdf

EARSC (February 2016): Position Paper: Creating a European marketplace for EO services. Online: http://earsc.org/file_download/308/EARSC+PP+-+Creating+a+European+marketplace+for+EO+services.pdf

Annex 1 – Proposal for a topic in the Societal Challenge 5 for the next call

SC5-XX-201X: European in situ sensors virtual research environment to address global and transversal challenges.

There is a vast amount of available information coming from in situ research infrastructures and scientific observing sites, smart sensors, and citizen observatories. Many coordination and integration efforts were invested, resulting in thematic networks of in situ sensors with the aim to organize the offered observation data sets in an interoperable manner (e.g. data models) and to make these data sets accessible. GEOSS has recognized the need to consider in situ data at the same level than the other data sources by driving a foundational task dedicated to it ("GEOSS in situ Earth Observation Resources").

An extra effort has to be undertaken in inter-disciplinary integration and in combining in situ with satellite and socio-economic data to provide the necessary knowledge to respond to transversal challenges such as global change and human sustainability and resilience.

The project should provide an open and inclusive computer-based collaboration environment that facilitates the mapping, discovery, execution, reuse and creation of knowledge from in situ network's digital offerings and activities. The system should consider the Digital Single Market strategy and in particular build on the European Cloud Initiative. In situ networks and infrastructures should present themselves in a comprehensive Earth observation context based on the Essential Variables (EVs) and the Sustainable Development Goals (SDGs) concept, expose their offerings to a broader community and demonstrate their usefulness for addressing cross-domain issues. Scientists should be able to find the observation data sets they needs and to document observation requirements in close contact with data providers. Policy makers should be able to formulate questions and get interpretations and their related policy options from data providers working with their experts.

This development should contribute to the GEOSS knowledge creation and should propose a strategy for its integration in the GEOSS Common Infrastructure and its sustainability after the project end. The system should consider the European leadership in the ESFRI Earth Observation infrastructures, GEOSS flagships and citizen science associations, and integrate previous initiatives in connecting EO networks and closing EO gaps.

Impacts:

- Contribute to the knowledge necessary to assess the progress towards the SDGs monitored through EVs.
- Increase and improve the integration of in situ networks, close gaps in in situ observation and provide inputs to solve interdisciplinary questions.
- Promote and strengthen the implementation of (common) data management principles by in situ data providers.
- Complement the use of satellite information, Copernicus services and socio-economic data with in situ observations.

- Evaluate and support the use of citizen science data as a validated source of information.
- Provide a contribution to the GEOSS Knowledge base.
- Continue the efforts in creating and growing an European Network of Earth Observation Networks

Annex 2 – Proposed ENEON activities (with their consequent benefits) for the first 2-years after the end of ConnectinGEO

Prioritized list:

Participate and lead the GEOSS in situ foundational task (formerly GD-06): ENEON will provide a European contribution to the GEOSS in situ foundational task and is available to lead the task. Our contribution could comprise the following activities:

1) Convene workshops to discuss the different topics that have been defined in the task.
2) Each workshop should result in an agreed report with recommendations to be disseminated among funding agencies (this shall motivate the funding agencies will pick up the recommendations and provide opportunities to address them).
3) Create a thematic subgroups with a contact point for the management of in situ data (e.g. in the Energy SBA).

Create a virtual commons: ENEON will design, develop and operate a virtual community platform to promote and support the European in situ data community. The platform will provide a set of social services to elicit experts. It will offer knowledge and provide information on ongoing European and international programmes as well as initiatives dealing with in situ Earth Observation data. Within the WaterInnEU project, 52°North has developed a marketplace (based on the Open Source CMS Drupal) which could be used a basis for a possible collaboration and networking platform for ENEON. It is available as open source software (https://github.com/52North/waterinneu). Within the ConnectinGEO project, this development was used as basis for building a first prototype of an ENEON Commons portal. This virtual commons portal shall provide a tool set, which allows

1) Registration of in situ networks, collecting information about each network, including details which support the individual networks need
2) Sharing information across network members (particularly about data access)
3) Using a Working Group forum area
4) Outreach and dissemination by the ENEON secretariat and others (e.g. success stories, etc).
5) Formulating questions that will require EO data and models to be addressed
6) Referencing and discovering to in situ data sets (e.g. links to Sensor Web servers) but also work such as tools for data provision, analysis and visualisation, best practices, relevant projects, standards.

This would be extremely valuable not only to assess the availability of in situ observation data sets but to provide also a very powerful discovery mechanism that is complementary to the current GCI.

Enable private sector linkages: It is widely acknowledged that the private sector is critical to drive economic growth, create jobs, develop and deliver operational services creating the bridge between research and commercialization. Since the engagement with the commercial sector will be strategic ENEON will provide a valuable channel to connect the private and public sectors dealing with in situ Earth Observation data. We should also consider exploring possibilities to bring data from private networks activities (oil and gas platforms, renewable energy infrastructures, etc.) as a way to increase EO data and knowledge. ENEON can benefit from the Marketplace Alliance for EO Services (MAEOS; http://earsc.org/news/study-to-establish-a-marketplace-alliance-for-eo-services-maeos)

that EARSC is enabling, as well as the EOMall that will implement a marketplace on behalf of those companies, which choose to join and invest in the venture. Private sector can participate in defining policy and governance conditions for the private sector working together under a lighter structure, which will be the MAEOS.

Apply the GEOSS Data Management Principles (DMP) to in situ data: ENEON will advocate the GEOSS DMP for in situ Earth observation data by providing help on the implementation of those principles. In particular, the GEOSS DMP will be applied to in situ data in the following ways:

1) Promote GEOSS data sharing policies and procedures.
2) Improve discovery mechanisms, metadata quality and increment the amount of "directly" accessible and usable in situ datasets.

Report the state of the art: ENEON will carry out a survey (e.g. with specialized meetings or electronic forms) to assess the state of the art of cross-cutting in situ networks on challenges, capacities as a way to create a common place to detect cross cutting gaps, to enable the exchange of expertise and coordinate common needs. ENEON will describe the current situation of in situ EO networks in Europe, their functions and the interactions between them. A regular report will pay special attention to the funding situation of each network and their connection to GEO/GEOSS. It will be supported by a live online interactions graph showing dependencies among them. One of the expected outcomes is that the coordination of multidisciplinary observation sites among networks can be a way to increase efficiency, reduce costs and share data exchange capabilities.

Increase linking to the GCI of in situ data (data access): ENEON will play the role of a facilitator to advice in situ data networks and systems how to contribute to GEOSS via the GCI. Domain specific facilitators are foreseen. A critical need is to provide data owners with tools and best practices to facilitate the publication of their data so that it can be harvested by the GCI. In that sense, this will require:

1) 'Teach' networks about the process to make their data visible in the GEO DAB
2) Realize the linking to the GEO DAB
3) Demonstrate the benefits of being linked to the GCI
4) Develop standard practices for data insertion into the GCI
5) Define business-interface agreements and provide a user handbook for the GCI.

In addition to that, an extension of the GCI could be required which would lead to the following actions:

1) Update the DAB to work with in situ data (e.g. improved support of the OGC Sensor Observation Service (SOS) interface) and add support for social and economic data (including non-geospatial data)
2) Adapt, visualization and overlay of disparate data in the portal (e.g. show temporal time series of observation data
3) Support technical experiments in order to enable a more robust workflow between OGC SWE based resources into the GCI. This includes the DAB and the GEO Web Portal (GWP) components and one or more OGC Sensor Web Enablement (SWE) based recognized GEO Community resources.

This should enable a better search and discovery experience in the DAB and GWP for stakeholders searching for in situ data. By implementing a Sensor Web-based link to the GCI in a series of different domains, we could also show how INSPIRE can help to improve the link of in situ data sources to the GCI. In this context we would be able to

demonstrate the link of INSPIRE Sensor Web tools and the GCI as a best practice. In that respect, 52°North has been working on integrating many different forms of observation data (in situ data is handled in many forms and formats) into OGC SWE compliant data flows and components. As a result of these activities, different kinds of publications that deal with possible approaches on these integration efforts (whitepapers, tutorials, pilots) will be released and promoted with the aim of integrating in situ datasets into GCI (e.g. by using the OGC SOS, IS/OGC Observations and Measurements (O&M) and OGC Sensor Model Language (SensorML) standards).

Recommendation for policy: ENEON will be able to aggregate the knowledge in a way that recommendations affecting several individual networks can be formulated by a consensus process and elevated to policy makers. These recommendations could include actions to mitigate some gaps in EO or the creation and maintenance of operational infrastructures.

Peer reviewed journal about data and operations of in situ observation networks: ENEON will create and sustain a peer reviewed Web based journal on in situ monitoring, data and observation system operations. As the journal could be formally published by an existing publisher, we will explore the space of peer review journals specialized on data, in situ operations, and operational activities. ENEON will promote this journal with the relevant communities as a way to reward data sharing and open data policies. Eventually it could be required to create new journals or recommend editorials to have existent ones on a more cross-cutting scope. Some existent journals require the sharing of data on public repositories that can contribute to the GEOSS DAB. ENEON will also support existing journals with significant contributions of papers and reviewers. The goal is to provide a citable community resource to bring in situ observations routinely into the literature. One possible topic could be "experiences and examples of interoperable provision of in situ observation data in different domains (e.g. oceans, air quality, hydrology, energy, etc.)".

Have a membership mechanism: ENEON will require a formal membership to enter in the network. In exchange, ENEON membership will imply engagement and recognition as key player. The members will have access to a variety of services and possible tools that will be supplied with the aim of both strengthening networks and their roles in the European in situ arena as part of a mutually beneficial relationship.

Newsletters (e.g. success stories and opportunities): This dissemination mechanism will target stakeholders including policy makers, SMEs, industry, research, governmental agencies, and NGOs. First editions of the newsletter will focus on fostering the coordination between providers, users and system operators in order to define a sustainable development model to enable long-term activities.

Creating a stable and active set of WGs. The ENEON management structure will be very light at the beginning. It is important that ENEON has mechanisms to initiate activities and working groups to discuss and publish their results in form of reports, databases or tools. There will be permanent groups and targeted groups. It will also benefit from the establishment of thematic ambassadors.

Annex 3 – ENEON Commons concept paper

The ENEON (European Network of in situ Earth Observation Networks) aims to provide an integrated and harmonized perspective on observing networks, helping users to find answers to trans-disciplinary problems, and networks to reduce redundancies and detect gaps in the European EO arena. Its characteristics have evolved from the ConnectinGEO project.

The **ENEON Commons** portal is supporting ENEON networks by providing an open and inclusive computer-based collaboration environment that facilitates the discovery, execution, reuse and creation of knowledge from in situ network's digital offerings and activities. **In situ networks** and infrastructures are able to present themselves in a comprehensive Earth observation context, expose their offerings to a broader community and demonstrate their usefulness for addressing cross-domain issues. **Scientists** are able to find the observation data they need and document observation requirements in close contact with data providers. **Policy makers** are able to formulate questions and get interpretations and options from data providers working with their experts.

In practice, the ENEON Commons is a collaboration environment offered through a **Web portal** (SaaS) developed and maintained by 52°North. It offers a forum for debates and exchange of information, as well as, a queryable graph of networks and their observation types connected to the actual data through the GEOSS Discovery and Access Broker GEODAB. It accepts questions that are redirected to the appropriate network experts as well as providing automatically generated results (based on previous answers, user feedback, the GEODAB and the GEOSS Knowledge Base). It is also a **Web service** (PaaS) that can be integrated in other systems (Figure 5).

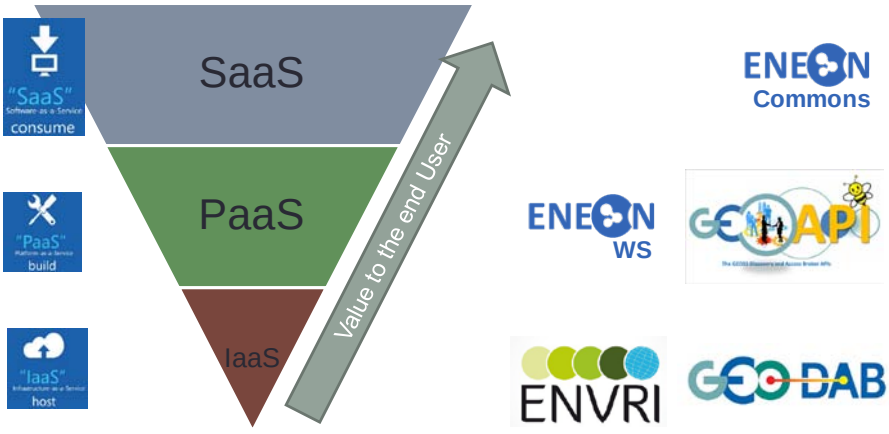

Figure 5: ENEON Commons topology

We are considering the possibility that the ENEON Commons will be aligned with the industry effort (led by EARSC) to develop a dedicated marketplace targeting different users and using different business models.

ConnectinGEO has conducted **a pilot** of the ENEON Commons, during which an already existing 52°North Web portal development was customized. The pilot involved three in situ Earth observation networks (including the emerging Solar Renewable Energy Network, LTER-Europe and Citizens Science) that offer a comprehensive description of their

offerings (observations variables and observation outcomes), and connection to the GEODAB. For the selected networks, experts are identified. Scientific and decision-making questions are accepted, automatically answered, redirected, and/or redirected for review by experts (Figure 6).

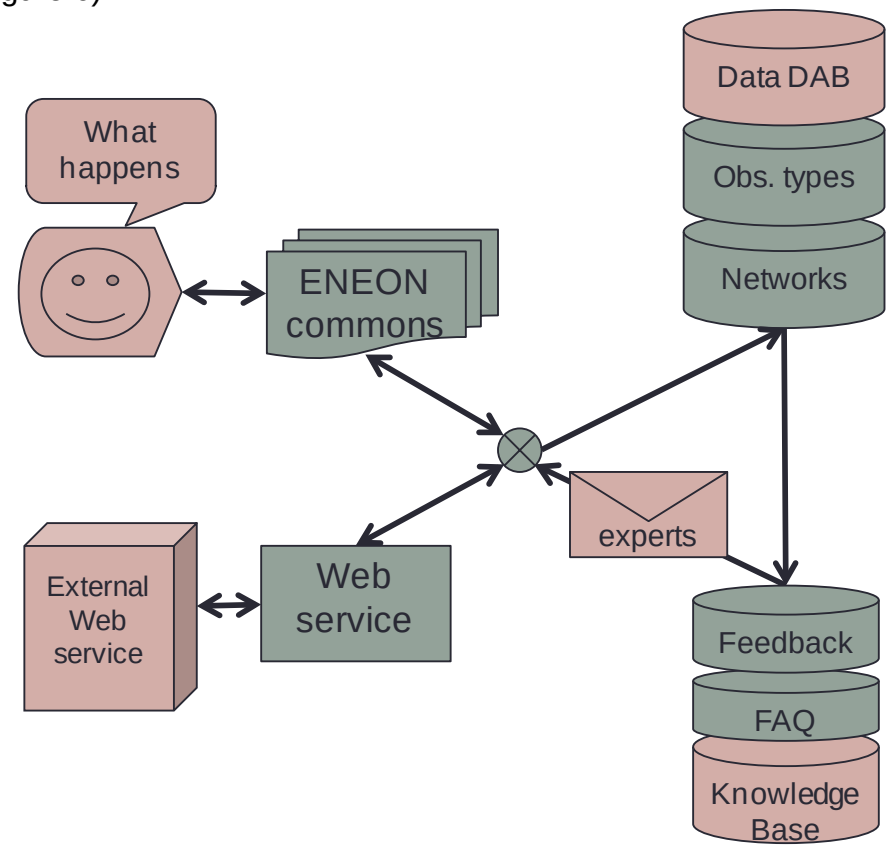

Figure 6: Conceptual diagram of the ENEON Commons components.

The types of questions we expect to be able to support are:

- I'm interested in studying the Carbon Nitrogen Phosphorus cycle. Are there network of EO that can help me?
- Can the public roofs in my city support the generation of solar energy to run the traffic lights system?
- Which are the variables measured in the Arctic and what are their spatial and temporal resolutions?