

2nd Exchange of Experience Workshop

*Monitoring of Projects and
Pilot Periodic Review of Landmarks*



Report

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StR-ESFRI

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INTRODUCTION

Since the first European Roadmap for Research Infrastructures developed in 2006 by the European Strategy Forum for Research Infrastructures (ESFRI), the Forum has continuously worked on identifying new or upgrades of Research Infrastructures (RIs) of strategic interest for Europe. As a result of the 2006 Roadmap and its updates in 2008 and 2010, as well as the 2015-2016 roadmapping exercise, the ESFRI Roadmap 2016 includes 29 ESFRI Landmarks (RIs which are well-advanced in the implementation phase or have already been implemented) and 21 ESFRI Projects (RIs in preparatory or pre-implementation phase). To ensure the follow-up of implementation of already ongoing ESFRI projects as requested by the Competitiveness Council in 2012¹, ESFRI established a comprehensive assessment and prioritisation process of the infrastructure projects listed in the ESFRI Roadmap. For this reason, ESFRI has developed and applies distinct and transparent evaluation, assessment, monitoring and periodic review mechanisms based on two independent processes, i.e. 1) the evaluation of the scientific case and 2) the assessment of implementation. In both cases, international and independent reviewers are involved to provide advice, but ESFRI is solely and entirely responsible of the evaluation and assessment procedures and outcomes.

2nd Exchange of Experience workshop about the Monitoring of Projects and Pilot Periodic Review of Landmarks / Objectives

The 2nd workshop to exchange experience and best practise was focused on the monitoring and periodic review of Research Infrastructures on the ESFRI Roadmap. The purpose behind the 2nd workshop was to explain the ESFRI monitoring and evaluation process, to make it clear, comprehensible, transparent and fair. The workshop also provided a platform for effective, high-level interaction (exchange of experiences), coordination and networking between ESFRI projects and ESFRI Landmarks on the one hand, and the European Commission, H2020 Expert Advisory Group on RIs and ESFRI Strategy Working Groups (SWG) & Implementation Group (IG) on the other hand.

In parallel to the workshop, the European Commission has organised *informal interviews* with project coordinators of 2008 projects. The idea was to allow intensified discussions between project coordinators and the chairs of the SWGs and members of the IG about project developments and readiness to be monitored by ESFRI.

The workshop thus mobilised substantial combined expertise (best practices) to provide answers to the following issues:

- Evolution of the field and how the infrastructure is contributing to this
- The risks RIs are facing and the consequent mitigation plans (with respect to the 10-years rule)
- Successful achievements that other projects could learn from
- Bottlenecks for the individual projects and how to overcome them
- Identification of the relevant user-group in the business plans and the interaction with them
- The added value of the RI compared to a collaboration network of legally and economically independent RIs
- Evolvement of the scientific case, and how this affect the business model
- The way to monitor the Projects
- Interacting with the ESFRI MOS system

¹ *Conclusions of the Competitiveness Council, 11 December 2012*

Workshop organization

The workshop was organised by StR-ESFRI, in close cooperation with ESFRI and the European Commission (EC) and was hosted by the Spanish Secretariat of State for Research, Development and Innovation, Ministry of Economy and Competitiveness. An *information day* about the next ESFRI roadmap in 2018 followed the next day.

Link of STR-ESFRI web-page: <http://www.esfri.eu/workshops/save-date-2nd-exchange-experience-workshop>. The following chapters summarise the different challenges that projects were faced in the past.

SUMMARY

The workshop to exchange experiences and best practice on the ***Monitoring of Projects and the Pilot Periodic Review of Landmarks*** took place on 18th January 2017 in the University of Málaga, Spain. More than 150 participants represented the target group comprising scientific leaders and managers of ESFRI-Projects and Landmarks currently preparing for the monitoring -or periodic review- process. The workshop was also open for other participants such as representatives of emerging projects, national ministries, the European Commission, national managing authorities, and ESFRI members, multipliers of the scientific community and other ERA stakeholders or policy makers. Especially newcomers (project coordinators entering the next roadmap update) would be able to benefit by getting an idea about what they should expect in the future. According to the survey conducted after the end of the workshop, 97% of the participants were very satisfied/ satisfied with the content and the workshop quality. The discussions and presentations of speakers helped to provide answers regarding main challenges that ESFRI projects are currently facing. In parallel to the workshop, some informal interviews between project coordinators and members of the SWGs/IGs took place to provide a platform to discuss specific issues in a more intensive way. This document thus helps to summarise some main thematic issues of interest to the community.

The first session of the workshop was dedicated to an introduction of the monitoring and the periodic review process as key elements contributing to the long-term sustainability of the ESFRI RI portfolio. This session was introduced by Giorgio Rossi, Chair of ESFRI, followed by David Bohmert, Member of the ESFRI Executive Board, who presented the definition, methods, procedures and questionnaires of the processes. These presentations are shortly summarised in the following chapters.

The second part of the workshop was dedicated to panels with intensive discussions about the *monitoring of projects and the pilot periodic review of Landmarks*. This part started with four short keynote speeches to stimulate discussions on each topic and was moderated by respectively two high-level experts or chairs of either the ESFRI Implementation Working Group (IG) or from one of the Strategic Working Groups (SWGs) of ESFRI.

The outcomes of the workshop can be summarised as follows:

a) General:

- **Exchange of experience workshops (EoE)** are valued as very useful. They help ESFRI Projects and Landmarks to avoid making the same mistakes or starting from scratch, rather build on top of previous experiences. This saves time and money for the future roadmap processes. Therefore, conferences and meetings are very welcome by coordinators to identify and share principles and good practices. Beyond this, an even stronger mechanism to disseminate success stories would likely empower managers with a good track record (inclusive of industrial and commercial experiences) to go through the different evolution phases of RIs.
- EoE Workshops have to be prepared well in advance to stimulate discussions and to structure the outcome and thus makes it easier to compare different case studies.
- The **monitoring process** was valued positively as a fair and transparent process providing project coordinators a reflection about internal challenges, but it is also a useful instrument for decision-makers at national level. The monitoring results and corresponding recommendations are key in overcoming bottlenecks and ultimately facilitating the implementation process of the projects. However, as projects vary, it was proposed that some of the criteria for monitoring should be more differentiated. The pilot periodic review of Landmarks was also valued as very helpful exercise.

- The **MOS System** was judged as a user-friendly, easy accessible system to convey a sufficient level of detail on project status and a firm basis for the monitoring process.

b) With respect to the 10 years rule, main risks ESFRI Projects 2010 were faced with:

- ESFRI RI Projects differ from other EU projects as they aim to serve for a longer period. The preparatory phase requires a solid business plan as one of the criteria for further financial support by the EU. Member States (MS) and Funding Organisations however calculate on an annual financial window, therefore the main risk for the Projects is to achieve a **long-term financial commitment from the MS**. RI MYRRHA adapted e.g. a phased implementation plan allowing the spreading of investment cost and hence risks overrun mitigation. Partners involved in the WindScanner.eu Project have agreed to intermediate steps in order not to lose momentum in the interim phase between the finalisation of the preparatory phase and the establishment of the ERIC. An interim Director is now needed and financed by MS to transfer the project in a more targeted “Implementation Phase”, to bridge the dialog with MS and to gradually establish a “start-up” Hub.
- Linked to a lack of long-term commitment of MS is a **limited personal capacity** in establishing robust academic, public and private user communities. A strong user engagement policy is vital to e.g. AnaEE’s implementation (see p. 37). Conversely, the lack thereof would question the project’s “raison d’être”.
- Within the 10 years rule, the **framework conditions** of a determined RI **can change** (diminishing or increasing political interest in a specific research activity or according to the MS capacity to commit financially in relation to their respective economic circumstances; e.g. see EU-SOLARIS p.31, MYRRHA p. 26, AnaEE p. 37). This may demand a modification of the design of the RI to apply to the external influences. A flexible business plan would therefore be of great value.
- **Weaknesses in the Transitional Governance and Management structures** in case of AnaEE were sorted out by instating a Scientific Advisory Board to guide the RI’s vision (see p. 38).
- In case **licensing processes** are required, it would be useful to involve at an early stage regulators in view of the definition of the licensing process (see MYRRHA p. 27).

c) The main bottlenecks/challenges identified by the 2010 Projects:

- **Long-term financial commitments:** One of the main bottlenecks is the long-term sustainability by means of long-term funding commitments by Member States. Even if Projects do not require a high yearly budget to perform the activities proposed for the legal entity during its operational phase (e.g. EU-SOLARIS p.22), the yearly budget cannot fluctuate too much from one year to another, if the activities have to be performed in an efficient manner.
- **Financial commitment of MS** depends on a credible business plan of the respective RIs. As MS are involved in the negotiation of costs, they often request low costs as precondition to fund a hub or a node (e.g. WindScanner p. 33). This may lead to a dilemma for coordinators; as the MS fee is low, they may underestimate the construction costs which will later cause enormous problems.
- **Human Recourses Management:** A challenge seems to be the recruitment of highly specialised experts and professionals on an international level.
- **Management of contributions:**

- a) **In-kind:** Most of the ESFRI Projects rely to an important extent on the provision of technical contributions and facility components through “in-kind” contributions from project partners. The management of in-kind contributions involves different aspects such as the valuation of the contributions, technical specifications and quality assurance and control, budget, schedule and legal management.
- b) **Uneven cash contribution by Member States:** MS usually demand a measurable fair return for their yearly financial contribution to an ESFRI project. Since the fair return is usually uneven among the Member States, uneven contributions are therefore given (e.g. EU-SOLARIS p. 22)
- **Project management:** The transition from the project preparation phase into the project construction phase could be particularly challenging in terms of increased project scale, (acceleration) in cash capital expenditure, increasing the demands on the project management organisation. This occurs especially when the project is distributed as it demands a smooth and coordinated approach from hubs and nodes.
- **External parties and contractor management:** During the construction phase, the progress of the project will highly depend on contributions from external parties and contractors. The management, supervision and control of external contractors during the project implementation phase is challenging.
- **Project knowledge transfer and continuity until start of construction.** The large RI projects are becoming so time demanding to start, that the project knowledge transfer until start of construction is becoming a real challenge that can result in redoing things that were completed and forgotten in the meantime.
- **Unsynchronised process between ESFRI and National Roadmaps:** If the inclusion of projects in National Roadmaps is not synchronized across MS and ACs or even unilaterally recognised as such, the alignment in decision-making processes is complicated and may cause delays in project development (e.g. AnaEE p. 39).
- **Formalised Engineering System to follow-up ESFRI Projects:** Further development of the ESFRI reference model to include more formalised System Engineering approaches and Project Management to define, track and report the scope, budget, risk, and schedule using proven resource loading tools.

d) Specific issues, risks, challenges or bottlenecks identified by ESFRI Landmarks:

- **Long term sustainability,** including long-term commitment of MS and AC, is also the main bottleneck and challenge Landmarks are faced with (see also above for ESFRI projects). Especially distributed RIs suffer under cost pressures as this has also a negative effect on the quality of data collection and data availability (see SHARE ERIC p. 51).
- On the other hand, it was mentioned that the transformation from a project into a Landmark with legal entity can stabilise the core funding from MS (e.g. SHARE ERIC p. 51, Spiral2 p. 58). Being directly involved in the government of a RI creates a greater sense of ownership, trust and thus willingness for financial support. Also, having a legal entity (e.g. an ERIC) enhancing the visibility of a RI and helps to foster sustainability in the long term (see SHARE ERIC p. 51). Another indicator for the long-term sustainability of the entire infrastructure is an increased geographical coverage (e.g. ICOS ERIC p. 53). Other aspects such as a high industrial involvement, a good quality of the technical equipment, consolidated scientific activities, are key performance indicators showing a positive impact on the long term sustainability of Landmarks (e.g. ICOS ERIC p. 53-54).

- If central facilities that are linked to a Landmark (especially distributed RIs) have different financial accounting systems, this may lead to a lack of transparency of the reports towards national authorities. This may affect their willingness of their financial contribution.
- RIs that depend on a large user community or even industrial participation, are advised to set up a dedicated **user strategy** including an international strategy to reach users outside Europe. In the case of SPIRAL2 they have even established a department of Industrial Applications (see SPIRAL2 p. 58).
- **Any change** of current RI performance because of changing framework conditions (BREXIT, move of legal entity from one to another EU country, etc) is challenging and may cause unexpected risks (see SHARE ERIC p. 51).
- The more MS or AC participate in a Landmark the less a single country has to financially contribute as the costs are split over a large number of partners. However, there are still **barriers** for non-EU countries to take part in an ERIC.
- **Data protection** regulations, make it difficult for users to provide data or for mainly distributed RIs to work with these data.

Monitoring and Periodic Review as key elements contributing to the long-term sustainability of the ESFRI RI portfolio

Giorgio Rossi, ESFRI Chair

The Roadmap identifies new pan-European Research Infrastructures or major upgrades to existing ones, corresponding to the needs of European research communities in the next 10 to 20 years, in all fields of research. While the first ESFRI Roadmap in 2006 contained 35 projects, the number of projects increased on the first update in 2008 to 44 projects and in 2010 to 48 projects. In 2016 the Roadmap update identified also the ESFRI Landmarks. These are implemented projects, leading in their domain and structuring the European and global landscape. The Roadmap of 2016 therefore contains 21 projects & 29 Landmarks.

Fig. 1 provides an overview of all ESFRI projects (left) and the ESFRI Landmarks (right) of the Roadmap 2016 in their specific scientific field:

| 1 ESFRI PROJECTS | | | | | | | 1 ESFRI LANDMARKS | | | | | | | | |
|------------------------|---|--|------------------|------------------------------------|-------------------------|-------------------------------------|-------------------|---------------------------------|--|---|------------------------------------|--|-------------------------------------|-------|----|
| NAME | FULL NAME | ROADMAP EDITION | OPERATION (YEAR) | LEGAL STATUS (AS OF 30 MARCH 2016) | CONSTRUCTION COSTS (M€) | OPERATIONAL ANNUAL BUDGET (M€/YEAR) | NAME | FULL NAME | ROADMAP EDITION | OPERATION (YEAR) | LEGAL STATUS (AS OF 30 MARCH 2016) | CAPITAL VALUE (M€) | OPERATIONAL ANNUAL BUDGET (M€/YEAR) | | |
| ENERGY | ECCSEL | European Carbon Dioxide Capture and Storage Laboratory Infrastructure | 2008 | 2016 | ERIC under preparation | 80-120 | 1** | JHR | Jules Horowitz Reactor | 2006 | 2020* | 1,000 | NA | | |
| | EU-SOLARIS | European SOLAR Research Infrastructure for Concentrated Solar Power | 2010 | 2020* | ERIC under preparation | 130 | 3-4 | ENVIRONMENT | EMSO | European Multi-scale primary seafloor and water column Observatory | 2006 | 2016 | ERIC under preparation | 106 | 36 |
| | MYRIADA | Multi-purpose hybrid Reactor for High-tech Applications | 2010 | 2024* | | NA | 100 | | EURO-ARGO ERIC | European contribution to the International Argo Programme | 2006 | 2014 | ERIC, 2014 | 10 | 8 |
| | WindGarden | European WindGarden Facility | 2010 | 2018* | | 45-60 | 8 | | IAGOS | In-service Aircraft for a Global Observing System | 2006 | 2014 | ASRL, 2014 | 25 | 6 |
| ACTRES | Aerosols, Clouds and Trace-gases Research Infrastructure | 2016 | 2020* | | 130 | 30 | ICOS ERIC | | Integrated Carbon Observation System | 2006 | 2016 | ERIC, 2015 | 48 | 24-35 | |
| ENVIRONMENT | DANUBIUS-RI | International Centre for Advanced Studies on River Sea Systems | 2016 | 2022* | | 222 | 28 | LIFEwatch | Life Infrastructure for Biodiversity and Ecosystem Research | 2006 | 2016 | ERIC under preparation | 66 | 10 | |
| | ESCAT_ID | Next generation European Incoherent scatter radar system | 2006 | 2021* | | 74 | 6 | HEALTH | ENRI ERIC | Reborn and Biobioscience Research Infrastructure | 2006 | 2014 | ERIC, 2013 | 170 | 15 |
| | EPOS | European Plate Observing System | 2006 | 2020* | ERIC under preparation | 53 | 11 | | EATRIS ERIC | European Advanced Translational Research Infrastructure in Medicine | 2006 | 2013 | ERIC, 2013 | 500 | 25 |
| | SIOS | Swissair Integrated Arctic Earth Observing System | 2006 | 2020* | | 80 | 2-3 | | ECRN ERIC | European Clinical Research Infrastructure Network | 2006 | 2014 | ERIC, 2013 | 1.5 | 2 |
| AnaB | Infrastructure for Analysis and Experimentation on Ecosystems | 2010 | 2018* | | 200 | 2-3** | ELIXIR | | A distributed infrastructure for life-science information | 2006 | 2014 | ELIXIR Consortium Agreement, 2013 | 125 | 95 | |
| HEALTH | EMBRIC | European Marine Biological Resource Centre | 2006 | 2016 | ERIC under preparation | 4.5 | 6 | INFRACOMTER | European Research Infrastructure for the generation, phenotyping, archiving and distribution of mouse disease models | 2006 | 2013 | GmbH, 2013 | 180 | 80 | |
| | EMPHASIS | European Infrastructure for multi-scale Plant Phenomics and Simulation for food security in a changing climate | 2016 | 2020* | | 73 | 3.6 | INSTRUCT | Integrated Structural Biology Infrastructure | 2006 | 2012 | International Consortium Agreement, 2012 | 285 | 23 | |
| | ERINHA | European research infrastructure on highly pathogenic agents | 2008 | 2018* | | NA | NA | SPACE & AERIAL IMAGING | E-ELT | European Extremely Large Telescope | 2006 | 2024* | Programme of ESC | 1,000 | 40 |
| | EIA-OPENSCREEN | European Infrastructure of Open Screening Platforms for Chemical Biology | 2006 | 2018* | ERIC under preparation | 7 | 1.2 | | ELI | Extreme Light Infrastructure | 2006 | 2018* | ASRL, 2013 | 850 | 90 |
| Euro-BioImaging | European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences | 2006 | 2017* | ERIC under preparation | NA | 1.55 | ESRF | | European Synchrotron Radiation Laboratory | 2008 | 2014 | ASRL, 2013 | 170 | 20 | |
| ISBE | Infrastructure for Systems Biology Europe | 2010 | 2018* | | 30 | 3.2 | ESRF UPGRADES | | Phase B: Extremely Brilliant Source | 2006 | 2013 | Programme of ESRF | 180 | 92 | |
| SPACE & AERIAL IMAGING | MIRRI | Microbial Research Infrastructure | 2010 | 2019* | | 6.2 | 1 | European Spallation Source ERIC | European Spallation Source | 2006 | 2021* | ERIC, 2015 | 1,843 | 140 | |
| | CTA | Cherenkov Telescope Array | 2006 | 2021* | | 237 | 20 | European XFEL | European X-Ray Free Electron Laser Facility | 2006 | 2017* | GmbH, 2009 | 1,680 | 115 | |
| | EST | European Solar Telescope | 2016 | 2026* | | 200 | 9 | FAIR | Facility for Antiproton and Ion Research | 2006 | 2022* | GmbH, 2018 | 1,262 | 234 | |
| | KM3NET 2.0 | KM3 Neutrino Telescope 2.0: Atmospheric & Oscillation Research with Cosmics in the Abyss | 2016 | 2020* | | 92 | 3 | HLLHC | High Luminosity Large Hadron Collider | 2016 | 2026* | Programme of CERN | 1,370 | 100 | |
| SPACE & AERIAL IMAGING | E-RIMS | European Research Infrastructure for Heritage Science | 2016 | 2022* | | 4 | 3 | ILL-2020 | INSITU Maxion Loup-Paul Langmuir | 2006 | 2020* | Programme of ILL | 171 | 52 | |
| | | | | | | | | SKA | Square Kilometre Array | 2006 | 2020* | SKAO, 2011 | 600 | 78 | |
| | | | | | | | | SPIRAL2 | Système de Production d'Ions Radioactifs en Ligne de 2e génération | 2006 | 2016 | Programme of GANIL | 110 | 1-6 | |
| | | | | | | | | CESSDA | Consortium of European Social Science Data Archives | 2006 | 2013 | Nonwgan funded compans, 2013 | NA | 1.9 | |
| SPACE & AERIAL IMAGING | E-RIMS | European Research Infrastructure for Heritage Science | 2016 | 2022* | | 4 | 3 | CLARIN ERIC | Common Language Resources and Technology Infrastructure | 2006 | 2012 | ERIC, 2012 | NA | 12 | |
| | | | | | | | | DARIAH ERIC | Digital Research Infrastructure for the Arts and Humanities | 2006 | 2019* | ERIC, 2014 | 4.3 | 0.8 | |
| | | | | | | | | ESS ERIC | European Social Survey | 2006 | 2013 | ERIC, 2013 | NA | 6 | |
| | | | | | | | | SHARE ERIC | Survey of Health, Ageing and Retirement in Europe | 2006 | 2011 | ERIC, 2011 | 110 | 12 | |
| SPACE & AERIAL IMAGING | E-RIMS | European Research Infrastructure for Heritage Science | 2016 | 2022* | | 4 | 3 | PRACE | Partnership for Advanced Computing in Europe | 2006 | 2010 | ASRL, 2010 | 500 | 120 | |

[Fig. 1/Source: ESFRI Roadmap 2016]

The monitoring and the periodic review of the ESFRI RIs are key elements contributing to the long-term sustainability of the ESFRI RI portfolio. The roadmap thus is subject of a steady dynamic. Diverse guidelines, publications and workshops - such as the Exchange and Experiences workshop in Málaga – help to establish a clear, fair and transparent Roadmap process.

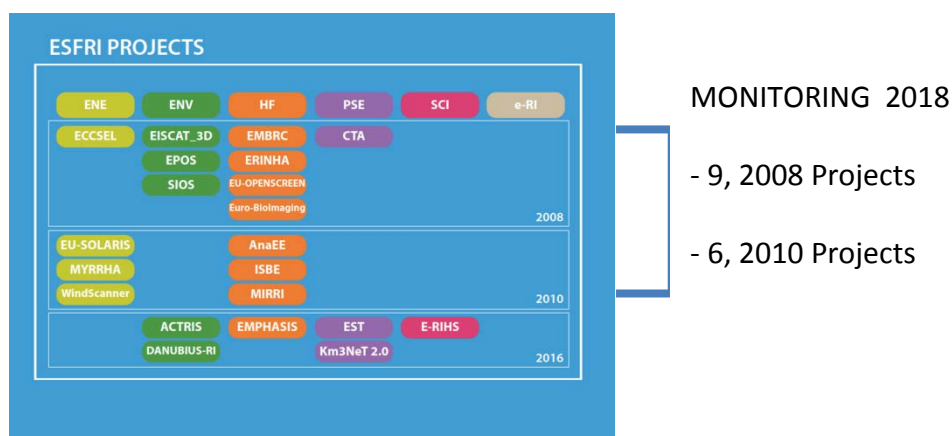
• Definition of “ESFRI Projects”

ESFRI projects are selected for scientific excellence and maturity and represent strategic objectives for strengthening the European Research Infrastructure system. Fifteen projects were listed in previous editions of the ESFRI Roadmap – nine in the 2008 update, and six in the 2010 update. Five new entries and one reoriented project were included in the Roadmap 2016.

The latter were selected among the 20 eligible proposals through the evaluation procedure. The ESFRI projects have a maximum term of “residency” on the roadmap of 10 years. After that term the fully implemented Projects may become Landmarks. Non-implemented Projects leave the Roadmap: if desired they can be re-submitted with a revised programme and will compete with other new projects.

| |
|--|
| 10 years maximum Term for status of ESFRI project; |
| Scientific and maturity evaluation; |
| Pan-European added value; |
| Hearings; |
| Monitoring; |
| Assessment; |

The following graphic (Fig.2) provides an overview of the ESFRI Projects on the Roadmap in 2008 and 2010 which will be monitored to eventually receive the status of ESFRI Landmark.



[Fig.2 ESFRI Projects]

The four projects *EU-Solaris*, *MYRRHA*, *WindScanner* and *AnaEE* provide their experiences about the evolution of their projects in the following chapter about “Monitoring of ESFRI Projects”.

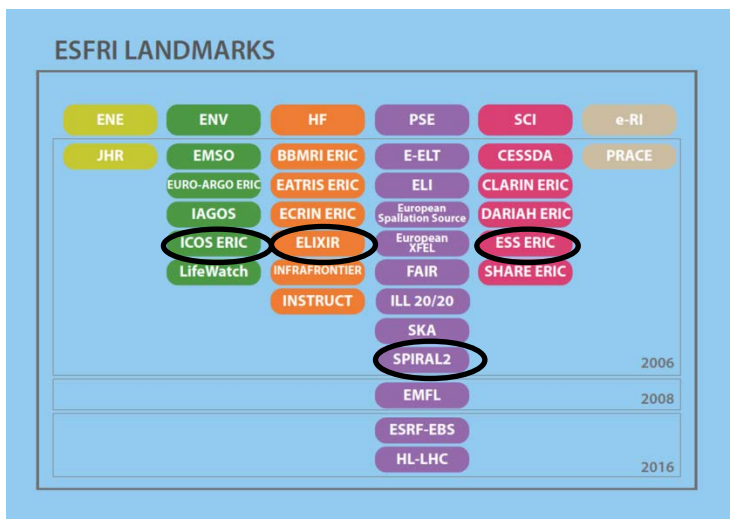
- **Definition of “ESFRI Landmarks”**

ESFRI Landmarks are former ESFRI Projects that have reached the implementation stage and are now established as major elements of competitiveness of the European Research Area. Most of the Landmarks were first identified as ESFRI Projects in the Roadmaps 2006 and 2008. Two Landmarks were selected among the 20 Roadmap 2016 eligible proposals through the evaluation procedure recognising that their implementation is underway.

| |
|--|
| Periodic monitoring for confirmation of status of ESFRI Landmarks; |
| Scientific impact and good management evaluation; |
| GLOBAL dimension; GLOBAL access; GLOBAL data access; |
| Possible evaluation towards GRI; |

The ESFRI Landmarks need continuous support for successful completion, operating and upgrade in line with the optimal management and maximum return on investment criteria. Periodic review of the Landmarks will be carried out by ESFRI in order to verify the continuous fulfilment of the reference role in their respective scientific domains.

The following graphic (Fig.3) provides an overview of the Landmarks and their entry date in the Roadmaps. In the chapter about “periodic review” of this report, the four Landmarks (ICOS ERIC, ELIXIR, SPIRAL2, and the European Social Survey ERIC) demonstrate their experiences in the evolution to become an ESFRI Landscape and in passing a pilot periodic review.



[Fig.3 ESFRI Landmarks]

• **ESFRI Instruments**

Important instruments for the monitoring and the periodic review process of ESFRI are the Strategy Working Groups (SWG), the Implementation Group (IG) and *ad-hoc* Working Groups. While the SWG represent experts of research and innovation in their specific scientific domain, the IG represents experts of research infrastructure management, risk analysis and human capital management, covering the aspects of users access strategy and issues connected to siting, governance and financing. e-Infrastructures experts are included in all SWGs and the IG. *Ad hoc* Working Groups are created to provide vision and advise on specific issues of general interest for RIs and to respond to specific mandates of the Competitiveness Council of the European Union.

Each Group is chaired by a member of the Forum with specific competences or by an expert, nominated by the Forum and permanently invited to the Forum meetings. This makes sure that all information is transferred to the Forum and *viceversa*, and guarantees that all Groups operate coherently to the mandate and policy of ESFRI. The following table (Fig.4) gives an overview of the specific mandates of each working group and their respective duties:

| Working Groups | Strategy Working Groups (SWG) | Implementation Group (IG) | Long Term Sustainability expert working-group (LTS) |
|----------------|---|--|--|
| Mandate | Assess the scientific excellence of the Research Infrastructure Projects and Landmarks | Assesses the maturity of the Research Infrastructure Projects and the implementation/strengthening of the Landmarks | to prepare recommendations |
| Duties | <ul style="list-style-type: none"> - carry out the Landscape Analysis - perform the scientific evaluation of new proposals - carry out the monitoring of Projects and the Periodic Review of | <ul style="list-style-type: none"> - assess the maturity of new proposals for an ESFRI roadmap update - monitor the implementation of ESFRI Projects - contribute to the periodic review of | <ul style="list-style-type: none"> - Costs of all the stages of the LIFECYCLE of the RI, including decommissioning - Public perception of VALUE of RI is a key element for sustainability - Strategic planning of |

| | | | |
|--|--|---|--|
| | <p>Landmarks</p> <ul style="list-style-type: none"> - engage, through the Forum, additional experts according to the specificity of the project - consult external, international referees, with proven experience and declared absence of conflict of interest - collaborate with the IG on evaluation/monitoring procedures - report their results to EB and Forum - enforce the dialogue with the Projects and Landmarks | <p>ESFRI Landmarks</p> <ul style="list-style-type: none"> - collaborate with the SWGs on evaluation/monitoring procedures - report their results to EB and Forum - offer targeted and specific (non-financial) support to ESFRI Projects to move towards implementation and to ESFRI Landmarks - contribute to the further development of the methodology for ESFRI roadmap updates | <p>resources according to LIFECYCLE</p> <ul style="list-style-type: none"> - Understanding the VALUE of Research Infrastructure investment in economic terms - Training, impact in forming scientists and international managers of complex undertakings - Understanding the optimal fraction of GERD to be invested in RIs |
|--|--|---|--|

[Fig. 4: ESFRI working Groups]

Assisting the Working Groups, a **Database System (ESFRI MOS)** has been implemented by the **StR-ESFRI** Project. The objectives of ESFRI-MOS are to support key target groups in their periodical monitoring / review process and to develop a user-friendly and user-targeted scalable system. The Monitoring System of ESFRI will guarantee an *updated description* of the Projects and Landmarks as of the legal, membership, siting of headquarters, budgetary aspects as certified by the ESFRI National Delegations. The modular design of ESFRI-MOS includes a repository for viewing, editing, adding, and querying basic ESFRI data, and statistics on research infrastructures. It also includes a monitoring system for performance data of corresponding research infrastructures and is available online for registered users.

- **Key Dates & Timeline**

In order to realise the Roadmap 2018, ESFRI will update the Landscape Analysis. It will monitor all 2008 and 2010 Projects and pilot the periodic review of a limited number of Landmarks. ESFRI will also evaluate proposals and decide upon new Projects and will monitor and evaluate the effectiveness and efficiency of its methods and procedures, including definitions and models. The following overall planning provides an overview of the different phases which are linked also to the development and upgrade of the MOS Database.

Definitions, methods, procedures and questionnaires for the Monitoring of ESFRI Projects and the Pilot Periodic Review of ESFRI Landmarks

David Bohmert, former Chair of the ESFRI WG on Implementation, ESFRI Delegate and Executive Board Member

State of the art Research Infrastructures Roadmapping

The Roadmapping process of ESFRI is an important step to operate at the forefront of European & global science policy for Research Infrastructures. ESFRI and its Strategy Working Groups (SWG) therefore carry out analyses of the RI landscape in five scientific domains and ensure national commitments for the implementation of RI on the Roadmap. ESFRI gives advice & guidance on overcoming obstacles and offers support to RI in its portfolio and facilitate their implementation. ESFRI also plays a key role in linking RI stakeholders at the regional, national, European & international levels.

Due to long years of experiences and steady adaption, the roadmapping process became a robust methodology. It applies and improves common definitions, models, methods and procedures and addresses entire life cycle safeguarding Long Term Sustainability (LTS) of RI portfolio. ESFRI organises open calls, checks eligibility and reviews against clear and transparent criteria. The methodology applies independent and international peer review procedures, adheres to strict principles, avoids conflict of interest and safeguards confidentiality. It also applies `parallel` evaluation of the scientific case and assessment of implementation. More information about the definition of RI and their constitutions can be found on the roadmap guide at

https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri.

- **Research Infrastructure Lifecycle**

Phase 1: Concept development

The roadmapping process is closely linked to the lifecycle of RIs. It is split in different phases of development and starts with a concept screening, the formation of a consortium, an access policy and funding concept, and includes a scientific and project leadership definition. In this first phase RI projects – if they are successful - are funded via the framework programme of the European Commission.

Phase 2: Design

The design study includes the definition of a business case and obtains political and financial support. For a further financial support by the European community, the definition of a common access policy is requested, as well a top-level breakdown of costs and the identification of governance and HR policy.

Phase 3: Preparation

Past experiences have shown that the step between a RI project and the implementation of a Research Infrastructure seems to be critical and needs much more time and financial support. Therefore the EC has established the so called *preparatory phase* where successful applicants of RI projects are further financially supported to define a business & construction plan, to secure political and financial support, to work out data policy and a data management plan, to establish a cost book and to prepare the necessary steps for an adequate legal entity. Only excellent and mature proposals are able to undergo the next step to become a Research Infrastructure on the ESFRI Roadmap. In

order to get the privilege to become an ESFRI Landmark the following three phases have to become into practice.

While the first three phases are funded by the EU the following phases 4 until 6 are mainly funded by the Member States.

Phase 4: Implementation

During the implementation phase the consortium, together with their funding organisations, has to decide on the site construction and deployment of the organisation. Staff has to be recruited, IPR and innovation policies to be defined. Perennial operations and upgrade plan has to be developed and the funding for the operation for the following years secured.

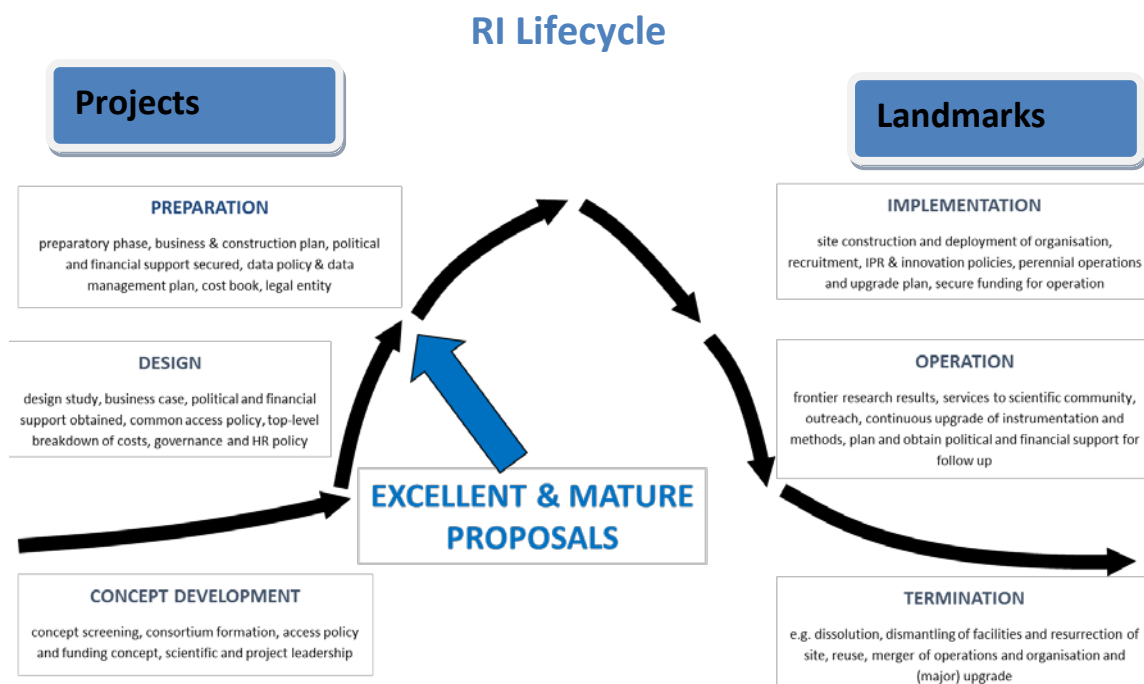
Phase 5: Operation

The operation phase is characterised by the outcome of frontier research results, services to the scientific community and outreach activities. Beyond this, the RI management has to secure the continuous upgrade of instrumentation and methods and has to plan and obtain political and financial support for the follow up of the Research Infrastructure.

Phase 6: Termination

The lifecycle of an ESFRI Landscape ends with the termination phase which includes e.g. the dissolution and the dismantling of facilities and resurrection of the site, reuse, merger of operations and organisation and (major) upgrade.

The graphic below (fig. 6) pictures the whole process from the beginning to the end of the RI lifecycle.



[Fig.6 RI Lifecycle]

In order to comply with the different requirements, ESFRI has established two kinds of Working Groups with different emphasis of evaluation: The Strategy Working Groups (SWGs) are mainly focused on evaluating in five scientific domains the scientific case to ensure the scientific excellence, the pan-European relevance, the socio-economic impact, and the e-needs of RI projects. The Implementation Group (IG) assess the implementation of RI including stakeholder commitment, user

strategy and access policy, the preparatory work, the planning, governance and management, human resources policy, finances and risks.

- **Evaluation and Assessment**

The evaluation and assessment of Research Infrastructures requires solid and reliable methodologies. Therefore, ESFRI has developed progress information on Projects & Landmarks (from AEG 2012 & IG 2015) and thus sends specific questionnaires to each Project/Landmark. Both are invited to demonstrate how they have followed up on prior conclusions and recommendations. The SWG and IG take entire questionnaires into account when they evaluate the scientific case or assess the implementation. Careful attention will be paid to border between the preparation and implementation process of RIs.

The Projects and Landmarks will receive targeted conclusions or recommendations for following up. Minimal key requirements serve as basis for scoring (see box) the evaluation and assessment processes. Meeting minimal requirements is mandatory, but not necessarily sufficient to be listed on the Roadmap 2018. 2008 Projects however need to fulfil minimal key requirements to be qualified for the implementation. In order to be considered as a Landmark, a proposal must meet at least key requirements for the implementation and thus score at least 'high' for both the scientific case and the Implementation.

| Scoring |
|---|
| Very high = key requirements are outstandingly met |
| High = key requirements are comprehensively met |
| Medium = key requirements are partly met, but proposal/Project/Landmark shows weaknesses with regard to specific requirements > enhancing RI's future success requires (significant) changes to (specific parts of) proposal/plans |
| Low = key requirements are insufficiently met and evidence for future success of RI is not convincing |

ESFRI adheres to four **principles** which apply for persons/experts involved in all evaluation and assessment processes:

1. **INDEPENDENCE:** Involved persons carrying out evaluations and assessments have to act in personal capacity and they neither represent their employer nor their country.
2. **IMPARTIALITY:** Involved persons must treat all proposals, Projects and Landmarks equally and evaluate and assess them impartially on their merits, irrespective of their origin or identity of applicants and coordinators.
3. **OBJECTIVITY:** Involved persons evaluate and assess each proposal or questionnaire as submitted; meaning on its own merit, not it's potential if certain changes were to be made.
4. **ACCURANCY:** Involved persons make their judgment solely against formal evaluation and assessment criteria and relevant ESFRI documentation.

- **Monitoring 2008 and 2010 Projects**

In order to monitor the 2008 and 2010 Projects, evaluators check the overall progress the Projects have made towards implementation (i.e. to what degree Projects fulfil the minimal key requirements and what plans they have for reaching full implementation). Evaluators also check and report on whether and how Projects have addressed the conclusions and if project coordinators follow up on the recommendations from earlier assessment (e.g. 2015) of implementation. Thus, a report is prepared about the proposed status, conclusions and recommendations on Projects, and reported to Plenary Forum, including possible recommendation for transition from Project to a Landmark. Finally,

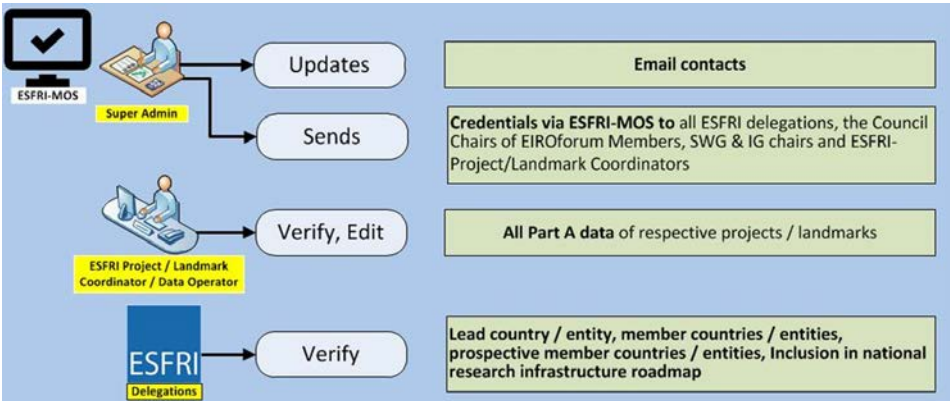
all public information about the Projects will be updated for Roadmap 2018 and inserted into the ESFRI MOS system. ESFRI has established a “ten-year term” for all Projects on its roadmap. This means that e.g. 2008 Projects have to decide whether they want a) to undergo a monitoring or b) to re-apply for the Roadmap 2018. Those 2008 Projects that have successfully reached the implementation or operation phase may be evaluated with respect to requirements of Landmarks. Any Project that wants to be re-considered after ten years to be included in the ESFRI Project list, must re-apply, as a new proposal overcoming bottlenecks that prevented its implementation (in such case, Project will be competing - on equal footing - with all other new proposals applying to Roadmap). ESFRI will not monitor the six 2016 Projects in this round.

- **Pilot periodic review of Landmarks**

The pilot periodic review of four selected ESFRI Landmarks is an exercise of ESFRI to update public information on these Landmarks and to gather information of any changes. The initially four Landmarks will be reviewed for the Roadmap 2018. The pilot exercise is focused on the scientific case and the implementation of the Landmarks. The results are without any consequences for their “Landmark” status. The review will also identify their main long-term sustainability challenges. This pilot review will help ESFRI to develop comprehensive and robust methodologies for periodic reviews applicable to all Landmarks for future updates of ESFRI Roadmaps together with clear and well accepted criteria. In order to avoid duplication, ESFRI investigates to what degree Landmarks are willing to share (internal & external) evaluation and assessment results. ESFRI will decide upon the frequency of such periodic reviews of Landmarks in future - a decision that will also be informed by the outcome of the pilot review.

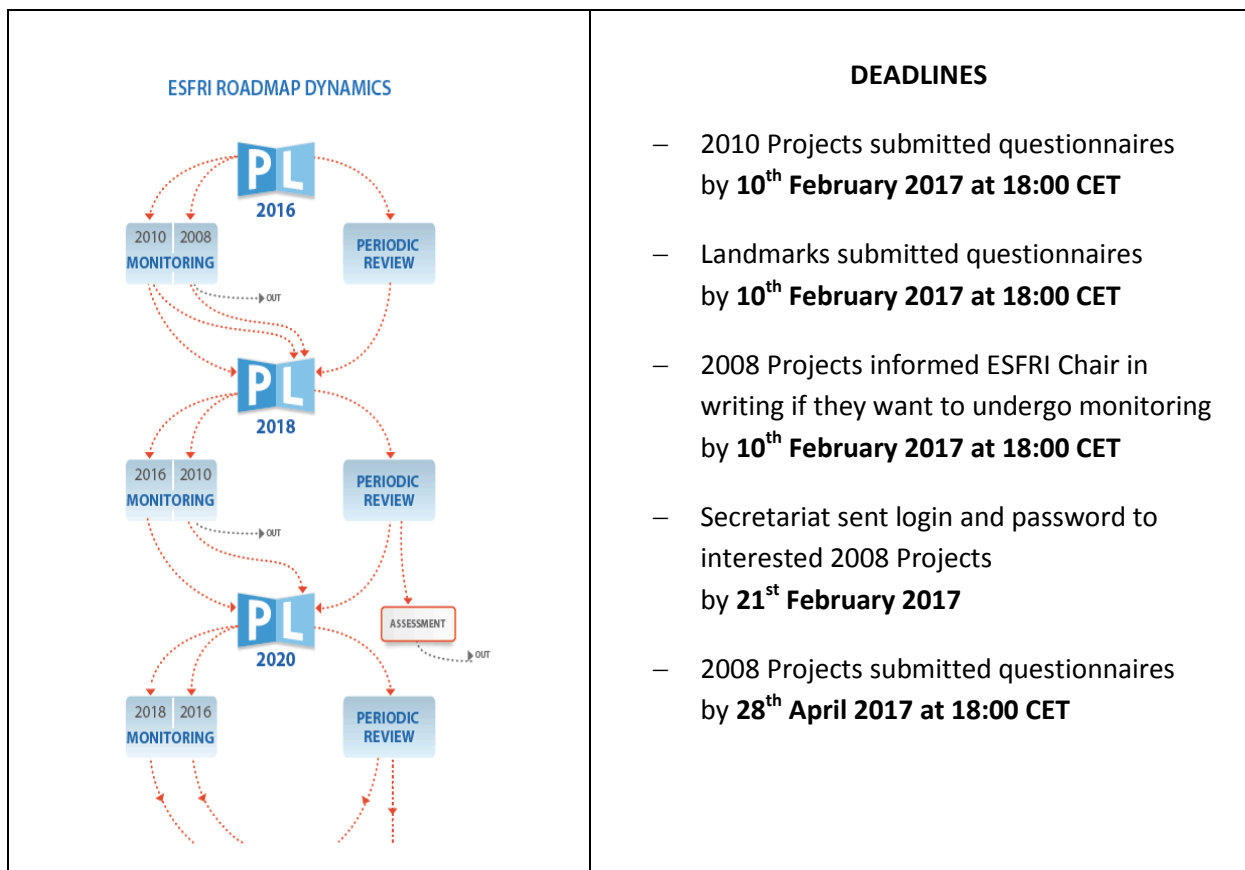
- **Monitoring System (ESFRI-MOS) and questionnaires**

The ESFRI-MOS system follows Projects and Landmarks along their lifecycles. It offers easy access to data related Projects and the Landmarks and pre-defines reports from data to be available for an online consultation. It offers a workflow management of monitoring Projects and periodic review Landmarks and retrieval single and combined information on both (see fig. 6). Beyond this, ESFRI-MOS provides an interaction between Coordinators, Delegates, the SWG, the IG and the ESFRI Secretariat for viewing, editing, adding and querying information on Projects and Landmarks. Within different parts (A,B,C) coordinators verify, adjust and enrich pre-filled information which will be proofed before published on the ESFRI Roadmap.



[Fig.6 MOS-workflow]

The ESFRI Secretariat transfers single passwords to coordinators in order to protect data-entry. Thereafter ESFRI validates the information on stakeholder and about the financial commitments - incl. inclusion in national RI roadmaps together with ESFRI Delegations and with Council chairs of EIROforum members. The questionnaires consist of three parts. While part A about general information is used as background information and for public description in Roadmap 2018, part B about the Scientific case and part C about the implementation are used by SWGs to monitor the scientific case as well by the IG to monitor the implementation. Part A is prefilled and needs adjustment and completion. The questionnaires may be completed progressively as saving of work underway is technically possible. Some questions require ticking a bullet, filling a text section with strictly limited number of characters or uploading documents in PDF format at maximum 1MB each. If a question does not apply to the Project/Landmark it is possible to enter 'not applicable', but it is requested to explain why the question is not relevant in the specific case. The following picture (see fig.7) gives an overview of the dynamics of the ESFRI Roadmaps and respective deadlines.



[Fig. 7: dynamics of the ESFRI Roadmaps]

The following two chapters highlight experiences and challenges ESFRI 2010 Projects and Landmarks were faced with on their way of evolution. A structured questionnaire was send to the coordinators of each RI passing the monitoring and review process to get a feedback about their experiences.

1st Panel on Monitoring of 2010 ESFRI Projects

Moderators: Harald Bolt (ENE SWG Chair) & Maria Anvret (HF SWG vice Chair)

1. EU-SOLARIS

| | |
|-------------------------|---|
| Panellist (name) | Eduardo Zarza |
| RI Acronym | EU-SOLARIS (The European SOLAR Research Infrastructure for Concentrating Solar Power) |
| Scientific field | <ul style="list-style-type: none"> • Concentrating solar thermal technologies (Tower systems, Parabolic-trough collectors, Linear Fresnel concentrators and Parabolic dishes) • Solar furnaces and solar simulators to achieve high photon fluxes • Applications of concentrating solar thermal systems (electricity production, chemical applications, process heat applications and any other application demanding medium/high temperatures or high photon fluxes) • New testing devices and standardized test protocols related to experimental facilities devoted to concentrating solar thermal technologies and their application |
| RI Legal status | <p>The Preparatory Phase of EU-SOLARIS formally ended on October 31st 2016. Several possible legal forms were analyzed and three options were pre-selected:</p> <ul style="list-style-type: none"> • ERIC (European Research Infrastructure Consortium), • an European Public Limited Company (SE), • a purely contractual joint venture (JV). <p>After evaluating these three options, ERIC was selected as the most suitable option for EU-SOLARIS. All this process has been reported and explained in detail in the Deliverable ID2.1 “Motivational report on the legal organism selected to host EU-SOLARIS”.</p> <p>A first version of the Articles of “Association and Internal Law” for EU-SOLARIS ERIC has also been elaborated during the preparatory phase.</p> <p>A simple collegiate system has been selected for the Governance model of EU-SOLARIS, taking into consideration the reasons explained in the Preparatory Phase Deliverable D2.1 “Governance Structure motivational report”.</p> <p>Finally, a Business Plan for EU-SOLARIS ERIC was prepared during the Preparatory Phase (deliverable D.1.3) assuming three different scenarios depending on the level of success.</p> <p>In summary, all the background information and documents required to implement EU-SOLARIS ERIC have been elaborated during the preparatory phase, and the administrative process for its legal implementation can be initiated as soon as the Member States decide it.</p> <p>Now we are in an interim period where the final documents for formal closure of the preparatory phase are being prepared and submitted to the E.C. and some aspects</p> |

| | |
|--|---|
| | proposed in the preparatory phase for the Implementation phase are being refined. |
| RI type (single sited/distri buted) | Distributed |

The main challenges EU-SOLARIS was faced with:

a) *Evolution of the field and how EU-SOLARIS infrastructure is contributing to this*

EU-SOLARIS is designed as a large distributed RI of European character and global reach. The main purpose of this distributed RI is to foster, contribute to, and promote the scientific and technological development of Concentrating Solar Thermal (CST) and Solar Chemistry (SCH) technologies. EU-SOLARIS primary objective is to provide scientists and industry with the needed experimental capabilities for advancing the state of the art of these technologies and reinforcing Europe's leadership in this field.

CST technologies must achieve a significant cost reduction in a short-medium term to become more competitive with fossil-fuelled systems, especially considering that the externalities of fossil fuel, the damage to the environment and adverse effect on climate change are not yet integrated to any significant degree in the cost of using them, and EU-SOLARIS can contribute to this effort in different ways:

- providing this sector with the most comprehensive set of EU test facilities and laboratories (large outdoor facilities: 7 for Tower technology, 10 for parabolic-trough technology, 4 for thermal storage, 18 solar furnaces, 4 solar simulators and 8 parabolic dishes; 30 laboratories for: optics, radiometry, equipment testing, chemistry and meteorology)
- providing up to 170 services that have been grouped into 16 different types, which cover all the subjects related to key components and subsystems (e.g., solar reflectors and concentrators, receivers, heat transfer fluids, thermal storage, Heat exchangers and horizontal activities like policy and planning activities)
- optimizing the use of the associated national research facilities, improving their management, expanding and upgrading their services, streamlining and enhancing the user experience, and leveraging synergies among them.
- developing common test protocols for all EU facilities in this field, and developing innovative test equipment
- providing Access to the facilities coordinated by EU-SOLARIS, with proper procedures according to each type of Access.

One of the more important challenges we are facing in this technology sector is the lack of a well-defined alignment of National priorities among the potential Member States concerning CST technologies, and a consensus about the joint effort that must be devoted now to achieve a significant cost reduction.

b) *With respect to the 10-years rule, the risks EU-SOLARIS is facing and the consequent mitigation plans*

The detailed studies performed during the Preparation Phase of EU-SOLARIS have depicted that current experimental facilities devoted to Concentrating Solar Thermal (CST) and Solar Chemical (SCH) Technologies meet most of the industrial needs at present. The outdoor facilities and laboratories installed during the last years in several EU countries for CST and SCH technologies, together with the experimental facilities installed earlier, already provide this sector with a very comprehensive portfolio of capacities and services available. Therefore, EU-SOLARIS will not need a significant budget for the implementation of new large experimental facility in a short term, but a moderate yearly budget to perform the activities described in section a) of this document.

However, the main reason why the CST and SCH industrial sectors think they do not need new experimental facilities now is because they are mainly worried about the short term, without thinking on innovative options that could be technology breakthroughs in a medium or long term. On the other hand, the R&D centres think that new research facilities are likely to be needed in order to develop innovative concepts in a medium and long term.

At the very beginning of EU-SOLARIS it was assumed that new test facilities would enhance the development of the Concentrating Solar Thermal (CST) and Solar Chemical (SCH) sectors. However, the rapid commercial deployment started at the end of the first decade on this Century supported by public incentives pushed ahead the promotion and implementation of new facilities in several EU countries (in Spain, Germany, France and Italy mainly), thus significantly improving the capacities available in Europe. This rapid growth of the R+D sector raised other problems: the lack of common protocols and standards in Europe for this sector. This situation has led to the existence of different characterization, evaluation and monitoring procedures, so that the evaluation results of a component depend on the laboratory or facility where it is evaluated and characterized. This lack of common protocols and standards, together with a large number of laboratories and test facilities is a barrier for a good development of the CST and SCH sector. So, it has become evident the need for a new entity to coordinate and provide cohesion not only among the EU R+D centres themselves, but also among the R+D centres and the industrial sector, while at the same time optimizing the Access to the existing EU experimental facilities.

This is the reason why the role of EU-SOLARIS has been somehow shifted during the preparatory phase from the promotion and implementation of new European large experimental facilities to a more coordinating and management role to become a distributed RI and undertake the activities explained in section a) of this document- The proposed business plan has been prepared during the preparatory phase taken into account this scenario.

The moderate yearly budget required to perform these activities in a successful manner (about 1.5-2 Mio €/year) according to the proposed Business Plan requires long-term financing commitments from the Member States to secure this budget along the time. This long-term commitment could become the main risk at present, even more than the amount of the budget to be committed.

Additionally, although the benefits that EU-SOLARIS will provide to the European CST and SCH sector are clear and they have been well identified during the preparatory phase, some Member Countries could be unwilling to consider these benefits globally (i.e., benefits for the EU as a whole), thus taking into account the benefits for the specific country only. If this situation happens, it could be a barrier for the Implementation Phase of EU-SOLARIS because both the industrial and R+D sectors in this field are not evenly distributed among the EU countries.

Since the preparatory phase of EU-SOLARIS has just ended, the possibility to achieve long-term financial commitments is now being discussed with executive representatives of the Member countries. The business plan proposed is rather flexible, so that it can be easily modified to meet a different approach if demanded by the Member States without changing the main objectives. If

these meetings and discussions currently underway are successful EU-SOLARIS will be legally implemented and no mitigation plan would be needed.

c) *EU-SOLARIS achievements*

- A very well structured and managed Preparatory Phase, which has fulfilled all the objectives defined in the DoW. All the documents and studies required for the Implementation Phase of EU-SOLARIS have been duly prepared, so that only the final approval of the Member States is required now.

A very efficient legal advisor with a great experience in European matters was subcontracted during the preparatory Phase to provide the Partners with guidance and information to take the right decisions.

- Pooling of technical and scientific knowledge in the field of CST and SCH technologies during the Preparatory Phase, including all the relevant sectors in the consortium (R+D centres from 9 European countries, a Ministry and the European Solar Thermal Electricity Association)

d) *The bottlenecks for EU-SOLARIS project*

- **Management of industrial participation to the yearly budget in terms of in cash contributions.** The involvement of the industry in EU-SOLARIS to assure a good alignment of R&D activities with the industrial needs is very important and it does not require in cash contributions by the industry, but their participation in a technical committee. On the other hand, the standardization activities, elaboration of common protocols, monitoring and evaluation procedures for all the European R+D centres will be of benefit for the industrial sector, this sector should somehow contribute to the budget of EU-SOLARIS. It would be useful to hear how another ESFRI projects have encouraged and successfully managed the financial contribution of the industry.
- **Long-term financial commitments by Member States.** Although EU-SOLARIS does not require a high yearly budget to perform the activities proposed for the legal entity during its operational phase, the yearly budget cannot fluctuate too much from one year to another if the activities have to be performed in an efficient manner. Since one of the bottlenecks is the long-term sustainability of EU-SOLARIS by means of long-term funding commitments, it would be very useful to know how other ESFRI projects have solved this issue.
- **Contribution Model: uneven cash contribution by the Member States (measurable fair return to the Member States).** Member States usually demand a measurable fair return for their yearly financial contribution to an ESFRI project. Since the fair return is usually uneven among the Member States uneven contributions are therefore given. What kind of measurable fair return has been considered in other ESFRI projects to determine the benefits and therefore the contribution to be given by each Member State?

e) *The user-groups in EU-SOLARIS business plan and how EU-SOLARIS interacts with them:*

The EU-SOLARIS business plan considers three different groups of Users:

- **Members of public R&D groups that do not have the facilities required to perform their experiments and R&D activities:** these researchers may request EU-SOLARIS to provide Access to the European RIs coordinated by EU-SOLARIS. Training services may be requested also by this group of Users. The application procedure to submit the request for Access, the selection process, the support to be provided to these Users before, during and after the

Access and the duties to be fulfilled by the Users have been defined in detail during the Preparatory Phase.

- **Industrial Users:** these Users include people from the commercial sector requesting the use of the experimental facilities to better target their selling, as well as providers of services, data, tools, components or other resources for the CST and SCH systems that may request the use of the EU-SOLARIS RIs for the good manufacturing of their products. Training services may be requested also by this group of Users.
- **Policy makers (national and international) and Funders (governments, research funding agencies, the EC and international funding bodies, private funding):** these Users may request technical/scientific advice and guidance from EU-SOLARIS to develop an efficient policy framework for the development of infrastructures and RD programs related to CST and SCH technologies. These Users are relevant since they are the ones that contribute to the political and legal framework for the development of these technologies.

Three types of access will be offered by EU-SOLARIS to the Users:

- a. **Market-based Access:** This type of Access applies when the requested Access has a clear commercial objective (e.g., qualification of a prototype, development of an innovative component or technology, etc.) and it is especially suited for companies (e.g., equipment manufacturer, engineering companies, industrial developers, etc.) wanting to test new designs or concepts at a pilot scale. The cost of this Access will be fully paid by the User. Since this Access is aimed at developing a commercial product a more intensive use of the RIs is demanded by the applicants. Therefore, the duration of a market-based Access could be of several months or even several years. It is also suitable for small R&D groups that have got externally to EU-SOLARIS the funding required to pay 100% of the cost associated to the requested Access to conduct experiments in the experimental facilities included in EU-SOLARIS and they do not want to enter the selection process that is compulsory for the "Quality-based" Access
- b. **Quality-based Access:** this Access is more likely to be requested by public R&D groups working on CST technologies and chemical applications when they need experimental facilities that they do not have. The quality-based Access mode is exclusively dependent on the scientific excellence, originality, quality and feasibility of the objectives pursued by the applicants. These features are therefore the parameters to be evaluated by a Selection Panel and the Access Committee that will be implemented in EU-SOLARIS for this purpose. Depending on the Access policy finally adopted for EU-SOLARIS RIs and the availability of funds, the quality-based Access will be partially or totally financed by EU-SOLARIS.
- c. **Archival Access:** this Access mode is more oriented to on-line and remote access to data bases of information related to the test facilities and their experimental results. The Archival Access mode aims at Users in need of scientific data and/or advanced integrated digital services to carry out world class (cross-disciplinary) research. These digital services do not include the remote performance of test by Users, but the access to services that might be useful for Users to remotely prepare experiments or conduct high-level solar research (e.g., access to simulation computer codes related to the RIs, access to non-commercial computer codes specially developed for solar research, etc.).

f) *The added value of the RI as compared to a collaboration network of legally and economically independent RIs*

One of the added values of EU-SOLARIS is that EU-SOLARIS will offer to the world a unique European distributed research infrastructure in CST and Solar Chemistry technologies. The existence of EU-SOLARIS will provide, whenever requested by Users, a central contact point for European experimental facilities in this field, thus enhancing the access of European and non-European Users to the complete set of European experimental facilities coordinated by EU-SOLARIS.

Once implemented, EU-SOLARIS will also provide the Member States with a legal vehicle to channel their financial contributions to a common fund for further development and optimization of CST and SCH technologies, thus making the national efforts to keep the current European leadership in this field more efficient. The existence of EU-SOLARIS as an ERIC will also enhance the alignment of national policies and R+D programs devoted to these technologies and will avoid overlapping or duplication of activities developed at national level.

It is expected that the financial support now provided by the European Commission within projects like SFERA for the Access to the experimental facilities currently managed by the main R&D centres that will be under the umbrella of EU-SOLARIS (i.e., CIEMAT, DLR, CNRS and ENEA) will be reduced or even completely removed in the future, and in such a case the international access to high-quality facilities will be significantly jeopardized, especially for small R&D groups (e.g. university groups) without high-quality facilities. This situation would be a significant barrier for the scientific growth of Europe in the CST and SCH fields and the current European leadership will be thus lost. The financial support for Access activities will have to be undertaken by the Member States to avoid that situation and EU-SOLARIS will be the perfect legal entity to manage national funds (or even European funds if available) supporting the international and national access to first-class European experimental facilities in the CST and SCH fields.

The legal implementation of EU-SOLARIS as an ERIC will assure the long-term financial commitments required to define and develop an efficient plan to quickly achieve the cost reduction required by this sector, because the financial support is assured by the Member States, not by national entities or R+D centres with a non-guaranteed funds availability.

Last, but not least, Implementation of EU-SOLARIS as an ERIC will leave the door open to a joint effort by the Member States to invest in a new large research facility if needed in the future, because the legal nature of an ERIC is especially suited to this purpose. It has been already explained in section b) that new large facilities are not demanded by the European CST and SCH industrial sectors at present because they are thinking on their short-term needs mainly, without thinking on innovative options that could be technology breakthroughs in a medium or long term. This is the main reason why new experimental facilities will probably be needed in the future, and in such a case EU-SOLARIS would be of great help to channel national efforts to this extent.

g) Evolution of EU-SOLARIS scientific case, and how this affected the business model

The portfolio of European experimental facilities for CST and SCH technologies has significantly grown during the last years and no new large facility is required now to boost the commercial and technical development of this sector. What this sector needs now concerning experimental facilities is EU-SOLARIS: a distributed RI providing a proper coordination and harmonization among all the existing European experimental facilities, together with an efficient Access program to optimize their use, and a long-term commitment undertaken by the Member States to make achievement of these objectives feasible.

Taking into consideration the evolution of this sector during the last years, the business model proposed for the first years of the operational phase of EU-SOLARIS is more aimed at these objectives than at implementing new large experimental facilities in Europe.

h) Feedback on the monitoring of ESFRI projects

- **Scope:** The ESFRI survey monitors multiple project dimensions, notably project governance and management, technical work and advancements, feasibility, financing, schedule, stakeholder involvement and project risk. The scope of the survey provides a sound

assessment basis for the monitoring of ESFRI projects in terms of progression towards implementation.

- **Frequency:** The monitoring of ESFRI project with a two-year frequency is appropriate since this timeframe enables demonstrating major advancements or evolutions with respect to the different project dimensions.
- **Recommendations/assistance offered by ESFRI:** Recommendations by ESFRI are pertinent, important and helpful in defining areas requiring additional effort and weak aspects that must be carefully addressed by the partners. It is also useful to share experiences among projects, thus taking benefit from the lessons learnt in previous projects.

i) Feedback on the ESFRI MOS system

We do not have any experience with this system so far, because the information required to get access to ESFRI MOS has been lost due to the change of the Coordinator after the Preparatory Phase.

2. MYRRHA

| | |
|--------------------------|---|
| Panellist (name) | Alain Sneyers |
| RI Acronym | MYRRHA (Multipurpose hYbrid Research Reactor for High-tech Applications) |
| Scientific fields | <ul style="list-style-type: none"> • Accelerator Driven System (ADS) concept demonstration • Nuclear Spent Fuel & High Level Waste Mgt R&D through P&T • Fusion Material research • Gen.IV LFR/SMR D&D • Gen.IV materials R&D • Radioisotopes for mediacal & industrial applications • Radioactive beams through ISOL |
| RI Legal status | <p>International non-profit association under Belgian law (AISBL) (to be implemented). European Research Infrastructure Consortium ERIC (alternative legal status but currently not applicable under EURATOM Treaty)</p> <p>Several options of legal forms for MYRRHA have been considered and analysed in detail so far, amongst others in a Joint Task force report mandated by the European Commissioner for Energy G. Oettinger & Belgian State Secretary for Energy M. Wathelet, and formal Deliverables supported by FP7 Euratom Framework Programme:</p> <ul style="list-style-type: none"> • "The MYRRHA ESFRI Project - Report in support to the task force initiated by Commissioner Günther Oettinger and Secretary of State Melchior Wathelet", May 2013 (Restricted Report SCK•CEN R-5455 - M14/MMT/SCK•CEN/1779197) • FP7 Project "MyrrhA Research Infrastructure Support Action (MARISA)", final report August 2016. Deliverable D3.1 "Identification of adequate legal structures for the setting-up, construction, operation and decommissioning" (Reference number SCK•CEN/4810237) |

| | |
|----------------|---|
| | <p>The objective of both reports was to identify the funding opportunities within the European framework and legal status options to serve for a pan-European research infrastructures like MYRRHA. The ERIC structure was found to offer several advantages, but is (today) unfortunately not applicable to EURATOM nuclear projects like MYRRHA.</p> <p>As conversations with (private) partners are advancing and translated into agreements, MYRRHA expects to create the legal entity in 2017 – 2018 H1.</p> |
| RI type | Single sited |

The main challenges that MYRRHA faced

a) Evolution of the field and how MYRRHA infrastructure is contributing to this

MYRRHA is designed as a multi-purpose flexible fast neutron spectrum research infrastructure (50-100 MWth). MYRRHA has a catalogue of application fields including:

- Demonstrate Partitioning & Transmutation of long-lived radio-active waste and spent nuclear fuel: Directive 2011/70/EURATOM on the responsible and safe management of spent fuel and radioactive waste requires EU Member States to establish a dedicated policy, including the implementation of national programmes for the management of spent fuel and radioactive waste. MYRRHA demonstrates the concept of “transmutation”: a process whereby the long-lived radioactive elements in spent nuclear fuel are transformed, meaning that quantity and radiotoxicity are strongly reduced. Transmutation reduces the volume of spent nuclear fuel by a factor of 100 and shortens radiotoxicity by a factor 1,000 from some hundreds of thousands of years to some hundreds of years.
- Commercially produce medical and industrial radioisotopes, including the next generation of accelerator-based medical radio-isotopes
- Test materials and components for new nuclear fission (GEN IV) and nuclear fusion reactors
- Develop advanced nuclear reactors, particularly heavy liquid metal cooled ones. This new type of reactor produces significantly less waste and uses nuclear fuel much more efficiently, contributing to the low-carbon energy-mix in an even more sustainable way.
- Fundamental research into nuclear physics, atomic physics, fundamental interactions, solid state physics, nuclear medicine etc. via ISOL@MYRRHA

One of the most important challenges we are facing in this facility are the most stringent safety rules and aversion for risk of the society whereas we are creating an innovative facility. This requests a continuous interaction with the safety authority that has also to undergo learning traject.

b) With respect to the 10-years rule, the risks MYRRHA are facing and the consequent mitigation plans

MYRRHA is a **complex multi-purpose nuclear** RI, which inherently results in a **longer implementation timeline** when compared to i) non-nuclear RIs; ii) single-purpose RIs. As an

innovative nuclear research infrastructure consisting of a high-power proton accelerator with unprecedented reliability constraints and a lead-cooled fast spectrum, the MYRRHA Research infrastructure is **technically challenging**. MYRRHA has mitigated technical risk through the following measures:

- the establishing of formal technical co-operation agreements with world-class organisations (bi-lateral agreements or through EU Community-supported programmes)
- the implementation of a dedicated research, development and demonstration programme focussing on the most critical components of the MYRRHA facility;
- the development and the testing of prototypes of components at scale 1/1 and the implementation of an extensive technology demonstration programme;
- the technical review of the MYRRHA technical design options by high-level external independent experts (OECD/NEA MYRRHA International Review Team (2009), MYRRHA Sounding (2014), Board and MYRRHA International Review Panel (2015)).
- As a nuclear research infrastructure, MYRRHA is subject to licensing requirements applicable to Class 1 nuclear installations. For MYRRHA, risk associated with the licensing process is mitigated by:
 - The pro-active involvement at an early stage of the nuclear regulator in view of the definition of the licensing process and requirements. The MYRRHA has been in information conversations with the Belgian nuclear regulator FANC / AFCN since 2001, and in a formal pre-licensing dialogue since 2011.
 - The adoption of a pre-licensing phase (preceding the licensing phase) agreed with the nuclear regulator. The pre-licensing enables an in-depth assessment of the most important licensing aspects and addressing through a list of Focus Points relative to the most innovative components, technologies or procedures of the project and to be answered by the licensee prior to the licensing phase. The outcome of the pre-licensing phase is a licensability statement by the regulator.

Considering the scale and the timeline of MYRRHA, the construction of an innovative nuclear research infrastructure as MYRRHA requires substantial **long-term financing commitments** from key stakeholders. Risk associated with the financing of the MYRRHA RI is mitigated by:

- The close involvement and significant financial contribution of major stakeholder such as the Belgian Government, who committed 40% of the total Budget of MYRRHA;
- The independent assessment of the MYRRHA Business Plan by the European Investment Bank under the InnovFin Advisory panel (Consultancy started in 2015, ongoing), providing a positive signalling effect to potential international Consortium Members and private partners;
- Actively pursuing of private sector investment through the involvement of nuclear technology providers, engineering companies, the pharmaceutical industry, ...;

The adoption of a **phased implementation plan** allowing for a spreading of the investment cost and hence risks overrun mitigation.

c) MYRRHA achievements that other projects could learn from

Pooling of technical knowledge in **two rather different research fields** which are needed in an Accelerator Driven System (ADS):

Lead-cooled fast reactor: MYRRHA groups the most advanced research community in lead-cooled fast reactors in the world (outside Russia), illustrated among others by GUINEVERE, and the **first lead-cooled zero-power reactor** in the world (outside Russia).

Accelerator: the **reliability requirements** within MYRRHA are of an unprecedented level, and are one order higher than similar-size accelerators.

MYRRHA's main achievement is to bring together world-class research capabilities from both research communities.

Licensing approach: consultation with nuclear regulator early on and agreement on (pre-) licensing process (cfr. supra under b)

- Phased implementation: reducing technical, financial, and implantation risk (cfr. supra under b)
- Private sector investment: as a lever to unlock international public government commitments in the International Consortium (cfr. supra under b)

d) The bottlenecks for MYRRHA project

- **Human resources management:** The implementation of MYRRHA strongly relies on the availability of highly specialised experts and professional profiles, which are scarce on the market. The recruitment of experts at the international level is particularly challenging. Examples of successful strategies from other projects dealing with this issue are highly relevant.
- **Management of in-kind contributions:** The implementation of innovative RIs such as MYRRHA relies to an important extent on the provision of technical contributions and facility components through “in-kind” contributions from project partners. The management of in-kind contributions involves different aspects such as the valuation of the contributions, technical specifications and quality assurance and control, budget, schedule and legal management. A “Return-of-Experience” and the adoption of “Best Practices” from more advanced projects in terms of implementation would be beneficial to MYRRHA.
- **Project management:** We expect that the transition from the project preparation phase into the project construction phase could be particularly challenging in terms of increased project scale, (acceleration in) cash capital expenditure, increasing the demands on the project management organisation. Lessons learned from projects in an advanced stage of implementation are most useful to projects planning to make the transition from the pre-construction to the construction phase.
- **External parties and contractor management:** During the construction phase, the progression of the project will highly depend on contributions from external parties and contractors. MYRRHA would benefit from a “Return of Experience” and “Best practices” regarding the management, the supervision and the control of external contractors during the project implementation phase.
- **Project knowledge transfer and continuity until start of construction.** The large RIs project are becoming so time demanding to start that the project knowledge transfer until start of construction is becoming a real challenge that can result in redoing things that were completed and forgotten in the meantime. Return of experience in this field would be helpful for MYRRHA.

e) *Identification of the user-groups in MYRRHA business plan and how MYRRHA interacts with them*

The MYRRHA business plan is built around the service revenue streams generated by the following products and their respective associated user groups:

- **Research – Reactor fast flux for Transmutation:** the core of the MYRRHA reactor generates high intensity fast fluxes relevant for Transmutation R&D and technological demonstration of Minor Actinides. User groups targeted are the Nuclear Research Centres in the Countries of the Consortium Members. MYRRHA has been maintaining close relationships with these Research Centres and their Ministries of Science / Research in the respective countries. Interaction with this user group occurs both in the context of Consortium-building and of the formal technical co-operation agreements with world-class organisations mentioned supra under b)
- **Research – Reactor fast Flux for Fusion community interested in materials research:** In the coming decade MYRRHA will be the only flexible EU fast spectrum irradiation facility for material development and can perfectly fit support the fusion roadmap for what concerns the materials research required by F4E, providing a bridging and complementary irradiations to IFMIF facility for materials research.
- **Commercial – Reactor fast flux:** MYRRHA forecasts to offer part of the fast Flux capacity for commercial users. Market demand analysis indicates that existing relationships from the BR2 user community and new user groups provide (more than) sufficient demand for the scarce fast flux irradiation capacity available today.
- **Commercial – Reactor thermal flux:** Produce radio-isotopes for private pharma-companies with the Reactor thermal flux: SCK•CEN has existing relationships with user groups via the BR2 users community for commercial activities, who will be transferred to MYRRHA.
- **Research – Accelerator (ISOL@MYRRHA):** The ISOL@MYRRHA facility has been listed in the Nuclear Physics European Collaboration Committee (NuPECC) long range plan “Perspective of Nuclear Physics in Europe”. ISOL@MYRRHA is a dedicated facility for experiments in need of long continuous beam-time periods. ISOL@MYRRHA team maintains ongoing interaction with the ISOL user groups via several research projects and pro-active analysis and development of the market.
- **Commercial – Accelerator:** Produce innovative new radio-isotopes for private pharma-companies with Accelerator: both existing and new innovative radio-isotopes will be produced on a commercial basis in the MYRRHA accelerator

Four types of access will be offered to the above **user groups**:

Access mode 1: Access to MYRRHA by Members of the **MYRRHA Consortium** provided in accordance with the shares owned by each member of the MYRRHA Consortium.

Access mode 2: Access to MYRRHA as on “**Open User Facility**” will be provided on the basis of scientific or technological excellence and will be subject to an assessment by an Independent Programme Access Committee (PAC).

Access mode 3: Access to the MYRRHA facility for the purpose of **collaborative research** on subjects of common interest provided to interested parties not forming part of the MYRRHA Consortium and granted subject to availability.

Access mode 4: The usage of MYRRHA for **contract research and commercial services** is also subject to availability

f) The added value of the RI as compared to a collaboration network of legally and economically independent RIs

MYRRHA is a world class nuclear research infrastructure, which is unique and which is of international significance. The technical scope of MYRRHA **requires one single-sited research infrastructure** consisting of a **proton accelerator** coupled to a **fast spectrum heavy liquid metal cooled nuclear reactor**. This implies that the technical scope of MYRRHA is **undividable** and cannot be realised through a network of distributed facilities of research infrastructures.

The construction and the operation of the RI can only be managed through one single physical RI and legal entity in conjunction with the RI rather than through a network of legally and economically independent RIs.

The challenge of responsible and safe management of spent fuel and radioactive waste is **similar to different EU Member States**. Therefore, an **EU strategy regarding Partitioning and Transmutation (P&T)** was developed in 2005, identifying MYRRHA as the demonstration facility for Transmutation.

g) Evolution of MYRRHA scientific case, and how this has affected MYRRHA business model

The **overall scientific case and technical concept** of the MYRRHA facility as an Accelerator-driven System (ADS) has **remained consistent** over time. During the pre-construction phase, specific scientific and technical challenges have been addressed and resolved.

As MYRRHA's pre-implementation phase matured, a number of practical adjustments were made, aimed at optimizing the Economic Business Case (in line with market developments) and at the same time minimizing (technical, financial, and execution) risk:

In December 2015, SCK•CEN Board endorsed a **phased implementation strategy** reducing technical risk, spreading investment cost, and allowing first R&D facility available by 2024. The phased Implementation Plan was validated by two independent expert panels: Sounding Board of nuclear engineering experts, and Evaluation Panel of nuclear research experts

In terms of the **catalogue of applications** of the MYRRHA Research Infrastructure, a limited number of evolutions in the underlying markets have occurred:

→Technological developments in the semi-conductor technologies have led to the exclusion of Si-doping in the MYRRHA catalogue of applications;

A market evolution in medical radioisotopes - driven by a nascent technology - shifts from reactor-based to accelerator-based medical radio-isotopes. The net impact on MYRRHA of this shift is limited, as MYRRHA has both a reactor and an accelerator.

h) Feedback on the way of monitoring ESFRI projects

Scope: The ESFRI survey monitors multiple project dimensions, notably project governance and management, technical work and advancements, feasibility, financing, schedule, stakeholder involvement and project risk. The scope of the survey provides a sound assessment basis for the monitoring of ESFRI projects in terms of progression towards implementation.

Frequency: The monitoring of ESFRI project with a two-year frequency is appropriate since this timeframe enables demonstrating major advancements or evolutions with respect to the different project dimensions.

Recommendations/assistance offered by ESFRI: Recommendations by ESFRI are pertinent, important and helpful in defining areas requiring additional effort.

i) Feedback on the ESFRI MOS system

The ESFRI MOS system is user-friendly, contains clear instructions and enables to convey a sufficient level of detail on the project status as a basis for the monitoring of ESFRI projects.

3. WindScanner

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| Panellist (name) | Søren Knudsen |
| RI Acronym | The European WindScanner Facility – WindScanner.eu |
| Scientific field | <p>The WindScanner research infrastructure provides state-of-the-art wind measurements of wind fields provided by multiple space- and time synchronized wind LiDARs (Laser Doppler-based wind measuring systems) operated to scan at distant points.</p> <p>The research infrastructure has its primary use within wind energy wind field measurements around large wind turbines and entire wind farms, on and offshore. However, it also provides unique 3D wind and turbulence data for atmospheric boundary layer research, air safety, wind loads on buildings and bridges, wind circulation in streets and the urban environment in general, etc.</p> |
| RI Legal status | The WindScanner.eu FP7 Preparatory Phase project finished by the end of 2015 with a Business Plan and draft ERIC statutes as the key outputs. All partners involved in the Preparatory Phase project has signed a MoU stating their common objective to work towards establishing WindScanner.eu as a legal entity based on the European Research Infrastructure Consortium (ERIC) Model. However the WindScanner.eu legal entity has not been established yet (January 2017). |
| RI type | The Research Infrastructure will become a distributed research infrastructure and will consist of a set of National Nodes from leading European wind energy research organizations, operating mobile WindScanners, linked together by the WindScanner Central Hub. |

The main challenges that WindScanner faced

a) Evolution of the field and how WindScanner infrastructure is contributing to this

Wind energy has become a leading electricity generating technology all across Europe and a massive increase in installed wind power capacity is still required to meet the political goals for a sustainable energy system. Wind Turbines has also increased in size, where today wind turbines soar more than 200 meters into the sky and they are installed offshore and in wind farms, which implies that their driving winds to a lesser extent can be characterized from a single met mast measurements but require detailed measurements in their rotor planes and of the entire 3D wind fields, upwind and in their wakes.

Many full-scale experimental investigations with 3D WindScanners are therefore continuously needed to achieve a better understanding of the complex flow and turbulence that creates loads and causes fatigue on wind turbines and wind plants in operation. This knowledge, available only from full-scale experimental wind scanning, is key to optimize turbine's design and siting and thus an important drive for reducing the cost of energy.

WindScanner based measurement technology is currently being developed and exploited with better accuracy and longer ranges to provide the necessary research tool as an alternative to the traditional in-situ wind anemometry.

The continuous improvement of this RI's remote sensing based (wind lidar) wind scanning measurement technology (cf. www.windscanner.eu) over the past few years, with enhanced spatio-temporal resolution, improved signal-to-noise ratio, and considerable reduction of the physical package, has made 3D wind scanning a very appealing research and development tool for providing hitherto unprecedented measurements of the 3-D wind field surrounding today's huge wind turbines, wind farms, bridges, buildings, forests and mountains.

b) With respect to the 10-years rule, the risks WindScanner.eu are facing and the consequent mitigation plans

A Business Plan for the realization of WindScanner.eu as an ERIC that all current partners agree to has been drafted during the RI's Preparatory Phase. However, sufficient national funding has not yet been secured to start the establishment of the ERIC. This is currently the major challenge as several countries are experiencing financial cut-backs and reluctance from national funders and road maps to make long-term financial commitments.

Since the end of the WindScanner.eu Preparatory Phase Project (End 2015) the collaboration has continued on a voluntary base mainly driven by national efforts. However, intermediate steps have been agreed upon between the partners in order not to lose momentum in the interim phase between the finalization of the Preparatory Phase, and the establishment of the ERIC.

The partners have agreed on a framework for involvement of the scientific and industrial community based on the already established EERA Joint Programme (JP) on Wind Energy, where all the present partners are members. Utilizing the EERA framework has not only provided a familiar and proven effective governance structure, but it is also serving as a way of expanding the number of partners involved among the more than 45 members in the EERA JP Wind from currently 14 different Member States.

The key focus in this phase has been to develop and implement ambitious European measurement campaigns where the wind scanners have demonstrated their use and relevance as a joint, European distributed research infrastructure. This has already shown very successful as several measurement campaigns has been implemented using WindScanners owned by partners from different countries resulting in experiments on a scale not seen before.

However, this presently voluntary collaboration in the framework of EERA needs to be supplemented by a more targeted “Implementation Phase” focusing on the final steps towards establishing an ERIC and gradually starting specific hub activities. For this to happen one or more countries needs to take the lead, including hiring an interim Director with a clear mandate to intensify the dialogue with relevant partners and Member States and to gradually establish a “start-up” Hub. The “Implementation phase” should start in 2017-2018.

c) WindScanner achievements that other projects could learn from

The new and emerging wind lidar technology combined with synchronized scanning from several simultaneous operated scanners has enabled a globally unique methodology for accurately measured 3D wind fields around full-scale operating wind turbines and wind farms.

For the first time, it's now possible to unmask the complex and up to now basically invisible turbulent flows. By joining forces regarding knowledge and WindScanner systems in a distributed research infrastructure we can literally switch on the light in the black box, which the resource wind in many aspects still is today.

We have showed that it is possible to pull resources and distributed equipment and allow for unique full-scale atmospheric boundary-layer wind flow experiments on a European scale, requiring competences and budgets previously only possible in a few countries.

d) The bottlenecks for WindScanner project

The challenge is to get all member states equally prepared for the construction phase, including obtaining funding from their respective national road maps, research councils etc.

As a smaller, distributed facility with a foreseen large dependency on the delivery of the national nodes it will be a key challenge to ensure the link between the hub and the nodes, especially since the Membership Fee (financing the hub) is expected to be low. The latter is probably going to be the case to make it appealing for MS's to join. It would be interesting to hear how this dilemma has been handled by other distributed RIs.

e) The user-groups in WindScanner business plan and their interaction

The WindScanner will have a broad range of user-groups and stakeholders and the interaction will mainly be ensured through the WindScanner e-Science and User Platform. The platform represents a one-point-of-entry for users where they can acquire necessary knowledge about the technology, have a possibility to run it and obtain access to the acquired measurements and other research data, contribute, communicate and collaborate with peers etc.

f) The added value of the RI as compared to a collaboration network of legally and economically independent RIs

WindScanner will be a unique, and mobile European research infrastructure, capable of scanning 3D wind fields at different sites in different terrains all over Europe, so the infrastructure goes to the sample, not the other way around. The added value comes from being able to do ambitious, large-scale experiments that a single university, institute or most countries currently will not be able to do.

The infrastructure will also enable joint planning and execution of large scale experiments with multiple WindScanners owned by various national nodes, but linked via common software, using common standards for data processing etc. The WindScanner E-science and User Platform will be used for campaign design, documentation, data management and data analysis. Furthermore, the hub will coordinate purchasing, commissioning, calibration and maintenance of WindScanner equipment as well as organize training and education in WindScanner operation and data analysis. The competences to do this separately at national level are not adequately developed and a genuine European approach, providing equal open user access for academia researchers and industry, is needed to ensure excellence and cost-efficiency.

WindScanner will develop and implement services tailored to the needs of their users and operators of the scanners and ensure a coordinated and complementary infrastructure development and functionality. This includes establishment of a unique one-point-of-entry WindScanner e-Science and User Platform that facilitate a wide range of users - from industry and the research community - to use these unique 3D scanned wind field research data. This will bring together national facilities to enhance and further develop cutting-edge experimental research for wind energy in complex wind flows, supporting the further development of synergies and alliances, which will not be possible within national facilities only.

g) Evolution of the scientific case, and how has this affected your business model

The scientific case, and in particular its applications to related research fields (load on bridges, effect of wind breaks, hovercraft downwash, wind lidar based wind turbine control, race boat wind profiling, detailed wind tunnel 3D field measurements, calibration of cup anemometry etc. and more are under way) has indeed evolved since WindScanner emerged on the ESFRI road map in 2010.

h) Feedback on the way we monitor the projects

Generally, the monitoring process is meaningful as well as useful, internally as well as for decision-makers at national level.

However, as a smaller RI compared to spallation sources and XRAY- facilities our challenges are different, so some of the criteria could be more differentiated.

i) Feedback on the ESFRI MOS system

It could be considered to include ESFRI / RI Experts more directly during the Preparatory Phase project. In this way they could be more familiar with the projects and also more specifically point to issues that should be addressed.

j) General recommendation

In some ways it is “too easy” for a partner to be involved in a Preparatory Phase Project without a real link to MS Representatives. It could be a requirement that a partner can only be involved if a MS has committed (support letter, including the commitment to participate in i.e. a Yearly Meeting, and willingness to comment on key documents etc.)

Training programmes or Exchange programmes for RI managers should be offered.

4. AnaEE

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| Panellist (name) | Dr. habil. Abad Chabbi |
| RI Acronym | AnaEE (Analysis and Experimentation on Ecosystems) – see www.anaee.com |
| Scientific field | Food, Health and Environment |
| RI Legal status | ERIC application to be submitted |
| RI type | Distributed |

The main challenges that AnaEE faced

a) Evolution of the field and how AnaEE infrastructure is contributing to this

The rapid pace of large-scale global environmental changes has stressed the need to better understand and forecast ecological and agroecosystem processes for our society to prepare, plan and adapt to such changes. We are also entering an era of large-scale and interdisciplinary science, fueled by large datasets to be analyzed scientifically.

Natural, managed and socioeconomic systems are subject to complex, interactive and chronic stresses that play out over extended periods of time and spaces. These ecosystem changes threaten to erode our environmental capital, resulting in disruptions likely to alter the fundamental trajectory of societies and our overall quality of life in Europe and around the world. Such uncertainties in relations to ecoagrosystems responses and adaptive behavior are expected to weigh in substantially on the ultimate costs of addressing ecosystem changes. In other words, it is critical we better understand the magnitude and driving mechanisms of such changes in order to devise cost-effective policies.

AnaEE would accomplish this by adapting approaches that have proven successful in forecasting weather patterns and epidemiology. AnaEE aims on cyclically iterating the rigorous examination and comparative analyses of data generated by theory-observations models and experiments. Indeed, key information regarding ecosystems’ non-linear and stochastic behavior under projected conditions can only be derived from unprecedented experimental research. Interpreting the resulting wealth of data requires observation and predictive technologies to be fitted with corresponding methods. As such, the RI stands to make a key contribution in informing future programmatic needs, scope, budget allocations, risk management strategies and innovations.

The AnaEE Research Infrastructure is ultimately designed to meet the societal and scientific challenges outlined above, by advancing our knowledge of *how* to forecast ecology. Developing ecological forecasting ultimately paves the way for better decision-making tools and decision trade spaces. This preparedness towards known and unknown future environmental conditions also equips industries and policy-makers with options and opportunities to better manage our global natural capital.

b) With respect to the 10-years rule, the risks AnaEE are facing and the consequent mitigation plans

On October 31, 2016, AnaEE ended its Preparatory Phase: its key challenge now lies in pursuing the initiatives set forth so far and lead the project from an implementation Phase into applying for ERIC status. Five countries have committed to the Implementation Phase, by signing a non-binding Letter of Intent (LoI). However, securing AnaEE’s long-term sustainability will depend on the full commitment of its signatory states and the RI’s capacity to attract additional members. This will likely be challenged by growing budgetary constraints and political issues across Europe, in addition to selective engagement policies at country level, regardless of the fact AnaEE RI was included in their initial roadmaps. Due to the inherent complexity of the AnaEE infrastructure, the Consortium leveraged in-house expertise and active management and stakeholder engagement policy, to shortlist the following critical risks. Indeed, the project governance will closely track all risks through the use of a spiral management approach (magnitude and occurrence) so as to prioritize the corresponding mitigation efforts.

| Description of risk (level of likelihood: Low/Medium/High) | Proposed risk mitigation measures |
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| <p>A lack of country-level financial commitment (High). Funding authorities are increasingly reluctant to make firm commitments. The AnaEE’s signatory states’ respective economic uncertainties will surely affect funding made available to RIs, which may jeopardize their proposed schedule, scope and governance scheme.</p> | <ul style="list-style-type: none"> - Develop an implementation plan detailed the corresponding deliverables, the options to be decided for the set-up for the ERIC and the future key performance indicators. This plan will present potential new member states with a realistic and convincing offer. A strong incentive to join the implementation phase is that an early participation of a member State will grant it a greater influence on the operating rules of the ERIC. - Actively engage key funders and the Member States’ relevant ministries from the earliest stages of AnaEE’s implementation. This can only be achieved by defining a clear lobbying strategy and appointing a dedicated and senior-level staff with the relevant scientific and diplomatic skills, as well as a keen understanding of the political issues at play. - Constrain the Implementation Phase to swiftly recruit the infrastructure’s Director General (DG), associated support staff and governance structure. The AnaEE Central Hub host must demonstrate a credible commitment to build trust amongst its Member States and ultimately convince |

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| | <p>further signatories to undertake the necessary financial investment for the project's implementation.</p> |
| <p>A number of signatory countries insufficient to ensure the long-term sustainability of the RI (High).</p> <p>The achievement of ambitious scientific goals (in both basic and applied research) is met with varying degrees of uncertainty, whereas signatory states are typically risk-averse in deciding to make firm commitments with financial implications.</p> | <ul style="list-style-type: none"> - Collect letters from research institutions and universities across Europe to demonstrate their interest in a coordinated approach at the European level and their readiness to involve their platforms into AnaEE, to streamline a European buy-in of AnaEE's mission statement. Bring core partners to agree on the modalities of activating the ERIC statutes to the specificities of the AnaEE infrastructure. This two-pronged approach would ultimately strengthen governments and funders' confidence in the RI and make the case for a sufficient number of ignatory states to support AnaEE's applying for ERIC status. - Recruit the DG and core staff as soon as possible, to reinforce the overall confidence in the sustainability of the project's governance. |
| <p>A lack of alignment across country-level programs and funding profiles towards achieving an operational RI (Medium).</p> <p>National funding depending on national policy, the main risk for AnaEE lies in its Member States' capacity to commit financially in relations to their respective economic circumstances.</p> | <ul style="list-style-type: none"> - Develop a solid business plan for the operational phase, proposing a realistic budget that is commensurate with an attractive, important set of deliverables within a finite timeframe, and based on credible expectations for cash and/or in-kind contributions. - Develop a detailed activity plan, complete with suitable deliverables and key performance indicators, in order to present prospective funders with a reasonable and convincing offer (see above). |
| <p>A limited capacity in establishing robust academic, public and private user communities (Medium).</p> <p>A strong user engagement policy is vital to AnaEE's implementation. Conversely, the lack thereof would question of the project's "raison d'être".</p> | <ul style="list-style-type: none"> - Develop a comprehensive and regularly updated User Strategy. This would contribute to AnaEE's user engagement policy and highlight success stories in relations to ecological experimentation. - Develop a plan for a tangible return on investment in AnaEE, in order to maximize prospects for long-term economic growth, jobs creation and enhanced competitiveness, the result of which would be to mount the case for national investments in AnaEE. - Develop pilots to demonstrate AnaEE's measurable impact on the economy by way of industrial partnerships. Launching a pilot study of science's capacity to forecast ecosystem changes may for instance |

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| | <p>underpin the rise of new industries, sustain current players and markets, improve our risk analysis and ultimately dovetail our adaptation plans.</p> <ul style="list-style-type: none"> - Formally engage industries by inviting their representatives to sit on AnaEE’s External Advisory Board. - Likewise, AnaEE might consider the opportunity to invite academia representatives to join the POP Assembly of Members during specific decision-making sessions. - Assume leadership in promoting pilot cases for new EU leadership technologies in environmental/agroecosystem, using the AnaEE RI as a testbed whenever industrial partners are onboard. - Establish the appropriate funding mechanisms and stakeholders engagement policy to develop public/private partnerships. |
| <p>Potential weaknesses in the Transitional Governance and Management structures (Medium).</p> <p>The accountability of AnaEE’s signatories must be maintained despite the transitory nature of the interim period between its Preparatory and Operational Phases. The resulting risks would generate (i) delays in schedule and additional costs in ramping-up construction efforts up once the next phase begins, (ii) the inconstancy of having to instate a new governance model, and (iii) a lack of an empowering structure for the DG to operate once hired and (iv) resulting setbacks in exceeding cost projections and missing potential opportunities. As a result, a certain sense of urgency needs to guide the swift formalization of the AnaEE Central Hub’s implementation and management of scientific and technical excellence.</p> | <ul style="list-style-type: none"> - Current meetings are being convened to organize the project’s new phase and may (i) include a special governance session to solidify a truly international transitional team, (ii) promptly hire the DG, (iii) accelerate the ERIC application process and overall schedule, etc. - Instate a Scientific Advisory Board to guide the RI’s vision. |

c) AnaEE’s achievements that other projects could learn from

While each RI is different, AnaEE has certainly taken advantage of the lessons learned from other RIs. For this reason, the project welcomes the opportunity to share certain notable results, which may enable the ESFRI community:

- Community Building: through community-driven processes, the culture and advancements in experimental ecosystem science were gradually established at the site, national continental and international scales. This active community engagement allows for the ongoing co-development of prototype workflows and the devising of comprehensive deliverables;
- Boosting interest for experimental facilities distributed across the European territory: upwards of a hundred facilities were identified and shortlisted, based on criteria of scientific

and programmatic excellence. This allows AnaEE to make a substantial contribution both to optimizing cross-use of platforms in pan-European experiments (in a way that is both consistent and feasible) and engaging individual platforms to take an active part in meeting AnaEE's overarching goals;

- Proactive lobbying of the RI's innovation potential beyond European boundaries. AnaEE seeks to contribute towards the implementation of a global vision for cross-cutting ecosystems research in open collaborations with TERN, NEON, iLTER and ICOS, amongst others. This shows leadership, vision, innovation and potential and conveys additional visibility onto its signatory's countries and their partnering institutions.
- Strategic industry and SMEs partnerships: AnaEE strongly believes in placing RI-derived knowledge at the heart of industrial developments and innovation. We seek innovation capability in order to develop new marketable ideas and products (both data and physical infrastructures, e.g., sensors), economies, jobs and generally, a more secure society. AnaEE's business plan indeed presents an extensive market analysis to identify and quantify existing opportunities, in order to reach out to the broadest user community possible.
- Strengthening experimental approaches in ecosystem-agroecosystem science: AnaEE stands to exemplify a culture of cooperation in constructing comprehensive networks to address thematic challenges in Europe and beyond. Hence, understanding how ecosystems and interdependent economies fit within the broader global context is essential for our European countries to maintain their competitive advantage in science and the economy — particularly in relations to natural resources, water, soil, air, food and fibers. Looking to the future, AnaEE is studying complementarities and possible synergies with EMPHASIS as well as ENVRIPlus, both potential case studies for its overarching strategic research plan. Worldwide, AnaEE has extended its engagement policies internationally, expressing a strong willingness to cooperate with other RIs in the United States (NEON), China (Nanjing large-scale warming experiments) and Australia (TERN), as well as ongoing activities in South Africa.

d) Bottlenecks for AnaEE project

AnaEE, like other RIs, needs to challenge existing funding paradigms and develop a more diversified and sustainable funding model, while securing the necessary core funding from Member States (MS) and Associated Countries (AC). In addition to this challenge common to all RIs, AnaEE faces the following bottlenecks: •

- Securing sufficient investment from MS and AC to support the management activities of the Central Hub and the supra-national Centers. This requires a careful balance between in-kind contributions and cash funding for which we would like to learn from other projects. •
- The process by which MS and ACs ratify decisions to support AnaEE needs to be speed up in order to comply with AnaEE's projected schedule. The inclusion of AnaEE in National Roadmaps is not synchronized across MS and ACs or even unilaterally recognized as such, which does not facilitate alignment in decision-making processes and may cause delay in AnaEE's development schedule. How was this handled by other projects?
- Cyberinfrastructures and dataflow models continue to challenge all RIs and AnaEE is no exception. The cyberinfrastructure approach, federated computing services and data access (data portals) are constantly evolving by nature. Under such circumstances, the implementation of the proposed sustainable business model relies on accurately identifying and prototyping the needs of ANAEE's user community.
- Further development of the ESFRI Reference model to include more formalized System Engineering approaches and Project Management to define, track and report the scope, budget, risk, and schedule using proven resource loading tools.

The call for a distributed management tends to challenge scientists seldom trained to become effective managers. The skillset required by environmental RIs are novel and come with a set of issues quite different from those that typically face project managers. AnaEE and other RIs on the

ESFRI roadmap would do well to seek feedback from other RIs in terms of dealing with this challenge (i.e. formal trainings, corporate mentorships etc...). As a result, AnaEE will seek to advance:

- a clear engagement strategy towards managing and advancing science;
- a formal risk and mitigation management plan, to deal with known and unforeseen programmatic challenges that may occur while developing an ERIC and a federated research infrastructure;
- solid management hypotheses to align with user needs and expectations and to define how the AnaEE Central Hub and the supra-national Centres can organize to provide optimal services.

e) Identification of the user-groups in AnaEE business plan and how AnaEE interacts with them

As part of the AnaEE Preparatory Phase, a broad stakeholder mapping initiative was conducted and summarized in the RI’s business plan. Six groups of priority users were listed according to their interest in supporting AnaEE, but also their ultimate impact in the development and advancement of the European Ecosystems Research Infrastructure. They are summarized in the following table:

| | |
|--|---|
| Research community | Policy makers |
| Research institutions, Scientific networks, International Research Alliances, Sister initiatives (NEON, TERN), Other EU and international Research Infrastructures | Government : ministries in charge of research, in charge of agriculture Public administration Environmental protection agencies Geo-hazard monitoring and prevention agencies Disaster management and mitigation agencies Climate change modelling and forecasting agencies |
| Funding Agencies and funding bodies | Industries |
| Member States funding agencies, Joint Programming Initiatives, International Research Agencies or consortium of agencies (Belmont Forum), EU Commission | Agriculture, Agrochemicals, Food production Forestry, Energy , Insurance Aquaculture, Water provision Biotechnology, Sensors Land development Tourism – Recreation |
| Educators | Civil society |
| Primary and secondary schools, Higher Education institutions, University lecturers | Environmental organizations (NGOs), Public interest groups National media, culture General public |

Echoing the AnaEE prospective User Strategy ventured in its Business Plan, a corollary Community Engagement Plan will focus on the four following priority groups, each requiring a specific outreach approach:

1. Scientists and science managers;
2. Public and private sector innovators;
3. Policy makers and funding bodies;
4. Educators, the media and the broader public.

AnaEE’s user mapping will play a strategic role in bringing about the AnaEE brand as an internationally recognized flagship for scientific probity and excellence. The aim is also to establish AnaEE as a benchmark and key ally for industries looking to develop innovative technologies and solutions for the global Greentech market. We indeed bring together users from all horizons (scientists, engineers, academics, innovators, industries (notably sensor/instruments/data acquisition key players, Insurance and re-insurance economies) to

develop a strategic forum with the goal of combined projects that address both economic and societal benefit. In developing the corresponding structure and processes, we take pride in our innovative approach to public and private engagement.

First and foremost, AnaEE is intended to enable the research community to respond to the challenges highlighted by the ecosystems science community, meet national and international imperatives and support the advancement of the European Research Area (ERA). In that regard, a key contribution of AnaEE's lies in deriving novel scientific expertise from the RI, through targeted training, data workshops and courses for early career scientists. AnaEE will support exchange of staff between platforms to share expertise and develop common experimental procedures across Europe. AnaEE will actively contribute to student and scientist mobility opportunities. Hence, a new generation of researchers will be educated and equipped to fully leverage the experimental tools developed by AnaEE. AnaEE seminal approach to pushing new frontiers in science is grounded in prototyping end-to-end data workflows as well as its own physical infrastructures. This will in turn provide the research community with deep insights into its knowledge gaps and potential to influence future strategic planning. Lessons learned indeed aim to directly inform operational optimization processes, budget, schedule and risks management strategies for distributed RIs.

AnaEE will also collaborate with **industries**, as innovation developers and contractors, or as customers (e.g. to mobilize national platforms as testbeds). Re/insurance companies, agribusinesses and sensing and instrumentation industries are likely to be particularly receptive and are consequently natural partners for AnaEE. Indeed, corporate engagement initiatives will strive to demonstrate how co-designed and co-developed experimental data could significantly reduce exposure to risk and advance socio-ecological-economic resilience, by providing (i) explicit decision-space and uncertainty estimates for (ecological) processes affected by climate change, (ii) comparative capability, (iii) diverse modelling platforms and tools for ecological forecasting and (iv), effective data flow management and common standards. Bearing in mind intellectual property rights and data sovereignty issues inevitably arise from working across geopolitical borders, it will also belong to the AnaEE team to leverage the pan-European nature of its infrastructure – and precisely, the diversity of its stakeholder community – to spark such collaborations.

Governments and local administrations will profit from AnaEE's reporting, consulting and decision support activities. Funding research agencies will profit from AnaEE's foresight activities and reporting to plan their strategy and will be able to launch research programs enabled by the high-quality platforms of AnaEE.

Finally, AnaEE's outreach documents will help **educators** to play an essential role in developing tomorrow's experts through formal curricula, student internships, graduate assistantships, visiting scientists, citizen science activities and the overall promotion of environmental literacy. This is ultimately expected to flow down to the civil society in such a way as to inform the day-to-day governance of our global economy.

f) The added value of AnaEE RI as compared to a collaboration network of legally and economically independent RIs

Research infrastructures (RIs) are key elements in research and innovation policies. Their complexity in terms of their high development, construction and operational costs, their requirement of a critical mass of highly qualified human resources, or simply the global nature of the scientific challenges they address, makes it impossible for a single country or region to build and operate such facilities alone.

This is how RIs differ from regular networks and how they generate added value:

- AnaEE is a unique coordinated and distributed experimental infrastructure designed to provide the necessary research to advance our ecological literacy as well as our analytical and decision making tools. Through the critical mass they leverage and their integrative experimental approach, AnaEE will identify gaps to orient future investments of member states and will avoid potential redundancies. Likewise, AnaEE stands to maximize available funding to tackle global challenges and push back new frontiers in scientific knowledge.
- Specifically, AnaEE centralizes key services to its diverse user communities, through the coordinated strength of a Central Hub overseeing three Supranational Service Centres. For instance, the Technology Centre and the Data and Modelling Centre will develop technical standards and metadata stands to facilitate an integrated understanding of ecological processes across large time and space domains, which would otherwise not be achievable.
- As a result, RIs provide a concerted solution to the issues arising from the management of Big Science and Big Data. National academies and research communities throughout the EC and globally have recognized the need for large integrated environmental datasets to answer novel scientific questions key to global societies.
- Streamlining a framework in order to advance our ecological understanding and literacy, trouble-shooting in a more concerted fashion than federated independent RIs could. Hence, an ERIC RI provides an enhanced ability for concerted decision-making and minimizes uncertainties.
- Leveraging robust scientific and technology synergies based on the complementarity of the services provided, so as to generate a broader range, stemming from different sites with different sets of expertise.
- Strengthening the connection between the distributed nodes through a central hub and supra-national centers.
- This overarching governance system provides oversight for National Research Infrastructure and ultimately optimizes decision-making processes in terms of funding allotment all the while reducing the risk in duplication or gaps. ERIC status indeed sanctions the optimization of the science agenda and the infrastructure management all the while requiring comparatively less public capital investment and operational cost per site. The visibility of ERICs also ensures further willingness from countries to contribute and in term benefit from VAT exemptions.

g) Evolution of AnaEE scientific case, and how this has affected AnaEE business model

In the past, our scientific methods and institutions have tended to emphasize the study of individual natural processes rather than systems, analysis over synthesis and understanding nature more than predicting its behavior. In many instances, science focused on short-term, small-scale problems, often in monodisciplinary mode, rather than on long-term, large-scale or integrated problems.

While these approaches and perspectives have converged into a substantial body of knowledge and adjacent portfolio of related technologies, the problems now facing humankind require a vastly more holistic approach to science, as developed by large scale integrated Research Infrastructures.

In this regard, AnaEE's goal is to generate state-of-the-science experimental methods to detect and study the non-linear behaviors of environmental drivers (climate, invasive species, land use change) and their ecosystem processes (biodiversity, biogeochemistry, water and energy, stability and resilience).

Through a new Spiral Management Approach integrating theory, observations, experiments, models and analytics, we will be able to pinpoint functional thresholds, tipping points and stochastic events. This would enable the RI to offer an additional prognostic understanding of the services ecosystems provide as well as real-world scenarios.

AnaEE will also build a network with the capacity for data management, informatics and e-infrastructures necessary to facilitate the interoperability of datasets, models and analytical

tools. The end goal would then be to further enable scaling, scientific discovery and inform the next experiment required to answer new societal needs. As a result, AnaEE will effectively:

- Co-develop analytical tools (in open partnership with academia, researchers, planners and decision-makers) that take into account a realistic range of socioeconomic conditions, as well as multiple time and space scales. The community at large would then derive a better understanding of how to plan mitigation of- and adaptation efforts in the face of a changing and anthropogenically-influenced natural world;
- Better inform the management of agronomic and forestry systems and natural resources at different levels of decision-making, this in relations to food security and manufacturing resources at the local, national and international scales.

h) Feedback on the monitoring of ESFRI projects

It appears the monitoring exercise is fair and the approach used is very helpful to depict and shed light on what has worked well in the project and what has not. The monitoring results and corresponding recommendations are keys in overcoming bottlenecks and ultimately facilitating the implementation process of the project.

The professional management of RIs as championed by the ESFRI is fundamental in the ultimate success of the RI. AnaEE has indeed gained much traction from the systematic observation and critical review of its activities, rapidly detecting and reporting metrics and subsequent investigation of the appropriate remedial action. This effectively brings RI to establish, implement and maintain a comprehensive monitoring and risk management and mitigation system that is understood and approved by the stakeholders.

This highlights our RI's critical need for competent managers and technical staff running the RI, which may become available through the existence of dedicated training programs and substantially increase RI's attractiveness as prospective employers.

In this regard, one might advocate for ESFRI to organize the development and training of international managers and Executive Directors for research infrastructures courses, as well as streamline the implementation of exchange programs for managers between RIs. Conferences and meetings provide us with welcome opportunities to identify and share principles and good practices. As such, a stronger mechanism to disseminate such success stories would likely empower managers with a good track record (inclusive of industrial and commercial experience) to move from one research infrastructure to another, or to take part in international taskforces, alongside experts in procurement, financial planning, user management, governance, risk and project management.

i) Feedback on the ESFRI MOS system

The ESFRI MOS appears to be an internal project designed to provide constant feedback on the progress of a project, the problems it is facing and the efficiency with which it is being implemented. In this regard, the ESFRI MOS is sound and useful as it provides practical recommendations in tackling weak and critical issues, possible remediation options to overcome the bottlenecks and ultimately speed up the implementation of an ERIC.

j) General recommendation

One might like to see a more proactive involvement of ESFRI toward MS, with a view to facilitate their financial commitments, especially (i) when the RI was added to their national roadmap and

(ii) when the country has already provided support to the PP. Additional support from ESFRI to tap into available funding resources would greatly boost the development of an integrated European science.

This however, requires further insight into complying with the specifications of such funding instruments. A concerted approach from ESFRI would create an additional incentive for states to involve in research infrastructures.

A coordinated approach in RI applications to structural funding holds great potential. Yet such a tool tends to only cover investment costs and can only be used on a national regional basis, hindering its recourse in terms of developing European Research Infrastructures. The help of ESFRI would enable RIs to lobby towards adapting the current financial and procurement rules corresponding to various funding instruments (Horizon 2020, ERDF and national funds) to their specific realities. This would likely be key in ensuring operational costs are indeed covered, most notably in convergence areas.

2nd Panel on Pilot Periodic Review of ESFRI Landmarks

Moderator: Odd Ivar Eriksen (IG Chair) & Jacques Dubucs (SCI SWG Chair)

As a novelty, ESFRI will perform a periodic review of four Landmarks as a pilot exercise without consequences for their Landmark status. Periodic reviews refer to the evaluation of the scientific case and the assessment of implementation of the Landmarks on the Roadmap. The goals of this pilot periodic review of Landmarks are to:

- address their scientific case and their implementation;
- identify their main long-term sustainability challenges;
- update all public information on the Landmarks for the Roadmap 2018;
- Develop a comprehensive and robust methodology for the periodic review applicable to all Landmarks for future updates of the Roadmap together with clear and well accepted criteria.

In order to avoid duplication of efforts, ESFRI will investigate to what degree the Landmarks are willing to share (internal and other external) evaluation and assessment results, e.g. from their Scientific Advisory Committee, as complementary information of high interest for the periodic review.

ESFRI will decide upon the periodicity of the periodic review of Landmarks in the future, also based on the outcome of the pilot.

The discussions during the workshop were stimulated on the bases of the following questions:

- KPIs and how these evolve?
- Evolution of the field and how the infrastructure contributes?
- The impact of your RI in research and innovation?
- Plans to be technically updated to deliver top-services in the coming years?
- Business plan: user-groups and how you interact with them?
- Access policy to your RI and how is this part of your business model?
- How do you monitor your user's base and their needs?
- Risks with respect to maintaining the top service level for your users?
- Risks connected to sustainability?
- What are the most critical actions to be undertaken?

The second panel provided an overview of experiences by ESFRI Landmarks responding to the questions above.

1. ELIXIR

| | |
|-----------------------------|--|
| Panellist (name) | Andrew Smith |
| RI Acronym | ELIXIR |
| Scientific field | Life sciences data |
| Roadmap entry (year) | 2006 |
| RI Legal status | ELIXIR Consortium Agreement is an International treaty – ELIXIR uses the legal personality of EMBL |
| RI type | Distributed, virtual |

The main challenges that ELIXIR faced

a) Which KPIs did you adopt and how have these evolved since they were defined?

ELIXIR's five-year scientific programme includes a detailed scorecard of KPIs that are being developed. For the early phases of ELIXIR these related to Member States joining and the signature of collaboration agreements between the Hub and the Nodes – the focus was very much on capacity and organisational building and the establishment of processes. More recently, as the technical budget has increased, the KPIs have moved to more scientific including number of researchers trained by ELIXIR, etc. The establishment of science-based KPIs will continue over the coming years.

b) Evolution of the field and how the infrastructure is contributing to this?

Bioinformatics and indeed life sciences in general is a rapidly moving field due to advances in high-throughput technologies that generate data at unprecedented scales. ELIXIR directly supports efforts to sustain, integrate and coordinate these data (i.e. genomics, proteomics, metabolomics, and image data). We operate the databases that store and make available these data. We train scientists to use these databases and train developers to help improve the operation of them. There are a multitude of different analysis tools and databases for scientists to use so we have developed a discovery portal (Bio.Tools) to help researchers find the right resource. We operate compute centres that allow people to compute on the data. We develop standards and ontologies to help ensure that the data are interoperable (FAIR).

c) What is the impact of your RI in research and innovation?

ELIXIR has a major impact on research and innovation. The databases run as part of ELIXIR have extensive usage, ie:

- 20,000 academic papers in 2014 cited the ten largest bioinformatics databases (<https://f1000research.com/articles/5-160/v1>)
- Over 8,400 patents in 2014 referenced the same two databases (<https://f1000research.com/articles/5-160/v1>)
- A researcher deposits data in the European Nucleotide Archive every 6 minutes
- The Human Protein Atlas has five new citations each day
- For every 1 Euro invested in the European Bioinformatics Institute (the largest ELIXIR Node) there is a 20-fold return (<http://www.beagrie.com/static/resource/EBI-impact-summary.pdf>)
- ELIXIR's Innovation and SME programme has trained over 150 companies in how to use the free resources within ELIXIR

d) What are your plans to be technically updated to deliver top-services in the coming years?

With a high level five year scientific programme (<https://drive.google.com/file/d/0B7btK9HAXhx1Qj1aQ01wTINzN0E/view>), and annual Work Plans and budgets underneath that programme, ELIXIR has enough flexibility to commit resources on key projects and be responsive to emerging scientific and technological advancements, yet still work to an overarching programme. The SAB reviews progress every six months, and the planning for the next annual Work Plan begins 9 months ahead of the plan being approved.

e) In your business plan: who are the user-groups and how do you interact with them?

ELIXIR has multiple user groups: at the most general level these are the researchers in academia and industry that need to access the data within ELIXIR, or use our services to store their data. These range from life scientists in general, who are not experts in bioinformatics, through to those that are active users of the data on a daily basis.

The challenge for ELIXIR is reaching out to these groups effectively as there are so many researchers (500,000) that are potential users of the resources within ELIXIR. We have four Use Cases (marine, plant sciences, rare diseases and human data), in which we reach out to make sure that our services are fit for purpose for those groups. We also attend regular conferences and events to reach out, including sponsoring and having a major presence on the agenda of the major computational biology conferences in the world (ECCB). We also have an International Strategy to reach users outside Europe, and our Communications Strategy ensures that we have the right web, social media and digital channels set up to communicate with our users.

Indirectly, the funders are also stakeholders as ELIXIR stores data from nationally and EU-funded research projects.

f) What is the access policy to your RI and how is this part of your business model?

ELIXIR brings together hundreds of databases, tools and compute centres across over 180 institutes in 21 countries.

Each database has its own access policy and usage terms, however the standard is that the data are free and available to anyone. This means that the resources are publically funded and operated for the public good. They are supported through investments in ELIXIR Nodes, and through additional national, EU and international project funding.

Some resources, like the European Genome Phenome Archive, which contain sensitive data, require approval from a data access committee first. However, the data are still free of charge, including for industry.

For Compute centres in ELIXIR, the access policies are described here: <https://www.elixir-europe.org/platforms/compute>. Charges are often applied for users outside that country.

g) How do you monitor your user's base and their needs?

We do this through outreach and user input. User surveys are regularly carried out by those running the databases. Workshops and outreach events help as well. Most of the largest databases have their own outreach teams and also helpdesk services, so users can send requests directly to the infrastructure operators and the operators get an understand of new features and services required.

h) What are the risks in the coming years with respect to maintaining the top service level for your users? What are the risks connected to sustainability? What are the most critical actions to be undertaken?

The volume and diversity of the data being generated pose challenges in coordinating this effectively across Europe. As more data are generated, and more funders mandate Open Data principles, the need for continued support to data infrastructures increases. Meeting the demands of 500.000 users is more of a funding challenge than technical, though there are clearly many ethical and legal implications in data transfer. The structure and shape of

ELIXIR allow us to coordinate effectively across Europe; the level of effectiveness to which we can do this depends on the continued investments of Member States and other funders.

2. European Social Survey ERIC (ESS)

| | |
|-----------------------------|---|
| Panellist (name) | Rory Fitzgerald |
| RI Acronym | ESS ERIC |
| Scientific field | Social Science |
| Roadmap entry (year) | 2006 |
| RI Legal status | European Research Infrastructure Consortium (ERIC) (awarded December 2013) |
| RI type | Distributed |

The main challenges that ESS faced

a) Which KPIs did you adopt and how have these evolved since they were defined?

Formal KPIs have not been adopted by the ESS ERIC General Assembly. However, the ESS does monitor its performance in a number of key areas. First, the ESS has a quality matrix for assessing national fieldwork quality against key indicators e.g. response rates, non-contact rates, compliance with ESS procedures, timeliness etc. Second, the ESS monitors and tries to increase the number of participating countries on a round by round basis with the number and geographical spread both relevant. Third, the ESS monitors the number, type and location of its data users. Fourth, the ESS monitors the publications that use ESS data. More recently the ESS has commissioned an Impact Case Study that is seeking evidence of non-academic impact such as use of ESS findings by policy makers and NGOs.

b) Evolution of the field and how the infrastructure is contributing to this?

The European Social Survey (ESS) has set new standards in key areas of cross-national social research such as sampling, translation, questionnaire design, pre-testing, measurement of non-response, as well as in data archiving and data provision. Some of these approaches have been adopted by other surveys. The ESS has also conducted extensive research into mixed mode data collection which will be published shortly and is experimenting with the establishment of an on-line follow-up web panel, the latter with H2020 support from the 'Synergies for Europe's Research Infrastructure in the Social Sciences' (SERISS) cluster award.

c) What is the impact of your RI in research and innovation?

100,000 people have now registered with the ESS since 2002 to view or download all our survey data, available for free online for non-commercial use. The milestone was reached in mid-December 2016, with the overwhelming majority of registered users based in academia. Of the 100,600 registered users as of 19 December 2016, 64% are students; 19% belong to a

faculty or are researchers and 7.5% are undertaking a PhD thesis. 2.7% registered as private individuals; 1.7% belongs to Governments across Europe; 1.7% belongs to non-Governmental Organisations (NGOs) and a further 1.4% is in private enterprise. The highest number of users is based in Germany - in fact, this group accounts for more than 10% of the total registered users. ESS data is also popular amongst those in Belgium (8%); the United Kingdom (8%); the Netherlands (6%); United States (5%); Spain (5%) and Norway (5%). When it comes to downloading the data for use in a statistical analysis programme such as SPSS or R, 69,830 of the registered users have downloaded all or some of the ESS data available online.

The first cumulative ESS data file was published in 2003 which is the year when methodological and substantive ESS publications and presentations began to emerge. In the 13 publishing years (2003-2015) ESS has experienced a significant growth in the number of publications and presentations. There are now 3140 publications with the annual count currently close to 400 English language publications per annum. The bibliographic data for the last decade confirm that ESS has brought added value to the comparative landscape, having established itself as the leading European comparative data source for attitudinal indicators.

ESS has also had non-academic impact. Further information is currently being collated on this topic through an Impact Case Study. However, some examples in this area are already known such as influencing Bulgarian legislation on immigration, British policy on policing and the development of European indicators of Justice. In addition, results on democracy were presented in the European and Italian parliaments, immigration results at the OECD and wellbeing at the UK Cabinet Office influencing discussion and debate in each case. Further examples of these types of impact will be known after June 2017.

d) *What are your plans to be technically updated to deliver top-services in the coming years?*

As noted above the ESS has been experimenting with on-line and mixed mode data collection to prepare for the future. The testing of the first cross-national probability based panel is a pioneering enterprise under ESS ERIC leadership. The ESS is also investing in its data management capabilities to ensure it can handle increasing volumes of data. One recent innovation has been the production of a cumulative data wizard that allows users to custom data sets and the development and population of a multilevel data depository. Under the SERISS award the ESS is preparing for future centralised field monitoring, developing software for cross-national project management of surveys, designing a questionnaire design and documentation tool, adapting the SHARE translation tool as well as developing a question variable data bank. These will together allow more efficient collection, storage and provision of data. Finally, under the current ESS ERIC work programme the data archive team are scoping options to increase data versatility through the development of an ESS data 'warehouse' allowing greater user determined development of bespoke data sets across the different ESS data resources.

Also under the SERISS collaboration with the CESSDA data archive consortium ESS ERIC is contributing to shared work on data protection, curation and the handling of new forms of data.

e) *In your business plan: who are the user-groups and how do you interact with them?*

ESS ERIC has direct and indirect user groups. Direct users include academics and students who work with the data themselves. Indirect users tend to be non-academic and are exposed to ESS data via academic or other publications. These users include policy makers / NGOs, journalists and the general public (although some of these choose to access the data personally). The main mode of interaction with the direct users is via the ESS website that now has over 100,000 registered users. A periodic data user bulletin provides related information. The ESS ERIC also convenes periodic policy seminars in locations such as the OECD, European Parliament, European Commission and national parliaments amongst others. Periodic ESS conferences also provide a key opportunity to interact with users. Finally, ESS top-line publications on a range of topics constitute a key dissemination channel. The ESS uses social media and currently has 2522 followers on Twitter. The ESS is also regularly covered in the media across Europe. In 2016 for example 856 articles were published worldwide (766 of them in Europe). Articles published by country: UK (168); Portugal (113), Greece (82), USA (61), Germany (55), Switzerland (48), France (43), Hungary (41), Sweden (33). Austria (27), Poland (21), Russian Federation (18), Denmark (15), Finland (15), Netherlands (14), Spain (9), Belgium (8), Ireland (7), Canada, Italy, Norway, Romania (6). Lithuania (5), Bulgaria, China (4), Brazil, Croatia, Czech Republic, Estonia, Israel (3), Australia, Azerbaijan, Cape Verde, Cyprus, India, Slovenia (2), Albania, Iceland, Japan, Luxembourg, Macau, Malaysia, Mexico, New Zealand, Pakistan, Saudi Arabia, Slovakia, South Africa, Turkey, Ukraine (1).

The ESS conducts a biennial competition for space to design a 'rotating module' providing a 'bottom up' element to the survey for the social science community. This allows multi-national teams of social scientists to bid for space for 30 items on the ESS questionnaire. In addition, ESS National Coordinators and teams also conduct dissemination activities. These are not currently monitored centrally but a new tool is being developed to help these being logged in the future.

f) *What is the access policy to your RI and how is this part of your business model?*

The European Social Survey (ESS) provides access to all of its data and protocols without charge to users in any location or country for non-commercial use. In addition, the ESS has operated in-person and on-line training for users. All that is required is a simple registration to provide a name and e-mail address as well as a few details such as type of user. There is no privileged access to the data for any of those involved in the infrastructure.

g) *How do you monitor your user's base and their needs?*

The number of registered users and information about their on-line activity on the ESS website is collected by the ESS data archive. The ESS also monitors publications using the ESS via google scholar searches and via its own on-line Bibliography.

Periodic surveys of data users have also taken place with the most recent about to be fielded. The ESS Core Scientific Team also consults the social science community through its National Coordinators Forum, Scientific Advisory Board, Methods Advisory Board and General Assembly. Periodic ESS conferences as well as ESS attendance at key social science conferences and events provide further opportunities to consult users about their needs.

The ESS HQ and data archive also provide a 'queries service' to users in regard to the ESS data holdings and more generally about the infrastructure.

h) What are the risks in the coming years with respect to maintaining the top service level for your users? What are the risks connected to sustainability? What are the most critical actions to be undertaken?

Key risks include: the exit of the ESS ERIC host country from the EU; further countries exiting the EU; the failure to attract further countries to membership of ESS ERIC (including but not limited to the inability to measure the EU28; the barriers for countries outside of the EU / EEA to participate in a legal entity like an ERIC eg Russia, Ukraine, Turkey, Serbia); further declines in the willingness of residents to participate in social research like the ESS; increasing costs for conducting ESS face-to-face fieldwork and reduced availability of fieldwork agencies to conduct the research; pressure to reduce costs of data collection leading to poorer quality data that requires increasingly complex statistical manipulation in order to use; poor quality data collection from other surveys undermining trust in social survey research (eg the failure of political opinion polls to predict election outcomes); increased data protection requirements that reduce participation in surveys and / or the ability to make data available. The main risks in terms of sustainability relate to attracting further countries in order to ensure full European coverage. However, there is a wish to try and avoid a complete reliance on the European Commission for funding which is unlikely to be sustainable as a single funding source in the longer term. A model of co-funding between the Commission and members for the operational costs would increase the likelihood of further countries joining in the future.

The most critical actions to undertake are to increase membership of ESS ERIC in order to reduce central membership costs for all participating countries. Other priorities include examining bringing data collection costs into the formal budget of ESS ERIC in order to allow the VAT exemption to be applied to these costs as well as continuing to look at ways to replace or augment face-to-face data collection which is becoming increasingly expensive (and possibly unavailable). One way to reduce costs in future would be to develop greater sharing of resources between social sciences infrastructures in the future a process that SERISS is beginning to foster. Finally, contingency planning for the impact of a possible Brexit is also underway.

i) How does your governance model support the long-term sustainability?

The transformation of ESS into an ERIC has created greater stability for the core funding of ESS compared to the earlier reliance on European Commission funding alone. There are now 18 committed Member countries and Switzerland is an Observer. These funders are now directly involved in the governance of the infrastructure creating a greater sense of ownership than in the past. In addition to participation and voting rights in the General Assembly the Members get to appoint the Director as well as members of the other committees like the SAB and MAB ensuring refreshment and renewal periodically. Being an ERIC and an ESFRI landmark infrastructure also ensures higher visibility helping to foster sustainability in the longer term.

A further 5 countries will participate in ESS Round 8 as Guest countries – a special status created via a standing order of the GA which supports countries in their transition to membership. This has been a useful addition to the original statutes of the ERIC.

j) Give feedback on the ESFRI MOS system

This system works well and we have had no problems entering the basic information required.

3. European ICOS ERIC

| | |
|-----------------------------|--|
| Panellist (name) | Werner Kutsch |
| RI Acronym | ICOS ERIC |
| Scientific field | Environment |
| Roadmap entry (year) | 2006 |
| RI Legal status | European Research Infrastructure Consortium (ERIC) (awarded December 2013) |
| RI type | <p>Distributed</p> <p>ICOS RI is a distributed Research Infrastructure to provide data and knowledge on greenhouse gas (GHG) budgets and their perturbations. ICOS RI provides long-term observations required to understand the present state and predict future behavior of the global carbon cycle and GHG fluxes. Technological developments and implementations, related to GHGs, will be promoted by the linking of research, education and innovation.</p> <p>The first objective of the ICOS RI is to provide effective access to a single and coherent data set to facilitate research into multi-scale analysis of GHG emissions, sinks and the processes that determine them. The ICOS RI aims to establish a template for the future development of similar integrated and operative GHG observation networks also beyond Europe.</p> <p>The second objective is to provide information for understanding of regional budgets of greenhouse gas sources and sinks, their human and natural drivers, and the controlling mechanisms. The ICOS RI will permit to detect changes in regional greenhouse gas fluxes, early warning of negative developments and the response of natural fluxes to extreme climate events. This information will also reduce uncertainties in Earth System models and their predictions.</p> <p>The ICOS RI data policy endorses full and open exchange of data, metadata and products which will be made available with minimum time delay. It follows general data sharing principles as outlined by GEOSS.</p> <p>The structure of the ICOS RI consists of ICOS National Networks,</p> |

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| | <p>ICOS Central Facilities, and ICOS ERIC. ICOS Central Facilities include Atmosphere Thematic Centre, Ecosystem Thematic Centre, Ocean Thematic Centre and Central Analytical Laboratories. ICOS ERIC includes the Head Office and Carbon Portal. ICOS ERIC manages and oversees the overall activities and strategic goals of ICOS RI.</p> |
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The main challenges that ICOS ERIC faced

a) Which KPIs did you adopt and how have these evolved since they were defined?

KPIs are still under development. An outline has been developed in the INFRADEV-03-2016 proposal RINGO and will be deepened as task of the project which has started in January 2016 and is described here. The KPIs are covering some of the questions below.

1. Impact on membership and sustainability of ICOS ERIC

ICOS aims to enlarge the network and to enable potential new members to join ICOS RI by thus enabling the transfer of knowledge, contact and cooperation of the existing members and new members aspiring to join. Establishing the contacts and learning to work together as a part of the network will increase the maturity level of the potential new members. ICOS RI will benefit from wider and enlarged geographical coverage by including countries such as Ireland, Portugal, Spain, Greece, Hungary, Romania, Poland or Estonia. Increased geographical coverage supports the long-term sustainability of the entire infrastructure.

KPI used for measuring the impact:

- Number of new countries in preparation of joining the ICOS ERIC.

Sub-KPIs:

- Number of additional stations provided by new countries.
- Geographical coverage of the network.
- Number of persons trained

2. Impact on the further technical development of GHG measurements

Domain- and scale-overarching bundling of existing expertise on the GHG measurements technologies and methods will create valuable synergies and foster the development and standardization of new measurement methodologies, applications and parameters measured. The standardization of the above approach will provide a basis for a continuous development and adoption of new techniques and thus secure the relevance and sustainability of ICOS ERIC.

KPI used for measuring the impact:

- Number of new methods/parameters standardized and made operational within ICOS ERIC

Sub-KPIs:

- Number of new instruments or methods tested
- Number of specifications or protocols developed

3. Impact on industry and SME in technical development

The high performance of ICOS in the specification of its stations and sensors that has been achieved during the past decade of developing this RI. During this process, the cooperation with sensor providers has been very close and ICOS internal studies have resulted in manifold developments on the company side. At the current state the scientific base for the next technological developments has priority.

Nevertheless, during this development phase, ICOS will provide access for testing new instruments and transfer results in the framework of the permanent industry dialogue that is conducted anyway.

KPI used for measuring the impact of the proposal:

- Number of industry contacts during the development of future activities.

Sub-KPIs:

- Number of physical access cases.
- Number of results provided for further developments.

4. Scientific Impact

The consolidation of the well-established ICOS activities and the addition of high quality data streams from novel platforms and parts of the three domains previously not covered by measurements will help reducing the current uncertainties in the carbon budget estimates and stimulate the development of new scientific approaches. This will increase the scientific value of ICOS data and data products in global context, and provide the opportunity for ICOS to set standards for construction and operation of future cross-domain research infrastructures.

KPI used for measuring the impact:

- Number of publications on global climate and biogeochemical cycles research in which ICOS has a key role;
- Number of publications on new scientific approaches based on newly available data types.

5. Impact on global in-situ observation system on GHG

The involvement of ICOS in a global observation and information system on carbon and GHG can be measured by indicators that describe the degree of cooperation achieved with RIs on other continents, by the intensity of data flow into global integrations and by the amount of services ICOS provides to global data integration networks and to global initiatives such as IG³IS or then envisaged GEO flagship on carbon and GHG. However, none of these indicators can be defined as key indicator.

KPI used for measuring the impact:

- Degree of connectivity of ICOS in global observation systems

Sub-KPIs:

- Number of signed MoUs
- Number of global data portals that are connected to ICOS via metadata

6. Societal impact

The main indicator for societal impact of ICOS is the degree of knowledge transfer to the main policy forums such as IPCC, GCP and UNFCCC. By providing access to high quality data and data products in a transparent, well-organized and easily accessible way through the Carbon Portal, also the public will be able to relate better to climate science and monitoring. A key challenge will be to develop data products that are enabling to distinguish between natural processes and anthropogenic fossil fuel emissions and connect this knowledge to mitigation and adaptation activities.

KPI used for measuring the impact:

- Measures of societal relevance of ICOS data and products (to be developed during the project).

Sub-KPIs:

- Citation of ICOS-related publications in reports of IPCC, GCP and UNFCCC.
- Amount of data cites in respective reports.
- Development of a general societal impact assessment scheme for ENV RIs in the ESFRI framework.

b) Evolution of the field and how the infrastructure is contributing to this?

The “field” of GHG observations is very agile after the COP 21 Agreement: there are several initiatives for developing a global GHG observation and information system, e.g. in the frameworks of WMO (IG³IS) and GEO. The cooperation and communication towards UNFCCC is coordinated by GCOS. ICOS is contributing to these initiatives and aims to become a driving force in data harmonisation and support for open data and data citation. (see also a.5)

c) What is the impact of your RI in research and innovation?

(See a.4)

d) What are your plans to be technically updated to deliver top-services in the coming years?

Technical innovation is very fast in the field of GHG observations. Instruments for the continuous in-situ observation of N₂O are available, also the next generation of FTIR sensors. Furthermore, novel observational concepts to distinguish between natural and anthropogenic fluxes are under development.

It is expected that ICOS will need a major update in the first half of the 2020ies.

It should be discussed between ESFRI and national governments how such a major upgrade could be evaluated in a simplified process that harmonizes the ESFRI and the National Roadmap evaluation. Otherwise the overall evaluation in ESFRI and 12 + x member countries will last too long.

Also a novel model for financial support of a major upgrade that coherently connects national funding and financial engagement of the European Commission (research funding and structural funds) should be developed.

e) In your business plan: who are the user-groups and how do you interact with them?

Main user is the scientific community, the most important interaction is the biannual ICOS Science Conference. The first was held in 2014 in Brussels with >200 participants, the second was held in 2016 in Helsinki with >250 participants. The conference gives a very comprehensive overview of the science related to GHG and has been attended also by participants from overseas. Furthermore, the ICOS scientific community is very active in conferences such as EGU and AGU and convenes sessions and meetings there.

More recently ICOS has started building bridges to agencies that are responsible for the national greenhouse gas inventories in order to support the reporting with independent data.

f) What is the access policy to your RI and how is this part of your business model?

Access to data is open and free under the Creative Commons 4.0 BY license.

Access to the infrastructure for additional observations can be granted but is constrained by possible disturbances of the core measurements. Since ICOS is a distributed RI there is no central business model for physical access.

g) How do you monitor your user's base and their needs?

Main monitoring is done by tracking of the data usage and data citation.

See also a.4

h) What are the risks in the coming years with respect to maintaining the top service level for your users? What are the risks connected to sustainability? What are the most critical actions to be undertaken?

Financial sustainability is the most important risk and has several aspects that reflect the complex structure of the distributed infrastructure:

- The observational stations are organized in National Networks, which are mainly funded on temporary projects or by in-kind contributions of host institutions (e.g. universities). This funding model is vulnerable.
- The Central Facilities (including Head Office and Carbon Portal) are funded by a mixed model comprising of national contributions (in-cash from the host countries' ministries or funding organisations or in-kind from the host institution) and ERIC contributions re-distributed from the membership contributions to the ERIC. The sustainability of the national contributions to the Central Facilities varies strongly between countries. For the 2017 budget only one country realized 100 % of the contributions envisaged in the ERIC application one year ago.
- The financial reporting system for ERIC and the Central Facilities is under development. Unfortunately, some of the Central Facilities are reluctant to report in a fully transparent way. This lack of a transparent financial accounting and reporting affects the overall management of the RI by the ERIC and the sustainability of the resources. The national stakeholders in the General Assembly (GA) should have a very clear position on this. The actions taken by the ERIC is to support the national networks and the central facilities in communication and administration. Furthermore, the reporting by ERIC on progress and impact of ICOS is a key action. ESFRI and the European Commission should perhaps re-discuss the general funding of the RIs since higher sustainability may be achieved by a EC contribution to the core funding of the RI.

i) How does your governance model support the long-term sustainability?

"The principal task of ICOS ERIC shall be to establish a distributed Integrated Carbon Observation System Research Infrastructure (ICOS RI) and to coordinate the operations of ICOS RI, distribute information from ICOS RI to user communities and to establish integrated data and analysis from GHG observation systems." (Statutes) The coordination of ICOS RI by the ERIC depends on several activities:

- Internal communication organized by the Director General and the Head Office in the General Assembly, the Research Infrastructure Committee, and the Monitoring Station Assemblies of the different observational networks.
- A document management and archiving system run by the Carbon Portal.
- A data life cycle description with a clear assignment of responsibilities.
- A series of internal rules that are developed by a thorough discussion within the RI and approved by the GA.
- A very clear definition of the station requirements and a strong labelling process for stations entering ICOS. Furthermore, an intense communication between the Central Facilities and the principle investigators (PIs) of the stations. These coordination activities guarantee the functioning of the RI and with that support the sustainability. The second important activity enhancing the sustainability of ICOS is the connection to COPERNICUS, GEO, WMO, GCOS etc. as described earlier to increase the societal impact of the RI in the field of Climate Change mitigation.

j) General recommendation

The process to evaluate the landmarks in the future should be thoroughly developed. Particularly for environmental infrastructures, the societal impact is difficult to evaluate. ICOS is interested in participating in this activity and support the development of indicators.

4. European SPIRAL2

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|-----------------------------|---|
| Panellist (name) | Marek Lewitowicz |
| RI Acronym | SPIRAL2 |
| Scientific field | Physical sciences and Engineering, subfield: Nuclear physics and related applications |
| Roadmap entry (year) | 2006 |
| RI Legal status | Project of the GIE (Economical Interest Group) GANIL |
| RI type | Single sited |

The main challenges that SPIRAL2 faced

a) Which KPIs did you adopt and how have these evolved since they were defined?

- Current financial resources allocation
- Current financial resources spending
- Estimate to project completion
- Project schedule
- Issues found by Quality Assurance
- List of unresolved issues

b) Evolution of the field and how the infrastructure is contributing to this?

The Phase 1 of the SPIRAL2 project is currently under commissioning and is expecting to produce first scientific results in 1-2 years.

The expected performances of the accelerator in terms of the light and heavy-ion beam intensity will be among the best in the world.

c) What is the impact of your RI in research and innovation?

Before the operation of the facility the impact is measurable only for technical developments. The SPIRAL2 accelerator and one of the associated research instruments namely the S3 magnetic separator-spectrometer are based on innovative design of superconducting cavities and magnetic multipoles.

d) What are your plans to be technically updated to deliver top-services in the coming years?

There are following steps foreseen beyond the current Phase 1 of the project which will enhance significantly its performances and the services provided to users:

- new experimental hall called DESIR (design study and construction of technical components well advanced, fully founded)
- new heavy-ion injector for accelerator which will enlarge a range of beams, limited today to about Ca – Ni, up to the heaviest elements (design study will start this year but the construction is not founded yet)

e) In your business plan: who are the user-groups and how do you interact with them?

The only user group included in the business plan are industrial companies using beams and services provided by the facility. A dedicated Department of Industrial Applications is in charge of interactions (contracts) with this group of users.

f) What is the access policy to your RI and how is this part of your business model?

The access to the nuclear research facilities including GANIL-SPIRAL2 is worldwide free of charge for academic users. The experiments are selected by an international expert panel (Programme Advisory Committee) using scientific excellence and feasibility criteria. Industrial user fee is contributing with about 10% of the facility budget.

g) How do you monitor your user's base and their needs?

The user's base of GANIL is monitored yearly through the indicators: number of users, lab and country of user's institution, length of the stay at the facility, number of performed experiments etc. The user's needs are expressed through the yearly user oriented meetings (Colloque GANIL and GANIL-SPIRAL2 Weeks) and specific collaboration meetings (ex. AGATA, LISE, INDRA/FAZIA collaboration workshops).

A spokesperson of each experiment is providing a feedback (a dedicated questionnaire) after experiment is performed to the facility beam coordinator. Analysis of the corresponding indicators is done every year.

h) What are the risks in the coming years with respect to maintaining the top service level for your users? What are the risks connected to sustainability? What are the most critical actions to be undertaken?

Thanks to the position of landmark facility the project was granted with the dedicated H2020 project (IDEAAL) dealing precisely with the sustainability issues. The 3-year project started on January 1st, 2017.

The major risks currently identified are: a lack of manpower and financial resources to operate the facility the nominal 8 months a year. Only a half of this operation time is possible today.

Phase 2 of the project, essential for the success of the whole SPIRAL2 project, was put on standby by stakeholders in 2014 due to lack of necessary resources. The uncertainty persists with respect to the further development of the project.

i) How does your governance model support the long-term sustainability?

Thanks to the position of landmark facility the project was granted with the dedicated H2020 project (IDEAAL) dealing with the sustainability issues.

The GIE GANIL was extended in 2015 for the next 30 years ensuring a sustainable situation for the legal and administrative structure.

j) Give feedback on the ESFRI MOS system

The MOS system is user friendly.

In part A it seems to be impossible to remove contact persons or coordinators.

k) General recommendation

It would be very important that ESFRI monitors the evolution of the projects and landmark facilities much more frequently (every 2 years?). The corresponding evaluation results, especially in case of revealed difficulties, should be transmitted to the project management and stakeholders.

The current ESFRI evaluation of projects has a little influence on the major decisions taken by the project governing bodies especially during the implementation phase.

Speaker Profiles



Name: Professor Giorgio Rossi
Organization: Università degli Studi of Milan
Function in respect to the workshop: Chair of ESFRI

Giorgio Rossi is Professor of Physics at the Università degli Studi di Milano; he leads the APE (Advanced Photoelectric Effect Experiments) and NFFA group at CNR-IOM and Elettra in Trieste performing research in surface and interface science and operating advanced synchrotron radiation beamlines and in-situ growth laboratories that are open to academic as well as industrial users. He coordinates the NFFA-Europe (Nano Foundries and Fine Analysis) European infrastructure since 2008. He acts as Senior Official of Italy in the GSO-G8+5 group on Global Research Infrastructures. He has chaired the Physical Sciences and Engineering Strategy Work group of European Strategy Forum on research Infrastructures (ESFRI) in 2013-2016, and serves as ESFRI Chair since July 1st, 2016.



Name: David Bohmert
Organisation: Swiss National Science Foundation
Function in respect to the workshop: Member of ESFRI Executive Board

David BOHMERT combines the position of Secretary-General of the Conference of European Schools for Advanced Engineering Education and Research (CESAER) with his work at the Swiss National Science Foundation (SNSF) as Swiss ESFRI Delegate mandated by the State Secretariat for Education, Research and Innovation ([SERI](#)). He was Member of the ESFRI Implementation Group (IG) until 9th February 2014, then was elected Chair of the IG and presided it until 31st December 2015. Since 6th June 2016 he is Member of the ESFRI Executive Board.



Name: Odd Ivar Eriksen
Organisation: Research Council of Norway
Function in respect to the workshop:
Chair of the “Implementation” Group of ESFRI

Odd Ivar Erikson holds a Cand. Scient. Degree in Organic chemistry from University of Oslo. He worked as research scientist/Senior scientist in SINTEF for many years and later as Research Director for Organic synthesis and Vice President Research for SINTEF Applied Chemistry, an institute with 220 employees. He has experience with large research projects and planning, construction and operation of both analytical facilities and research laboratories with advanced scientific instrumentation. In the Research Council he has a position as Special Adviser in the Division for Science, working full time with research policies and strategies, funding of research infrastructures and Norway’s participation in projects in ESFRI Roadmap. He is delegate to ESFRI and member of the programme committee for Research Infrastructures since 2008 and also member of the ERIC-committee. He is currently Chair of the “Implementation” Group of ESFRI.



Name: Dr. habil. Abad Chabbi
Organisation: French National Institute of Agronomic Research INRA
Function in respect to the workshop: Coordinator of the AnaEE Preparatory Phase; In charge of the international affairs within the AnaEE Pre-Operational Phase

A specialized biogeochemist, **Abad Chabbi** is currently a Director of Research at the French National Institute for Agricultural Research (INRA). The leader of the National Observatory for Environmental Research Agro-Ecosystems, Biogeochemical Cycles and Biodiversity since 2009, his research centers on the linkage between soil carbon sequestration, nutrient availability and stoichiometry in the plant-soil system and their relations to land use management and climate change. He is also working with strategic Research Infrastructures and interested in science policy and societal challenges. Throughout his career, Abad Chabbi has focused on coordinating international and multidisciplinary projects, including ExpeER and AnaEE under the strategic European Commission framework. He also chairs the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and provides expertise to the German Research Science Foundation, the European Commission’s Direction of Research and Innovation as well as the Chinese Academy of Science, the Canada Foundation for Innovation and the American National Science Foundation.



Name: Dr. habil. Werner L. Kutsch
Organisation: Integrated Carbon Observation System
Function in respect to the workshop: Director General (ICOS ERIC)

Werner Kutsch has been appointed as Director General of ICOS in March 2014 almost two years before the ERIC was officially established in November 2015. His task was to steer the ICOS community through the last and crucial months of its construction. Beside liaison with national stakeholders, this work comprised optimizing the internal data workflow between the different observational programs of ICOS, on developing the data platform of ICOS ('Carbon Portal'), legal work on contracting the distributed central facilities, and deepening the cooperation with other RIs. He has a strong scientific background in ecosystem science with first experiences in organizing research cooperation from in the nationally founded Ecosystem Research Center at the University of Kiel. After a research stay in South Africa (2003/2004) he changed to the Max-Planck-Institute for Biogeochemistry, Jena, Germany in 2004. Since October 2009 he coordinated the national implementation of ICOS in Germany (ICOS-D). Since May 2015 he is also the coordinator of the H2020 project Environmental Research Infrastructures providing shared solutions for science and society (ENVRIplus) that clusters 21 environmental research infrastructures.



Name: Andrew Smith
Organisation: ELIXIR, ESFRI Landmark
Function in respect to the workshop: External Relations Manager, ELIXIR Europe

Andrew Smith joined ELIXIR in 2011 during ELIXIR's Preparatory Phase. Andy manages ELIXIR's engagement with Member States, funders and policy-makers and the EU institutions. He is responsible for ELIXIR's communication activities. He is developing ELIXIR's industry strategy and runs the ELIXIR Innovation SME programme, a series of events aimed ensuring companies are aware of and can access the resources run by ELIXIR partners. Andy's background is in EU research programmes. Previously he worked in Brussels for the UK Research Office (UKRO), covering various research programme and policy fields, including FP7 National Contact Point helpdesks and supporting UK delegations to FP7 Programme Committees. Andy has previously held roles in regional government, focusing on EU Structural Funds, and on education programmes in Slovenia and the Czech Republic.



Name: Rory Fitzgerald
Organisation: European Social Survey (ESS); ESFRI
Landmark
Function in respect to the workshop: ESS Director

Rory Fitzgerald has been a member of the Core Scientific Team (CST) of the European Social Survey (ESS) since 2004 and became ESS Director in 2012. The ESS is one of the world's leading cross-national surveys and has its headquarters at City, University of London. The ESS has over 100,000 registered users and its data has been used in over 3000 publications. Rory plays a leading role in the design, management, and overall coordination of the ESS, and directs the Core Scientific Team. He also works with the National Coordinators in each country to ensure the effective implementation of the survey. His key expertise is in cross-national survey methodology, with a focus on questionnaire design, pre-testing, and non-response.

Prior to working on the ESS he worked at the National Centre for Social Research and the Gallup Organization.

In 2016, he was awarded his PhD in Sociology which focused on cross-national survey methodology and in particular the application of the Total Survey Error framework to cross-national surveys. He was also part of the ESS team that was awarded the Descartes Prize for excellence in scientific collaborative research in 2005. Rory played a key role in developing the application for ESS to become a European Research Infrastructure Consortium (ERIC) which was awarded in 2013. In 2016 the ESS was also awarded the status of a landmark infrastructure on the European Strategy Forum for Research Infrastructure roadmap.



Name: Alain Sneyers
Organisation: Belgian Nuclear Research Centre SCK-CEN, Mol,
Belgium
Function in respect to the workshop: Member of the MYRRHA
Management Team

Alain Sneyers holds a PhD degree in Sciences from the Louvain University (Belgium). In 1992, he started work at the Belgian Nuclear Research Centre SCK-CEN in Mol, Belgium, as research scientist/senior scientist. In this capacity, Alain Sneyers coordinated several international collaborative projects on research, development and demonstration of the geological disposal of radioactive waste. Most of these projects were supported by the European Commission. In 1999 and 2000, Alain Sneyers joined the International Atomic Energy Agency where he established the IAEA Network for Underground Research Facilities. Since 2010, Alain Sneyers is a member of the MYRRHA Management Team at the Belgian Nuclear Research Centre SCK-CEN, where he manages the budget and the schedule of the MYRRHA project. MYRRHA is included as a priority infrastructure on the ESFRI Roadmap since 2010.



Name: Prof. Dr. Marek Lewitowicz
Organisation: GANIL-SPIRAL2 France
Function in respect to the workshop: Former Deputy Director of GANIL and Scientific Coordinator of the SPIRAL2 project

Marek LEWITOWICZ Professor of physical sciences and research director at CNRS, France is involved since 2000 in science and management of the GANIL facility and the ESFRI landmark SPIRAL2 project. He was a coordinator of the FP7 SPIRAL2 Preparatory Phase and he is currently the deputy coordinator of the HORIZON 2020 IA ENSAR2 project and the coordinator of the IDEAL project. He is a member of the NuPECC expert committee and chairs the EURISOL Steering Committee.



Name: Eduardo Zarza Moya
Organisation: CIEMAT-PSA
Function in respect to the workshop: Participated in the Preparatory Phase of EU-SOLARIS

Eduardo Zarza has participated in the Preparatory Phase of EU-SOLARIS as CIEMAT's representative in the Executive Committee and leading the Work Package "Legal status & User access Policies". He is representing EU-SOLARIS during the interim period between the preparatory phase and the operational phase. Eduardo Zarza has 30 years of experience in concentrating solar thermal technologies. At present, he is a member of the scientific staff of the Plataforma Solar de Almeria (PSA) and Head of the PSA R&D Unit for Concentrating Solar Systems. He has been involved in several International and National projects, as well in R&D collaboration agreements with industries.



Name: Jacques Dubucs
Organisation: Ministère de l'Enseignement Supérieur et de la Recherche
Function in respect to the workshop: SCI SWG Chair

Jacques Dubucs is director for Research of CNRS and since 2009 scientific director in the department of human science of the society in the general directorate of research and innovation in the Ministère de l'Enseignement Supérieur et de la Recherche in France. In 2012, he joined the SWG of Social and Cultural Innovation of ESFRI and later took over its chairmanship. He is member of several international committees such as the committee of Individuals, Societies, Cultures and Health (ISCH) of COST. Jacques Dubucs is author of several publications and he has provided several seminars and courses of Philosophy of sciences and others. He holds a Doctorat d'État ès-Lettres et Sciences Humaines, Université Paris I.



Name: Søren Knudsen
Organisation: Technical University of Denmark DTU,
Department of Wind Energy
Function in respect to the workshop: Project Manager,
WindScanner.eu Preparatory Phase project

Søren Knudsen coordinated the WindScanner.eu Preparatory Phase project from 2012 to 2015 where he was responsible for developing the Business Plan for the future WindScanner.eu ERIC. Since the finalization of the Preparatory Phase project he has been responsible for ensuring the contacts between the partners, including linking to the European Energy Research Alliance (EERA) Joint Programme on Wind Energy and facilitating contacts to stakeholders.

Søren has a background within research policy and research management with a special focus on EU research and innovation programmes. He is now heading the Management & Public Relations Office at DTU, Department of Wind Energy. Søren has previously worked as Special Advisor at the Danish National Research Laboratory for Renewable Energy as well as being employed at the National Research Council for Strategic Research and the Ministry of Science, Education and Innovation, where he focused on international research collaboration, where he was the national representative in the EU Programme Committees on Research Infrastructures.



Name: Prof. Dr.-Ing. Harald Bolt
Organisation: Forschungszentrum Jülich GmbH
Function in respect to the workshop: Chair of ESFRI
Energy SWG

Harald Bolt is member of the Board of Directors of Forschungszentrum Jülich, Germany, since 2008. He had previously been a scientific member of the Max Planck Society and director at the Max Planck Institute for Plasma Physics in Garching from 1999 to 2007, where he headed Materials Research, focusing on topics such as plasma-material interaction and advanced high-performance materials. He is involved in various international committees on which he holds a number of positions, including chairman of a European working group for the implementation of energy materials research in Horizon 2020, member of the Advisory Group on Energy (FP7), and member of the supervisory board of the European fusion agency "Fusion for Energy". He is also a member of several scientific societies and of the Berlin-Brandenburg Academy of Sciences as well as of the German National Academy of Science and Engineering (acatech).



Name: Maria Anvret

Organisation: The Sahlgrenska Academy, University of Gothenburg, Sweden

Function in respect to the workshop: Vice chair of Health and Food Strategy Working Group, ESFRI delegate of Sweden

Maria Anvret, Prof., FRCPath, Senior Advisor. She has held positions as scientific leader, manager, director, genetic counselor, chair and member of numerous boards, societal communication, policy making, spokesperson for science & innovation, value creation and responsibility for questions & issues related to research, development and innovation in general. She has achieved her expertise and experience from positions at the Karolinska Institute & University Hospital, AstraZeneca, Confederation of Swedish Enterprise and present position. She is involved in numerous national and international tasks related to academic/private/public cooperation, societal challenges, personalized medicine, knowledge translation and research infrastructures. She was a member of the HLEG Ex-Post-Evaluation of the 7th EU Framework Programme and is a member of the BBMRI-ERIC board and vice chair of ESFRI HFSWG.



Name: Beate Warneck

Organisation: German Aerospace Centre (DLR); Project Management Agency

Function in respect to the workshop: Coordinator of work-package 4 (Exchange of Experience) of Str-ESFRI/moderator

Beate WARNECK is a Senior Economist with 18 years of working experience in international relations, business development and marketing in national and international organisations (German Aerospace Center, BMBF, European Commission, ACEA, DeBeLux, John Holt Ltd.). She is responsible for project management and policy development and supports the Federal Ministry of Education and Research (BMBF) in issues concerning the Framework Programme and Horizon 2020. Beate Warneck was seconded (2005-2008) to the European Commission in Brussels /department of Research Infrastructures where she worked in the ESFRI Secretariat as Detached National Expert (END). She was a member in several international management boards and steering committees in order to support the development of the first European Roadmap for RIs in 2006, its follow up in 2010, and the Community legal framework for a European Research Infrastructure Consortium (ERIC).



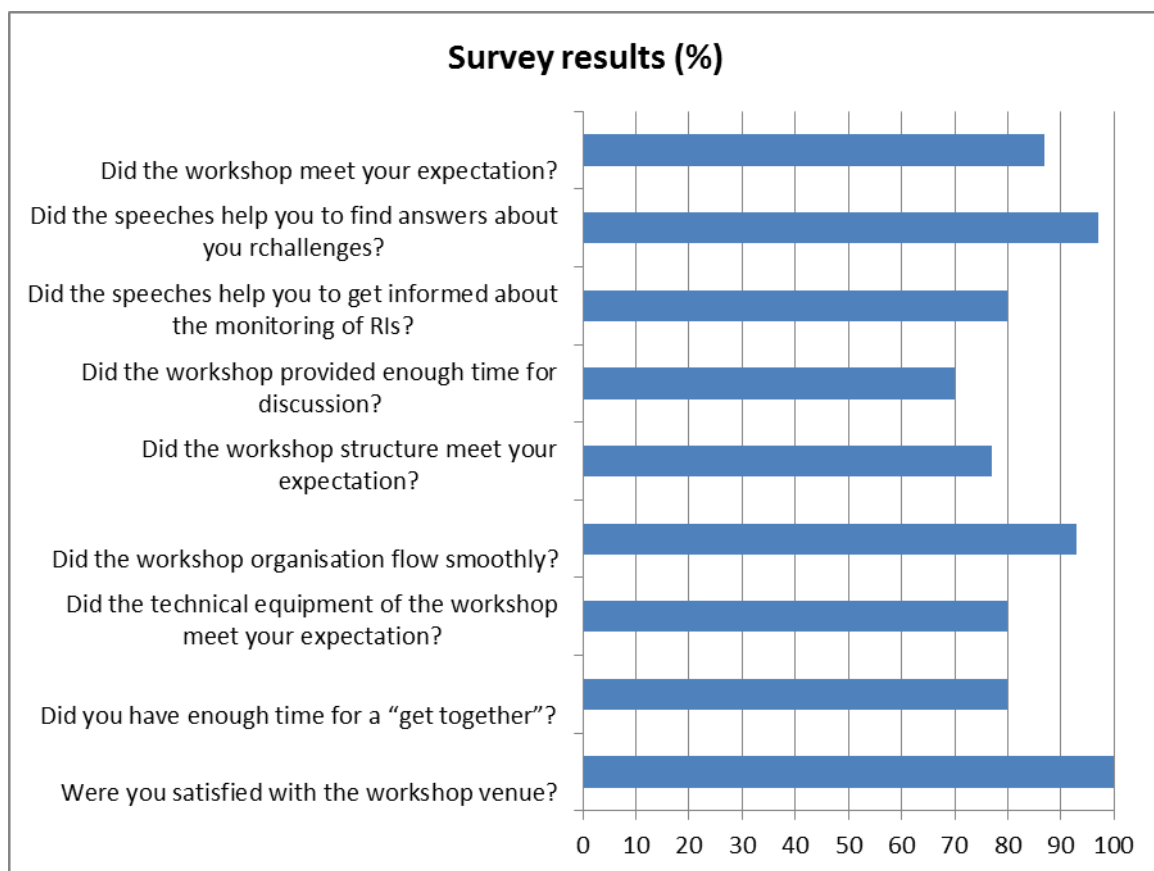
2nd Exchange of Experience Workshop
On Monitoring of Projects and Pilot Periodic Review of Landmarks
18th January 2017, from 9:30h to 16:00h
Malaga University, Av. de Cervantes, 2, 29071 Málaga, Spain

AGENDA

| | |
|-------------|---|
| 8:30-9:30 | Registration |
| 9:30-9:40 | Welcome <i>Representatives from ministerial and/or local authorities</i> |
| | INTRODUCTIONS |
| 9:40-10:00 | Monitoring and Periodic Review as key elements contributing to the long-term sustainability of the ESFRI RI portfolio <i>Giorgio Rossi, ESFRI Chair</i> |
| 10:00-10:30 | Definitions, methods, procedures and questionnaires for the Monitoring of ESFRI Projects and the Pilot Periodic Review of ESFRI Landmarks <i>David Bohmert, ESFRI EB Member</i> |
| 10:30-11:00 | Coffee break |
| | PANELS |
| 11:00-12:30 | 1st Panel on Monitoring of ESFRI Projects <i>Moderators: Harald Bolt (ENE SWG Chair) & Maria Anvret (HF SWG Vice Chair)</i> <i>Panelists: Eduardo Zarza (EU-SOLARIS), Alain Sneyers (MYRRHA), Søren Knudsen (WindScanner), Abad Chabbi (AnaEE)</i> |
| 12:30-14:00 | LUNCH |
| 14:00-15:30 | 2nd Panel on Pilot Periodic Review of ESFRI Landmarks <i>Moderators: Odd Ivar Eriksen (IG Chair) & Jacques Dubucs (SCI SWG Chair)</i> <i>Panelists: Andrew Smith (ELIXIR), Rory Fitzgerald (European Social Survey ERIC), Werner Kutsch (ICOS ERIC), Marek Lewitowicz (SPIRAL2)</i> |
| 15:30-16:00 | Final Q&A, summary and wrap-up <i>Giorgio Rossi, ESFRI Chair</i> |

Quality assessment of the workshop

According to the StR-ESFRI project policy to evaluate activities undertaken by project partners, a questionnaire was made available to measure and evaluate the quality of the workshops on exchange of experiences and best practice. The following figure demonstrates different categories of the overall satisfaction rate of workshop participants, which were collected through feedback sheets. Categories were indicated with: (-2) completely unsatisfied, (-1) not satisfied; (0) no opinion; (1) satisfied; and (2) very satisfied.



While the quality of the workshop content met the expectations of workshop participants, less satisfaction was expressed for the time provided for discussion. This seems to be a permanent issue – even though the time for discussion was extended in comparison to the first StR-ESFRI EoE workshop. The reason might be the complexity of the subject and the different levels of understanding among participants.

We will nevertheless pay more attention in future regarding the length of the workshop and we will perhaps consider organising a two-day workshop which will also allow more time for discussion in general, but also in groups regarding specifics of single-sited and distributed infrastructures. The results of the workshop however are summarized in this report and will be made public via the StR-ESFRI website.



ESFRI, the European Strategy Forum on Research Infrastructures, is a strategic instrument to develop the scientific integration of Europe and to strengthen its international outreach. The competitive and open access to high quality Research Infrastructures supports and benchmarks the quality of the activities of European scientists, and attracts the best researchers from around the world.

The mandate of ESFRI is to support a coherent and strategy-led approach to policy-making on research infrastructures in Europe, and to facilitate multilateral initiatives leading to the better use and development of research infrastructures, at EU and international level. ESFRI will thus address the existing challenges and has to deal with the follow-up of the implementation of already on-going ESFRI projects after a comprehensive assessment, as well as with the prioritization of the infrastructure projects listed in the ESFRI roadmap.

ESFRI's delegates are nominated by the Research Ministers of the Member States and Associate Countries, and include a representative of the Commission, working together to develop a joint vision and a common strategy. This strategy aims at overcoming the limits due to fragmentation of individual policies and provides Europe with the most up-to-date Research Infrastructures, responding to the rapidly evolving Science frontiers, advancing also the knowledge-based technologies and their extended use.

Created in 2002 by the Member States and the European Commission, ESFRI has become an increasingly important Forum to advise Ministries and Funding Agencies on strategic issues of research infrastructures. With the setting up of the first Roadmap for pan-European research infrastructures ESFRI has been a major contributor to the realisation of the European Research Area.

The ESFRI roadmap is an ongoing process. First published in 2006, with 35 projects, it was updated in 2008 bringing the number of RIs of pan-European relevance to 44. The ESFRI Roadmap 2010 was focused on projects dealing with energy, food and biology. Having identified 48 projects of new research infrastructures (or major upgrade on existing ones) so far, ESFRI more concentrated on their implementation. The Roadmap 2016 consists of 21 ESFRI Projects with a high degree of maturity - including 6 new Projects - and 29 ESFRI Landmarks - RIs that reached the implementation phase by the end of 2015. The ESFRI Roadmap 2016 was launched on 10 March 2016, in Amsterdam.

The European roadmap process has also stimulated the preparation of national roadmaps in many of the Member States and the Associated Countries contributing to an overview on major developments in the European Union. It fosters coordination, helps to avoid duplications and further develops complementarities of national investments.

The ongoing task of ESFRI will be to help the projects on the ESFRI roadmap to move towards implementation. This is in line with the commitment in the Europe 2010 Flagship Initiative - Innovation Union and the Digital Agenda, which states that by 2015, Member States together with the Commission should have completed or launched the construction of 60% of the priority European Research Infrastructures currently identified by ESFRI. However, to keep Europe at the rapidly evolving forefront of science and technology, and increase the capacity to meet the needs of the EU and World scientific community, much remains to be done: ESFRI looks forward to the challenging times ahead.

Further information and contact details:

ESFRI Secretariat, DG R&I, European Commission; ESFRI@ec.europa.eu;
www.ec.europa.eu/research/esfri

StR-ESFRI / Project content and objectives:

StR-ESFRI is a project funded under H2020. It aims - as its name already says - to **Support and to Reinforce** the **European Strategy Forum for Research Infrastructures** (ESFRI) under the guidance of its Chair, providing additional resources, tools and expertise in performing its activities and supporting its structures. StR-ESFRI strengthens the current ESFRI secretariat, offered by the European Commission, with additional resources and tools.

The project provides support to critical ESFRI activities such as to exchange experiences and best practice among RI coordinators, the development of the new ESFRI roadmap, the organisation of the international peer-review of science and managerial aspects of ESFRI infrastructures for a) the selection of new projects and b) for the assessment of currently running projects. StR-ESFRI builds on the experience of the prior CoPoRI project, facilitating and monitoring the exchange of practices through appropriate workshops and reports and realises an effective communication and dissemination activity through web-instruments and publications.

StR-ESFRI activities:

- Assists the ESFRI Chair in all ESFRI-related activities, and ensures that he/she has the necessary information and preparation of all ESFRI business.
- Supports the new ESFRI Roadmap process, organising its smooth execution and accomplishment.
- Disseminates and exploits ESFRI-related outputs to the European and global Research Infrastructures area and liaises with key stakeholders (policy makers, funding bodies or advisory groups), including the e-Infrastructure Reflection Group (e-IRG) and the Research Data Alliance (RDA).
- Identifies best practices and facilitates/ monitors the exchange of experiences among ESFRI projects, through appropriate means such as expert groups and workshops.

The above objectives are in line with ESFRI's new mandate which adequately addresses the existing challenges in the field of research infrastructures, towards a reinforced European research area partnership for excellence and growth. The new mandate calls for a reinforced ESFRI, strengthened with all the appropriate resources, tools and expertise to cope with the existing and upcoming challenges and to meet some of the commitments of the ERA Communication and the Innovation Union initiative.

StR-ESFRI project partners:

StR-ESFRI is led by the institute of the ESFRI Chair (Science and Technology Facilities Council, STFC) and the project members include experienced entities from different European Countries: Italy (Università degli Studi di Milano, UMIL), Greece (Research and Innovation Center in Information, Communication and Knowledge Technologies ATHENA, ATHENA RC) and Germany (German Aerospace Center, DLR) with strong involvement in ESFRI and its activities.

Contact for more information: www.esfri.eu