

Prioritisation of Support to ESFRI Projects for Implementation

The European Strategy Forum on Research Infrastructures

1. Background and Summary

In December 2012, at its 3208th meeting, the Competitiveness (Internal Market, Industry, Research and Space) Council agreed: *The Council of the European Union EMPHASISES the need for renewing and adapting the mandate of ESFRI to adequately address the existing challenges and also to ensure the follow-up of implementation of already on-going ESFRI projects after a comprehensive assessment, as well as the prioritisation of the infrastructure projects listed in the ESFRI Roadmap.* In support of that mandate, and following discussion in the ESFRI forum, this document proposes:

- three projects from the ESFRI roadmap that are priorities in that they are pushing the boundaries of scientific excellence, are strategically relevant for Europe, and are ready for immediate action:

EPOS, ELIXIR and the European Spallation Source

In addition we present

- additional projects which we recommend for support from the Member States and from suitable Horizon 2020 instruments to help reach the Innovation Union target of 60% of projects being in implementation by 2015:

ECCSEL, EISCAT-3D, EMSO, BBMRI, ELI, CTA, SKA, CLARIN and DARIAH

ESFRI gave particular consideration to the **ECCSEL** project in light of the strategic importance of carbon capture and storage in the SET plan.

- implemented projects that nonetheless require additional support for sustainability and support for European coverage: **CESSDA, SHARE and the European Social Survey**.
- a note on the potential for distributed RIs that can be linked together to deliver integrated services for greater scientific impact: in biomedical research **INFRAFRONTIER, EATRIS and ECRIN** and in environmental research **EURO-ARGO, IAGOS, ICOS and LIFEWATCH**
- a brief description of ESFRI's work to develop a framework within which it will deal with RI prioritisation in the short, medium and long term.

It should be noted that whilst there are projects that require additional support, there are already a very significant number of success stories on the ESFRI Roadmap: CESSDA, ESS-survey, SHARE, ESRF-Upgrade, XFEL, ILL 20/20, FAIR, SPIRAL2, PRACE, JHR, and E-ELT.

2. Three Priority Projects for implementation

ESFRI proposes the following three projects from the ESFRI roadmap as priorities, based on the criteria that they should be:

- pushing the boundaries of scientific excellence in their respective areas
- strategically relevant for Europe
- ready for immediate action towards implementation.

In addition, we have aimed to ensure some balance across subject areas. Our assessment is based on the work of the Assessment Expert Group and ESFRI's Strategic Working Groups.

Project	Project Summary and Key Goals
EPOS	European Plate Observing System EPOS will create a single sustainable, permanent geophysical observational infrastructure, integrating existing monitoring networks (e.g. seismic and geodetic networks), local observatories (e.g. volcano observatories) and experimental laboratories (e.g., experimental and analytic lab for rock physics and tectonic analogue modeling) in Europe and adjacent regions.
ELIXIR	The European Life-Science Infrastructure for Biological Information - ELIXIR will be a secure, rapidly evolving platform for collection, storage, annotation, validation, dissemination and utilization of biological data. Bioinformatics and 'big data' is widely seen as a key capability for the 21 st century with the potential to transform healthcare.
ESS	The European Spallation Source will be the world's most powerful long-pulse source of neutrons, with 5MW capability. It will offer transformative capabilities for interdisciplinary research in the physical and life sciences with strong connections to industry in areas such as engineering and electronics.

For each of these projects the Strategic working groups identified key areas that would benefit from financial support from the Member States, Associated States and from appropriate Horizon 2020 instruments and these are listed in Annex A.

In addition to the technical issues, we recommend EPOS to pursue greater integration with the other RIs in the environmental sciences area and foster clustering with other projects (as noted in section 5 below); we would like ELIXIR to broaden its membership and address the issues that some members have raised about governance; and ESS needs to address the challenges associated with handling of large in-kind contributions.

3. Implementation Support

ESFRI has identified an additional nine projects (in addition to the three above) that would benefit from additional funding from suitable Horizon 2020 instruments, and from the Member States and Associate States, to address specific bottlenecks and help reach the Innovation Union target of 60% of projects being in implementation by 2015. These projects are

ECCSEL, EISCAT-3D, EMSO, BBMRI, ELI, CTA, SKA, CLARIN and DARIAH

ESFRI gave particular consideration to the **ECCSEL** project in light of the strategic importance of carbon capture and storage in the SET plan, but felt that the project was not as far advanced towards implementation and that there was still considerable work to be done in strengthening the pan-European membership of the project.

The table on page 4 of this document gives a brief description of each project together with the bottleneck to be addressed. Annex A explains in more detail how ESFRI selected these projects and the way in which Horizon 2020 funding could be applied.

4. Support for Sustainability and European Coverage

A number of ESFRI roadmap projects which are implemented nonetheless require additional support to ensure ongoing sustainability and in particular to achieve the necessary European-wide coverage. This is especially true in the social sciences and humanities. Projects recommended for additional support in this way are:

CESSDA, SHARE and the ***European Social Survey***.

5. Networking and Integrated Services for Distributed Research Infrastructures

In the bio-medical sciences, three projects offer complementary processes and the development of integrated services matched with BBMRI and ELIXIR has the potential for very concrete benefits to the health of the European citizens, by overcoming current technical and operational barriers, and accelerate discovery and our understanding of health and disease. Appropriate ways should be found to use additional support through Horizon 2020 to help to link and network these research infrastructures together for greater scientific impact. These projects are:

INFRAFRONTIER, EATRIS and ***ECRIN***

In the environmental sciences there is similarly great potential to link and network together the data from each of the distributed research infrastructures to create integrated services for greater impact and support research that will greatly benefit society in the areas of environmental and climate science. The additional projects in this area that are on track for implementation by 2015 and should be linked with those listed already are:

EURO-ARGO, IAGOS, ICOS and ***LIFEWATCH***

6. ESFRI Prioritisation – next steps

ESFRI is developing a framework to support the implementation of the RIs on its roadmap and to address the need for RI prioritisation in the short, medium and long term. Current activities include

- assessing the roadmap projects not likely to achieve maturity by 2015, while noting that many of these are newer projects and only came onto the Roadmap in 2010
- work in the strategy working groups to develop landscape and gap analyses for their research areas
- work in the strategy working groups to follow up on the Assessment Expert Group report and to examine the progress of projects
- development of a framework for the next roadmap update in 2016 which will be launched shortly. Our goal is a shorter roadmap with projects required to be at a greater level of maturity for inclusion.

ESFRI anticipates that we will be in a position to update the Council of Ministers with progress towards implementation including additional priority projects that may be ready once they reach the required level of maturity, following the next update to the ESFRI roadmap in early 2016.

Table 1: additional 9 projects recommended for additional appropriate support for implementation, to address the bottlenecks identified. For more details, see Annex A.

Project	Project Summary and Key Bottlenecks addressed
ECCSEL	<p>European Carbon Dioxide Capture and Storage Laboratory Infrastructure (Distributed Research Infrastructure) - combining three approaches to capture and three approaches to CO₂ storage (aquifers, depleted oil/gas fields, coal bed methane) and transport of CO₂. Carbon dioxide capture and storage (CCS) is identified as a future key technology for reducing emissions from fossil fuels.</p> <p>Bottlenecks Addressed: Strengthen the capacity of a strong core group of initial members; further develop the pan-European dimension of the project; ensure an adequate pre-implementation budget distribution across several facilities in different countries, particularly concerning the necessary pre-implementation upgrades of national facilities; EU wide industry engagement; international best-practice exchange on storage facilities; management of legal/contractual issues to be properly established; large scale trial runs of infrastructure access.</p>
EISCAT_3D	<p>The next generation European incoherent scatter radar system will be a three-dimensional imaging radar for atmospheric and geo-space research, which constitutes an upgrade to EISCAT, an existing international infrastructure based in Europe and devoted to the study of the upper atmosphere, ionosphere and Geospace.</p> <p>Bottlenecks Addressed: Dedicated and short term support to form a science/industry alliance, building on existing partnerships with contract electronic manufacturers and related firms, to speed up the transition from engineering prototypes to production ready designs.</p>
EMSO	<p>EMSO, the European Multidisciplinary Seafloor and Water Column Observatory, will be a unique, multi-disciplinary, pan-European Research Infrastructure (RI) for advanced ocean observation with the objective of long-term, high resolution, (near) real-time monitoring of environmental processes related to the interaction between the geosphere, biosphere, hydrosphere, and lithosphere, including natural hazards, climate change, and marine ecosystems..</p> <p>Bottlenecks Addressed: Support for the development of an instrument package or generic sensor module to push the state-of-art and; achieve full standardization; make data coherent and attractive for the modeling community; reduce maintenance from yearly to 2-3 year periodicity by improved reliability; involve industry and create a European market; obtain significant cost savings.</p>
BBMRI	<p>The Biobanking and Biomolecular Resources Research Infrastructure is a pan-European distributed infrastructure of existing and new bio-banks and bio-molecular resource centres.</p> <p>Bottlenecks Addressed: Organise national biobanks and establish what each country will precisely offer in terms of data and services and amalgamate these efforts; increase discoverability and access to data by setting up infrastructure, standards and tools for data sharing whilst protecting privacy, and harmonise data and IT across biobanks; fully develop access procedures and services for the researchers; fully develop a strategy and find solutions to all ethical, legal and societal issues related to access to personal data, and involving all relevant sectors; enhance the connection between basic research through to the clinic; establish common services on rare diseases; support steps to continue expanding the membership of BBMRI.</p>
ELI	<p>The Extreme Light Infrastructure will be a multi-sited RI for the investigation and applications of laser matter interaction at more than 6 orders of magnitude higher intensities than today's state of the art.</p> <p>Bottlenecks Addressed: support of integration within a common structure across the three sites: since ELI depends upon structural funds for much of the construction cost, there is no clear funding mechanism at this stage for the necessary integration and scientific management across all three sites, which will allow ELI to function as a single infrastructure from the point of view of users and as service provider.</p>
CTA	<p>The Cherenkov Telescope Array will be the next-generation observatory for ground-based high-energy gamma-ray astronomy.</p> <p>Bottlenecks Addressed: Site preparation/site infrastructure to address the specific challenge of characterising and surveying remote sites in the southern hemisphere, designing and implementing site infrastructure, defining appropriate long term agreements with host country, and preparing for construction to begin.</p>
SKA	<p>The Square Kilometre Array will be the next generation radio telescope. With a very broad frequency range of 70 MHz - 25 GHz and a collecting area of about 1,000,000 m², it will be 50 times more sensitive than the current world's best facilities.</p> <p>Bottlenecks Addressed: Support for site preparation/site infrastructure to address the specific challenge of characterising and surveying remote sites in South Africa and Western Australia, designing and implementing site infrastructure, defining appropriate long term agreements with host countries, and preparing for construction to begin.</p>
CLARIN	<p>The Common Language Resources and Technology Infrastructure is a large-scale pan-European coordinated infrastructure effort to make language resources and technology available and useful to scholars of all disciplines, in particular the humanities and social Sciences.</p> <p>Bottlenecks Addressed: Support for a number of key central infrastructure coordination functions and development of a priority list for additional facilities if and when more funding becomes available, e.g. through new countries joining or Horizon 2020 projects.</p>
DARIAH	<p>The Digital Research Infrastructure for the Arts and Humanities aims to conceptualise and build an infrastructure in support of ICT-based research practices in the arts and humanities and to support researchers in the creation and use of research data and tools.</p> <p>Bottlenecks Addressed: Central coordination of the distributed infrastructure; networking relating to communities; online reference training material; transnational access and basic services; open data infrastructure; development of a platform for publishing and evaluating digital methods.</p>

Annex A:

Document describing projects recommended for INFRADEV-3 funding as originally presented to the 47A meeting of ESFRI in February 2014

Prioritisation of Support to ESFRI Projects for Implementation**Updated Report and Recommendations for
Pre-implementation EU funding in Horizon 2020****Background****Mandate from Council of Ministers**

In December 2012, at its 3208th meeting, the Competitiveness (Internal Market, Industry, Research and Space) Council agreed: *The Council of the European Union EMPHASISES the need for renewing and adapting the mandate of ESFRI to adequately address the existing challenges and also to ensure the follow-up of implementation of already on-going ESFRI projects after a comprehensive assessment, as well as the prioritisation of the infrastructure projects listed in the ESFRI Roadmap.*

ESFRI has undertaken a number of activities, some of which are still ongoing, in fulfilment of this mandate to support the implementation of ESFRI projects and to prioritise the projects listed in the Roadmap.

ESFRI Roadmap

The ESFRI Roadmap identifies new Research Infrastructures (RI) of pan-European interest with the goal of promoting the long term competitiveness of European research and innovation, covering all scientific areas and which are accessible by the best users through competitive proposals.

Novel RI projects (or major upgrades) require an incubation time of the order of 10 years and sometimes considerable construction time, so that at a given date different projects will be at different maturity levels. A growing number of countries have prepared national Roadmaps that prioritise national and pan-European RIs, using the ESFRI Roadmap as a reference. This helps to define national budgets, facilitates political support and helps cement long-term financial commitments.

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 latest update focusing on projects dealing with energy, food and biology was published in December 2010 and identifies a total of 48 projects including 10 “success stories” of projects which were already under construction or operation by the end of 2010. It is a goal of the Innovation Union that 60% should be implemented by 2015/16. ESFRI is committed to support this goal by helping projects achieve implementation.

All the ESFRI projects are funded by various different groups of EU Member States and Associated Countries (variable geometry) or by intergovernmental research organisations. The European Commission provides funding for the preparatory phase of the projects as well as for the implementation of common objectives within clusters of related projects.

Financial support from the European regional structural funds will also be instrumental for the construction phase of large facilities. ESFRI has promoted increased regional cooperation to facilitate a more even spread of the RIs across Europe. ESFRI delegates play a crucial role in working with governments and the European Commission to assist with the possibilities to use structural funds.

It is expected that ESFRI will approve the launch of its next Roadmap update process in April 2014 under new rules whereby fewer, more mature projects will be on the Roadmap with a time limit and clear specifications for entry. Our plans for this are described later in this document.

Assessment Expert Group

ESFRI's work in identifying projects which may benefit from targeted support by the European Commission to help achieve implementation by 2015 started from the report of the Assessment Expert Group (AEG), published in September 2013. This gave a snapshot of the status of implementation of 36 projects on the ESFRI Roadmap, not including the already implemented "success stories" and two other projects that fall within the domain of EURATOM. The assessment was based on a detailed methodology described in the report that looked critically at all non-scientific aspects of the projects, i.e. governance, management, funding, legal issues, etc. The AEG report gave a reasoned assessment of the status of maturity of each of the projects under these aspects and, specifically, of their likelihood of reaching the official kick-off of the implementation phase by the end of 2015, as sought by the "Innovation Union". The AEG rated the projects that they assessed under 3 categories: Category 1 – "ready for implementation in 2015" (although may not be fully secure in terms of financial commitments); Category 2 – "might be able to achieve maturity by 2015, if substantial actions are implemented to address the bottlenecks and weaknesses"; and Category 3 – "minimal chances of achieving maturity by 2015 for various reasons".

Discussion at ESFRI in Cork, Ireland, June 2013

At the 45th meeting of ESFRI in Cork, Ireland, in June 2013, it was agreed that the Strategy Working Groups (SWGs) should be mandated to re-evaluate the roadmap projects from a scientific and socio-economic viewpoint taking into account the evolution of the international landscape of research infrastructures, as well as to verify the overall progress made by the projects since the AEG interviews. In particular, the SWGs were mandated to carry out the re-evaluation according to the following criteria:

- appropriate level of funding commitment from at least three Member States or Associated Countries;
- concrete and credible plans for construction and operation including costs and financing over the whole life cycle of the project;
- scientific impact and scientific relevance for the respective scientific area in the updated context;
- is it a real distributed Research Infrastructure or rather a network or a research project?
- Social and economic impact including innovation potential and possible cooperation with industry;
- European added value;
- Timeliness.

Funding for Implementation under Horizon 2020

At the 46th meeting of ESFRI in Brussels, in October 2013, the European Commission explained plans to support a limited number of projects through one-off funding under the INFRADEV-3 instrument in Horizon 2020 in support of implementation, and thus to promote the goal of having 60% of the projects on the Roadmap implemented by 2015. ESFRI was requested by the Commission to identify projects which would benefit most from a relatively modest single grant of additional EU funding, to remove any roadblocks that could be overcome by such funds and be relevant and effective in achieving full implementation by 2015. This additional EU support should not displace support from the Member States, who remain ultimately responsible for the successful construction, launch and operation of research infrastructures on the ESFRI Roadmap. The Horizon 2020 Work-Plan for 2014-2015 concerning Research Infrastructures also calls for ESFRI advice on INFRADEV-1, INFRADEV-2 and

INFRADEV-4 that include reserved calls (preparatory phases) and “open calls” (clusters) with relevance also for the ESFRI projects. It is understood that projects that need a longer period of preparation and are therefore not yet fully ready for implementation might benefit from these other measures over the coming years.

Commission request

In order to ensure that ESFRI provides the commission with useful input, the chair requested updated guidance from DG-RTD. On January 20th 2014 ESFRI received a letter from the DG RTD with a request of indicating a “short-list” of projects that are both “...considered essential by ESFRI to extend the frontiers of knowledge in the fields concerned” and “mature enough to be under implementation by 2015-2016”.

The letter then asks the ESFRI Chair to communicate the short-list to the Greek Presidency of the Council, in view of the Competitiveness Council of May 2014.

Once the structural support to these projects is confirmed, then the Commission will make available the INFRADEV-3 call for specific complementary support to the implementation.

What is presented in this document?

This report summarises the results of the assessment by the SWGs. There is evidence that 27 (56%) of the projects on the ESFRI Roadmap are in good shape for implementation in 2015: we expect 16 additional projects to be successfully under implementation by then. Of these, we have identified 12 that need nevertheless to address some specific aspects and residual barriers that might effectively be solved by work under INFRADEV-3 special targeted call.

1. The *primary criteria* applied in selecting these 12 projects are the seven requirements listed above following discussion at Cork; if the SWG felt that a project did not meet these criteria it was not proposed for funding. In many cases criterion number one (national funding commitments) needs to be fully confirmed and cemented by the member states and associated states and it is critical that this happens.
2. The *secondary criterion* applied is that they can benefit from one-off funding through Horizon 2020 to address specific roadblocks to implementation, and that there is a reasonable chance of successful implementation by 2015-16.

This report contains the results of the SWG's analysis to identify projects meeting these criteria, and includes for each project the identification of the prominent bottlenecks that are slowing down its implementation as well as an estimate of the level of EU funding that is required to address such bottlenecks in order to achieve maximum benefit from this additional one off support. The results have been discussed extensively with the ESFRI Executive Board and are presented to ESFRI as a recommendation from the Executive Board for discussion and approval.

Success stories:

CESSDA, ESS-survey, SHARE, ESRF-Upgrade, XFEL, ILL 20/20, FAIR, SPIRAL2, PRACE, JHR, E-ELT

Projects that are progressing with a high likelihood to meet the 2015 implementation goal:

EURO-ARGO, IAGOS, ICOS, INFRAFRONTIER, ECCSEL*, EPOS*, EISCAT-3D*, EMSO*, BBMRI*, ELIXIR*, ESS*, ELI*, CTA*, SKA*, DARIAH*, CLARIN*, LIFEWATCH

The projects with asterisks need to overcome some specific bottlenecks for which special EU funds under INFRADEV-3 are recommended.

All Projects need to continue to address the recommendations of the Assessment Expert Group in taking steps to achieve timely implementation, ensure that they work with the funding agencies and Ministries in the Member States and Associated Countries and address any concerns of Member States that may be barriers to national support, and work with the Commission to provide the needed evidence of progress or documentation to respond to the INFRADEV-3 call.

The 12 projects listed below are our priority candidates for implementation support – they have been selected on this basis. They are likely to be in the list of projects that will be actually implemented by 2015, together with those independently progressing without need of one-off funds. Based on evidence available to ESFRI each of these projects has the potential of being financed for implementation by 2015, but the special financial support from Horizon 2020 should **lead to and leverage further support** from the Member States, Associated Countries and interested Third Countries that are already involved or interested in a project to enable implementation to occur by 2015-16.

All the listed projects are being supported by national funds by different Member States and Associated Countries, the stepping-up to full implementation is in the power of those Member States and Associated Countries, plus possible additional partners that must together reach the critical mass of financial commitment.

Candidate Projects for INFRADEV-3 support

The twelve projects that require special funding to overcome residual bottlenecks for the implementation by 2015 are listed in the table below. The table indicates the level of support that has been recommended by ESFRI for each project and the bottlenecks that this support will address. A further detailed analysis for each of these projects is given following the table, which explain how the level of support we are recommending will fund activities that will address specific bottlenecks and concerted actions required by each project and associated Member State to enable successful implementation by 2015.

(The individual reports and additional material used by the SWGs are appended to this report and provide further detailed information to support the recommendations).

Project	Project Summary and Key Bottlenecks addressed	Indicative Funding from INFRADEV-3
ECCSEL	<p>European Carbon Dioxide Capture and Storage Laboratory Infrastructure (Distributed Research Infrastructure) - combining three approaches to capture and three approaches to CO₂ storage (aquifers, depleted oil/gas fields, coal bed methane) and transport of CO₂. Carbon dioxide capture and storage (CCS) is identified as a future key technology for reducing emissions from fossil fuels.</p> <p><i>Bottlenecks Addressed:</i> Strengthen the capacity of a strong core group of initial members; further develop the pan-European dimension of the project; ensure an adequate pre-implementation budget distribution across several facilities in different countries, particularly concerning the necessary pre-implementation upgrades of national facilities; EU wide industry engagement; international best-practice exchange on storage facilities; management of legal/contractual issues to be properly established; large scale trial runs of infrastructure access.</p>	Up to 4 M€
EPOS	<p>European Plate Observing System, EPOS will create a single sustainable, permanent geophysical observational infrastructure, integrating existing monitoring networks (e.g. seismic and geodetic networks), local observatories (e.g. volcano observatories) and experimental laboratories (e.g., experimental and analytic lab for rock physics and tectonic analogue modeling) in Europe and adjacent regions.</p> <p><i>Bottlenecks Addressed:</i> Support for the early operation of the TCS (Thematic Core Services) in all the different domains, in particular activating the services on geo-hazards and geo-resources; and for activating a fully integrated and compliant ICS-TCS system (Integrated Core Services – Thematic Core Services) to be ready and operational as the ERIC is established and set up.</p>	6-7 M€
EISCAT_3D	<p>The next generation European incoherent scatter radar system will be a three-dimensional imaging radar for atmospheric and geo-space research, which constitutes an upgrade to EISCAT, an existing international infrastructure based in Europe and devoted to the study of the upper atmosphere, ionosphere and Geospace.</p> <p><i>Bottlenecks Addressed:</i> Dedicated and short term support to form a science/industry alliance, building on existing partnerships with contract electronic manufacturers and related firms, to speed up the transition from engineering prototypes to production ready designs.</p>	6-7 M€
EMSO	EMSO, the European Multidisciplinary Seafloor and Water Column	4 M€

	<p>Observatory, will be a unique, multi-disciplinary, pan-European Research Infrastructure (RI) for advanced ocean observation with the objective of long-term, high resolution, (near) real-time monitoring of environmental processes related to the interaction between the geosphere, biosphere, hydrosphere, and lithosphere, including natural hazards, climate change, and marine ecosystems..</p> <p><i>Bottlenecks Addressed:</i> Support for the development of an instrument package or generic sensor module to push the state-of-art and; achieve full standardisation; make data coherent and attractive for the modeling community; reduce maintenance from yearly to 2-3 year periodicity by improved reliability; involve industry and create a European market; obtain significant cost savings.</p>	
BBMRI	<p>The Biobanking and Biomolecular Resources Research Infrastructure is a pan-European distributed infrastructure of existing and new bio-banks and bio-molecular resource centres.</p> <p><i>Bottlenecks Addressed:</i> Organise national biobanks and establish what each country will precisely offer in terms of data and services and amalgamate these efforts; increase discoverability and access to data by setting up infrastructure, standards and tools for data sharing whilst protecting privacy, and harmonise data and IT across biobanks; fully develop access procedures and services for the researchers; fully develop a strategy and find solutions to all ethical, legal and societal issues related to access to personal data, and involving all relevant sectors; enhance the connection between basic research through to the clinic; establish common services on rare diseases; support steps to continue expanding the membership of BBMRI.</p>	5-8 M€
ELIXIR	<p>The European Life-Science Infrastructure for Biological Information -- ELIXIR will be a secure, rapidly evolving platform for collection, storage, annotation, validation, dissemination and utilization of biological data</p> <p><i>Bottlenecks Addressed:</i> Strengthen central coordination function with the goal of creating a single robust European research infrastructure, clarify the role of EMBL as a partner and contractor, and consider the long term sufficiency of the present legal framework as EMBL special project; fully develop the different service streams of the infrastructure across the nodes for data resources, compute provision, tools infrastructure, training and standards infrastructure; fully develop data access procedures and associated data protection, as well as ethical, legal and societal aspects; develop common procurement and recruitment procedures in order to maximize the impact and decrease costs, therefore achieving significant impact in production and access to services; establish a fully dedicated program for industry engagement including the pharmaceutical and agriculture sectors, supporting industry and SME innovation through service provisioning, joint projects and public-private partnerships and a 'pan-European SME and innovation programme'; take steps to expand the ELIXIR's membership.</p>	5 M€
ESS	<p>The European Spallation Source will be the world's most powerful long-pulse source of neutrons at 5MW for interdisciplinary research in the physical and life sciences.</p> <p><i>Bottlenecks Addressed:</i> Reduce two key risks to the project, by (1) the development of processes to manage in-kind contributions - the level of coordination and integration required for in-kind contributions has been identified as the project's No. 1 risk; and (2) work to develop alternative neutron detection technologies for low-energy neutrons that will reduce reliance on Helium 3 and hence alleviate the world-wide shortage of this element.</p>	4-6M€
ELI	<p>The Extreme Light Infrastructure will be a multi-sited RI for the investigation and applications of laser matter interaction at more than 6</p>	6-8M€

	<p>orders of magnitude higher intensities than today's state of the art.</p> <p><i>Bottlenecks Addressed:</i> Support of integration within a common structure across the three sites: since ELI depends upon structural funds for much of the construction cost, there is no clear funding mechanism at this stage for the necessary integration and scientific management across all three sites, which will allow ELI to function as a single infrastructure from the point of view of users and as a service provider.</p>	
CTA	<p>The Cherenkov Telescope Array will be the next-generation observatory for ground-based high-energy gamma-ray astronomy.</p> <p><i>Bottlenecks Addressed:</i> Site preparation/site infrastructure to address the specific challenge of characterising and surveying remote sites in the southern hemisphere, designing and implementing site infrastructure, defining appropriate long term agreements with host country, and preparing for construction to begin.</p>	7M€
SKA	<p>The Square Kilometre Array will be the next generation radio telescope. With a very broad frequency range of 70 MHz - 25 GHz and a collecting area of about 1,000,000 m², it will be 50 times more sensitive than the current world's best facilities.</p> <p><i>Bottlenecks Addressed:</i> Support for site preparation/site infrastructure to address the specific challenge of characterising and surveying remote sites in South Africa and Western Australia, designing and implementing site infrastructure, defining appropriate long term agreements with host countries, and preparing for construction to begin.</p>	7M€
CLARIN	<p>The Common Language Resources and Technology Infrastructure is a large-scale pan-European coordinated infrastructure effort to make language resources and technology available and useful to scholars of all disciplines, in particular the humanities and social Sciences.</p> <p><i>Bottlenecks Addressed:</i> Support for a number of key central infrastructure coordination functions and development of a priority list for additional facilities if and when more funding becomes available, e.g. through new countries joining or Horizon 2020 projects.</p>	750k€
DARIAH	<p>The Digital Research Infrastructure for the Arts and Humanities aims to conceptualise and build an infrastructure in support of ICT-based research practices in the arts and humanities and to support researchers in the creation and use of research data and tools. <i>Bottlenecks Addressed:</i> Central coordination of the distributed infrastructure; networking relating to communities; online reference training material; transnational access and basic services; open data infrastructure; development of a platform for publishing and evaluating digital methods.</p>	1.9M€
	<p>INDICATIVE TOTAL from Horizon 2020 :</p> <p>To be complemented by commitments to all projects from member states and associated states</p>	~56 - 66 M€

Energy Strategy Working Group

The AEG assessed all the projects in the energy field to be in Category 3, i.e. with very little chance of being implemented by 2015, at the time of their evaluation (January 2013). The ENE SWG, therefore, critically appraised the development of all projects since this time, with a view to understanding which if any had made significant progress since the report, taking into account the strategic importance of the field for Europe and the requirements and recommendations in the SET Plan. Of the six projects currently listed in the ESFRI Roadmap, only four (ECCSEL, Windscanner, EU-SOLARIS, HiPER) projects were assessed by the AEG, all at very different maturity levels; the other two (IFMIF and MYRRHA) fell into the domain of Euratom. After thorough assessment, one project, ECCSEL, was considered to have made sufficient progress since the AEG examination to be at a maturity stage to achieve implementation by 2015. Specific bottlenecks were identified through a set of interviews directly with the project coordinator and analysis of available documentation. Also, contextualisation in European Energy policy priorities was considered in the appraisal of all projects. The Energy Strategy Working Group has now started the analysis of the developments in MYRRHA and IFMIF. All projects will be analysed in light of the preparatory work towards the renewed ESFRI Roadmap.

HiPER

The HiPER Project finished its Preparatory Phase in April 2013. According to the project application the main aim of the Preparatory Phase was building of the European Laser Energy community, definition of the path to a full Laser Energy system solution, leading to the construction of a machine capable of advanced ignition physics demonstrations in this decade. Progress was achieved in light of the initial commitments; nevertheless, there are significant changes in the project driven by the progress of the US NIF facility and by the possibility of access to LMJ and PETAL facilities constructed in France. The project was therefore re-scoped to conceive a prototype power plant (from demonstrator of physics to power production demonstrator) in the 2020's and 2030's, and to pursue a programme of ignition physics investigations at existing facilities (e.g. Omega, LMJ, PETAL). The project is now starting a new phase – Technology Development and Risk Reduction (up to mid of 2020's). The project is divided into several phases – Preparatory Phase (already finished), Interim Phase and Technology Development & Risk Reduction Phase (running now, until late 2020's), and Construction and Commissioning Phase (planned at mid-2030's). These developments mean that implementation has moved by several years to the future.

WINDSCANNER

The overall concept of the WindScanner.eu RI can be summarised as a coordinated and European-scale development and dissemination of the already established Danish WindScanner.dk facility in the form of a network between distributed WindScanner research and demonstration nodes embedded within leading European energy research organisations. The participants are all partners of the European Energy Research Alliance (EERA) and the WindScanner vision is to develop a European RI that underpins the EERA Joint Programme on Wind Energy. The Preparatory Phase (PP) of the project only began on 1 October 2012 and the next steps to be taken and general strategies to be pursued are not entirely clear at this point.

EU SOLARIS

The project has only recently entered the EU funded Preparatory Phase (November 2012), and this is funded through to 2016. The host institution is the Centro Tecnológico Avanzado de Energías Renovables (CTAER) of Spain and partner countries include Cyprus, Germany, France, Israel, Turkey, Italy, Greece, and Portugal. Information on the next steps to be taken and general strategies to be pursued is very limited at this point.

MYRRHA

MYRRHA is a multipurpose fast spectrum irradiation facility (using an Accelerator Driven reactor system) strongly embedded in EURATOM framework programme activities. It was identified in the ESFRI Roadmap in 2006 as an emerging idea and was included in the Roadmap in December 2010 and in the SET-Plan European Sustainable Nuclear Industrial Initiative (ESNII), launched in November 2010. It is also listed in the long-range plan facilities issued in December 2010 by the Nuclear Physics European Collaboration Committee (NuPECC). An already-operating prototype GUINEVERE was launched in 2011 (in cooperation with French laboratories). Additional possible applications in materials testing for fusion have been included in the project, and these could be complementary to the IFMIF facility. A collaboration between ISOL@MYRRHA (using part of the proton accelerator of MYRRHA) and EURISOL has been established. The detailed engineering design of the facility should be completed in 2014. Many initiatives are being deployed to build the funding partnership of MYRRHA beyond the 40% already promised by Belgium. The facility is planned to be in operation in 2023.

IFMIF

IFMIF is conceived as a high power proton-accelerator driven irradiation facility for fusion reactor materials development. Currently, Engineering Validation and Engineering Design Activities are being performed by the IFMIF/EVEDA project within the framework of the Broader Approach agreement between EURATOM and Japan, complementing ITER, to validate the continuous and stable operation of the IFMIF subsystems. An IFMIF Intermediate Engineering Design Report was completed in June 2013. IFMIF is an essential adjunct to ITER and critical for the next phase (DEMO) of the international magnetic confinement fusion programme. The preparation for the construction of IFMIF through a phase of Engineering Validation, Engineering Design Activities (EVEDA phase) is part of the activities of the so-called "Broader Approach" agreement establishing collaboration between Europe and Japan on the way to a fusion reactor, and will run until 2017.

Case for INFRADEV-3 support for ECCSEL**ECCSEL - Up to 4 M€**

Carbon Capture, Transport and Storage (CCS) is a powerful tool in climate change mitigation and is an integral part of the SET Plan and the ongoing development of the SET Plan Integrated Roadmap. It is considered to be a key technology for Europe to reach its 2030 and 2050 emission targets, as mentioned in the 2014 EU communication "A policy framework for climate and energy in the period from 2020 to 2030". To secure European competitiveness and a sustainable industry, CCS will need to be deployed and will help to reduce leakage of carbon-intensive activities to other economies.

ECCSEL, the European Carbon dioxide Capture and Storage Laboratory, has made significant progress since the AEG hearings. Moreover, the AEG report was mainly based on an assessment of the ECCSEL Preparatory Phase 1 (PP1) information without any of the deliverables under Preparatory Phase 2 (PP2 started 1.1.2013) having been completed by the time the information for that report was collected.

The ECCSEL PP2 is currently on schedule with only two current deliverables expected to be completed 1-2 months later than projected. Those delays are not seen to impact the overall progress of the project. Since the AEG assessment, a number of important PP2 decisions have been made and several key deliverables completed, including the location of the ECCSEL Operations Centre, and the establishment of decision making processes engaging policy makers. Based on concrete plans and preliminary budgets for ECCSEL operation and upgrades / new builds, five countries (Norway, Spain, Italy, Netherlands and France) have now stated in the last governmental stakeholder meeting (PCG) that they are supporting ECCSEL into the operational phase. Other countries (The United Kingdom and Switzerland) are expected to commit themselves later this year.

The ENE SWG therefore believes that with some additional support, the ECCSEL project has the potential to meet all requirements of a European Research Infrastructure ready to be under implementation by 2015. The ENE SWG recommends that ECCSEL focus on the following issues that, if positively developed, will pave the way to an effective start of implementation by 2015:

- an adequate first stage (early) implementation to help align the different, currently nationally operated facilities to an upgraded common standard (technical, data, monitoring, etc.) with an adequate early implementation budget distribution. The ECCSEL RI will be developed in two layers, one layer consisting of distributed complimentary laboratories and one layer of large pilots and demo sites. A set of upgrades of existing experimental, mobile, developmental and testing facilities across several countries is planned for the initial implementation phase. As examples: in the CO₂ capture domain, the testing of H₂ rich fuels in gas turbine burners and combustor systems, or the upgrade of oxy combustion boiler system, enabled for various solid fuels, were identified as high priority. In the CO₂ transport domain, test various properties of CO₂ and mixtures with CO₂, phase behaviour, hydrate formation, physical and thermal properties. In the storage domain, a need was identified for a variety of test sites to validate numerical and laboratory studies, namely, injection strategies, fractured controlled migration, leakage simulation. While most of these developments are assured by national funding, pre-implementation funding should allow for initiating the joint planning process development from laboratory research scale to industrial pilot-phase through a coordinated budget planning and facility upgrade.
- International best-practice exchange for the benefit of storage site development; pilot large-scale trial runs of infrastructure access are a key step in its pre-implementation phase to allow a successful and smooth implementation by the end 2015.

The ENE SWG believes ECCSEL needs a strong and decisive support to successfully mitigate the existing internal and external risks connected with lack of standardization as well as to address the other identified key issues (beyond the current project plan). The recommended funding for this project is up to 4M€, to be complemented by contributions from the member states.

Environmental Sciences Strategy Working Group

The ENV SWG has made a complete evaluation of all the projects in its domain, taking the AEG report as a starting point and assessing the progress of each project since the AEG interviews.

In its evaluation, the ENV SWG has considered both the primary and secondary criteria as listed on page 4. The ENV SWG has requested specific feedback from the projects, in particular to address the progress made since the time of the AEG hearings; it also organised additional specific hearings with the project coordinators/representatives in October 2013. As a result of this evaluation process, the ENV SWG has identified three projects for which dedicated funding would be appropriate and where it would be instrumental to enable the RI to be fully implemented in 2015. These three projects are **EPOS**, **EISCAT_3D** and **EMSO**. The motivation for their selection, together with the bottlenecks to be addressed and the required maximum level of resources are reported at the end of this section.

Regarding the remaining projects the ENV SWG concluded that:

The projects *EURO-ARGO*, *IAGOS* and *ICOS* are well on track to implementation and are considered as **flagship projects**, i.e. examples for the other RIs of best practice.

EURO-ARGO already included in Category 1 in the AEG report, has made significant progress since the AEG hearings. It is already operational and for this reason does not need specific funding for implementation. 10 Member States are supporting the EURO-ARGO ERIC and further countries are expected to enter the ERIC in 2014/2015. The ENV SWG considers EURO-ARGO as a *flagship project* of the environmental domain.

IAGOS started as a smaller project (Germany, France, UK) but has now matured and grown (more airlines joined the project; and other countries are considering to join, e.g. Hungary and Romania). With more participants the RI will grow without any additional risks. It is a fully European/global project. Global partners are already integrated (China Airlines, Cathay Pacific Airways, etc). The project belongs to the Category 1 of the AEG report and it is already operational, and so there is no need for additional one off support from EU for the implementation. The ENV SWG considers IAGOS as a *flagship project* of the environmental domain.

ICOS, in Category 2 of the AEG report, is also considered to be on track for implementation and whilst it will need continued commitment from Member States, it does not require additional one off support from the EU. The assessment is that ICOS RI will be fully operational in 2015. In June 2013 the project's ERIC application was submitted to the EU for Step 1 evaluation. In this first phase 12 countries indicated the readiness to enter the ICOS ERIC. Substantial parts of the RI will be operational in 2014 with 95 observation stations forming part of the ICOS National Networks in 2014. The ICOS ERIC will also be established in 2014. Construction of some parts of ICOS will continue until 2015. Considering the progress made since the AEG hearings last January, the ENV-SWG considers ICOS as a *flagship project* of the environmental domain because it will be not only implemented but also operational by 2015.

LIFEWATCH, in Category 2 of the AEG report, has followed the recommendations of the AEG and since their interview, have made substantial progress. LIFEWATCH has worked hard with a core group of committed countries ready to found an ERIC using a downscaled, phased working growth model that will allow progress towards the LIFEWATCH concept with downscoped ambitions and an adapted access model. LIFEWATCH has demonstrated the capability to integrate different funding sources, including structural funds, and the construction phase takes advantage of currently operational facilities distributed in the different countries. On this basis, the project is considered to be adequately on track for implementation at reduced scale by 2015-2016 within the framework of this new phased and downsized model; additional implementation funding at this time is not required. In order to fasten and strengthen its implementation, LIFEWATCH would benefit from continuing to follow the AEG recommendations, commitment of the existing member States should

be maintained, and an agreed vision for how to handle biodiversity issues at the EU scale needs to be developed.

SIOS, in Category 3 of the AEG report, is expected to make good progress by 2015/16, but it is still in the preparatory phase and it is unlikely to be mature enough to move into implementation by then. For this reason SIOS has not been considered as candidate for INFRADEV-3.

COPAL, in Category 3 of the AEG report, has been not evaluated further after the AEG report because there are no commitments from Member States and no significant progress has been made after the end of the Preparatory Phase project in 2011. ENV SWG agreed that this project, even though it has been present on the ESFRI Roadmap since 2006, has minimal or no chance to be implemented by 2015/2016.

More details on the status of the different projects can be found in the ENV SWG Evaluation Report.

Case for INFRADEV-3 support for EPOS, EISCAT_3D and EMSO

EPOS (European Plate Observing System) - 6-7 M€

The European Plate Observing System EPOS will create a single sustainable, permanent geophysical observational infrastructure, integrating existing monitoring networks (e.g. seismic and geodetic networks), local observatories (e.g. volcano observatories) and experimental laboratories (e.g., experimental and analytic lab for rock physics and tectonic analogue modeling) in Europe and adjacent regions. The ENV SWG has identified EPOS as the prime ESFRI-ENV infrastructure for which dedicated funding under INFRADEV-3 would be instrumental in enabling the RI to be fully ready for implementation by 2015.

The recommendation to support EPOS implementation phase is motivated by:

- i. the excellent progress achieved by the project during its preparatory phase, which will be completed in 2014;
- ii. the size of the community involved in its integration plan of *existing* research infrastructures for solid Earth science;
- iii. the effective “community building” fostered by EPOS and the relevant cooperation with similar initiative at global level;
- iv. the uniqueness of the RI and its long-term scientific perspective;
- v. the real possibility to build a fully integrated and compliant ICS-TCS system (Integrated Core Services – Thematic Core Services) to be ready and operational by 2015.

The key added value of EPOS is in providing access to a common, shared data resource with researcher services optimized to thematic areas based on a common integrated set of core software and data services.

Specific support through INFRADEV3 is recommended to support the following activities:

- The state of advancement of the Thematic Core Services in the different disciplines covered by EPOS is not yet uniform, and EPOS needs to fully develop the TCS data and software across all the different domains in order to enter successfully in the implementation phase, with particular focus on areas of high societal interest identified in Horizon2020, i.e. geo-hazards and geo-resources.
- EPOS shows good progress on the design of its proposed structure based on the Integrated Core Service (ICS) and the Thematic Core Services, covering various scientific domains and communities. But EPOS needs to move beyond design activities and proceed with the definition of the technical specifications and procedures required to successfully initiate the

ICS-TCS implementation and integration, to be ready and operational as the ERIC comes into force.

For both of these actions cooperation with industry is needed - the industries to be involved are mainly from geo-hazards, geo-resources and ICT.

The ENV SWG estimates that a targeted project with EU funding of 6-7M€ over a 2 year period (complemented by the commitments from participating Member States) will be required to meet both targets, enabling EPOS to be implemented and operational in 2015.

EISCAT_3D - 6-7 M€

EISCAT_3D will provide a unique and world leading European system for studies of the Arctic atmosphere and space environment. Its capabilities range from atmospheric physics and plasma research to space security applications, such as tracking space debris and near-Earth objects.

The design of EISCAT_3D is based on several thousand identical antennas that are to be placed at remote locations and will have to operate under Arctic conditions. The project takes advantage of recent advances in the technology of radio frequency power amplifiers to provide significant improvements in efficiency and reliability. Cost-effective implementation of EISCAT_3D will benefit from further cooperation with industry to advance the design into antenna products that can be manufactured on an industrial scale. Dedicated and short term support to EISCAT to form a science/industry alliance, building on existing partnerships with contract electronic manufacturers and related firms, will speed up the transition from engineering prototypes to production ready designs, thus significantly shortening the time-span for implementing EISCAT_3D. It will also help ensure that the system will be manufactured more quickly, cost-efficiently and with tight feedback among the scientists and project engineers.

The ENV SWG therefore proposes a targeted project with EU funding of 6-7M€, complemented by commitments of Member States, over a 2 years period, for the full implementation of EISCAT_3D by 2015.

EMSO (European Multidisciplinary Seafloor and water-column Observatory) - 4 M€

EMSO, the European Multidisciplinary Seafloor and Water Column Observatory, will be an unique, multi-disciplinary, pan-European RI for advanced ocean observation with the objective of long-term, high resolution, (near) real-time monitoring of environmental processes related to the interaction between the geosphere, biosphere, hydrosphere, and lithosphere, including natural hazards, climate change, and marine ecosystems.

EMSO has registered significant progress since the AEG hearings in February 2013:

- Eight nodes are already operational.
- The EMSO ERIC, supported by 10 countries, has been submitted to the EU for Step 1 evaluation.
- As a result of the observations of the AEG, the project significantly developed the plans for, and role of, the central hub.
- Also as result of the AEG observations, clear KPI's were developed and an ethical group was implemented. Governance and management aspects were also addressed.
- The project has made progress towards the standardisation / interoperability of data collected at the various nodes of EMSO.
- The scientific case has been also developed (moving from seafloor observatories to observatories monitoring also the water column), taking into account the technical progress registered in the recent years.

Technology has moved fast in the last few years, and there is an opportunity to take advantage of this progress by designing and developing - in partnership with European industry - a state of the art instrument package for a generic sensor module to be used across all of the EMSO nodes. Targeted support for this will dramatically reduce the risk and cost of implementation of the full project, by

- achieving full standardisation and interoperability of the generic EMSO sensor package, enabling long-term observation of ocean parameters of high relevance for climate change, ecosystem disturbance and hazard monitoring across all EMSO infrastructure nodes;
- ensure common calibration, data archiving, user access schemes and improved data management. This will allow streamlining of time series analysis, increasing data coherency and attractiveness for the modelling community and for policy makers;
- reduce installation costs and reduce maintenance from yearly to 2-3 year periodicity by improved reliability, decreasing costly periodic interventions at sea and thus decreasing running costs.

The development of such a standardised module will require the involvement of innovation-oriented European SMEs and large scale industries and will reinforce their positioning in a rapidly growing global market. The joint development of sensors will benefit all EMSO sites and will contribute to development costs reduction. The package should be developed and implemented both at large and complex seafloor observatories as well as single deep sea moorings. This would strengthen the confidence in funding authorities that operational costs and maintenance risks can be minimized and kept under control in the long-term. It would also leverage the interest of the several scientific communities (climate change, ecosystem or hazards) in more sites by making these sites both more multidisciplinary and data standardised. The support will help focus the coordination of the fragmented funding scenario at national levels, will enable alignment of the state-of-advancement of the different EMSO nodes and encourage the interest of additional countries to become Full Members of the EMSO-ERIC.

These targets of standardisation and substantial reduction of operational costs will remove two critical bottlenecks and will therefore enable EMSO to meet the schedule of the EMSO-ERIC operation by 2015. On these grounds, the ENV SWG proposes a budget of up to 4 M€, complemented by commitments of Member States, over a 2 year period.

Health and Food Strategy Working Group

The Health and Food Strategic Working Group (HF SWG) performed the evaluation of its thirteen projects on the ESFRI Roadmap, based on the evaluation report of the Assessment Expert Group and additional reports that were requested from all projects. In its evaluation, the HF SWG used the seven criteria set out by ESFRI (see p2) together with an assessment of the likelihood of the projects to reach implementation by 2015/16 along with the possible contribution of one-off funding to achieve this. As a result, HF SWG identified two candidate projects, both in Category 1 in the AEG Report, for which an additional funding of 5M€ each would be appropriate and critical to enable these two RIs to be fully implemented in 2015/16: **BBMRI** and **ELIXIR**. The implementation of these two projects will have an immediate and large-scale impact on European research at large, on the remaining RIs in the ESFRI Roadmap and beyond, by providing access to key biobank resources and the delivery chain in personalised medicine and disease prevention, and access to large scale, world-class, underpinning life sciences data, tools, compute, standards, training and industry services that support the data challenges of all life sciences RIs, from health to marine sciences.

Of the remaining projects in Categories 1 and 2 in the AEG Report, HFSWG concluded that:

INFRAFRONTIER, rated as Category 1 by the AEG, is well established and currently operates as a limited company (GmbH) established in Germany in 2013. User requests for these services are steadily increasing and INFRAFRONTIER processes now more than 1000 user projects per year. The SWG recommended that this project would greatly benefit from inclusion in a Horizon 2020 cluster proposal together with EATRIS and ECRIN.

EATRIS (AEG category 2) and **ECRIN** (also AEG category 2) are progressing at a rapid pace and have established their legal entities as ERICs. These projects together with INFRAFRONTIER are in a unique position to offer complementary processes and integrated services matching with BBMRI and ELIXIR and will deliver very concrete benefits to the health of European citizens. These three projects would benefit from support to a common work programme to implement the model for integrated services where EATRIS provides the translational non-clinical as well as translational early clinical research, INFRAFRONTIER provides animal models to test hypotheses before entering human testing and ECRIN provides the clinical infrastructure for the clinical testing with patients in hospitals and clinics. In this case it is therefore recommended that other appropriate instruments available in Horizon 2020 (Clusters) should be investigated. Latest discussions highlight 'rare diseases' as a potential societal challenge related topic where a concerted effort would bring added value and allow for services to be tested quickly.

INSTRUCT (AEG category 2) has been operating as a non-profit legal entity supported by an International Collaboration Agreement. INSTRUCT brings together national sites with significant investments, and a well-established user community. INSTRUCT is progressing well in its plans for an ERIC application and, in the next 2 years, needs to encourage and ensure effective integration of its bodies within the infrastructure, an investment strategy (as recommended by AEG) and enhanced cooperation with the above RIs. Full implementation at this time is not felt to be probable given the state of maturity of the project as more work is required on an investment strategy as set out in the AEG report and to encourage effective collaboration and integration between the different organisational layers.

EMBRIC (AEG Category 2) is encouraged to build on an established network of excellent facilities, take necessary steps to enhance the role of the headquarters and its relationship with the distributed nodes, invest efforts in moving away from a purely networking activity and consider stages towards

an ERIC legal entity or equivalent. Whilst the project has made good progress, even with additional funding the project would be unlikely to be mature enough to move into implementation by 2015.

It is anticipated that most of the remaining projects in Category 3 of the AEG will make good progress by 2015/16, but they are unlikely to be mature enough to move into implementation by then. They were therefore not considered as candidates for INFRADEV-3. Details on their progress can be found in HF SWG Evaluation Report.

Case for INFRADEV-3 support for BBMRI and ELIXIR

BBMRI – 5-8M€

BBMRI was awarded ERIC status in November 2013. The BBMRI-ERIC focuses on securing and providing access to a key resource of hundreds of biobanks distributed in the EU for the advancement of personalised medicine and disease prevention. BBMRI has the potential to significantly improve competitiveness of health-related industries, such as the pharmaceutical industry, diagnostics manufacturers, and the biotech industry as well as vendors of biobanking-related products. There is currently no infrastructure like BBMRI-ERIC outside of Europe, giving Europe a striking competitive advantage. The key next steps to boost and accelerate the implementation of the main European bio-banking and biomolecular resources RI and prepare its functioning and services are:

- to organise national biobanks and the details of precisely what each country will offer in terms of data and services, and then combine these efforts into a coherent project plan for the European layer;
- to increase discoverability and access to data by setting up infrastructure, standards and tools for data sharing in a common central software and data framework whilst protecting privacy, and harmonise data and IT across biobanks;
- to fully develop access procedures and services for researchers;
- to fully develop a strategy and ensure solutions to the ethical, legal and societal issues related to access to personal data, and involving all relevant sectors
- to enhance the connection between basic research through to the clinical application;
- take steps to continue expanding BBMRI's membership.

A small fraction of the financial support for generic activities is requested to allow BBMRI to test rapidly the concept of common services using rare diseases as an example. In response to current demands of the sector, BBMRI, alongside other HF SWG infrastructures, will establish a dedicated Common Service for rare diseases as part of the services foreseen in the BBMRI-ERIC governance structure, and as described in the statutes of BBMRI-ERIC. A common service on rare diseases will aim to cover (1) access to high quality human biological materials as a prerequisite for research on rare diseases; (2) an online, dynamic, searchable catalogue of samples collected in rare diseases biobanks and also employed in omics studies; (3) harmonisation and quality control of registries, biobanks and research databases in rare diseases; and (4) an Expert Centre on ethical, legal and social issues as well as regulatory issues, which in this research area often pose a particular challenge to the development of new therapies.

A contribution of 5-8M€ (complemented by additional member state funding) is considered of high priority to address and overcome specific bottlenecks as described above, and to ensure that the above services are fully established by 2015/16.

ELIXIR – 5M€

ELIXIR is a unique RI that underpins and supports the data challenges of all life sciences RIs, from health to marine sciences. ELIXIR offers coordinated, distributed, and sustained access to large scale, world-class life sciences data, tools, compute, standards, training and industry services. ELIXIR's user community is hugely diverse and vast, with EMBL-EBI alone receiving 9 million requests per day from both academic and industrial (20%) sectors. ELIXIR's impact is enormous both at the European and global scale. ELIXIR is moving into implementation and the ELIXIR Consortium Agreement was ratified in December 2013 by 5 Member States and EMBL, and the agreement entered in force in 12th January 2014. The key next steps for ELIXIR to boost the construction of a pan-European bioinformatics research infrastructure, the support of which is essential for the functioning of all the ESFRI BMS infrastructures and necessary for the strategic and functional readiness of the ELIXIR infrastructure, are:

- to strengthen the central coordination function, integrating the nodes in this process, and including common software and data services with the goal of creating a single robust European research infrastructure;
- clarify the role of EMBL as a partner and contractor, and consider the long term sufficiency of the present legal framework as EMBL special project, which have raised concerns for some partners;
- fully develop the different service streams of the infrastructure across the nodes for data resources, compute provision, tools infrastructure, training and standards infrastructure;
- to fully develop data access procedures and associated data protection as well as ethical, legal and societal aspects;
- to develop common procurement and recruitment procedures in order to maximize the impact and decrease costs, therefore achieving significant impact in production and access to services;
- to establish a fully dedicated program for industry engagement including the pharmaceutical and agricultural sectors, supporting industry and SME innovation through service provisioning, joint programmes and public-private partnerships and a 'pan-European SME and innovation programme';
- take steps to expand ELIXIR's membership

In order to support the implementation of ELIXIR by 2015, support targeted at addressing the above issues is proposed of up to 5M€, (complemented by additional member state funding). All the above points require expertise and resources to be implemented by 2015/16. The scientific and socio-economic impact of ELIXIR will be high.

Physical Sciences and Engineering Strategy Working Group

The PSE SWG considered the current status of all projects in its domain, with the goal of identifying candidate projects where additional support from the EU would significantly improve the likelihood of implementation by 2015/16. The evaluation started with the output of the Assessment Expert Group (AEG). The AEG listed in categories 1 and 2 the 4 projects: **ESS, CTA, SKA** and **ELI**. On that basis, and from written consultation with each project, it was determined that all four of these projects have serious chances and intention to come to official implementation by the end of 2015. In all four cases nevertheless there are key issues, crucial for successful implementation, which require timely and specific attention through effective use of the INFRADEV-3 funding. The PSE SWG concentrated its attention on such issues and developed a proposal for the specific use of INFRADEV-3 funds.

As agreed by ESFRI, the PSE SWG also considered for the first time the priorities set out by the 2013 update to the European Strategy for Particle Physics (ESPP). The PSE WG agreed that the projects set out in the ESPP should be integrated into the next update of the ESFRI Roadmap and agreed that further re-prioritisation was not required. The PSE SWG considered three accelerator-based particle physics projects: the Large Hadron Collider upgrades, the International Linear Collider and the accelerator technology project TIARA and in all of these cases the PSE SWG does not feel that urgent actions requiring the INFRADEV-3 instrument are needed or appropriate at this time. The LHC upgrades are already included and funded within the CERN medium-term plan; the International Linear Collider project awaits an approach to Europe from Japan and implementation would not start until after 2-3 years of additional work recommended by the Japan Science Council; while TIARA was seen by the SWG as more of a network, and lacked firm commitments from the member states.

The PSE SWG also proceeded with interviewing the ESFRI projects that were not given by the AEG a high likelihood of implementation readiness by 2015 (category 3) together with the TIARA project from the ESPP. These were **EMFL, EuroFEL, KM3NET** and **TIARA**. Significant advances or reorientation of the EMFL and KM3NET projects have been registered, with a clear Roadmap towards implementation, while EuroFEL and TIARA appear more like networks and the level of commitment of the member states is not clear. The PSE SWG confirmed that none of these last projects are eligible for INFRADEV-3 since, in spite of excellent progress in some cases, implementation by 2015 will not be reached by them.

The PSE SWG concluded that all four category 1 and 2 projects are indeed aiming at the implementation by 2015 without major obstacles at technical, political or governance levels, and for each one a good case had been made that additional support would address specific issues of broad impact on timely implementation. It was agreed, therefore, to concentrate on the areas that had been identified within each of the projects where additional funding could make a real difference towards implementation, by addressing bottlenecks that other ESFRI projects could benefit from and by reducing the risk of not reaching implementation.

Case for INFRADEV-3 support for ESS, ELI, CTA and SKA

The following levels of funding are recommended:

European Spallation Source (ESS) – 4-6M€

The European Spallation Source will be the world's most powerful long-pulse source of neutrons for interdisciplinary research into the structure of materials for the physical and life sciences.

Two of the highest risks for this project are the management of in-kind contributions and the dependency on scarce supplies of helium-3 for neutron detection. Funding will support the development of processes to manage in-kind contributions. The level of coordination and integration required for in-kind contributions has been identified as the project's No. 1 risk. Based on recent experience by other projects, the careful management of in-kind contributions to the construction (and operation) of the RI is a prerequisite for a robust construction phase. The risk

connected with delay or failure of some in-kind contribution may endanger the whole project schedule and budget so that careful evaluation of competence transfer mechanism and contingency must be put in place in order to start implementation. Given the technological challenges and the size of the ESS the development of a robust scheme for managing in-kind contributions would result in an excellent reference input for all other projects on the Roadmap. INFRADEV-3 funds are appropriate to address this task.

A second risk of broad impact is the world-wide shortage of Helium 3 and the need to identify alternative detection technologies for low energy neutrons. The ESS must address this issue with a specific work-package and to promote R&D and fabrication of prototypes to be tested at existing neutron sources. Again specific INFRADEV-3 funds are appropriate, complemented by national funding contributions.

Extreme Light Infrastructure (ELI): 6-8 M€

The Extreme Light Infrastructure will be a multi-sited RI for the investigation and applications of laser matter interaction at more than 6 orders of magnitude higher intensities than today's state of the art.

Funding will support integration activities towards a common structure between the three pillars under construction and the future fourth pillar. The ELI pillars depend for the construction phase upon structural funds but there are no clear ways in the current project framework to support the integration and scientific management of ELI as a single integrated infrastructure from the point of view of users and as service provider. This is a hurdle in the implementation of ELI as a European RI, in spite of the construction budget for each pillar being covered. The PSE advises to support ELI under INFRADEV-3 with the specific goal of constructing the international coordination and users interface.

Cherenkov Telescope Array (CTA): 7 M€ and Square Kilometre Array (SKA): 7 M€

The Cherenkov Telescope Array will be the next-generation observatory for ground-based high-energy gamma-ray astronomy; the Square Kilometre Array will be the next generation global radio telescope, and with a very broad frequency range and a collecting area of about 1,000,000 m², it will be 50 times more sensitive than the best current facilities.

Both of these projects are seeking to develop a science facility of international/global impact and interest, European-led but of global scale, and both are working in remote location(s) outside the EU, which places special challenges in characterising and surveying the sites, designing and implementing site infrastructure of the observatories (provision of electric power; electricity and fibre cable routing and reticulation; access; water and sanitation; buildings; antenna foundations; network connections), starting work immediately in defining appropriate long term agreements with host countries including educational and socio-economic returns, hiring of personnel in host countries to interface with central project management, and preparing for construction to begin. Specific funding is needed to complement the national funds available from host countries (often limited) and therefore to expedite these tasks and prevent these issues becoming barriers to timely implementation.

Social and Cultural Innovation Strategy Working Group

Following the AEG report's conclusions, the Social and Cultural Innovation SWG started a process of evaluation of all five projects in the Roadmap.

Three of the projects are considered already "implemented" (SHARE, ESS and CESSDA) and therefore were not assessed by the AEG report; the only two considered were placed in Category 2 (DARIAH and CLARIN).

All five projects were evaluated using the criteria established by ESFRI forum in the Cork meeting: the seven requirements plus suitability of one-off supplementary funding via the INFRADEV-3 instrument. Similar to the AEG report, the SCI-SWG evaluation has identified two projects for which dedicated additional funding would ensure a proper implementation by 2015.

As described in detail below, there are projects which (at the date of the AEG report) were very advanced but not yet implemented, while one of the projects assessed by AEG already had obtained the status of an ERIC. For this reason, the SCI-SWG evaluated the projects irrespective of their categorisation in the report, and found both:

- specific bottlenecks for the two projects proposed for additional funding
- more general bottlenecks which globally affect all these (special type of) distributed research infrastructures

The SCI-SWG concluded that all five projects are critical to the research in the social sciences and humanities. They represent the foundation on which the new generation of research infrastructures will be built in the next update of the Roadmap. Such projects are needed on both local/regional but also, more importantly, to the European level in order to describe and understand the European population and its cultural diversity.

The SCI-SWG projects are a special type of distributed RIs, because each node of the infrastructure is different. For such projects to be relevant at the "European" scale the infrastructure must be sufficiently large to represent as much of the European population as possible.

The ideal situation is to involve all countries, with the following positive benefits:

- it ensures the long-term sustainability of the projects
- the shared operating costs get almost insignificant
- demonstrates a genuine European added value through the support for aggregate level policies.

SHARE is the very first ERIC (2011), considered a success story of the ESFRI Roadmap, dedicated to the study of health care, employment and retirement, social networks and intergenerational relations, allowing a better understanding of the interactions between demographic change and public policies in Europe. While it started as a predominantly centrally financed enterprise (primarily by the European Commission through the 5th and 6th framework programmes), the adoption of ERIC status implied a decentralised funding model which, although generally stable, is still not completely sustainable.

In order to study generational processes, SHARE needs to observe the changes longitudinally across multiple points in space and time. Interrupting the process, for example a country dropping out, makes the overall results extremely difficult (if not impossible) to interpret. It is very important to understand that, even though financial crisis might undermine the funding of international research infrastructures in countries with a weaker economy, the social sciences and humanities researchers (and the Commission) are interested exactly in those countries where austerity measures are

harshes. The community of researchers is highly interested in these countries even if the countries themselves have little interest or no funds.

The European Social Survey ESS was established in 2001 in order to monitor change and stability in the social fabric of Europe and to improve standards of cross-national measurement. The European Social Survey is the most recent ERIC in the ESFRI Roadmap, declared and approved in December 2013. It has been widely used to inform public policy and debate on key social and political issues and its Core Scientific Team were awarded the Descartes prize in 2005 in recognition of the scientific excellence of the infrastructure.

The key bottleneck that needs to be unblocked to fully implement ESS as an ERIC is the diminished country participation resulting from the protracted transition to ERIC status. In Round 6 as many as 30 countries participated but this may fall to as few as 15 in Round 7. Such a reduction could seriously undermine the value of the time series and make the ESS dataset less attractive to analysts. Moreover there is a clear risk that countries excluded from Round 7 may miss subsequent rounds or drift away from the ESS altogether.

CESSDA also has experienced a very recent implementation, being set up as a Norwegian legal entity in December 2013. While fresh as an established RI, it has in fact a very long and respected history of four decades of continuous European activity. The major objective is to provide seamless access to data across repositories, nations, languages and research purposes. For this purpose, CESSDA will work to promote standardisation of data and metadata, data sharing and knowledge mobility.

The main bottleneck refers to the transition from a well-represented and functional organisation to the European level entity. Less than half of the former members were able to join the new legal entity, for reasons that have very little to do with the financial contribution, given that 90% of the required funding is jointly covered by Norway and Germany. In the meantime, new potential members are being setup in candidate countries in the Western Balkan region.

Decades of experience and immense quantities of data in countries outside the current legal entity are at a risk of being excluded from European-wide research.

Case for INFRADEV-3 support for CLARIN and DARIAH

The remaining two projects are not yet implemented and are recommended for the one-off supplementary funding under INFRADEV-3.

Both CLARIN and DARIAH performed an exercise to identify the most serious bottlenecks which additional funding would help overcome. This is close to a full gap analysis, performed to identify missing RI elements. Particularly, the two projects experience a lot of heterogeneity on both the nature of digital information processed by the infrastructures, and the very different legal systems that govern the dissemination and exchange of such information. In order to ensure the European character of the five infrastructures, there is a very real need to develop ways of obtaining more comparable data.

CLARIN: 750k €

This is already established as an ERIC, since February 2012. The main bottlenecks refer to:

- differences in speed at which the development of the national infrastructures takes place
- differences in funding conditions, and to the fact that national teams are bound to the terms of their national funding contract and not flexible enough to quickly accommodate requirements following from the implementation of key infrastructure functions at the European level.

The additional funding is needed for the centralisation of a number of key infrastructure functions, and a priority list for additional facilities if and when more funding becomes available, e.g. through new countries joining or Horizon 2020 projects. Bringing in more countries is crucial.

The centralisation operation started in 2014, and can be completed by 2016 if the additional EU funding would cover the planned activities for 2015.

DARIAH: 1.9 M€

DARIAH is an example where centralised technological deployment must move fast to synchronise with the quick evolution of digital methods in the humanities, where new communities are emerging and new needs are constantly expressed. It covers a very large scope of research activities in the arts and humanities, with a real bottleneck to help various communities to collaborate with one another.

Further refinement of governance structures is needed, and the additional funding will help addressing specific bottlenecks in the following areas:

- general coordination;
- networking relating to communities;
- online reference training material;
- transnational access and basic services;
- open data infrastructure;
- platform for publishing and evaluating digital methods.

What we recommend to happen to any uncommitted funding

The sum of the recommended funding levels for the 12 projects above would total between 56 and 66M€. The total available funding for INFRADEV-3 is 90M€ so there is sufficient funding to allow projects to bid for some additional support if their proposals are of high enough quality. We would recommend that any uncommitted funding should be allocated to other funding instruments to support ESFRI research infrastructures under Horizon 2020,

Once they have the ratification of support from their contributor Member States, the 12 proposed projects will be invited to submit proposals to the EU Commission for evaluation.

Other activities underway in ESFRI and 2016 Roadmap update process

The SWGs are undertaking other activities (some in parallel with this exercise) in support of ESFRI's mandate to prioritise the projects listed in the Roadmap.

As presented to ESFRI in December 2013, our plan is to update the Roadmap by 2015/16 recognising that the new Roadmap will only be credible if a substantial fraction of the existing Roadmap is in implementation. The new Roadmap will aim to be a more strategic document based on an analysis of the landscape of RIs in Europe and elsewhere, including gaps in the European Research Infrastructure ecosystem, synergies with national and regional RI projects and between existing RIs including strategies for optimal use, global opportunities, continuous upgrade and sustainability and decommissioning perspectives.

Work has already started by the SWGs to assess the AEG Report Category 3 projects (those projects assessed by AEG as having "minimal chances of achieving maturity by 2015" for various reasons), noting that some are newer projects but others have been on the Roadmap since 2006.

The SWGs are considering the broader global landscapes (e.g. the Physical Sciences and Engineering SWG is looking at neutron scattering facilities across Europe) and gap analyses of projects on the Roadmap. They will also look at National and Regional Infrastructures in their subject areas as part of the landscape analysis.

Following discussions at the ESFRI forum in December 2013, it is anticipated that ESFRI will approve the launch of the next Roadmap process in April 2014 under new rules whereby fewer projects will be on the Roadmap. Projects that come onto the Roadmap will be at a higher level of maturity than previously, with very clear specifications for entry. Projects on the current Roadmap that have not reached implementation after 10 years will go off of the Roadmap (or have to reapply) and projects on the new Roadmap will undergo periodic audit/assessment to monitor the actual progress according to the AEG's "assessment matrix".

The procedure and timescale to be followed for the new Roadmap will be agreed in the spring of 2014. Clear guidelines will be issued to stakeholders and scientific communities about what we expect to see in a proposal. The intention and plan for the new Roadmap could then be announced with a press conference during ICRI 2014 in Athens.

Publication of the new Roadmap is anticipated in January 2016, with a target size of about 25 active projects.

Summary/Wrap Up

The Innovation Union goal of implementing 60% of the ESFRI Roadmap by 2015 can potentially be roughly reached – a total of 16 projects, in addition to the 11 already implemented ones, have a sufficiently firm scientific, managerial, governance and support basis by Member States and Associated Countries to allow them to proceed to implementation.

ESFRI has identified 12 projects, among these 16, that could benefit from carefully targeted funding from the EU via Horizon 2020 INFRADEV-3 and where the provision of this funding, complemented by support from the MS and AS, would overcome some residual bottlenecks to implementation by 2015.

These recommendations are proposed to the Commission, the member states and the projects:

- **Members States and Associated Countries** should consider that the above projects are ready for implementation and are crucially important for the realization of the ERA and for European competitiveness. To be able to receive funding by the INFRADEV-3 call, the current levels of national support must be scaled up or confirmed in order to match the challenge of full implementation. According to variable geometry not all Member States and Associated Countries will support all of the projects. Member States and Associated Countries will need to make their own judgment of their national priorities within the overall list, but all projects need the continued commitment and support of the member states that are involved.
- **The Commission** has opened a targeted call to a limited number of projects, for Horizon 2020 funding under the INFRADEV-3 instrument to provide a single injection of resources to support their implementation, once the implementation conditions created by Member States and Associated Countries financial commitment are verified.
- **The Projects** need to continue to address the recommendations of the Assessment Expert Group in taking steps to achieve implementation, ensure that they work with and address any concerns of Member States that may be barriers to national support, and work with the Commission to provide the needed documentation to respond to the INFRADEV-3 funding call for overcoming the residual bottlenecks.

Two Strategy Working Groups have additionally highlighted the need for sustainable solutions that address the need of groups of projects that have similar problems to reach implementation by 2015 and sustain their continued operations.

In the Social and Cultural Innovation area, it is recommended that suitable support is made available for **CESSDA**, **SHARE** and the **European Social Survey** to ensure that full Europe-wide coverage is quickly achieved provided the projects demonstrate robust sustainability plans for the future.

In the bio-medical sciences, **INFRAFRONTIER**, **EATRIS** and **ECRIN** offer complementary processes and integrated services that have to be matched with BBMRI and ELIXIR which have very concrete benefits to the health of the European citizens. It is recommended that these projects investigate appropriate Horizon 2020 funding instruments (the Clusters instrument seems most suited).

All the other projects, some of which have been added to the ESFRI Roadmap in 2008 and 2010 and are currently still in the Preparatory Phase, are being assessed by the strategy working groups. In the majority of cases their current readiness level is such as to imply an implementation schedule extending beyond 2016.

ESFRI will continue to support all projects which are currently on the Roadmap with assessment exercises helping to overcome barriers and delays in the implementation, and assisting the projects on demand.

ESFRI will also further contribute in the future with proposals and suggestions on how to optimize the ensemble of measures of Horizon 2020 in support of the ESFRI Roadmap projects, aiming to

support the successful implementation of infrastructure projects that have reached the necessary maturity level.