ESFRI

European Strategy Forum
on Research Infrastructures

PUBLIC ROADMAP 2018 GUIDE

Final version dated 9th December 2016

FOREWORD

After the completion of the Roadmap 2006 and the 2008 and 2010 updates, the European Strategy Forum on Research Infrastructures (ESFRI) on 10th March 2016 published its Roadmap 2016 based on a thoroughly updated evaluation and selection procedure. Therein it introduced the ESFRI Landmarks - successfully implemented Research Infrastructures (RI) - along with the ESFRI Projects to be guided towards implementation in less than a decade.

Following the mandate of the Council of the European Union (EU), ESFRI launched its Roadmap 2018 update during the 3rd International Conference on Research Infrastructures (ICRI) on 4th October 2016 in Cape Town (South Africa) to stress the openness of European RI to international use and to consider the possibilities to enforce the concept of Global Research Infrastructures (GRI).

We offer this Public Roadmap 2018 Guide as support to proposers preparing a submission and to the Projects and Landmarks involved in the update procedure. It contains the definitions, models, methods and describes the procedures applied for this update. It represents ESFRI's best effort in road-mapping methodology and may thus serve as reference to complementary national exercises.

We look forward to the engagement of the research and innovation communities, as well as of the stakeholders from Europe and beyond, to identify potential new Projects and the ways to strengthen the running ones, and to maximise the return from the pan-European RI investment in terms of science, international collaboration and innovation.

Giorgio Rossi

ESFRI Chair

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STRATEGIC ROLE

ESFRI was set-up following a recommendation of the Council of the EU[1] and has the following scope:

- to support a coherent and strategy-led approach to policy making on RI in Europe;
- to facilitate multilateral initiatives leading to a better use and development of RI acting as an incubator for pan-European RI and GRI;
- to establish a European roadmap for RI (new and major upgrades, pan-European interest) for the coming ten to twenty year, stimulate the implementation of these facilities and update the Roadmap as the need arises[2];
- to ensure the follow-up of implementation of already on-going Projects after comprehensive assessment, as well as the prioritisation of the RI listed in the Roadmap[3].

The effective investment in and use of RI became one of the priorities in realising the European Research Area (ERA). The essential elements of the RI priority in the ERA are to:

- ensure national commitments to the implementation of the Roadmap;
- complete or launch construction by 2015 of 60% of the priority RI on the Roadmap;
- encourage EU Member States (MS) or Associated Countries (AC) to the EU Framework Programme for Research and Innovation to link their national RI roadmaps to the ESFRI Roadmap and smart specialisation strategies in the European Structural and Investment Funds (ESIF);
- set priorities for implementing the Roadmap and to provide advice and guidance to MS on overcoming legal, financial or technical obstacles to implementation;
- define common evaluation principles, impact-assessment criteria and monitoring tools to be applied in regional, national and EU programmes to help combine funds from different sources.

In 2014, the EC concluded[4] that "the importance of excellent RI for achieving excellent research is widely acknowledged, […] (but that) doubts were raised regarding whether some national (RI) roadmaps can really be considered roadmaps, as no specific plans were incorporated on how to achieve the targets set and coherent harmonised approaches are missing." The Competitiveness Council[5] "recognised the great efforts made by MS to strategically plan their investments in RI, noted the need for further coordination of country specific and European roadmaps on RI and of national funding decisions for the development and operation of RI, including those identified by ESFRI." Similarly, the Council also emphasised the need and importance of e-infrastructures. ESFRI thus is not only one of the seven ERA-related expert groups, but it also provides for a unique combination of scientific expertise and political competence to fulfil a strategic role at European and international level and has been a driving force for the alignment of national RI roadmaps.

[1] In June 2001, the Research Council invited "the EC - in close collaboration with the MS - to explore the establishment of new arrangements to support policies related to RI". The first meeting of ESFRI took place on 25th April 2002 in Brussels.

[2] Conclusions of the Competitiveness Council, 25th - 26th November 2004 and 21st - 22nd May 2007

[3] Conclusions of the Competitiveness Council, 11th December 2012

[4] EC (2014) Analysis of the state of play of the European Research Area in Member States and Associated Countries: focus on priority areas at http://ec.europa.eu/research/era/pdf/era-communication/analysis_of_the_state_of_play_of_era_vf20140826.pdf

[5] Council conclusions dated 5th December 2014 at http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/intm/146063.pdf

ESFRI since 2002 plays the leading role in the development of pan-European RI that provide tools to science to explore the frontiers of knowledge. The strategic role of ESFRI presents itself as follows:

- By regularly carrying out analysis of RI landscapes in five reference scientific domains, in addition to e-infrastructures[6]. ESFRI captures and describes the key RI defining the entire landscape, identifies gaps and enables stakeholders at institutional, regional, national, European and global level to position their RI initiatives within a broader context and identifies synergies and complementarities with existing RI to refine their strategic priority setting.
- ESFRI addresses the entire life cycle of RI with the aim of safeguarding long-term sustainability of the ESFRI RI portfolio and the effective and efficient use of - at often times - limited private and public funds. It thereby plays an important role in the reduction of barriers to multilateral and multi-organisational co-operation and development of options for joint funding of RI.
- ESFRI organises open calls for proposals, selects proposals based on strict eligibility criteria and reviews them in a clear and transparent manner through independent, international peer review; thus contributing to a balance within the ERA between the bottom-up design of RI and the subsequent strategic top-down prioritisation of a limited portfolio of pan-European RI. ESFRI reports directly to the Council where the ministers have acknowledged ESFRI`s role and value.
- ESFRI has developed and applies distinct and transparent evaluation, assessment, monitoring and periodic review mechanisms based on two independent processes, i.e. 1) the evaluation of the scientific case through the Strategy Workings Groups (SWG) and 2) the assessment of implementation through the Implementation Group (IG) – both processes being conducted in close cooperation with experts from the e-Infrastructure Reflections Group (e-IRG). In both cases, international and independent Reviewers are involved to provide advice, but ESFRI is solely and entirely responsible of the evaluation and assessment procedures and outcomes.
- ESFRI has also become an important point of reference for funding strategy for RI concerning national and EU funding instruments. It contributes to the alignment of RI decision making at regional, national and global level – particularly with a view on smart specialisation strategies and with national RI roadmap development.
- ESFRI has contributed to the creation of the European Charter for Access to Research Infrastructures[7] and is committed to improve this reference document in the future.
- Through regular and periodic monitoring of its entire RI portfolio, by providing constructive recommendations with distinct attention for the business case of its RI and by facilitating the exchange of information and the identification of best practice, ESFRI supports its RI to move towards implementation and promotes synergies and integration amongst them.
- By collaborating with the e-Infrastructure Reflection Group (e-IRG) on issues related to data management, data communication and other related matters, ESFRI ensures that the opportunities provided by the digitisation of research are fully included in its processes.
- By offering non-financial support to its RI portfolio, ESFRI facilitates the implementation of pan-European RI.
- ESFRI operates at the forefront of European and global science policy and contributes to its development translating political objectives into concrete advice for RI in Europe.

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[6] I.e. services for data communication, data storage and management, computing and data analysis, including implementations using e.g. communication networks, resources and high performance computing systems.

7 EC (2016) European Charter for Access to Research Infrastructures at https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf

DEFINITIONS

ESFRI engages in a fully transparent road mapping process with clearly stated rules and procedures. The definitions, models and methods described herein apply to Roadmap 2018 update.

RESEARCH INFRASTRUCTURE (RI)

The following definition for RI from Article 2 (6) of the Regulation (EU) No 1291/2013 of 11 December 2013: `Establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)` applies:

"RI are facilities, resources and services that are used by the research communities to conduct research and foster innovation in their fields. They include: major scientific equipment (or sets of instruments), knowledge-based resources such as collections, archives and scientific data, e-infrastructures, such as data and computing systems and communication networks and any other tools that are essential to achieve excellence in research and innovation."

Accordingly, RI are implemented along different organisational models, including central sources and laboratories for experiments and measurement sessions, coordination and management of geographically distributed observatories or laboratories, remotely accessible resources for computing, data banks, physical sample repositories, surveys and longitudinal studies. While the above definition captures the common features of RI, there are at least three types of RI, as defined below.

SINGLE-SITE RI

A single-site RI is a geographically localised central facility designed for user access whose governance - in the case of ESFRI - is European or international. A single-site RI needs to:

- have a legal status and governance structure with clear responsibilities and reporting lines, including international supervisory and relevant external advisory bodies;
- have an access policy[8] and access point for external users facilitating the submission of proposals through a user programme designed to absorb a considerable part of the total capacity of the RI;
- have a user support structure in place to optimise access, such as user's office space, ancillary laboratories, accommodation arrangements and logistics;
- have a data management system allowing for easy storage, retrieval of data and on-line/in-situ/remote data reduction and analysis;
- identify and agree upon relevant and measurable Key Performance Indicators (KPI) addressing both excellence of scientific services and sustainability issues;
- demonstrate a human resources policy to gather the necessary competences for its operation, hiring, equal opportunities, education and training.

[8] When drafting and deciding upon an access policy, please consider EC (2016) European Charter for Access to Research Infrastructures at https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf

DISTRIBUTED RI

A distributed RI consists of a Central Hub and interlinked National Nodes and needs to:

- have a unique specific name and legal status and governance structure with clear responsibilities and reporting lines, including international supervisory and appropriate external advisory bodies;
- have legally binding attributions of coordination competences and resources to the Central Hub;
- have a common access policy[9] and provide for a single point of access for all users with a support structure dedicated to optimise the access for the proposed research;
- have a user programme designed to absorb a considerable part of the total capacity of the RI;
- identify and agree upon relevant and measurable Key Performance Indicators (KPI) addressing both excellence of scientific services and sustainability of operation;
- have a human resources policy adequate to warrant the necessary competences for the effective operation of the Central Hub and to support the user's programme, and to encompass hiring, equal opportunities, secondments, education and training;
- define a joint investment strategy aimed at strengthening the RI through the Nodes and common/shared facilities.

These features characterise a distributed-RI and thus mark the difference with respect to coordinated research networks (international collaborations). The Nodes may be only partially absorbed by the distributed RI maintaining their national or institutional programmes, but the capacity and amount of resources devoted to the RI must be clearly identified, coordinated and managed by the Central Hub according to agreed statutes and common rules and procedures of the RI consortium.

Importantly, distributed RI must demonstrate a capability to attribute optimal personnel capacity and coordinating power to the Central Hub, therefore displaying:

1) a high level of integration of the National Nodes (such as a unique portal with thorough explanation and guidance towards the common access policy, harmonised and coherent IPR & data policies; adequate central resources; procurement and upgrading of technological infrastructure; human resources policy allowing for staff exchange and secondment);
2) added value compared with the merits of a research cooperation network open to external use. The Central Hub therefore must represent a truly international organisation capable of operating with a high level of efficiency and mediating across different scientific cultures.

GLOBAL RESEARCH INFRASTRUCTURE (GRI)

The GSO has defined GRI upon mandate by the G8+5[10] and recognises the vital role of GRI in addressing worldwide science and technology challenges and the benefits of coordinating investments in GRI to efficiently use the available resources and fully realise their potential benefits. GRI may be single-site or distributed RI and should follow the 'GSO Framework for Global Research Infrastructures'[10] approved by the GSO in 2014. The GSO updated a list[11] of potential GRI is continuously offering opportunities for matchmaking exercises. The GSO members can propose GRI

[9] https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf

[10] https://ec.europa.eu/research/infrastructures/pdf/gso_framework_for_global_ris.pdf

[11] https://www.bmbf.de/files/151109_G7_Broschere.pdf

candidates seeking for international partnership. GSO members, including the EC, can propose an ESFRI RI as potential GRI.

MAJOR UPGRADE

A major upgrade is an upgrade to an operational RI with the goal of delivering a transformative effect to its scientific outputs, or a substantial change of technical approach and does not mean routine maintenance or incremental gains. To that end, any applications to the Roadmap, which come under the category of upgrade, will be required to include robust justification describing the degree of upgrade. An existing RI planning a major upgrade can submit a proposal to become a Project.

PROJECTS

Projects are RI in their preparation phase, which have been selected for the excellence of their scientific case and for their maturity, according to a sound expectation that the Project will reach implementation phase within the ten-year term. They are included in the Roadmap in order to underline their strategic importance to the ERA and to support their timely implementation. The Projects can be at different stages of their development towards implementation, according to their respective date of inclusion in the Roadmap. ESFRI differentiates between the following participants:

- LEAD COUNTRY/ENTITY: MS, AC or EIROforum member, which leads the preparation of the RI.
- PROSPECTIVE MEMBER COUNTRIES/ENTITIES: MS, AC and third countries, which have submitted Expressions of political Support (EoS) signed by the national ministries responsible for RI, or other entities such as EIROforum members of which the mandated authorities have expressed interest to join the RI through a Council resolution.
- PARTICIPANTS: MS, AC and third countries neither being the lead country nor (prospective) member countries, but which host research institutions and international organisations formally involved in the consortium. Such countries may be observers to the RI.

LANDMARKS

Landmarks are RI that were implemented or reached the implementation phase under the Roadmap and that are established as major elements of competitiveness of the ERA. The Landmarks can already deliver science services and grant access, or can be in advanced stage of construction with a clear schedule for the start of operation. Landmarks need continuous support and advice for successful completion, operation and - when necessary - upgrade to ensure the provision of state-of-the-art services, optimal management and maximum return from the investment. To this end, the continuity, scope and effectiveness of the Landmarks are periodically reviewed. ESFRI differentiates between the following participants:

- LEAD COUNTRY/ENTITY: MS, AC or an EIROforum member, which leads the implementation/operation of the RI.
- MEMBER COUNTRIES/ENTITIES: MS, AC, third countries and other entity (-ies) such as EIROforum members, which are members of the legal entity by any formal agreement.
- PROSPECTIVE MEMBER COUNTRIES/ENTITIES: MS, AC and third countries, which have submitted EoS signed by the national ministries responsible for RI, or other entities such as EIROforum members of which the mandated authorities have expressed interest to join the RI through a Council resolution.

- PARTICIPANTS: MS, AC and third countries neither being the lead country nor (prospective) member countries, but which host research institutions and international organisations formally involved in the consortium. Such countries may be observers to the RI.

ESTIMATED AND REAL COSTS

CAPITAL VALUE (CV)

The Capital Value (CV) of a RI concerns the total assets of a RI or value of the investment for realising it. Sometimes a Replacement Value (RV) is quoted as the value of the RI, i.e. the amount that an entity would have to pay to replace that RI at the present time, according to its current worth. The actual depreciation of RI is typically compensated by constant upgrade so that a CV-RV should be calculated as a stable figure as far as a medium-long term perspective of operation of the RI, at state of the art performances, is foreseen. The CV-RV calculation should be reasonably straightforward for single-site RI. The CV-RV for distributed RI has to be evaluated taking into account the CV of the Central Hub as well as the CV-RV of the Nodes as per quota of participation in the distributed RI. So if a CV-RV is defined for a given node (national node, institutional node) and if the Node is contributing X% to the distributed RI then this X% of the node's CV-RV is added to the total CV-RV of the distributed RI. Special cases exist for which the above definitions may not easily apply: surveys, data banks or sample collections for example are nevertheless representing a CV as soon as their results become assets available to users and can be defined by a RV according to their current worth.

DESIGN COSTS

The design costs cover all costs (in-kind and cash) invested in the conceptual design and the design to feasibility, including the costs for drafting the proposal. They include specific budgets obtained to develop the project from institutional, national, European and international funds (such as Design Studies and Integration Actions of the EU Framework Programmes for Research and Innovation); labour of scientific, technical and managerial personnel dedicated to the project; prototype design and development; coordination of potential users, etc. At the time of submission of a proposal for the Roadmap, these costs actually all concern real costs.

PREPARATION COSTS

The preparation costs cover all real or estimated costs for the preparation phase of an RI, including the funding from a Preparatory Phase under the Framework Programmes and all other in-kind and cash third party contributions. Importantly, the preparation costs also cover all costs from a possible interim-phase following a Preparatory Phase project.

IMPLEMENTATION COSTS

The implementation costs cover the value invested in the implementation of the RI, including hiring personnel, acquiring the site and goods, construction costs, legal costs, coordination of users' communities, data management infrastructure costs, commissioning and pre-operation costs.

AVERAGE ANNUAL OPERATION COSTS

The average annual operation costs cover all costs of running the RI for one year, operating users' access and delivering scientific services as described by the project. They include all RI's costs (such as personnel, power, rents/mortgages, taxes, maintenance and continuous upgrade, users support, in-house scientific programme). Some operation cost may become CV (such as results of surveys or organised observational data).

MODELS AND METHODS

LIFECYCLE

ESFRI applies a life cycle approach coherent and consistent with RI funding under the EU Framework Programme for Research and Innovation (FP) and the GSO concerning GRI. Moreover, the lifecycle of a RI is a reference to understand the needs and targets of RI at a given time and at various levels.

The **concept development** of a RI typically emerges bottom-up where science communities cluster around well-identified scientific needs and develop a strategy to attract users and stakeholders. Such concept can originate from completely novel approaches to answering scientific questions, clear needs of enhanced capacity at pan-European level as well as from new insights in existing RI, e.g. resulting in a major upgrade or merger.

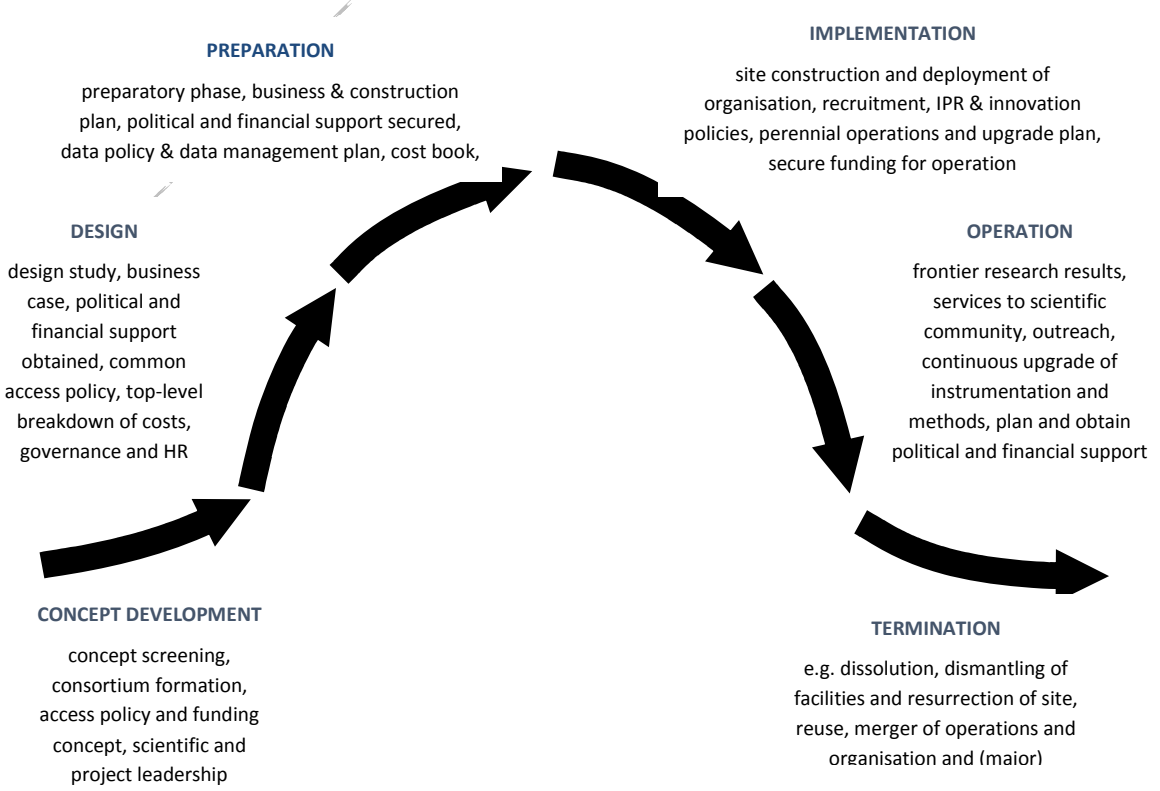
The **design** covers the proof of the scientific concept and the testing of its feasibility, the analysis of the potential user community (both science and innovation oriented), the outline of a business case and the formation of the consortium through a national or international *ad hoc* competitive project (e.g. Design and Feasibility Studies). The design also includes an initial analysis of the relations to other RI as critical success factors. Such an analysis includes a discussion on e-infrastructure requirements of the RI and the potential need of external e-infrastructure resources. Also, a policy regarding the RI required and generated data is outlined. Importantly, the consortium also gathers the financial and political support from governments and funding agencies necessary for the preparation phase.

The **preparation** - carried out at institutional, national, European or international level - is directed towards developing the RI as a fully-fledged organisation. The completion of the preparation of the RI in the Roadmap is usually carried out through a `Preparatory Phase` contract under FP resulting in a business plan, a legal entity, an agreed role for the RI also in the context of the landscape of existing RI at European and global level, and secured funding safeguarding the financial sustainability for the implementation and extending also for the operation. Some Projects face a gap of funding between the end of their Preparatory Phase and the final decisions for implementation (legal, funding and construction). Therefore, the signatory parties sometimes establish *ad hoc interim* legal entities and governance allowing to join the RI over a period of time. Such an **interim phase** - aimed at reaching full implementation - requires appropriate funding.

The **implementation of RI** differs between single-site and distributed RI. In case of **single-site RI**, it corresponds to an intense investment period of **construction** lasting several years during which human resources are devoted to the implementation and financial resources are largely transferred to the market (suppliers of goods and technologies). Longer-term benefits are generated to the hosting territory: employment, upgrade of services, internationalisation and up-skilling of the population, increased demand on high level services (schools, communication, financial services for international employees) and joint development of novel technologies that remain as a competitiveness legacy to the procuring firms. In the case of **distributed RI,** the above aspects may also apply concerning the setting up of a Central Hub or the construction or upgrade of one or more national nodes, but often the investment is less intense then in the case of single site facilities. The development of a successful governance and management structure may be of higher complexity than for single-site RI.

During its **operation**, a RI delivers advanced services for excellent science satisfying a steady demand and - where necessary - upgrading its instrumentation and methods. The RI has continuous demand for early career scientists, facilitating their training and development and boosts the ranking of the connected academic institutions. The RI can generate spin-offs and start-ups and attracts corporate partners generating a high potential for innovation as an effect of the concentration of highly trained individuals around the RI. These socio-economic effects also manifest for the Central Hub and the National Nodes of distributed RI enhancing the specialisation and effectiveness of multiple production sites. The operational costs of traditional single-site RI are typically around 8 to 12% of the initial capital investment per year - depending on the RI's energy consumption and level of dependence on manpower. Mobile RI, such as vessels, and many distributed RI and e-infrastructures - often have much higher operational cost, which is why sustainability during operation is a real issue for many of them. The operational costs of distributed RI include those related to the Central Hub as well as those incremental costs of the National Nodes which form the distributed RI. For single-site RI, typically a twenty-year cycle applies before major upgrades are needed, requiring new investment amounting to a significant fraction of the first capital investment. A special case regards computing, data storage and networking equipment and software: their upgrade cycles are much shorter because of rapid improvement in capability, energy efficiency, and market constraints. This is particularly important for the sustainability of e-infrastructures.

The **termination** differs greatly depending on the types of RI and their scope. It may encompass the dissolution of the organisation, the dismantling of facilities and the resurrection of the original state of the site. Such decommission does not apply to all areas and depends strongly on the type of RI as far as safety is concerned. The economic impact of decommission also depends on the type of RI concerning hazard and safety aspects. This terminal phase may also result in a merger of operations and organisations, reuse, a major upgrade or re-orientation of the RI. Re-orientation of RI sites has already occurred, e.g. in nuclear research or high-energy physics, where outdated RI have been transformed into analytical facilities with new scientific missions built upon the presence of a technological infrastructure, logistics, human resources and organisation.



EVALUATION OF SCIENTIFIC CASE

The goals of the scientific evaluation of proposals for the Roadmap (*ex ante*) and of Projects and Landmarks on the Roadmap (*ex post*) are to:

- evaluate which minimal key requirements along the four dimensions of the scientific case are met;
- assess future scientific plans;
- advise ESFRI on the strategic value of the proposals, Projects and Landmarks within the broader RI ecosystem;
- evaluate the potential of the proposals, Projects and Landmarks for further internationalisation as GRI in the context of the 'GSO Framework for Global Research Infrastructures'[12];
- identify links and complementarities among RI and the potential of integration;
- recognise e-infrastructure needs, including the integration of RI in open e-networks.

The SWG evaluate the scientific case along four dimensions:

1. scientific excellence;
2. pan-European relevance;
3. socio-economic impact;
4. e-needs.

The SWG evaluate the scientific case - taking into account aspects related to User Strategy & Access Policy, Preparatory Work and other dimensions as described under the assessment of implementation.

ASSESSMENT OF IMPLEMENTATION

The goals of the assessment of implementation of proposals, the Projects and Landmarks are to:

- assess which minimal key requirements along the eight dimensions of the implementation are met;
- assess future implementation plans;
- enable specific and targeted follow-up by ESFRI and support to the projects to move towards full implementation within the ten-year rule.

The Implementation Group (IG) assesses the implementation along eight dimensions:

1. stakeholder commitment;
2. user strategy & access policy;
3. preparatory work;
4. planning;
5. governance & management;
6. human resources policy;
7. finances;
8. risks.

When assessing the implementation, the IG takes the dimensions of the scientific case into account.

[12] GSO Framework for Global Research Infrastructures at https://ec.europa.eu/research/infrastructures/pdf/gso_framework_for_global_ris.pdf

MINIMAL KEY REQUIREMENTS ALONG DIMENSIONS AND LIFE CYCLE

ESFRI applies minimal key requirements on all dimensions described above and along the RI life cycle. For the scientific case, these are described in annex II and for the implementation in annex III. These minimal key requirements serve as the basis for the scoring in the evaluation and assessment. Meeting minimal requirements is mandatory, but not sufficient to be automatically listed in the Roadmap.

SCORING

The following scoring values are attributed to each dimension following the minimal key requirements described in the annexes II and III:

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

In order to be considered as a Project, a proposal must meet the key requirements for `preparation` and score a grading of at least `High` for both the scientific case and the implementation. In order to be considered as a Landmark, a Project must meet the key requirements for at least `implementation` and score a grading of at least `High` for both the scientific case and the implementation. The status of each RI on the Roadmap is a strategic decision of the Plenary Forum that takes into account the outcomes of the evaluations and assessments.

PRINCIPLES, CONFLICT OF INTEREST (COI) AND CONFIDENTIALITY

All evaluations and assessments must comply with the following four principles:

1. **Independence**, i.e. involved persons carry out the evaluations and assessments in a personal capacity and they represent neither their employer nor their country.
2. **Impartiality**, i.e. persons must treat all proposals, Projects and Landmarks equally and evaluate and assess them impartially on their merits, irrespective of their origin or the identity of the applicants and coordinators.
3. **Objectivity**, i.e. involved persons evaluate and assess each proposal or questionnaire as submitted; meaning on its own merit, not its potential if certain changes were to be made.
4. **Accuracy**, i.e. involved persons make their judgment solely against the formal evaluation and assessment criteria and the relevant ESFRI documentation.

ESFRI checks any CoI with all SWG and IG Members and with all external Reviewers, which must declare non-conflict of interest and confidentiality on the proposals, Projects or Landmarks they are evaluating and assessing. A CoI may arise, in particular, due to science competition, scientific and economic interests, political or national affinities, family or emotional ties, or any other relevant connection or shared interest. Strict rules for confidentiality apply.

ROADMAP 2018 UPDATE

With the Roadmap 2018, ESFRI will update the strategy on European RI. It will cover:

- landscape of RI in Europe and globally;
- gaps in the European RI ecosystem;
- new pan-European RI Projects;
- synergies with regional, national, European and international RI and strategies for optimal use;
- links between and integration of RI;
- e-infrastructure needs and integration of RI in open e-networks;
- continuous upgrade (if necessary), long-term sustainability and end of life perspectives;
- innovation potential and socio-economic benefit analysis;
- GRI opportunities and science diplomacy aspects – where appropriate.

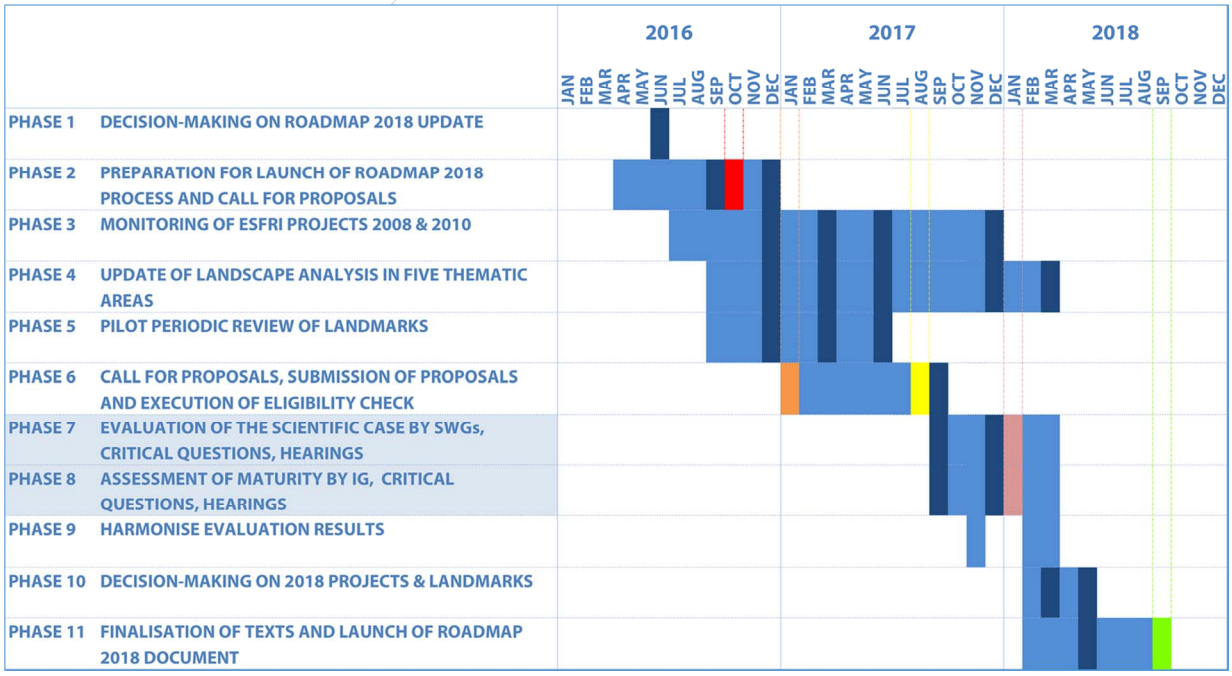
The following generic considerations and rules apply for the Roadmap 2018:

- ESFRI will continue to strengthen its strategic role.
- The Roadmap will contain up to 25 Projects.
- ESFRI will validate all information on stakeholder support and financial commitments - including the inclusion in national RI roadmaps - with the active role of the ESFRI Delegations and the Council Chairs of the EIROforum members.

In order to realise the Roadmap 2018, ESFRI will:

a. update the Landscape Analysis;
b. monitor all 2008 and 2010 Projects;
c. pilot the periodic review of a limited number of Landmarks;
d. evaluate proposals and decide upon new Projects;
e. monitor and evaluate and the effectiveness and efficiency of its methods and procedures, including definitions and models

The following overall planning applies:



LANDSCAPE ANALYSIS

The Landscape Analysis is a key ingredient of the Roadmap 2018. It provides an overview of the European RI ecosystem by identifying the main RI operating transnational access in Europe, in all fields of research, and major new or ongoing projects, as well as an outlook to the global landscape of relevance. This includes national, regional, international facilities and consortia that offer integrated services and transnational access to state-of-the-art resources for research. The Landscape Analysis is a reference document and does not imply a prioritisation by ESFRI nor any national financial and political commitments. The SWG draft the Landscape Analysis broadening the view of ESFRI beyond the RI in its Roadmap. The thorough knowledge of the RI Landscape and of its dynamics is a prerequisite for developing optimal strategies in the field of RI aimed at strengthening the competitiveness and value (excellence and impact) of European research. The goals of the Landscape Analysis are to:

- provide a survey on major transnational RI offering open access to researchers, students, teachers, support staff, education and research institutions, business, industries and public services in all domains;
- keep track of the developments and trends from thematic roadmaps and strategy papers;
- understand the complementarity and effectiveness of interfaces between RI, also across areas;
- provide an overview of the European RI ecosystem enabling ESFRI to fulfil its strategic and incubator roles;
- enable ESFRI to identify gaps in the European RI landscape and promote inter- and cross-disciplinary aspects;
- help the involved governments to position their RI in the global RI landscapes;
- update evidence on the overall value and sustainability issues of the operational RI.

In addition to the Landscape Analyses provided by the five SWG, the e-IRG provides a Landscape Analysis for European e-infrastructures, including a description of the interaction between e-infrastructures and other RI and research efforts.

MONITORING 2008 AND 2010 PROJECTS

Monitoring is used to describe the evaluation of the scientific case and assessment of implementation of the Projects on the Roadmap. The goals of the monitoring of the 2008 and 2010 Projects are to:

- check the overall progress towards implementation, i.e. to what degree they fulfil the minimal key requirements for the phases of lifecycle and what the plans are for reaching full implementation;
- check and report on whether and how the Projects have addressed the conclusions and followed up on the recommendations from the 2015 assessment of implementation;
- propose a status, conclusions and recommendations on the Projects to the Plenary Forum, including the possible transition from Project to Landmark;
- update all public information on the Projects for the Roadmap 2018.

ESFRI will monitor the Projects along the following considerations:

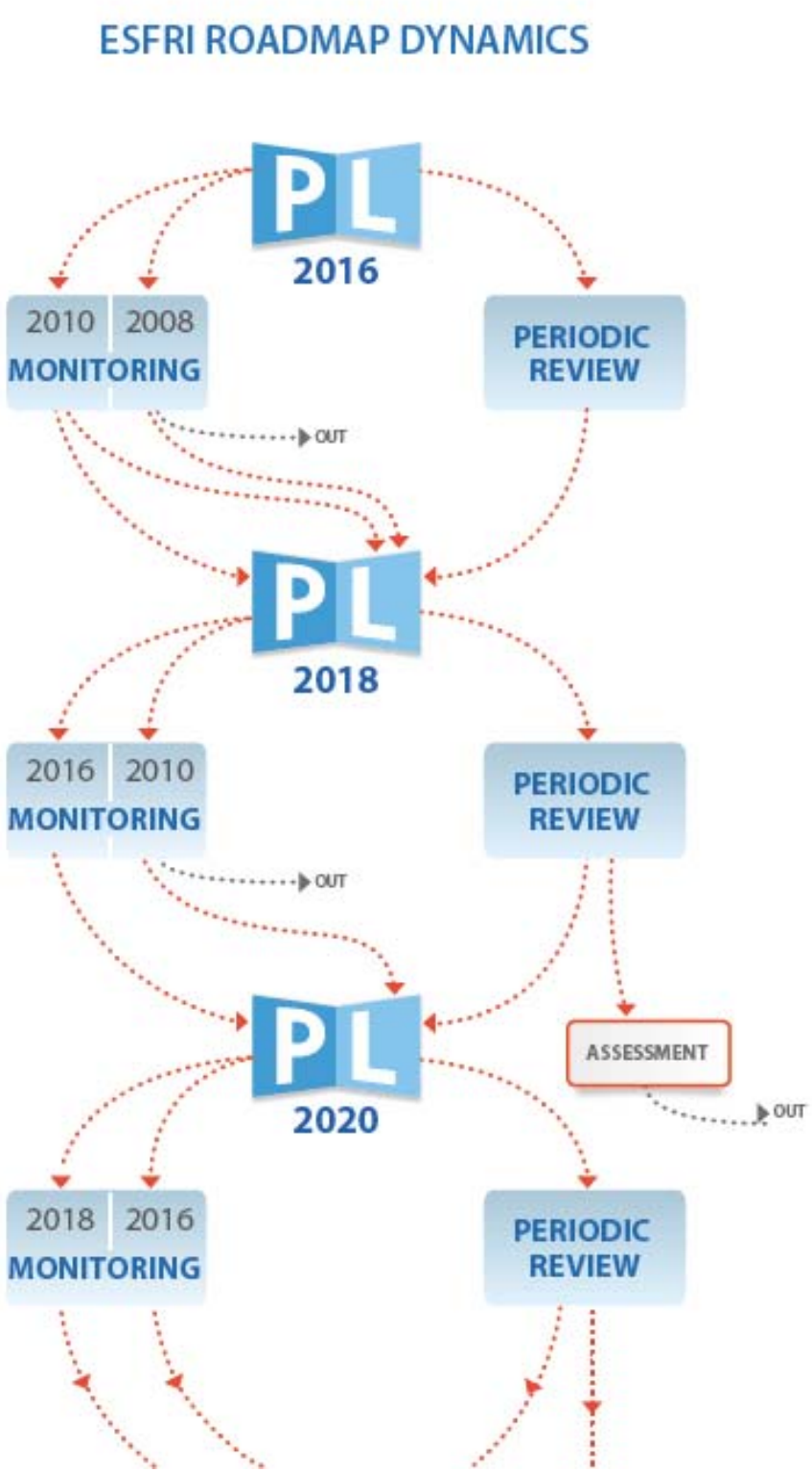
- The monitoring involves an evaluation of the scientific case of each Project and an assessment of implementation - when relevant - following up on prior conclusions and recommendations. SWG and IG together draft a specific questionnaire per Project addressing generic and specific aspects of the scientific case and implementation.
- The ten-year term will expire for the 2008 Projects and they will not appear as Projects in the Roadmap 2018.
- Those 2008 Projects that have successfully reached the implementation may be evaluated with respect to the requirements of Landmarks.
- Any Project that wants to be re-considered after ten years on the ESFRI Project list, must re-apply, as a new proposal clearly overcoming the bottlenecks that prevented its implementation. In such case, the Project will be competing - on equal footing - with all other new proposals applying to the Roadmap.
- ESFRI will not monitor the six 2016 Projects.

PILOT PERIODIC REVIEW LANDMARKS

ESFRI will perform a periodic review of four Landmarks, as a pilot exercise only and without consequence for their Landmark status. The purpose of the exercise is to test the process of periodic review. Periodic review refers to the evaluation of the scientific case and the assessment of implementation of the Landmarks on the Roadmap. The goals of this pilot periodic review of Landmarks are to:

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

In order to avoid duplication of efforts the ESFRI will investigate to what degree the Landmarks are willing to share (internal and other external) evaluation and assessment results - e.g. from their Scientific Advisory Committee as complementary information of high interest for the periodic review. ESFRI will decide upon the frequency of periodic review of Landmarks in the future - a decision that will also be informed by the outcome of the pilot.


ESFRI ROADMAP DYNAMICS
PL
2016
2010
2008
MONITORING
PERIODIC REVIEW
OUT
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2018
2016
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PERIODIC REVIEW
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2020
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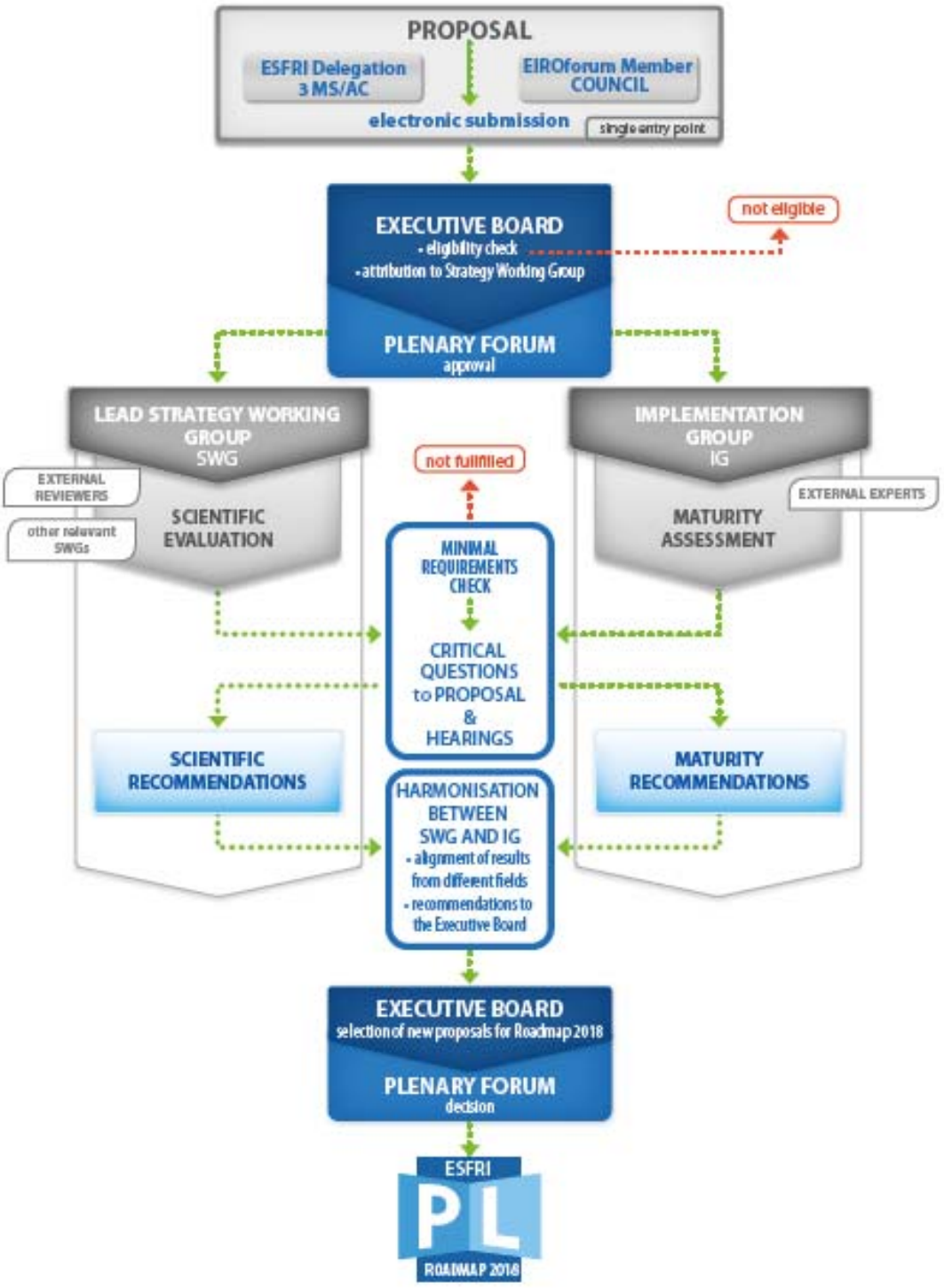
PERIODIC REVIEW

SUBMISSION AND EVALUATION OF PROPOSALS

The following diagram summarises the submission and evaluation of proposals:



SUBMISSION OF PROPOSALS

The following rules and considerations apply for the submission of proposals:

- The Secretariat will provide a password protecting the data-entry into the online submission form in EU Survey to the ESFRI Delegations and the EIROforum members exclusively. This password is for the internal use of the Delegations and EIROforum members only.
- Only ESFRI Delegations and EIROforum members may upload proposals and may do so up to the deadline for submission on 31st August 2017 at 18:00 CET. Proposers will act as a first filter before submission confirming the necessary stakeholder commitment.
- National procedures may be in place for submissions to the Roadmap 2018, which may have earlier deadlines.
- New Projects must demonstrate an adequate maturity level, i.e. a proposal must:
  1. have successfully completed a design/feasibility study;
  2. have planned its business case/delivery strategy;
  3. provide proof of political support, i.e. Expression of political Support (EoS) by the lead country and at least two additional MS and AC signed by the national ministries responsible for RI[13] (in case of an EIROforum member commitment a Council resolution);
  4. provide proof of financial commitment, i.e. Expression of Commitment (EoC) to financially contribute to the preparation and implementation phases by an authority[14] from the lead country (in case of an EIROforum member the financial commitment should be explained in the Council resolution);
  5. provide proof of an inter-institutional and multi-lateral agreement, e.g. a Memorandum of Understanding (MoU) signed by the core partners - being research institutions - formally involved in the consortium.

The online submission form consists of three parts to be fully completed and allow for a limited number of essential attachments:

PART A: GENERAL INFORMATION is used for the eligibility check by the EB and – if selected - for the public description of the Project in the Roadmap 2018.

PART B: SCIENTIFIC CASE and PART C: IMPLEMENTATION are used by the SWG to evaluate the scientific case of the proposal and by the IG to assess its implementation.

ELIGIBILITY CHECK AND ASSIGNMENT TO SWG

The EB will check whether the proposals are complete, submitted within the deadline, written in English and compliant with the requested stakeholder commitment, and proposes to the Plenary Forum a list of eligible proposals and their assignment to the SWG.

EVALUATION OF SCIENTIFIC CASE AND ASSESSMENT OF IMPLEMENTATION

The SWGs evaluate the scientific case of all proposals and the IG assesses their implementation and present their conclusions and recommendations to the EB.

[13] The ESFRI Delegation will validate such EoS.

[14] Any legal entity from a MS, AC or third country that can take binding decisions to financially support the RI can submit an EoC. It may concern a regional or national government (agency), an umbrella organisation negotiating and redistributing funding on behalf of its members, a Research Funding Organisation (RFO) or a Research Performing Organisation (RPO).

HARMONISATION OF CONCLUSIONS AND RECOMMENDATIONS

Harmonisation of the conclusions and recommendations occurs at various stages in order to:

- identify which proposals - if any - are uncompetitive and thus will not be invited for a hearing and thus no longer be considered as possible Projects;
- draft and agree on specific questions for clarification by the applicants of the (remaining) proposals during dedicated hearings;
- ensure coherence and consistency between all evaluation and assessment results;
- achieve consensus on proposed status, conclusions and recommendations.

RECOMMENDATION TO PLENARY FORUM AND FINAL DECISION

The EB will consider the draft conclusions and recommendations with respect to the strategic role of ESFRI, the added value, the balance between the different thematic domains, the new opportunities for the ERA, and the potential as GRIs. The Plenary Forum will discuss the status, the conclusions and the recommendations per proposal and will decide upon new Projects taking the Landscape Analysis and recommendations of the EB into account.

ANNEX I: LIST OF ABBREVIATIONS

ABBREVIATION	MEANING
AC	Associated Country to EU Framework Programme for Research and Innovation
CoI	Conflict of Interest
CV	Capital Value
DG	Drafting Group
DMP	Data Management Plan
EB	Executive Board
EC	European Commission
EoC	Expression of Commitment
EoE	Exchange of Experience Workshop
EoS	Expression of Support
EOSC	European Open Science Cloud
ERA	European Research Area
ESFRI	European Strategy Forum on Research Infrastructures
ESIF	European Structural and Investment Funds
EU	European Union
FP	EU Framework Programme for Research and Innovation
GRI	Global Research Infrastructure
GSO	Group of Senior Officials mandated by G8+5 to develop GRI concept
GSF	Global Science Forum
e-IRG	e-Infrastructure Reflection Group
ICRI	International Conference on Research Infrastructures
IG	Implementation Group
I3	Integrated Infrastructure Initiatives
KPI	Key Performance Indicator
LoI	Letter of Intent
MS	EU Member State
MoU	Memorandum of Understanding
OECD	Organisation for Economic Cooperation and Development
RI	Research Infrastructure
RFO	Research Funding Organisation
RoP	Rules of Procedures
RPO	Research Performing Organisation
RV	Replacement Value
SWG	Strategy Working Group
SWG ENER	Strategy Working Group Energy
SWG ENV	Strategy Working Group Environment
SWG H&F	Strategy Working Group Health & Food
SWG PSE	Strategy Working Group Physical Sciences & Engineering
SWG S&CI	Strategy Working Group Social & Cultural Innovation
ToR	Terms of Reference

ANNEX II: LIST OF MINIMAL KEY REQUIREMENTS FOR SCIENTIFIC CASE

The following table contains the **minimal key requirements** to a phase in the life cycle of RI on the four dimensions of the scientific case:

	PHASE				
	DESIGN	PREPARATION*	IMPLEMENTATION**	OPERATION	TERMINATION
SCIENTIFIC EXCELLENCE	– long term science programme defined – scientific community well-established – scientific leadership described	– scientific vision and mission outlined – (multidisciplinary) scientific new frontier outlined – scientific leadership recruited – science concept tested and found feasible – services for the scientific community described	– vision, mission and identity fully defined – positioning in RI landscape fully described and multidisciplinary scientific new frontier established – scientific leadership consolidated – services delivered to scientific community by national nodes	– vision, mission and identity consolidated – leading RI landscape and multidisciplinary scientific new frontier achieved – scientific leadership and impact visible at global level – continuous upgrade planned and undertaken - if relevant	–
PAN-EUROPEAN RELEVANCE	– pan-European approach for scientific area outlined – targeted user community is pan-European – national/international facilities with complementary or synergistic potential	– case for European added value defined – research capacity and current/potential geographical distribution defined – links to relevant RI and other large pan-European programmes identified – technical maturity and feasibility tested and achieved – availability of scientific human resources proven – distinct pan-European user community involved	– case studies or other evidence of emerging European-added value achieved – research capacity and geographical distribution consolidated – joint strategies, common services with relevant RI and other large pan-European programmes being implemented – distinct pan-European user community consolidated	– European added value consistently being delivered – research capacity and geographical distribution consolidated/expanding – common services with relevant RI and other large pan-EU programmes in place	–
SOCIO-ECONOMIC IMPACT	– relevance to societal challenges identified and potential economic impact predicted	- case for impact made: investments into new RI, increased efficiency by use of facilities at pan-European level, employment, influx of external researchers at the locations, enabling technology development, other types of benefits such as services for society, cultural aspects and attraction of business, industry and public services etc.	– socio-economic impact cases emerging – capacity building impact proven – contributing to tackling the societal challenges – ability to develop an open innovation culture established	– impact demonstrated consistently – new communities involved – private users involved – policies on key societal challenges, e.g. climate change, influenced	–

E-NEEDS	– vision on e-infrastructure requirements, including access policy and security measures ready – interfacing with communication networks or distributed calculation or HPC/HTC	– conceptual design of e-infrastructure ready – contributions of e-infrastructure resources at all levels (institutional, regional, national, international) described – access policy and Data Management Plan (DMP) outlined	– technical design of e-infrastructure ready and approved – draft operational planning for e-infrastructure service delivery – agreements with parties delivering core e-infrastructure services (Central Hub) drafted – access policy and DMP approved, including plan for sustainability of data – security policy defined and approved	– operational planning ready and approved – agreements with service provisioning parties signed – DMP implemented and security policy deployed	– deployed sustainability of data beyond decommissioning

Texts in blue only apply to single-site RI.

Texts in green only apply to distributed RI.

* Proposals that meet the minimal key requirements for `preparation` from the perspective of the evaluation of the scientific case may be considered as Projects.

** Projects that through an evaluation of the scientific case meet at least the minimal key requirements for `implementation` may be considered as Landmarks.

ANNEX III: LIST OF MINIMAL KEY REQUIREMENTS FOR IMPLEMENTATION

The following table contains the **minimal key requirements** to a phase in the life cycle of RI on the eight dimensions of the assessments of implementation:

	PHASE				
	DESIGN	**PREPARATION***	**IMPLEMENTATION**	**OPERATION**	**TERMINATION**
STAKEHOLDER COMMITMENT	– institutional Letters of Intent (LoI) signed – formal agreement amongst partners for design study agreed upon (e.g. Consortium Agreement)	– provide proof of political support, i.e. Expression of political Support (EoS) by the lead country and at least two additional MS and AC signed by the national ministries responsible for RI (in case of an EIROforum member commitment a Council resolution) – provide proof of financial commitment, i.e. Expression of Commitment (EoC) to financially contribute to the preparation and implementation phases by an authority from the lead country (in case of an EIROforum member the financial commitment should be explained in the Council resolution) – provide proof of an inter-institutional and multi-lateral agreement, e.g. a Memorandum of Understanding (MoU) signed by the core partners - being research institutions - formally involved in the consortium – clear idea about how to gather necessary commitments at institutional and governmental level	– RI (Central Hub and National Nodes) included in all relevant national RI roadmaps or similar political documents – commitment of a) MS and AC and b) core institutes and partners secured through signed legally binding document (e.g. statutes) – role and funding of Central Hub agreed in legally binding document (e.g. statutes)	– budget expressing intention to financially support operation and use for at least five years by all countries involved agreed – break-down of budget of nodes and relative resources with respect to their (potential) double accounting as national RI and nodes of international RI	– institutional, political and financial commitment on major upgrade/decommission/merger obtained
USER STRATEGY & ACCESS POLICY	– vision about user community, access units and access modes described	– User Strategy agreed and possibilities to develop a reasonably sized user community described considering costs common access policy described (incl. types of access units for different user groups, strategy for exploitation and IPR) – survey executed demonstrating expected user community and description of it in	– user community in terms of origin and size consolidated – plans for advanced training of professional scientists, engineers and data managers agreed and approved – common access policy – including embedding in international research programmes, pricing policy and quality assurance - agreed and	– operational single entry point for access established – Assistance to users for optimising proposals – IPR policies, protocols and organisation for data handling and access fully established – dissemination programmes	– data (policy) and IPR issues settled

		terms of origin and size – and services based on a clear identification of demands and needs – Single entry point for users outlined	approved – organisational structure and procedure for regulating access – including single entry point for users - decided and approved	are in place, including approved IPR and innovation actions – National Nodes disseminate and apply common standards and protocols for user access	
PREPARATORY WORK	– concept screening successfully completed and described in a conceptual design	- design study successfully completed - clear business case/delivery strategy developed - clear idea about how to tackle technological and construction issues	– preparatory phase successfully completed – sound and reviewed business plan agreed – all investment decisions for implementation have been effectively taken and those for operation are clearly planned – communication programmes are in place – decision on site taken – building licence obtained – procurement strategy clearly identified and procurement task force in place – tenders and commitments to fund construction approved – interest in responding to tender for construction OR construction started – decision on hosting of central hub taken – services to users at national level and services from Central Hub to National Nodes delivered	– achieving research results – delivering relevant services to scientific community – utilisation of RI monitored and reported – continuous upgrade (if necessary)/update plans to improve/reach full capacity in a staged process are decided and approved – construction effectively completed – provision of planned services secured	– plans for decommission/major upgrade/merger decided and approved
PLANNING	– overall project plan for design study with major milestones and deliverables approved	– detailed plan for preparation and implementation approved, including relevant investment decisions – overall plan for operation and decommission approved	– detailed plan for scientific, technical and organisational implementation validated	– medium term operations and upgrade plan approved – procedure to winding up applied	– detailed and validated plan for decommission, major upgrade or merger approved
GOVERNANCE & MANAGEMENT	– project organisation approved – scientific leadership and project manager identified	– satisfactory project organisation for preparation and implementation with clearly defined skills, responsibilities and reporting lines approved – measurable and satisfactory Key Performance Indicators identified – governance for operation with clearly defined responsibilities and reporting lines outlined, including Supervisory and other	– legal entity established – organisation for implementation in place – Key Performance Indicators for operation, management, administration and facilitation agreed	– planning and reporting mechanisms in place	– organisation of decommission/merger/upgrade approved

		Advisory Boards (including Ethical Board if appropriate)			
HUMAN RESOURCES POLICY	– staff required for design study identified and available	– satisfactory and timely staffing plan for preparation approved – qualified project management and clear reporting structure for preparation approved – human resources policy for implementation and operation to gather necessary competences, hiring, equal opportunities, secondments, education and training outlined	– key managers and staff for implementation recruited and necessary skills trained – viable organisation for operation with adequate staffing and independent monitoring approved – human resources policy to gather necessary competences for operation, hiring, equal opportunities, secondments, education and training approved	– staff for operation and management recruited and necessary skills trained – all human resources policies and instruments in place	– organisation and social plan for decommission approved
FINANCES	– funding concept and potential partners (e.g. nature of partnership, in-kind versus cash) contributions outlined – budget for design study approved	– top-level breakdown of cost elements with overall order of magnitude estimates (including for Central Hub, National Nodes and main upgrades) – estimates and confidence levels available for each element – funding opportunities identified – in-kind contribution policy outlined	– formal commitment for funding of implementation obtained – cost book with costs based on supplier discussions or quotes and accounting principles approved – financial reporting set up – Work Packages and in-kind contributions fully detailed and centrally budgeted – validated projection on operation costs for at least five years and agreement on how to cover them – costs for decommission identified – funding for Central Hub and firm projection on operation costs for at least five years	– funding for operation secured – auditing of accounting and budget systems in place	– budget for decommission/merger/major upgrade approved and covered
RISKS	– conceptual ideas about scientific, technological, political and financial risks	– identification of major risks involved and mitigation strategies described	– detailed risk inventory established and mitigation measures for implementation in place	– risk management and mitigation policies for operation in place	– risks involved in decommission/upgrade/merger described and mitigation strategies in place

Texts in blue only apply to single-site RI.
Texts in green only apply to distributed RI.
* Proposals that meet the minimal key requirements for `preparation` from the perspective of the assessment of maturity may be considered as Projects.
** Projects that through an assessment of implementation meet at least the minimal key requirements for `implementation` may be considered as Landmarks.