Status of Environmental RIs in Europe: EU and ESFRI perspectives

ROLE OF ESFRI

The European Strategy Forum on Research Infrastructures (ESFRI) was established in 2002 with a mandate from the Council of the European Union to:

- **support a coherent and strategy-led approach to policy-making on research infrastructures in Europe**
- **facilitate multilateral initiatives leading to the better use and development of research infrastructures**

ESFRI brings together representatives of Ministers of the 28 Member States, 12 Associated States, and of the European Commission that are the decision makers and financers of the ESFRI Research Infrastructures

-upon mandate of Competitiveness Council of the European Union, ESFRI has completed the ESFRI Roadmap 2018 and starts now the update process that will lead to the ESFRI Roadmap 2021

ROLE OF EU - RI

- To **open access** to the research infrastructures existing in the individual Member State to all European researchers
- To **avoid duplication of effort** and to coordinate and rationalise the use of these research infrastructures
- To trigger the **exchange of best practice**, develop **interoperability** of facilities and resources, develop the **training** of the next generation of researchers
- To **connect national research communities** and increase the overall quality of the research and innovation
- To **help pooling resources** so that the Union can also acquire and operate research infrastructures at **world level**
- To become an **international** partner

Strategic orientations

Long-term sustainability *of pan European Research Infrastructures (RIs): life cycle approach*

Interoperability *- European Open Science Cloud*

EU landscape: ***integrating/opening*** *RIs of European interest*

RIs for Open ***Innovation***

Training *(incl. RI managers)*

Global *dimension*

LTS: key issues for an action plan (1)

Synchronizing *RIs national roadmaps / budgets*

*Making RIs available more broadly (**cross-border access** schemes)*

*Fostering links **RI – Industry** (large-scale pilots involving RIs and industry)*

*Exploiting better **data** from European RIs*

*Putting in place effective **governance** mechanisms at European level*

LTS: key issues for an action plan (2)

*Making better use of the European Structural Investment Funds (**ESIF**), the European Fund for Strategic Investments (**EFSI**), and the **InnovFin** – EU Finance for Innovators programme for developing RIs*

*Promoting the **international outreach** of RIs, using them as flagships for European science policy*

The 2018 ESFRI Roadmap

European Commission

37 Landmarks

ESFRI PROJECTS

	NAME	FULL NAME	TYPE	LEGAL STATUS (Y)	ROADMAP ENTRY (Y)	OPERATION START (Y)	CONSTRUCTION COSTS (M€)	OPERATION COSTS (M€/Y)
ENERGY	EU-SOLARIS	European Solar Research Infrastructure for Concentrated Solar Power	distributed		2010	2020*	6	0.2
	IFMIF-DONES	International Fusion Materials Irradiation Facility - DEMO Oriented NEutron Source	single-sited		2018	2029*	420	50
	MYRRHA	Multi-purpose hYbrid Research Reactor for High-tech Applications	single-sited		2010	2027*	1.352	74
	WindScanner	European WindScanner Facility	distributed		2010	2021*	6.1	2
ENVIRONMENT	ACTRIS	Aerosols, Clouds and Trace gases Research Infrastructure	distributed		2016	2025*	190	50
	DANUBIUS-RI	International Centre for Advanced Studies on River-Sea Systems	distributed		2016	2022*	222	28
	DiSSCo	Distributed System of Scientific Collections	distributed		2018	2025*	69.4	12.1
	eLTER	Long-Term Ecosystem Research in Europe	distributed		2018	2026*	94	35
HEALTH & FOOD	AnaEE	Infrastructure for Analysis and Experimentation on Ecosystems	distributed	ERIC Step1, 2018	2010	2019*	1.1	0.8
	EMPHASIS	European Infrastructure for Multi-scale Plant Phenomics and Simulation	distributed		2016	2021*	73	3.6
	EU-IBISBA	Industrial Biotechnology Innovation and Synthetic Biology Accelerator	distributed		2018	2025*	11	65.1
	ISBE	Infrastructure for System Biology Europe	distributed		2010	2019*	10	5.2
	METROFOOD-RI	Infrastructure for promoting Metrology in Food and Nutrition	distributed		2018	2019*	78.8	31
	MIRRI	Microbial Resource Research Infrastructure	distributed		2010	2021*	0.8	0.7
PHYSICAL SCIENCES & ENGINEERING	EST	European Solar Telescope	single-sited		2016	2029*	200	12
	KM3NeT 2.0	KM3 Neutrino Telescope 2.0	distributed		2016	2020*	151	3
SOCIAL & CULTURAL INNOVATION	E-RIHS	European Research Infrastructure for Heritage Science	distributed		2016	2025*	20	5
	EHRI	European Holocaust Research Infrastructure	distributed		2018	2022*	0.8	2
DIGIT	PRACE	Partnership for Advanced Computing in Europe	distributed		2006	2010	500	60

18 Projects

ESFRI LANDMARKS

NAME	FULL NAME	TYPE	LEGAL STATUS (Y)	ROADMAP ENTRY (Y)	OPERATION START (Y)	CAPITAL VALUE (M€)	OPERATION COSTS (M€/Y)
ECCSEL ERIC	European Carbon Dioxide Capture and Storage Laboratory Infrastructure	distributed	ERIC, 2017	2008	2016	1.000	0.85
JHR	Jules Horowitz Reactor	single-sited		2006	2022*	1.800	NA
EISCAT_3D	Next generation European Incoherent Scatter radar system	single-sited	EISCAT Scientific Association, 1975	2008	2022*	123	5.1
EMSO ERIC	European Multidisciplinary Seafloor and water-column Observatory	distributed	ERIC, 2016	2006	2016	100	20
EPOS	European Plate Observing System	distributed	ERIC Step2, 2018	2008	2020*	500	18
EURO-ARGO ERIC	European contribution to the International Argo Programme	distributed	ERIC, 2014	2006	2014	10	8
IAGOS	In-service Aircraft for a Global Observing System	distributed	AISBL, 2014	2006	2014	9.2	7
ICOS ERIC	Integrated Carbon Observation System	distributed	ERIC, 2015	2006	2016	116	24.2
LifeWatch ERIC	e-Infrastructure for Biodiversity and Ecosystem Research	distributed	ERIC, 2017	2006	2017	150	12
BBMRI ERIC	Biobanking and BioMolecular Resources Research Infrastructure	distributed	ERIC, 2013	2006	2014	195	3.5
EATRIS ERIC	European Advanced Translational Research Infrastructure in Medicine	distributed	ERIC, 2013	2006	2013	500	2.5
ECRIN ERIC	European Clinical Research Infrastructure Network	distributed	ERIC, 2013	2006	2014	5	5
ELIXIR	A distributed infrastructure for life-science information	distributed	ELIXIR Consortium Agreement, 2013	2006	2014	125	95
EMBRC ERIC	European Marine Biological Resource Centre	distributed	ERIC, 2018	2008	2017	164.4	11.2
ERINHA	European Research Infrastructure on Highly Pathogenic Agents	distributed	AISBL, 2017	2008	2018	5.8	0.7
EU-OPENSCREEN ERIC	European Infrastructure of Open Screening Platforms for Chemical Biology	distributed	ERIC, 2018	2008	2019*	82.3	1.2
Euro-BioImaging	European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences	distributed	ERIC Step2, 2018	2008	2016	90	1.6
INFRAFRONTIER	European Research Infrastructure for the generation, phenotyping, archiving and distribution of mouse disease models	distributed	GmbH, 2013	2006	2013	180	80
INSTRUCT ERIC	Integrated Structural Biology Infrastructure	distributed	ERIC, 2017	2006	2017	400	30
CTA	Cherenkov Telescope Array	single-sited	gGmbH, 2014	2008	2024*	400	20
ELI	Extreme Light Infrastructure	distributed	AISBL, 2013	2006	2018	850	80
ELT	Extremely Large Telescope	single-sited	ESO#	2006	2024*	1120	45
EMFL	European Magnetic Field Laboratory	distributed	AISBL, 2015	2008	2014	170	20
ESRF EBS	European Synchrotron Radiation Facility Extremely Brilliant Source	single-sited	ESRF#	2016	2023*	128	82
European Spallation Source ERIC	European Spallation Source	single-sited	ERIC, 2015	2006	2025*	1.843	140
European XFEL	European X-Ray Free-Electron Laser Facility	single-sited	European XFEL#	2006	2017	1.490	118
FAIR	Facility for Antiproton and Ion Research	single-sited	GmbH, 2010	2006	2025*	NA	234
HL-LHC	High-Luminosity Large Hadron Collider	single-sited	CERN#	2016	2026*	1.408	136
ILL	Institut Max von Laue-Paul Langevin	single-sited	ILL#	2006	2020*	188	97
SKA	Square Kilometre Array	single-sited		2006	2027*	1.000	77
SPIRAL2	Système de Production d'Ions Radioactifs en Ligne de 2e génération	single-sited	GANIL	2006	2019*	281	6
CESSDA ERIC	Consortium of European Social Science Data Archives	distributed	ERIC, 2017	2006	2013	117	39
CLARIN ERIC	Common Language Resources and Technology Infrastructure	distributed	ERIC, 2012	2006	2012	NA	14
DARIAH ERIC	Digital Research Infrastructure for the Arts and Humanities	distributed	ERIC, 2014	2006	2019*	NA	0.7
ESS ERIC	European Social Survey	distributed	ERIC, 2013	2006	2013	NA	2.5
SHARE ERIC	Survey of Health, Ageing and Retirement in Europe	distributed	ERIC, 2011	2006	2011	250	18
PRACE	Partnership for Advanced Computing in Europe	distributed	AISBL, 2010	2006	2010	500	60

European Commission

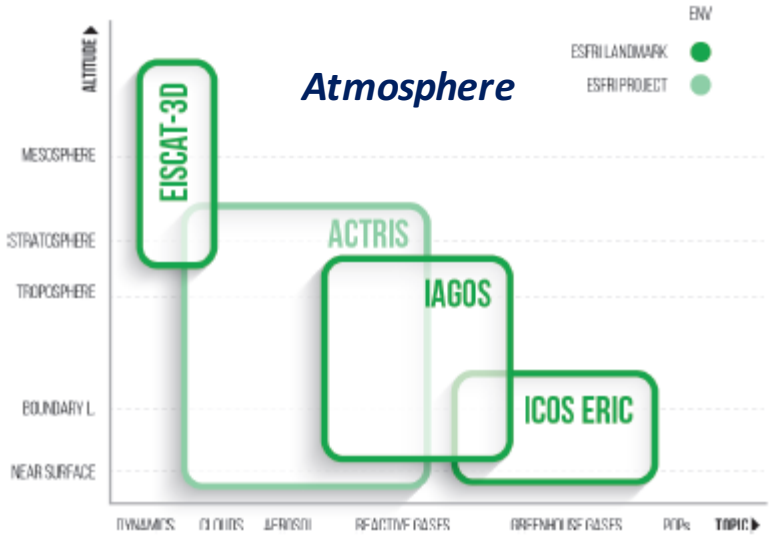
ENVIRONMENT

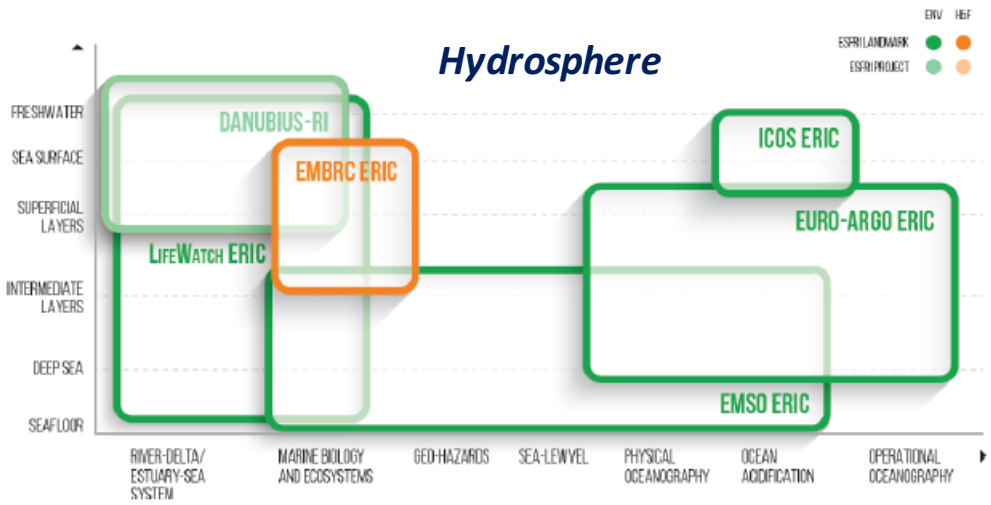
Environmental sciences are traditionally divided into four research and study domains: **ATMOSPHERE**, **HYDROSPHERE**, **BIOSPHERE** and **GEOSPHERE**. These different *spheres* are closely interlinked, and therefore, environmental sciences can also be presented according to *Grand Challenges*, such as loss of biodiversity, pollution, depletion of natural resources, risks, hazards and climate change.

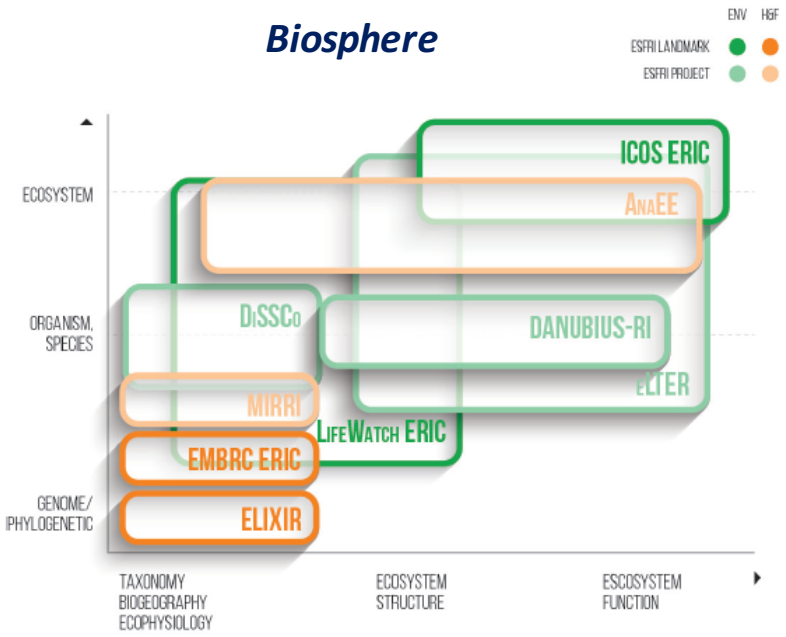
There is an urgent need to sustain, integrate and further develop a diverse set of Environmental RIs in a way that Europe can address both the key societal and economic challenges as well as improve our basic scientific knowledge.

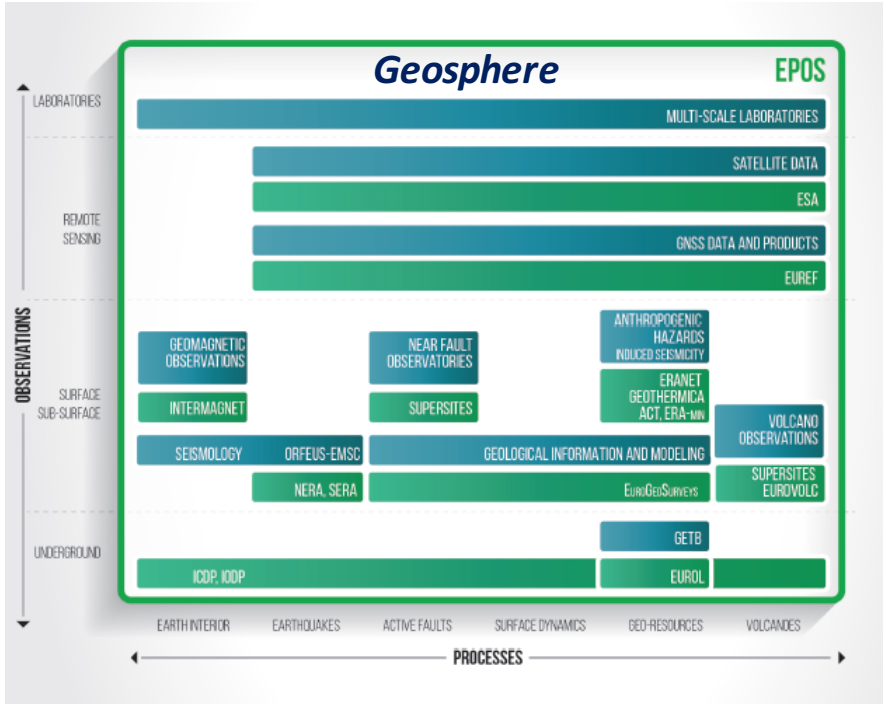
Schematic Spatial and Temporal Scale Earth System´s Processes and Phenomena

ENV RIs Landscape analysis report

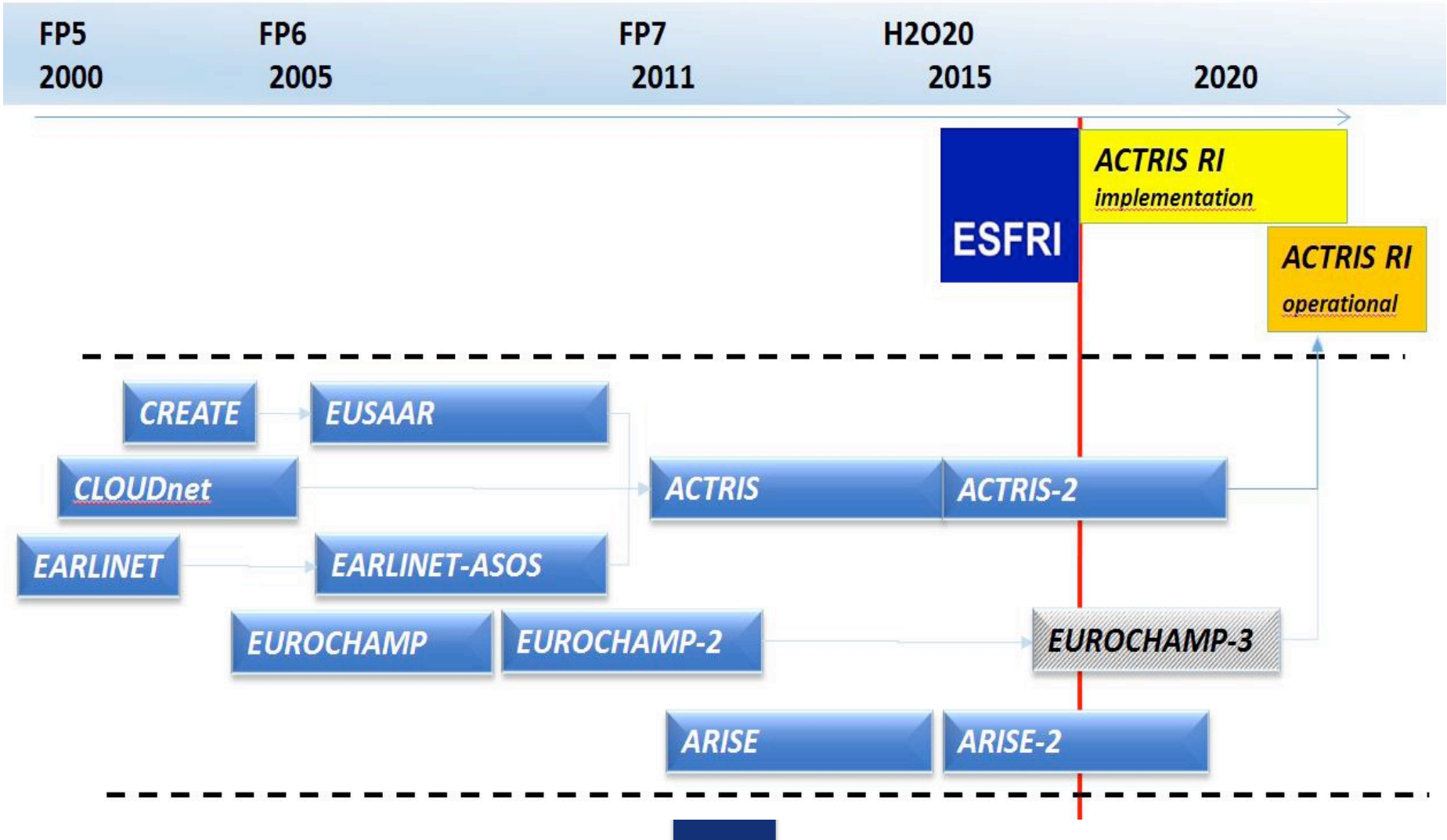








The evolvement of ACTRIS from FP5-H2020



Lessons Learnt

The ESFRI process with its Roadmap updates constitutes an important strategic framework for the development of Research Infrastructures of pan-European relevance and thus for then European Research Area as a whole.

The continuous assessment and adjustment on its methodology enables ESFRI to fullfill its strategic role, especially in view of upcoming political needs and challenges.

In order to preserve and further develop the strengths ESFRI has built up over time a constant focus on ESFRI's strategic mission is essential .

As the landscape of ESFRI RI becomes richer and more comprehensive it is important to focus on initiatives of strategic importance with high added-value and significant potential to develop unique resources and services for European research and innovation.

Examples of interconnections between domains, vision and perspectives across thematic areas from the ENV RIs

ENE: Environmental impact of Energy Supply and Consumption
specific instruments development: for wind Energy applications and for solar Energy application; carbon capture and storage verification; geothermal heating

H&F: Natural and anthropogenic environmental changes impact on food and health Food security, aquaculture, environmental medicine; water quality / air quality and impact on health; air quality and extreme weather events and impact on agriculture; marine environmental risk and marine food resources ; vectors for diseases and parasites, ecosystem impacts on/from agriculture and aquaculture.

PSE: Technological development; Physical process studies of the environmental/Earth system; Space-Earth physics Instruments; technologies ; Sun-Earth interactions, radio astronomy, space security, plasma physics, magnetic field studies; laser optics and detectors; atmospheric corrections; aerosol physics.

SCI: Natural and anthropogenic environmental changes impact on society
air quality and climate change impact on cultural heritage; impact on life

e-Infrastructure: HPC (Climate models, Large volume data processing) **/ e-Tools:** VRE (specific ENV applications); data interoperability, data access/curation/.....

ESFRI: Beyond 2018

- The important role of the ESFRI Landmarks
- Monitoring of the ESFRI landmarks and Periodic reviews
- Strong cooperation between Landmarks and ESFRI
- To strengthen the strategic role of ESFRI
- To foster cooperation outside Europe

ESFRI monitoring

The monitoring of RI performance is central to develop an effective strategy for the Long-Term Sustainability of Research Infrastructures.

ESFRI has established an ad hoc Working Group on Monitoring of Research Infrastructures Performance

The objective of this WG is to consolidate the existing knowledge on monitoring of RI performance, propose a common approach at European level and explore options to support this through the use of Key Performance Indicators (KPIs). Such KPIs must be easy to use, shall be adjustable to different systems and types of RIs (new as well as existing) and yet robust to ensure high a level of confidence. They could serve as one element of the monitoring carried out by RIs and their governance bodies to monitor their performance.

Horizon Europe

is the Commission proposal for a **€ 100 billion** research and innovation funding programme for seven years (2021-2027)

to strengthen the EU's scientific and technological bases

to boost Europe's innovation capacity, competitiveness and jobs

to deliver on citizens' priorities and sustain our socio-economic model and values

Additional **€ 4.1 billion** are proposed to be allocated for defence research, in a separate proposal for a European Defence Fund

Horizon Europe: evolution not revolution

Specific objectives of the Programme

Support the creation and diffusion of high-quality knowledge

Strengthen the impact of R&I in supporting EU policies

Foster all forms of innovation and strengthen market deployment

Optimise the Programme's delivery for impact in a strengthened ERA

Pillar 1
Open Science

- European Research Council
- Marie Skłodowska-Curie Actions
- Research Infrastructures

Pillar 2
Global Challenges and Industrial Competitiveness

Clusters

- Health
- Inclusive and Secure Society
- Digital and Industry
- Climate, Energy and Mobility
- Food and natural resources

Joint Research Centre

Pillar 3
Open Innovation

- European Innovation Council
- European innovation ecosystems
- European Institute of Innovation and Technology

Strengthening the European Research Area

- Sharing excellence
- Reforming and Enhancing the European R&I system

Research infrastructures: what, how?

- Endow Europe with world-class research infrastructures open and accessible to all researchers:
  - Support the development of pan-European research infrastructures (ESFRI, ERICs…)
  - Transnational access for researchers
  - Improve services provided to the users

- Findings interim evaluation:
  - research infrastructures are drivers for scientific excellence
  - still barriers to use the best research infrastructures throughout Europe
  - more attention for long-term sustainability
  - extend co-funding by EU regional and investment funds
- Stakeholders: more attention for sustainability of infrastructures and their innovation potential
- Implementation by DG RTD and CNECT

Research infrastructures in Horizon Europe

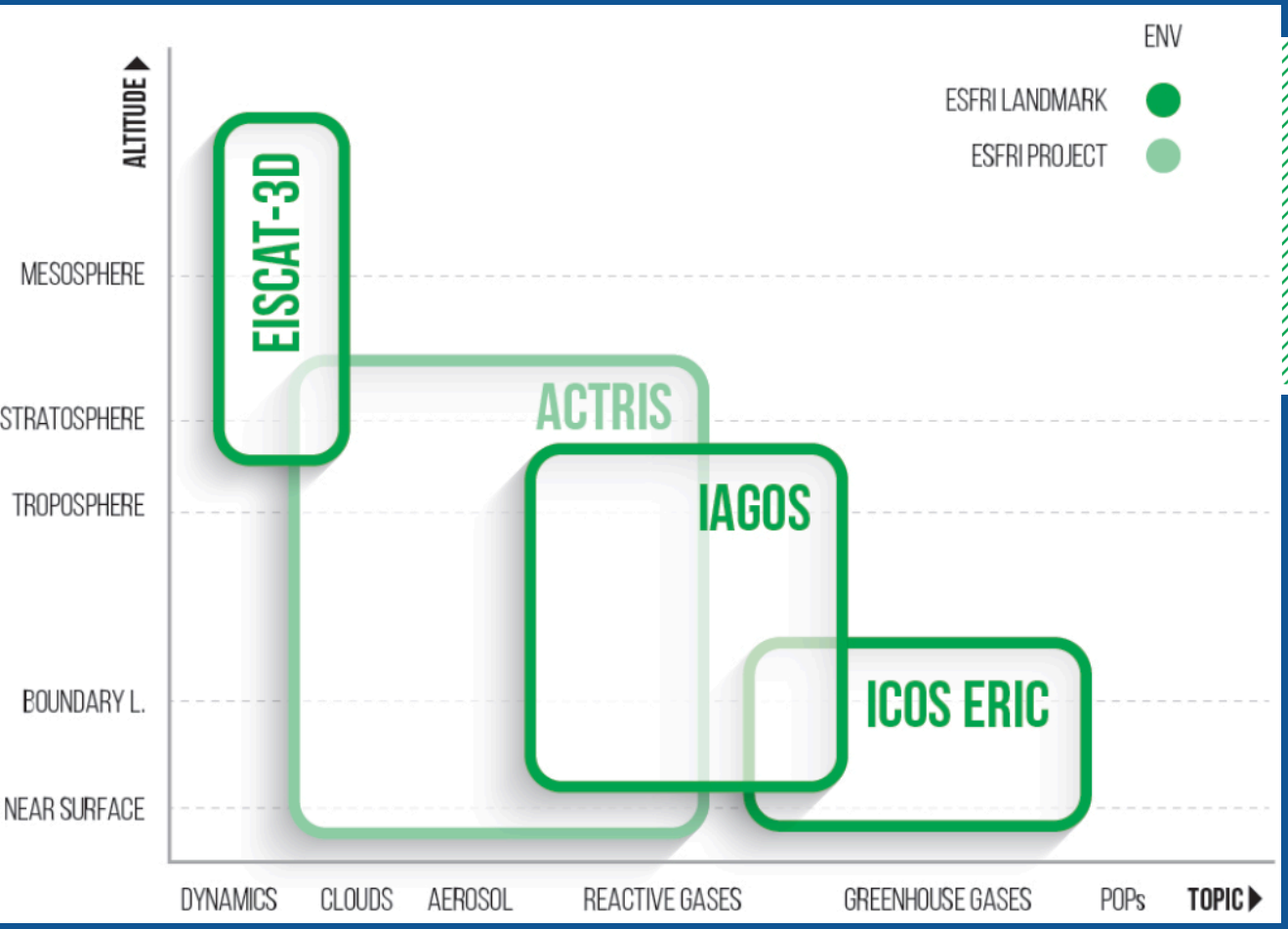
- Overall: continuation

- Intervention areas:
  - consolidating the landscape, emphasis on:
    - Life-cycle approach of European research infrastructures
    - European Open Science Cloud (EOSC),
    - European Data Infrastructure (EDI)
  - opening, integrating, interconnecting
    - co-funding of transnational access
    - joint research development through partnership with industry
  - reinforcing policy and international cooperation

Thank you for your attention!

Research and Innovation

ATMOSPHERE: FROM NEAR GROUND TO THE NEAR SPACE ATMOSPHERE



Perturbation of the atmosphere impacts on different thematic areas like climate change, air quality, environmental hazards, environmental risks, food security and the water cycle

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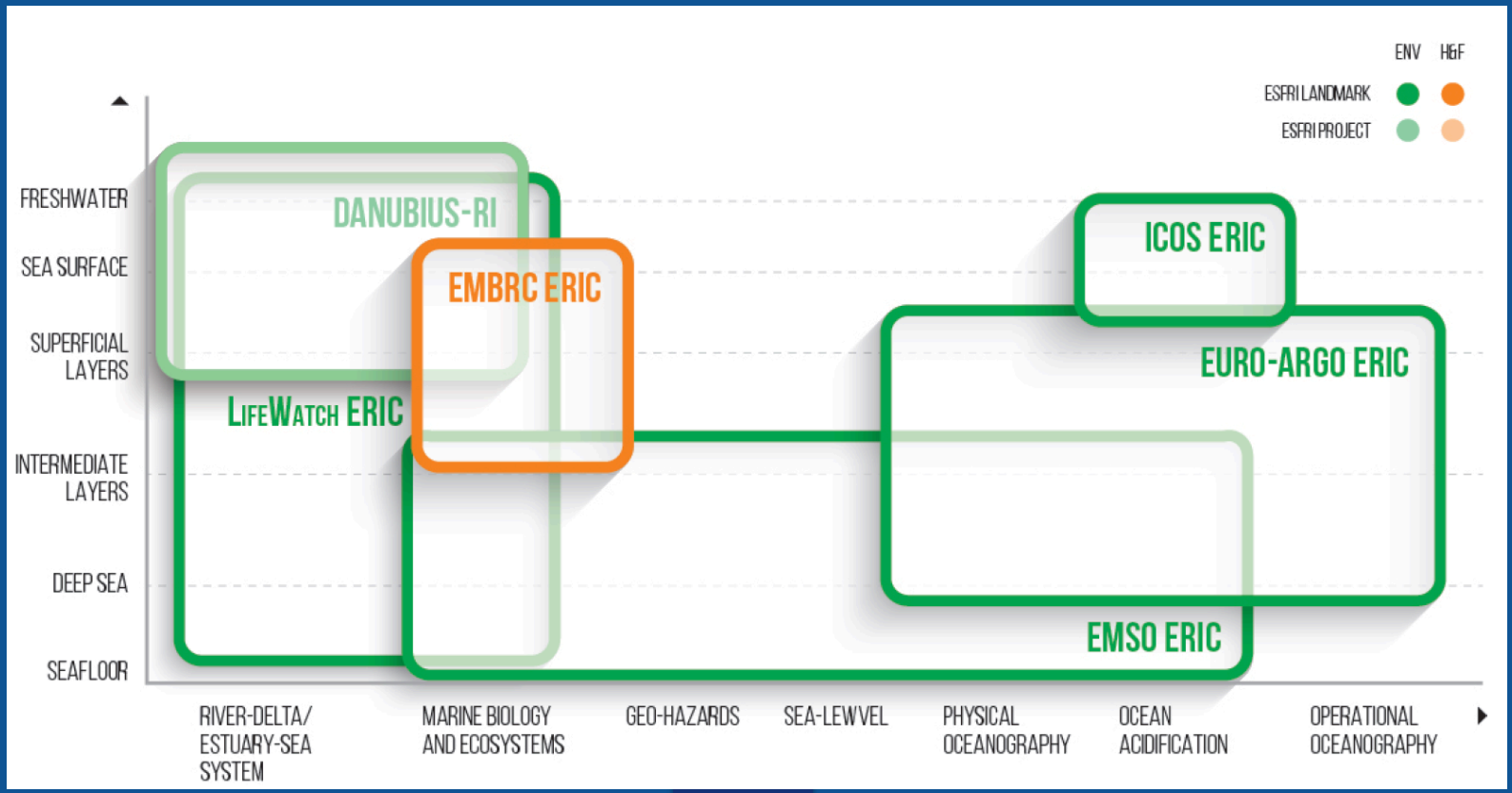
HYDROSPHERE

Water is of huge global geopolitical importance and is central to all the key, current environmental issues: climate change, biodiversity, natural hazards, pollution, ecosystem services, and desertification.



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BIOSPHERE: BIODIVERSITY AND ECOSYSTEMS

A better understanding of the interconnections, including quantitative relations, between biodiversity and ecosystem services will allow a better response to *Grand Challenges*, namely those included in the Sustainable Development Goals.

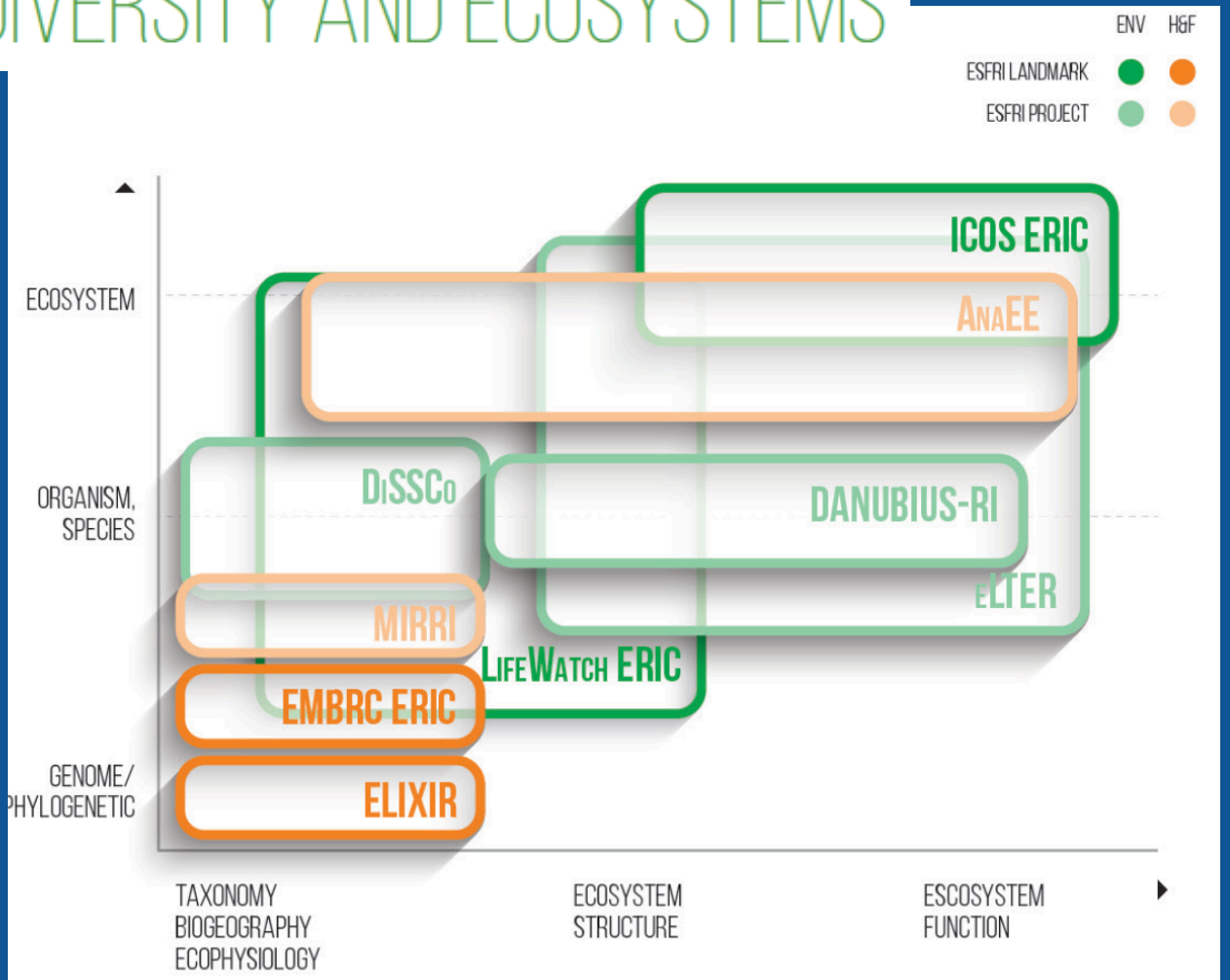

FIGURE 3.
Schematic landscape of biodiversity and ecosystem ESFRI Research Infrastructures.

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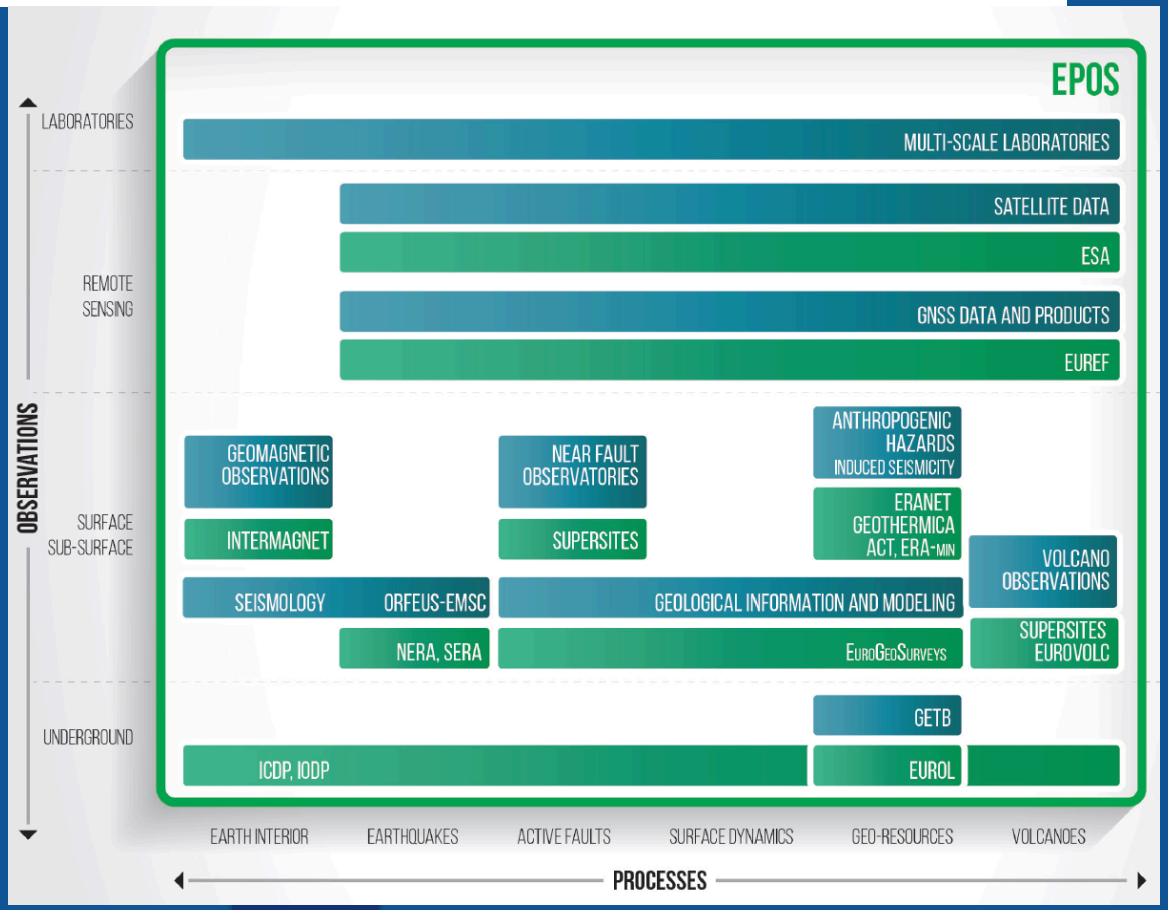
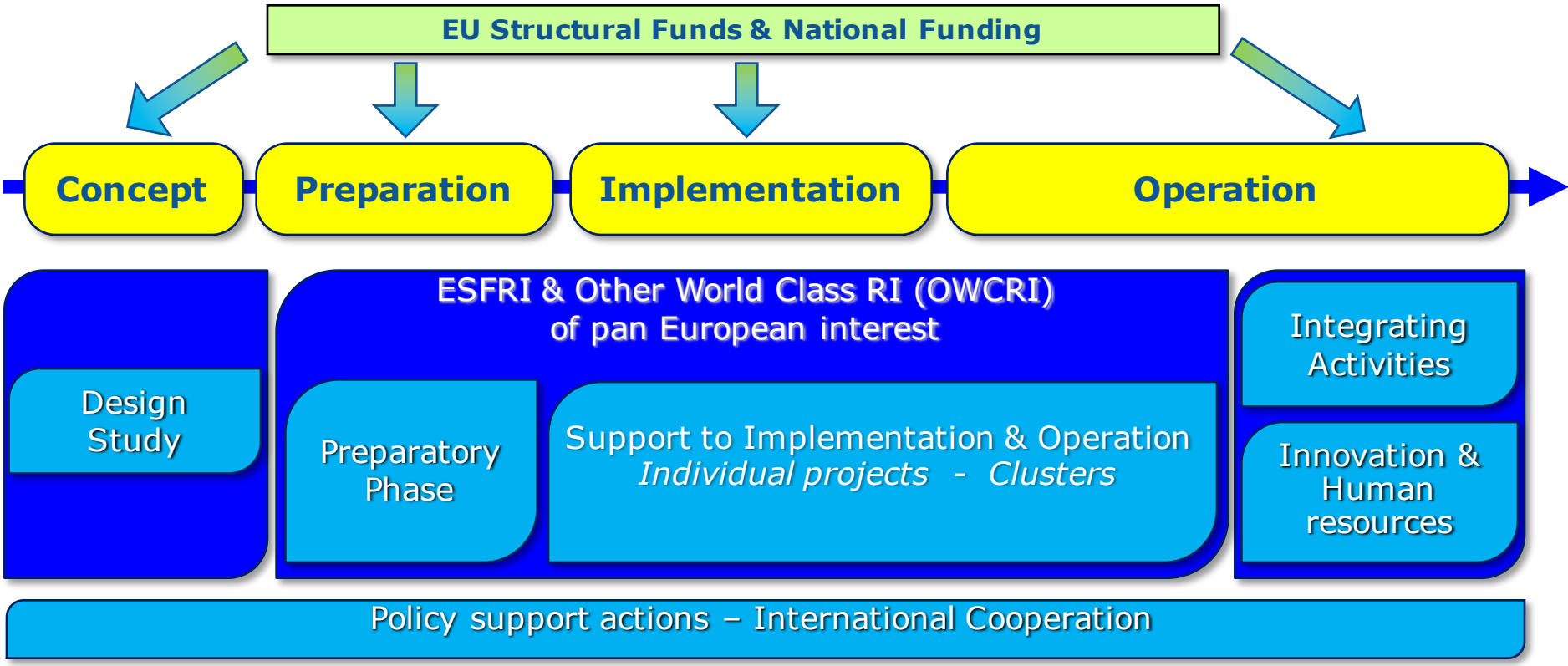
GEOSPHERE: FROM THE SURFACE TO THE INTERIOR OF THE EARTH, FROM GEOHAZARDS TO GEORESOURCES

Geology, natural hazards, natural resources and environmental processes, in general, do not respect national boundaries, therefore seamless, trans-national integration of measurements and calibrated data is crucial to enable research and societal applications.



RI WP - A Coherent Toolbox of Activities



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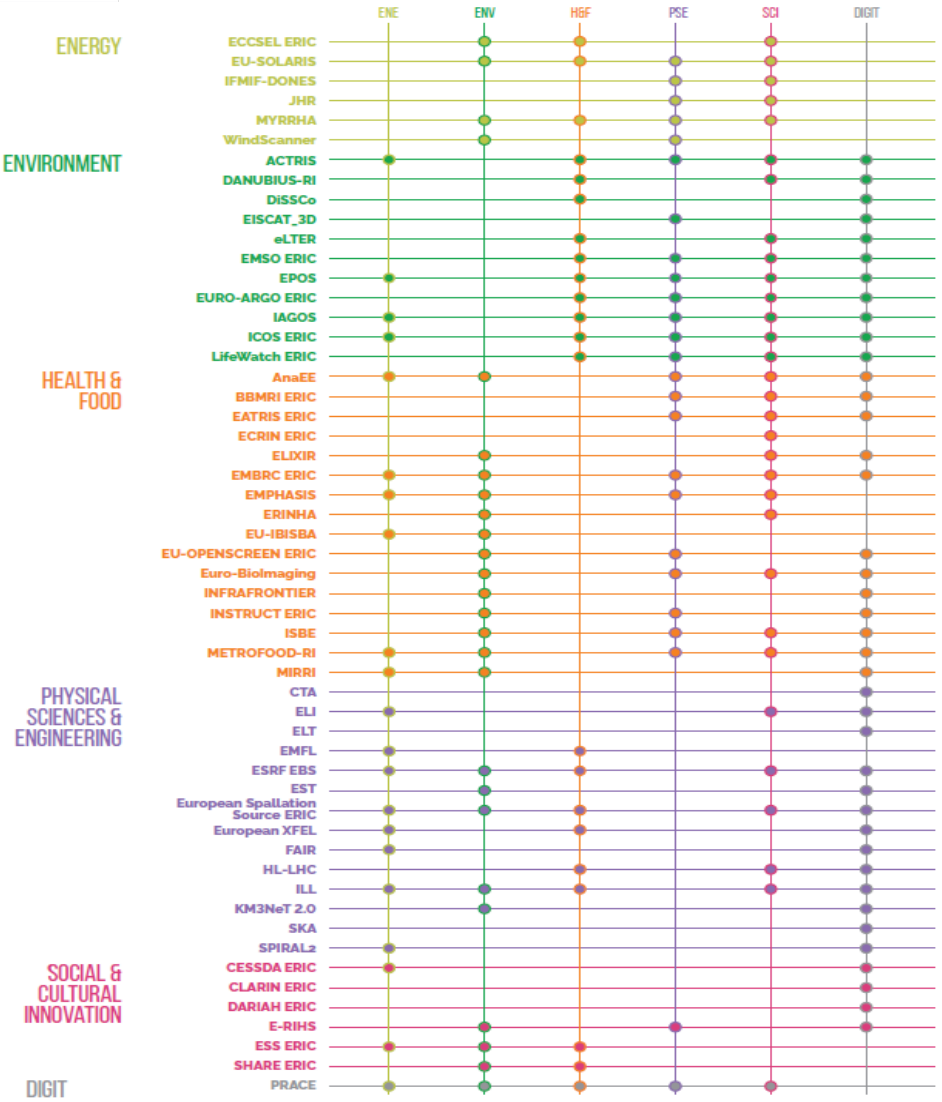
Landscape Analysis Section 2:

Interconnections between domai vision and perspectives across thematic areas

- Prepared with feedback collected by the ENV RIs directly
- Starting point to be better explored in the future
- Good basis for strategic developments within and outside the ENV domain



ESFRI WORKSHOP
MONITORING OF RESEARCH INFRASTRUCTURES, PERIODIC UPDATE OF LANDMARKS, USE OF KPIs
Milan, Italy
19/20 November 2018

The rationale for the workshop is to:
- follow-up of ESFRI Pilot Periodic Review Exercise with 4 ESFRI Landmarks performed in 2017,
- build on the need to develop a methodology for periodic update of ESFRI Landmarks "State of Play", defining the periodicity and appropriate, flexible KPIs,
- explore how the monitoring of Research Infrastructures can support their sustainability, taking into account the results of the Long Term Sustainability report.

The results of the workshop will feed into the activities of the ESFRI ad hoc Working Group on Monitoring of Research Infrastructures Performance, also in view of interacting with the European Commission High Level Expert Group on assessment of the progress of ESFRI and other World Class Research Infrastructures towards implementation and long-term sustainability.

Pillar 1

OPEN SCIENCE

reinforcing and extending the excellence of the Union's science base

European Research Council

- Frontier research by the best researchers and their teams

Marie Skłodowska-Curie Actions

- Equipping researchers with new knowledge and skills through mobility and training

Research Infrastructures

- Integrated and inter-connected world-class research infrastructures

Open science: why?

- Europe: 7% of global population, 20% of R&D investment, 32% of the best publications
- Global competition is increasing. Top-science is essential
- Pillar 1 contributes to all the objectives of Horizon Europe, esp. the creation and diffusion of high-quality new knowledge, skills, technologies and solutions
- Activities add value at the European level (EU-wide scale, character, funding)
- Continuation, no revolution: a sign of confidence
- Bottom-up