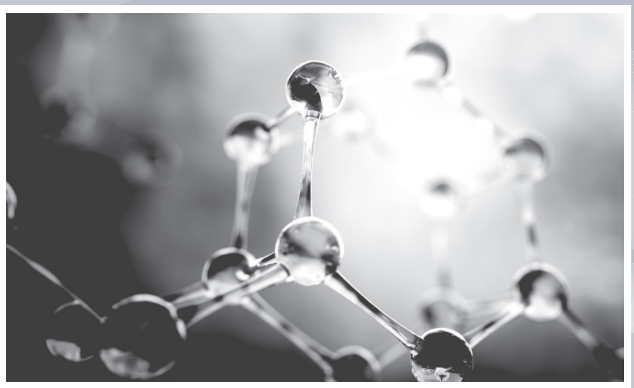
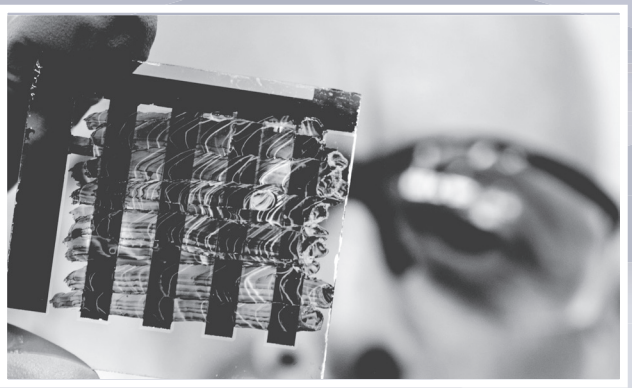
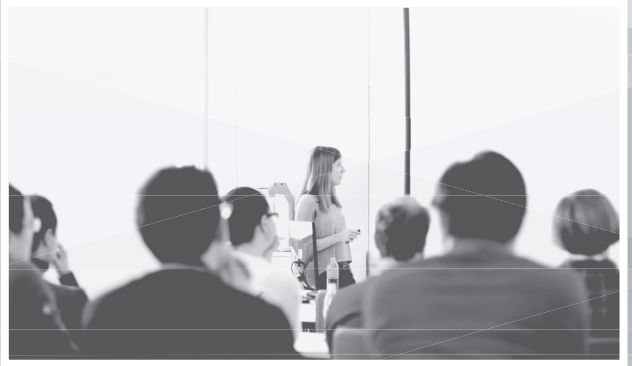
ERIC FORUM

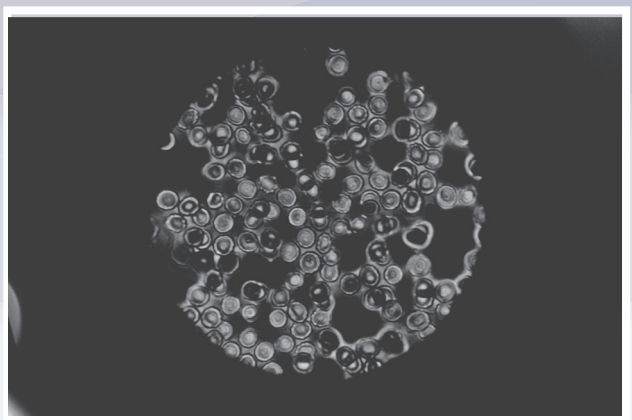
ERIC Forum Policy Brief

ASSESSING THE SOCIO-ECONOMIC IMPACT OF ERICS:
Paving the way towards evaluating the full value and contribution of RIs to resilient knowledge-based economies

October 2022





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ERIC FORUM

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INTRODUCTION

Research Infrastructure (RI), are according to the EU definition: “facilities that provide resources and services for the research communities to conduct research and foster innovation in their fields, including the associated human resources, major equipment or sets of instruments; knowledge-related facilities such as collections, archives or scientific data infrastructures; computing systems, communication networks and any other infrastructure of a unique nature and open to external users, essential to achieve excellence in R&I; they may, where relevant, be used beyond research, for example for education or public services and they may be 'single sited', 'virtual' or 'distributed'”[1]. RIs are long-term investments with outputs and anticipated outcomes that reach beyond generating scientific knowledge, to yield benefits that impact the economy and society at large. Their importance as the cornerstone of research and innovation in the European Research Area is underscored by the scale of allocated funding in the European Framework Programmes. Previous European Framework Programmes, with the support of the European Strategy Forum on Research Infrastructures (ESFRI)[2], have to date contributed to the development of 55 European Research Infrastructures across six scientific Clusters or Domains, mobilising close to €20 billion in investments[3]. Within the ongoing Horizon Europe (2020-2027) programme[4], RIs are endowed with 2.4 billion euros[5] with the overall objective “to empower Europe through world-class and accessible research infrastructures, as part of an integrated European research and technology infrastructures landscape”.

The scale of investment at European and national levels in RIs, as well as the broad range of stakeholders involved, warrant expectations on the return on investment in terms of socioeconomic impact (SEI), hence the increased scrutiny and demand for reliable assessment methodologies[6]. Socio-economic impact is requested by all the funding and evaluation agencies at national, regional and international levels. It is important to differentiate impact from the scientific and technological performance of RIs. Although there may be an overlap between performance and impact, performance indicates the efficient use of resources whereas impact reflects the transformative effect of an RI. The assessment of the socio economic impact does not rely only on the scientific output. The question raised is what would have been the development of the economy and the society without the Research Infrastructure. This question requires a sufficient timeframe to assess the impact of the RI and it also needs a comparator. But in practice there is no comparator. A number of diverse variables, including the political context, has to be taken into account to evaluate impact. The diversity of RIs in terms of objectives, access and other services, economic models as well as potential industry investment, should also be taken into consideration. In addition, some countries have different expectations for the same infrastructure when compared to another country. This diversity needs to be addressed in order to identify common denominators.

1 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R0695&from=EN
2 https://www.esfri.eu/
3 http://roadmap2018.esfri.eu/.
4 https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2021-2022/wp-3-research-infrastructures_horizon-2021-2022_en.pdf
5 https://ec.europa.eu/info/sites/default/files/research_and_innovation/strategy_on_research_and_innovation/presentations/horizon_europe/ec_rtd_he-investing-to-shape-our-future.pdf
6 https://air.unimi.it/bitstream/2434/611187/2/98.pdf

Twenty-four Research Infrastructures benefit to date from the European Research Infrastructure Consortia (ERIC) status as per the EU Regulation 723/2009[7] in the European Research Area (ERA) framework. This unique European legal framework facilitates on one hand the integration of resources from Member States (MS) and Associated Countries (AC) and on the other secures their commitment for sustainable support. The EU, European MS and the AC invest jointly in the Research Infrastructures, thus contributing together to strengthen European research, innovation and competitiveness. Each European Research Infrastructure Consortium is a multinational pan-European infrastructure composed at least by three European MS. The 24 ERICs are organized in six clusters identified in ESFRI[8], bringing together a diverse range of RIs which span entire fields of knowledge: Data, Energy, Physics and Engineering, Environment, Health and Food and Social and Cultural Innovation. One of the most important aspects of the ERIC System as defined by the ERIC Regulation is the flexible framework that brings together this very diverse array of Research Infrastructures.

The ERIC Forum is the bottom-up collaboration of all these 24 ERICs looking for common denominators. The Forum is the voice of the ERICs on matters of common interest with the overarching mission to foster their sustainability, impact and visibility within the ERA. One key mission of the ERIC Forum is to share best practice. ERICs having already carried out a socioeconomic impact assessment can, by identifying common grounds and challenges, help build a common framework that could help other ERICs to identify and measure their SEI while taking into account their diversity and the challenges therein.
The socioeconomic impact of Research Infrastructures is a burning question raised at national, European and international levels addressed in this policy report, jointly with RI stakeholders and the support of facilitators, in order to understand better the different parameters at play and to propose recommendations on how the assessment of the socioeconomic impact can be carried out and supported during the RIs' lifecycle.

The objective of this Policy Report is to bring together ERICs with their national, European and International stakeholders and collaborators to pave the way towards evaluating Research Infrastructures'(RI) full value and contribution to resilient knowledge-based economies. The ERIC Forum survey on the SEI evaluation practices as well as perspectives from the EMBL (EIROForum) and ERIC case studies presented in this report shed some light on the methodologies adopted by the different RIs as well as the gaps and challenges faced by ERICs. ERIC and RI stakeholders at EU, MS and ESFRI level provide their insight on their expectations regarding RI SEI as well as the resources needed to best support their assessment.

7 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009R0723&from=EN
8 https://roadmap2021.esfri.eu/media/1295/esfri-roadmap-2021.pdf

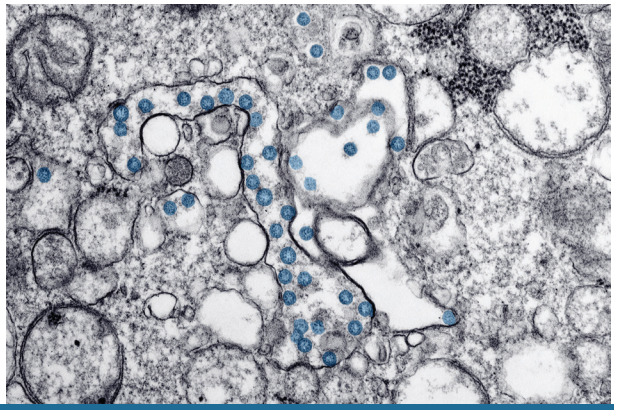
SETTING THE SCENE

Task 4.3 of the ERIC Forum Implementation Project, titled 'Report on SEI ERIC Framework' conducted a survey to gauge the current status of assessing SEI within the ERIC community. It explored the challenges and best practises encountered and established by the ERICs. The aim was also to collect information to inform the EC and stakeholders in developing ways to support the ERICs in assessing SEI, and to provide an overview of the process for those ERICs having not yet assessed their SEI. The following chapters present the methodology and results of this survey. The results provided data for work carried out in this policy report

FINDINGS OF THE ERIC FORUM SURVEY ON SEI EVALUATION PRACTICES BY ERICS

The socio-economic impact (SEI) of Research Infrastructures remains a challenging topic, both conceptually and methodologically. It is a topic that requires context-specific approach and assessment methods due to the scientifically and organisationally varied Research Infrastructure landscape in Europe. The approaches to assessing SEI have been varied, and a number of methodologies have been developed during the past years for example by the Organization for Economic Cooperation and Development (OECD) and a number of H2020 projects, such as ACCELERATE[9] and RI-PATHs[10]. Many ERICs have utilised or adapted these approaches, sometimes with help from external service providers. There is, however, no one-size fits all approach, and while such an approach is neither sought nor possible, it would be extremely useful for ERICs to share experience to identify a common framework towards approaching the process of assessing their SEI.

The objective of the survey has been to explore the current status of socio-economic impact assessment within the European Research Infrastructure Consortia (ERICs) (both established and those in the preparatory phase; referred to as ERICs). The findings shed light on the level on which ERICs have embedded SEI assessment in their design, engaged in assessing their socio-economic impact, the methodologies used, the challenges faced or foreseen, and the support further required from the European Commission and other stakeholders.



9 https://www.accelerate2020.eu/
10 ri-paths-tool.eu/en

Survey on SEI assessment practices

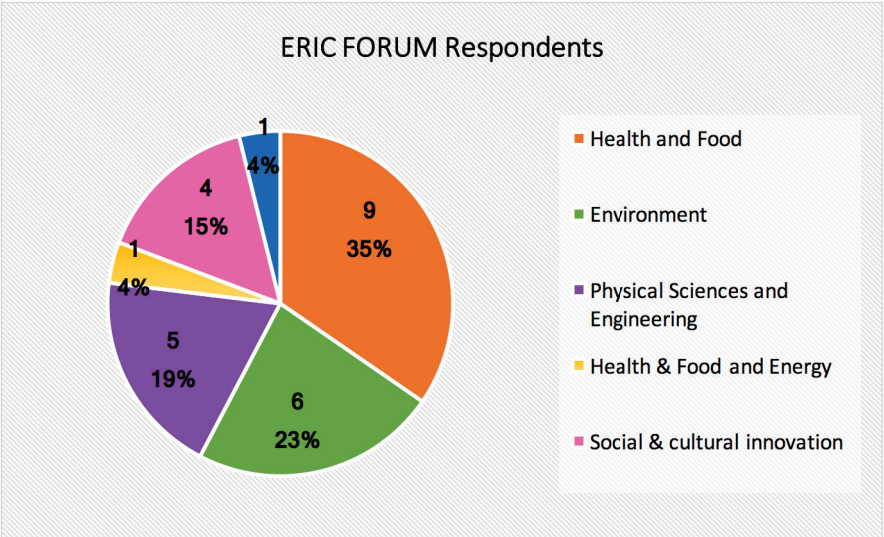
Methodology

The survey, developed by WP4 and WP6, consisted of a combination of 28 open-ended and multiple-choice questions carried out using an online survey tool. It first collected respondents' background information such as the type, domain, size, and operational phase of their ERIC, and then addressed questions about their SEI assessment status. Furthermore, the survey collected experienced and foreseen challenges in the assessment process and invited participants to convey suggestions and recommendations for the EC and stakeholders about providing guidance, support and resources to ERICs and prep-ERICs for carrying out their SEI assessment.

Results

Profile of RIs participating in the survey At the time of the Survey, all 32 RIs (21 ERICs and 11 prep-ERICs in the European RI landscape) were invited to participate. Among the 26 replies received, five ERICs were in the preparatory phase. A vast majority, 23, were distributed research infrastructures, and three were single-sited. Five of the six ESFRI scientific clusters were represented (Figure 2): six from the Environmental Cluster, nine from Health and Food, 5 from Physical Sciences and Engineering, one from Energy, and four from Social and Cultural Innovation. One respondent represented both health and social and cultural innovation.

Figure 2. Respondents' per Cluster



SEI assessment status The respondents were at different stages in planning or carrying out their SEI assessments. Seventeen of the 26 respondents had not yet carried out a SEI assessment, and four had already carried out an assessment several times (in the design, preparatory, and at different stages in the operational phase). Two ERICs had carried out the assessment in the operational phase, and one in its mature phase (having been operational for more than two five-year periods).

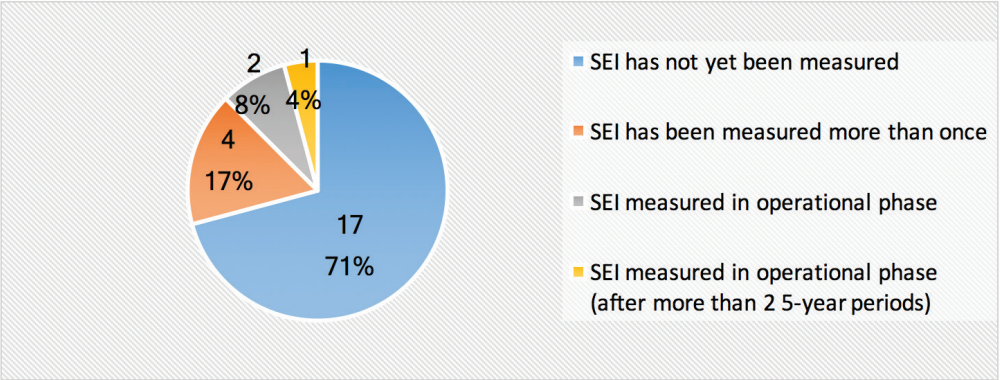
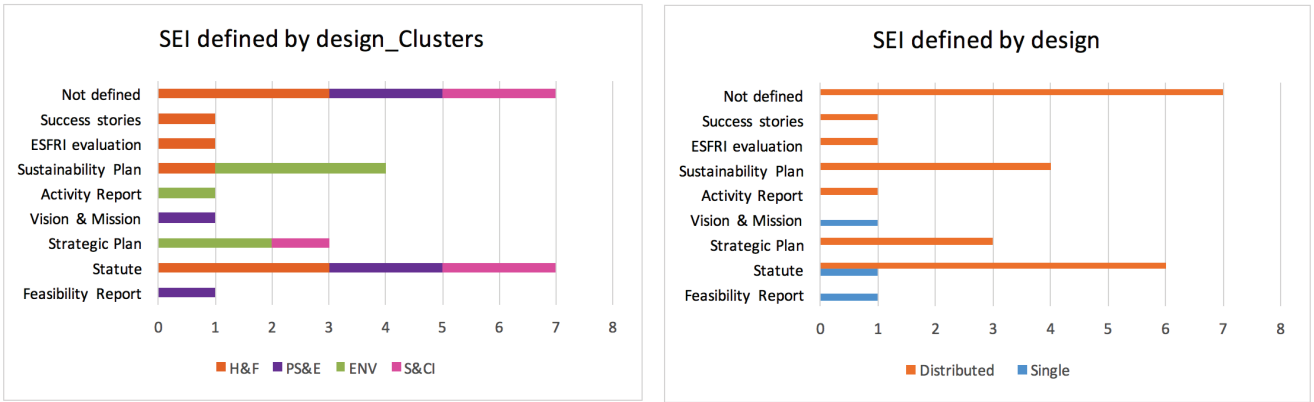


Figure 3. Status of carrying out an SEI assessment

Mapping Stakeholders and Defining SEI in ERICs' documentation

The stakeholders of ERICs were defined as funding bodies (8 ERICs) and policy-makers (11 ERICs). The rest described their stakeholders as consisting of a combination of representatives of ministries, funding bodies and universities; member countries as the founders, national ministries, researchers, fellow ERICs/RIs, national research councils and facilities, data management professionals, and general public.

Respondents indicated that, when mentioned, their SEI was defined in different documents: Five ERICs had not yet defined their SEI, or it was under discussion as part of their statutes but not yet included anywhere. Four ERICs indicated that their SEI was defined in connection to their strategy document or the objectives of the ERIC, and four ERICs indicated that their SEI had been defined through a specific impact pathway or impact area, such as 'economy', 'services', 'environment' or 'industry'. Six ERICs indicated that their SEI is defined in connection to the evaluation process, either to the required scientific evaluation that is carried out periodically by the ERIC itself, or in connection to the ESFRI evaluation process. One ERIC stated that their SEI was defined through success stories. In addition, respondents mentioned workplan, statutes, vision and mission statements, five-year plans, and policy documents.



Figures 4a&b. SEI by design

The Process of SEI assessment

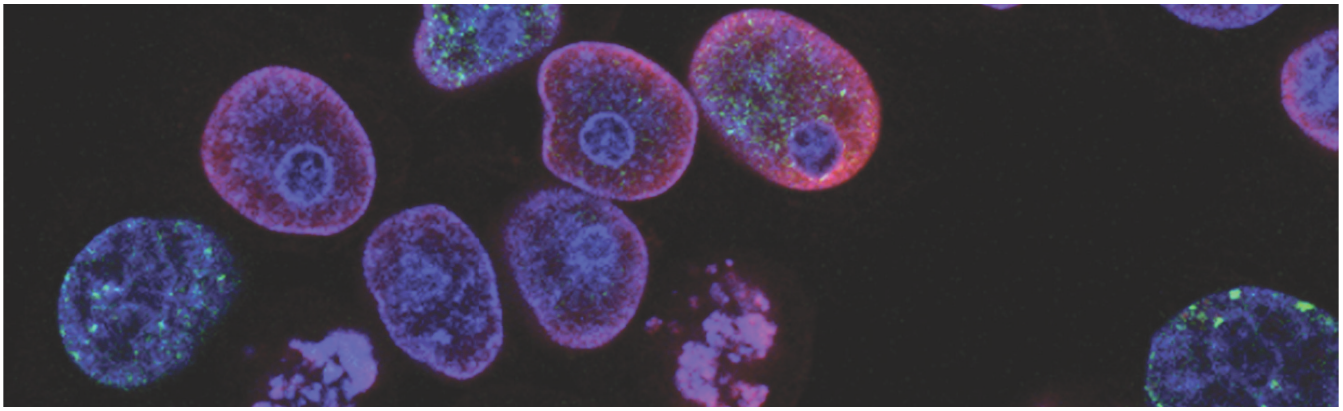
ERICs having already carried out a SEI assessment described the following main approaches:

1. Linked with the Management Plan and/or evaluation process or done through KPIs,
2. Using currently available SEI assessment methodologies (Accelerate, RI-Paths etc.) through internal resources,
3. Using a mix of internal and external resources (available tools used as guidelines internally). Some ERICs indicated having internal resources dedicated for SEI assessment. This was often linked to annual reports, where KPIs were reported,
4. Carried out in connection to an EU-funded project.

Respondents not having yet assessed their SEI indicated different approaches: Firstly, some indicated that the assessment requires dedicated resources not allocated due to pending strategic decisions or the finalisation of strategic documents or a strategy update. Secondly, some mentioned that the SEI would be carried out in connection to the development of KPIs or impact indicators, or to the development of management or sustainability plans. Thirdly, plans were underway for utilising an external service for carrying out the assessment. Some were also in the process of planning an internal process, or planning to link it to the scientific evaluation process. Furthermore, some explained that their SEI assessment would be done during a specific phase in the ERIC's life cycle in the near future.

Methodologies used for assessing SEI

A variety of existing SEI assessment methodologies have been used with 60% of the respondents having resorted to an external service provider (Figure 5). This was justified by the fact that the assessment was linked to project funding or a pilot assessment that was funded by a grant or to support an internal assessment that had been previously carried out. Some also indicated that they had specifically planned to use an external service, and some mentioned that they had used an external service due to the lack of available tools at the time of carrying out the assessment. Figures 6 and 7 indicate which of the currently available tools were used. In the 'other' category, respondents mentioned using the input-output methodology, or a combination of the other tools.



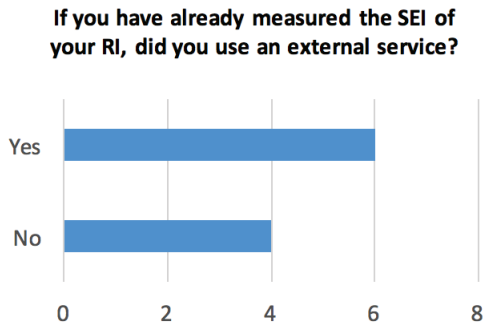


Figure 5. Use of external service

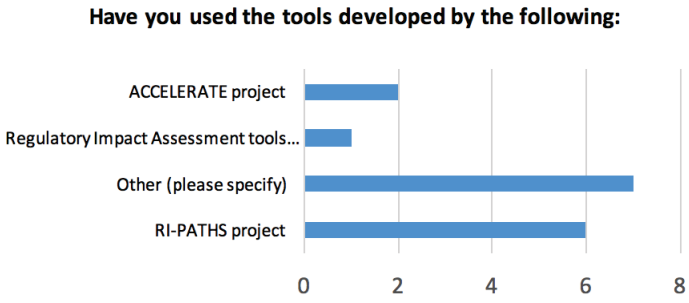


Figure 6. Use of available tools

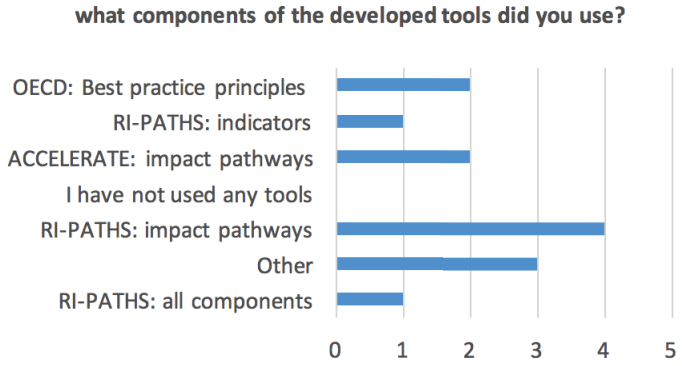


Figure 7. Components of available tools used

Respondents mentioned that the tools they had used had been, in general, compatible with the specificities of their ERICs. Some had used them as a framework and adapted them to suit their needs. Indicators developed within the toolkits were perceived to be complex to measure, or not suitable for distributed RIs. It was also pointed out that the tools may not be straightforward to use during the early stages of the RIs' construction phase.

The tools had nevertheless provided a framework for defining suitable indicators and impact pathways. What was found to be useful, especially in relation to the tools developed in the ACCELERATE project, was the emphasis on context, audience, basis information, and scales (national, European, global). The use of narratives and impact pathways was useful, given the focus on the underlying processes that generate impact, enabling the understanding of impact as an ongoing process.

Most challenging aspects in defining SEI

The vast majority of respondents perceived defining the SEI of their ERIC as challenging (Figure 8.)

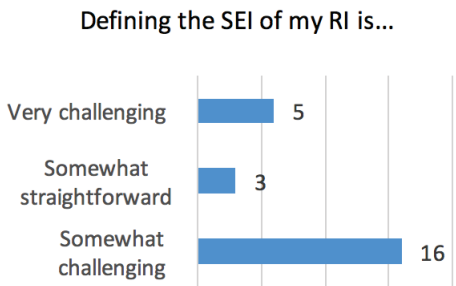


Figure 8. Defining SEI was perceived as challenging by the majority of respondents

The main challenges anticipated for SEI assessment were:

1. Geographical dimension particularly in the case of distributed RIs and the subsequent multi-scalar SEI (local, regional, pan-European),
2. Traceability:how to link data generated in the RI and its later use, especially in a longer timeframe,
3. Difficulty defining indicators; as some impacts are intangible (such as community building); criteria are difficult to determine as not all components of the RI are part of the ERIC,
4. Lack of a unified methodology or framework, as well as lack of dedicated funding,
5. Defining what 'societal' and 'economic' impacts actually mean in the specific context of an RI.

Those ERICs that had already assessed their SEI indicated having encountered similar challenges:

1. Geographical dimension (in the case of distributed RIs) and the subsequent multi-scalar SEI (local, regional, pan-European; multi-linguistic environments, country-specific regulations and decision-making schedule/differing funding structures),
2. Traceability: how to link data generated in the RI and its later use, especially in a longer timeframe; following the generation of indirect impacts,
3. Defining the correct methods that are not too resource-intense, finding right indicators that would measure relevant aspects, organising data collection within the RI, and differentiating between KPIs and impact indicators.

Indicators used for assessing SEI

The respondents were asked to mention the 1-20 most relevant indicators already in use, or identified, for assessing their SEI. ANNEX 1 includes the common themes, together with some of the more specific indicators.

In general, the indicators could be grouped into 12 areas that came through in the data:

Services	Visibility	Engaging decision-makers	Funding
Quality of the network & amount of personnel	Publications and other contributions to science	Scientific and policy-related activities	Users
Data	Education and training	Synergies with other RIs, bodies and industry.	Cost-benefit ratio

The more specific indicators under each themed area varied from very detailed to more broad, and were a combination of performance and impact indicators. The use of performance indicators is bound to the pathways: this approach proposes that once the pathways to impact are identified, feeding those would lead to impact. As a consequence, measuring the performance to assess its influence on the impact is part of the process.

Cluster-specific challenges in assessing SEI

Participants were also asked to indicate the specific features of their ERICs (domain, structure, etc.) that they saw as especially challenging when trying to assess their SEI. While all ERICs are, of course, different, a few common themes emerged from the data: • Firstly, the diversity of the communities was mentioned. This meant several different, smaller communities within the wider RIs, with different national structures, and a subsequent multi-level governance. • Secondly, many again mentioned traceability – the long-term impacts generated from the use of the RIs' data, multidisciplinary inputs from across RI with several scientific fields, and the indirect impacts. • Thirdly, they also mentioned the challenges in resourcing especially when some services are offered as in-kind, and because some services are resource-intensive to produce, and data is difficult to collect in cases where users need to be engaged on a large scale. Furthermore, the areas where SEI is assessed can be complex, and the expectations from funders and stakeholders are not always clarified. Additionally, defining what 'societal impact' means in the domain-specific cases is not straightforward, and finding the right indicators is difficult when it comes to measuring with quantitative and qualitative indicators. The following challenges were captured by cluster:

ENVIRONMENT

- Much of the impact is not direct but comes from the value chain,
- The societal impact is easier to assess as the importance of the ERIC to answer some Societal Grand Challenges (SDG 13-14) related to climate change monitoring and ocean health,
- Distributed RIs, impacts need to be collected across many countries,
- The need to point out long-term trends by having long time series,
- Measuring the SEI is challenging because it has to be assessed through KPIs and qualitative indicators, on the long-term period, dealing with the social and the economic impact,
- There is a wide range of applications where the information collected through the ERIC can be utilised. Quantification of the impact of the RI in question on society is challenging.

HEALTH & FOOD

- Very heterogeneous community with many different impact pathways; potentially multi-level governance with plenty of actors involved,
- Timeframe: Main challenges are the long-term aspects of the studies as well as the Indirect impact of the research infrastructure. It takes 10-20 years to develop novel drugs. It also takes several years to develop high-quality chemical probes,
- Structural biology is at the fundamental end of the scientific pipeline which makes it a long way from the societal impact. Therefore, the further removed, the harder it is to measure the SEI,
- Most impact is related to management methods, and also to sustainability/adaptation to climate change, which is difficult to measure and track,
- Traceability is an issue across fields, for example many collaborators from different scientific fields contribute to the drug discovery process, so tracking the contribution of the RI over years is challenging,
- The changing landscape of the national partner priorities,
- Project/TNA budget: Drug discovery projects are demanding in terms of resources and money,
- Related to the high access unit cost, the number of users per TNA budget is small,
- Tools are easily developed; but their maintenance is difficult (sustainability),
- Development takes place at the ERIC-HQ level, whereas the implementationis on the national level,
- Lack of incentives for the users to answer a survey or even take an interview; as well as the turnover of staff which makes long-term impact measurement particularly challenging,
- Monitor the extent one's open-source data has been used,

HEALTH AND SOCIAL & CULTURAL INNOVATION (combined)

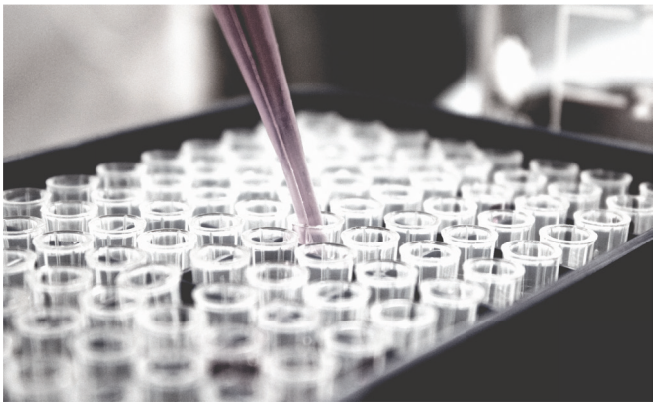
- Although users are obligated to report any scientific publications resulting from their work with the RI's data, this is happening on a voluntary basis and does not count for any further projects/project results/policy actions following this research/publication,
- Being a very large distributed infrastructure, tracking SEI is connected to extensive research and may never be 100% complete. Further, much of the impact becomes visible only in long-term since political decisions/processes often take time and are bound to further factors.

PHYSICAL SCIENCES AND ENGINEERING

- The combination of macro impact areas: 1/ traditional scientific impact, 2/ innovation dimension through technology push and participation in mission-oriented research and 3/ a strong regional development expectation require different strategies and assessment tools,
- Being a single site RI there are difficulties measuring SEI among partners not hosting components of the RI,
- Track impact over a long-time period plus the attribution of impact to the ERIC / RI,
- Many of the outcomes produced by fundamental research facilitated by the infrastructure are not directly produced by the RI itself but rather by its users,
- A long time between a theory being presented, experiments performed and a discovery to be confirmed, a long time between a discovery and its application in society.

SOCIAL & CULTURAL INNOVATION

- Challenging application of some indicators,
- The Social Sciences and Humanities (SSH) represent a very diverse scientific field including many disciplines using very different methods,
- The Social Sciences and Humanities (SSH) study aspects of human society and culture, one could argue that any production in that field as a social impact, however very difficult to measure,
- There are different paths to impact - direct and indirect. Impact is often an indirect effect of a data service: researchers that use a dataset as a step in achieving insight or in creating a model are often not the ones that generate non-academic impact outside academia,
- Impact is typically a long-term effect of the enabling role of an RI.



Perceived importance of assessing SEI

Respondents conveyed several points of view on the importance of assessing the SEI of their ERICs, and what they saw as important prerequisites for the assessment.

- Firstly, it was seen as important that stakeholders would share their expectations with the ERIC.
- Secondly, it would be important to ensure a relevant distribution of funds inside the RI so that SEI could be assessed on all relevant areas (for example not only at national level, but at the level of the whole RI).
- Thirdly, acknowledging that assessing the SEI is important and it should be planned during regular intervals is important. A continuous dialogue with the stakeholders in this regard was seen as crucial. Respondents also pointed out that the ERICs themselves also need to invest in maintaining communication about their SEI with their stakeholders, to keep the discussion about their societal relevance ongoing.

Furthermore, explaining and narrating the SEI to funders and to the general public was seen as important, as well as promoting the usage of the data and services produced by the RI. It was also mentioned that data policies should be defined thoroughly to enable the usage more effectively. Finally, it was highlighted that multinational cooperation is important to reduce duplication of resources, and to better understand the impact landscape of the RIs.

After assessing SEI

After carrying out the SEI assessment, some respondents indicated that they had been further developing their indicators and the evaluation process, as well as defining their impact areas. They also planned to continue using the results for increasing their impact or track the future developments through annual reporting. The information gained from the SEI assessments had also been used to define the cost-benefit structures of ERICs.

Suggestions collected by the survey on how the ERIC Forum, EC and stakeholders could better support the ERICs in carrying out their SEI assessments are presented in the Recommendations section (pg 36).

ERIC FORUM

CASE STUDIES

Perspectives from the EMBL/EIRO FORUM

Cluster (see info on ERIC clusters here: https://www.eric-forum.eu/the-eric-landscape/) - not directly applicable to EMBL

Distributed multisite RI

Status: EMBL is not an ERIC, and is legally established as an Intergovernmental Organisation. EMBL has infrastructures in six host sites that are distributed across five host countries, with which Laboratory Host Site Agreements are concluded.

However, EMBL is directly involved in a fairly similar way in ELIXIR (ESFRI Landmark) and Euro-BioImaging (ERIC), which are both established on the 'hub and nodes' model: as a founding member, sitting on the Board; as the host of the Hub; and as a node.

Established (year): 1974

Formal Impact Assessment carried out and references: Two formal, external and independent impact assessment studies were conducted:

1. Review of the impacts of EMBL experimental services, undertaken by the consulting group Technopolis. This Socio-Economic Impact Assessment (SEIA) study analysed the value and impact of EMBL's experimental services, 2. EMBL-EBI Impact report 2021, undertaken by the consulting company Charles Beagrie Ltd. This SEIA study analysed the value and impact of EMBL-EBI's open data resources and was carried out in 2020-2021. Since a previous version of this SEIA study had been conducted in 2015-16, the most recent SEIA enabled the comparison of impact and economic benefits across years.

Reasons for undertaking SEIA/stated goal: EMBL undertook two SEIAs to develop a framework and evidence base for demonstrating the economic value and impact of our data resources and experimental services. As the only intergovernmental European Life Sciences research organisation, EMBL aims to provide world class resources and services to scientists in all EMBL's member states and beyond, from both academia and industry, in a way that complements and expands the service provision of national research infrastructures. The SEIA allows EMBL to demonstrate the added value and impact of its open data resources and experimental services to its member states and other stakeholders, especially in the context of our five-year programme development and funding establishment.

METHODOLOGY

1. Methodology for Review of the impacts of EMBL experimental services: External academic and industry users of experimental services at EMBL sites in Barcelona, Grenoble, Hamburg, Heidelberg, and Rome were surveyed. The surveys, launched in June 2021, included questions to gain an understanding of the qualitative value of the services, as well as initial analyses to estimate the economic value of the services. In addition, a combination of desk research and interviews were used to develop impact case studies covering academic and industry use of EMBL experimental services. The case studies serve to illustrate the types of socio-economic impacts that have been realised as a result of using one or more EMBL experimental services.

2. Methodology for EMBL-EBI Impact report 2021: A user survey was carried out and cost-benefit models were applied to estimate the economic value of EMBL-EBI's data resources and tools. Application of economic models was possible due to the high number of data services users, which is in the order of several hundred thousands per year. Quantitative economic approaches used in the study include: estimates of access and use value; contingent valuation; estimating the efficiency impacts of EMBL-EBI data resources; and a macro-economic approach that seeks to explore the wider impacts of EMBL-EBI data resources on returns to investment in research. Alongside quantitative analysis, the user survey enabled qualitative analyses to be done based on user stories.

KEY INDICATORS

At EMBL, reporting and analysis of key performance indicators is carried out independently from SEIA. Key indicators of performance are monitored yearly and a subset of which are published in Annual Reports. Key indicators measured include: number of publications and collaborations, number and type of service users (internal or external, academic or industry), number of innovations co-developed with industry, and number of course and conference participants.

The SEI assessments presented in this case study relied on routinely collected key indicators of performance, especially the number and type of users. At the same time, each SEIA study developed more targeted indicators and models to measure socioeconomic value and impact:

Key indicators developed in the Review of the impacts of EMBL experimental services:

- Indicator of the quality of EMBL experimental services
- Indicator of the support provided by EMBL facility staff
- Indicator of the importance of the service provided by EMBL facilities to the user
- Number of publications attributable to EMBL experimental services
- Number of new techniques/tools/methods attributable to EMBL experimental services

- Indicator of the impact on skills and knowledge as a result of using EMBL experimental services
- Number of users reporting new intellectual property rights applications or registration as a consequence of the use of EMBL experimental services
- Indicator of the societal benefits of using EMBL experimental services
- Economic evaluation of EMBL experimental services
- Indicator of the importance of EMBL experimental services for company's research and development and innovation

Key indicators developed in the EMBL-EBI Impact report 2021:

- Investment value of EMBL-EBI managed data services
- Access value of EMBL-EBI managed data services
- Use value of EMBL-EBI managed data services
- Willingness to accept
  Willingness to pay
- Efficiency Savings
- Return on investment in R&D using EMBL-EBI managed data services

KEY FINDINGS

1. Key findings for SEIA of experimental services across EMBL:

a. EMBL Facilities are critical for research.
b. EMBL Facilities pioneer integrative services.
c. EMBL Facilities enable more research of higher quality.
d. EMBL Facilities ensure wider benefits for the research ecosystem.
e. EMBL Results contribute to solving global and societal challenges and generating economic impact.
f. EMBL Facilities support technology transfer and build industry relations.
g. EMBL Facilities are valued at €17.5 m per annum
h. 91% of users said access to EMBL experimental services was vital for their research.
i. 70% of users indicated that EMBL experimental services delivered societal impact.

2. Key findings for SEIA of open data resources managed by EMBL-EBI:

a. For every £1 spent providing EMBL-EBI resources, researchers save time worth up to £102, adding up to £11 billion in annual benefits to researchers and funders due to more efficient research.
b. Research and Development facilitated by the use of EMBL-EBI managed data resources is estimated at up to £2.2 billion annually.
c. Access value to data resources: estimated £465 million per annum, use value £5.5 billion per annum and investment value (by EMBL-EBI and collaborators) estimated £110 million per annum.

CHALLENGES AND MAIN LEARNINGS

For both case studies, it was a challenge to ensure that both internal and external stakeholders had a full understanding of what socioeconomic impact meant with respect to EMBL. For example, understanding that impact is more than the academic creation of knowledge and also includes wider social impacts in a range of thematic areas such as health, industrial biotechnology, environment and climate change, and food security and sustainable agriculture.
Concerning the Experimental Services SEIA led by Technopolis, an additional challenge was to create a survey that catered to a heterogeneous set of EMBL facilities that are located across Europe and have different modes of operation. Deducing which case studies were most likely to show financial impact, before beginning the labour-intensive research of each one, also proved challenging, with scientifically impactful cases not necessarily signifying economic and societal impacts. However, securing and maintaining buy-in from internal stakeholders proved to be crucial for both of these aspects. Their knowledge of the services user community maximised the relevance of the survey for the respondents and gave crucial insights into potentially relevant cases studies.
Despite the surveys being tailored to maximise relevance, feedback from some respondents indicated that the survey was too long. The response rate of the survey was classed as average and the length of the survey could have been one reason for this.
Finally, repeating the EMBL-EBI impact study showed how the impact of EMBL-EBI's data resources increased over the course of five years. Learning from this, it would be beneficial to regularly measure impact of both EMBL-EBI data resources and EMBL experimental services through the commission of SEIAs at regular intervals. Regularly measuring impact is likely to be appreciated by funders, who are keen to see continual returns on investment, especially in light of increasing costs.

LESSONS LEARNED

- Secure and maintain buy-in from internal stakeholders.
- Keep surveys short and relevant to the respondent.
- Measure impact regularly to understand how this changes through time.
- Implement regular collection of RI usage and user demographics to design more effective impact surveys

ERIC Case Study 1 ESS European Spallation Source

Cluster: PS&E
Single-site RI
Status: Landmark RI (ESFRI, 2016, 2018, 2021)
Established (year): The ESS ERIC has been in operation since 2002 and was awarded ERIC status in 2013.
Formal Impact Assessment carried out and references: SEIAs: Two comparative impact studies of the ESS ERIC carried out in 2016/2017 and 2021/2022. Both studies were supported by EU H2020 funding and were undertaken by Technopolis Group. 2016.1027: Comparative impact study of the ESS ERIC,
2022: SUSTAIN-2: Impact study of the European Social Survey
Reasons for undertaking SEIA/stated goal: The study (2022) explores the academic, non-academic and teaching impacts that have been achieved through the ESS, by all different user groups and in all current member/observer countries. It also assesses how these impacts came about ('pathways' to impact), identifies best practice, and makes recommendations to ensure the long-term sustainability of the ESS.

METHODOLOGY

Qualitative and quantitative methodologies were employed.

KEY INDICATORS

- ESS co-publications by Member Country per year
- Accumulated number of new partners involved in grant projects
- Total number of new suppliers per Member Country
- Proportion of Cost Book value
- Number of online media articles about ESS and mentions
- Share of contracts awarded to Member Countries
- Innovation level of products and services supplied to ESS
- Share of tenders received from Member Countries
- Number of nationalities employed at ESS
- Number of In-Kind Partners with various team sizes working on the ESS In-Kind Contributions
- Overall economic benefits from supplying to ESS.

KEY FINDINGS

The second impact study explored changes between the first study under taken in 2016 and the results of a follow up in 2021. Analysis of ESS data users established that, as of June 2021, there were 182,778 registered users - almost double the figure at the start of the original Impact Study (June 2016). The number of registered users has grown consistently by 14-15% in each of the last five years and 74% registered users have downloaded our data.
The overall number of academic publications including significant analysis of our data has increased by at least 150% since the first Impact Study including various different publication types and non-English language publications, University of Ljubljana data suggests that there are over 7,500 publications in existence (the first Impact Study reported 2,704).The citation impact of these publications is well above average, being about 70% more highly cited than average, with 21% of all ESS publications belonging to the top 10%. The journals in which work is being published have a citation impact of 40% above the world average.

Several examples of non-academic impact, of many different types and across different domains have been identified. These include data being used for insight by NGOs or government ministries, agencies or advisory bodies; and data being used to highlight a particular problem or challenge, leading to policy action. The study also reported that data was used in the news media to Influence public debate or highlight social issues; and our indicators are used to assess whether certain policies are achieving the desired outcomes.

MAIN LEARNINGS

Different pathways to impact are identified - direct and indirect use of ESS data by different actors, including policy makers.

CHALLENGES UNDERTAKING SEIA

Not everything that can be counted counts, and not everything that counts can be counted (William Bruce Cameron): it is a challenge to select the right indicators, both from the perspective of what you would want and from the perspective of what can be delivered.
Trustworthiness and transparence are important when selecting indicators. One doubtful or unclear indicator will discredit the rest.

LESSONS FOR OTHER ERICS

Make sure that the indicators are relevant.

Remember the “I” i.e. it is not an exact science but an indicator.
Indicators should be defined from the concept phase and fine-tuned throughout the lifecycle of a RI, for example when phase milestones are achieved or when context or surrounding parameters have changed.
Monitoring should be seen as a continuous project for a RI with reporting dates e.g. on an annual basis. It does not have the same shape and form for all RI stakeholders:

- ESS created narratives/translations for each member country,
- A translation of indicators along the lines “what does it mean for you?”

Working towards a joint SEI philosophy, definition,and methodology will help all RIs!

ERIC Case Study 2 CERIC Central European Research Infrastructure Consortium

Cluster: PS&E
Distributed RI (8 sites in Members and 3 associated facilities)
Status: non-ESFRI
Established (year): 2014
Formal Impact Assessment carried out and references: Internal impact assessment has been performed, following the impact pathways approach, in preparation for the external SEI evaluation. The analysis consisted in identifying the main pathways leading to impact, along the objectives of CERIC. The impacts were analysed retrospectively, to identify the processes that led to impact: how the inputs are transformed into outputs, outcomes and impact. For these processes, indicators were identified, which weree collecdt periodically as a part of the monitoring framework of CERIC.
Reason SEIA was undertaken/stated goal: It was undertaken to show the stakeholders how their contributions to the ERIC generated impact. This included an analysis of the local impact. However, although not intended as one of the main objectives, the impact assessment proved to be very useful to engage all employees in understanding how their part of the work contributes to delivering impact and proposing initiatives that can contribute to the objectives of CERIC.

METHODOLOGY

We used a methodology developed in the European project ACCELERATE, based on the theory of change and impact pathways, with the support of the Rathenau Institute. The methodology is publicly available:
https://www.ceric-eric.eu/wp-content/uploads/2022/02/ACCELERATE_D-1.5_Final-Assessment-Protocol.pdf

KEY INDICATORS

CERIC adopted as much as possible the performance indicators proposed by ESFRI (Annex 2) which are used to track their contribution to the pathways and to impact.

KEY FINDINGS

It was very relevant that CERIC could show its impact to the members of the consortium. We found out when testing the first draft protocol, that the impact assessment methodology was very similar to the one developed by the project RI-PATHS, which started during the execution of ACCELERATE.

LEARNING CAPTURED BY THIS PROCESS

The identification of the processes linking to impact also helped to raise understanding among the employees on how to contribute and how to maximise the impact

CHALLENGES UNDERTAKING SEIA

The main challenges were related to understanding how to apply the methodology: starting from the objectives, and how to reconstruct the pathway that would lead to impact. Since the exercise involved all of the employees, another difficulty was to engage them all, independently of their background or interests. For the execution of the external SEI assessment, we expect to allocate a considerable budget. We also expect that it will be necessary to dedicate a considerable amount of time to discussing with the consultants, although we expect that the preparatory work will save time for both parties.

LESSONS FOR OTHER ERICS

The SEI assessment helps to demonstrate to the stakeholders the value they get for the contributions they provide. It helps at all levels, not only at the level of the funders but also for employees and the participating institutions, to understand how the consortium produces value and contributes to different impacts, and how every actor can maximise their contribution.

ERIC Case Study 3 ESS European Social Survey

Cluster: SSH/Social and Cultural Innovation
Distributed RI
Status: On ESFRI Roadmap from 2006; Landmark RI (ESFRI:2016, 2018, 2022)
Established (year): The ESS ERIC has been in operation since 2002 and was awarded ERIC status in 2013.
Formal Impact Assessment carried out and references: Two comparative impact studies of the ESS ERIC carried out in 2016/2017 and 2021/2022. Both studies were undertaken with the support of EU H2020 funding and were carried out by Technopolis Group.
2016: ESS SUSTAIN (GA 676166): Comparative impact study of the ESS ERIC (Technopolis Group » Comparative impact study of the European Social Survey (ESS) ERIC (technopolis-group.com))
2022: SUSTAIN-2 (GA 871063): Impact study of the European Social Survey (SUSTAIN-2: Impact study of the European Social Survey (technopolis-group.com))
These studies explored academic and non-academic impact. To date, ESS ERIC has not completed a SEIA.
Reasons for undertaking SEIA/stated goal: The study (2022) explores the academic, non-academic and teaching impacts that have been achieved through the ESS, by all different user groups and in all current member/observer countries. It also assesses how these impacts came about ('pathways' to impact), identifies best practices, and makes recommendations to ensure the long-term sustainability of the ESS.

METHODOLOGY

Qualitative and quantitative methodologies were employed. Web of Science citation data as well as interviews with key stakeholders; academics and policy makers.

KEY INDICATORS

These included bibliographic indicators, number of publications; number of citations; indicators of ESS dataset downloads; social media mentions. Impact on academic data use, on teaching use and on the development of capacity of national teams and students was also explored.

KEY FINDINGS

The second impact study (2022) explored changes between the first study under taken in 2016 and the results of a follow up in 2021. Analysis of ESS data users established that, as of June 2021, there were 182,778 registered users - almost double the figure at the start of the original Impact Study (June 2016). The number of registered users has grown consistently by 14-15% in each of the last five years and 74% registered users have downloaded our data.
The overall number of academic publications including significant analysis of our data has increased by at least 150% since the first Impact Study including various different publication types and non-English language publications, University of Ljubljana data suggests that there are over 7,500 publications in existence (the first Impact Study reported 2,704).The citation impact of these publications is well above average, being about 70% more highly cited than average, with 21% of all ESS publications belonging to the top 10%. The journals in which work is being published have a citation impact of 40% above the world average.

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MAIN LEARNING CAPTURED BY THIS PROCESS

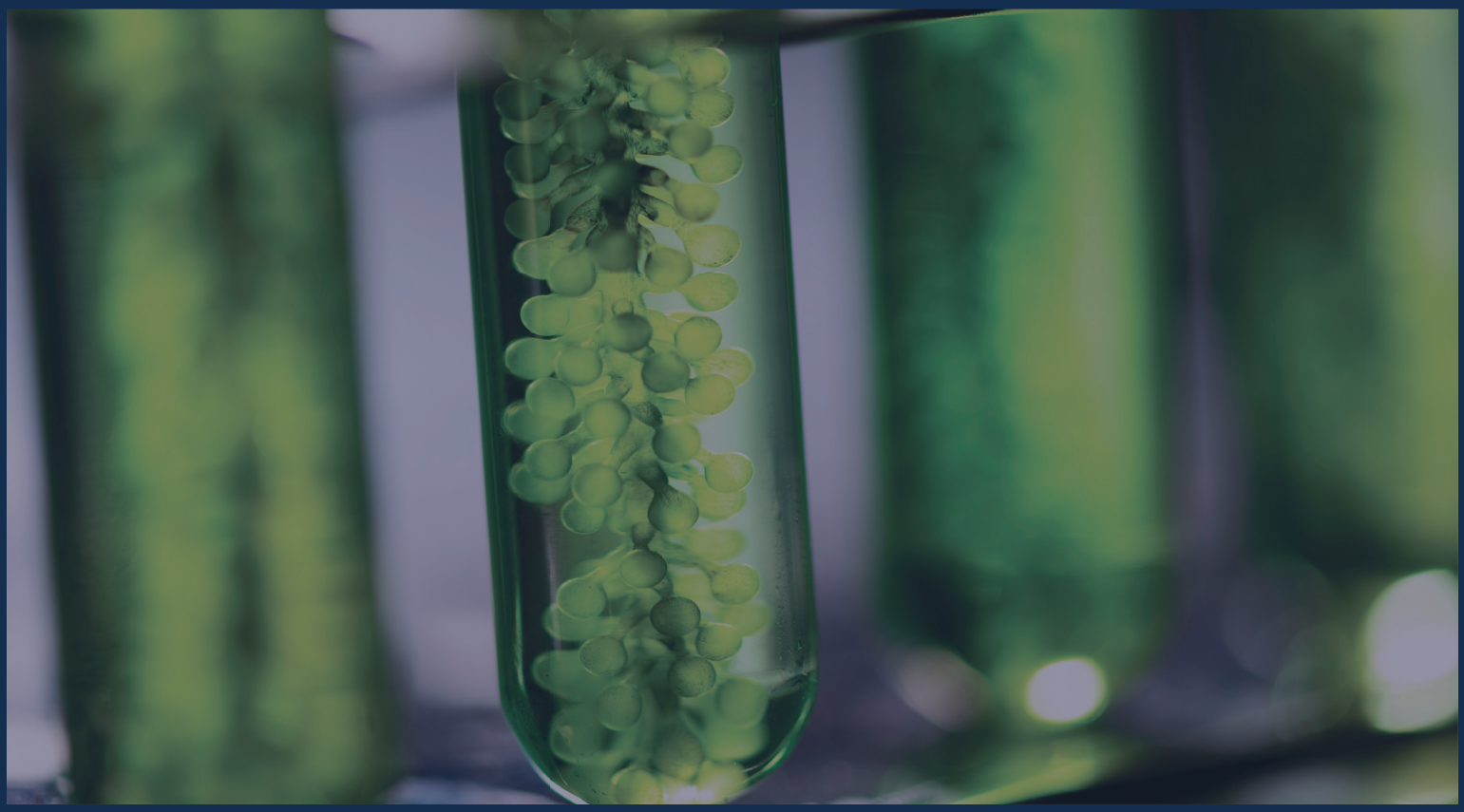
Different pathways to impact are identified - direct and indirect use of ESS data by different actors, including policy makers. The difficulties of capturing impacts included the identification of appropriate indicators. It is important to address the time-frame of assessment (when during the life-cycle) and acknowledge the 'time to impact' of actions and results. Qualitative and quantitative data are required to assess the social impact of social sciences and humanities research.

CHALLENGES UNDERTAKING IA

The challenges include the identification of appropriate indicators for the assessment of different types of impact. There is a need to distinguish between asesssments of performance and those of impact; between direct and indirect impact; and between expected and unexpected impacts.

LESSONS FOR OTHER ERICS

It is important to allocate resources for impact assessment in budgets; to consider data availability – often there is a need for forward planning to collect relevant, that is required for impact assessment - data and to consider the possible dual use of performance data. It is important to consider the stated aims of the ERIC and to have clarity about the mission of an ERIC when making assessments of its impact.



ERIC Case Study 4 SHARE Survey of Health, Ageing and Retirement in Europe

Cluster: S&CI
Distributed RI
Status: ESFRI landmark since 2016
Established (year): SHARE has been in operation since 2004 and was awarded ERIC status in 2011 as the first ever ERIC.
Reasons for undertaking SEIA/stated goal: Measuring and communicating SHARE's SEI is essential for several reasons. Since SHARE is based on funding from different national and international sources, reporting its impact is fundamental for past and future funding. Further, SHARE is working with a sometimes vulnerable group of population – people aged 50 and above – which requires following ethical principles. Open communication to SHARE's respondents about the impact of SHARE is an essential part of this work.
Many of the SHARE findings have strong policy implications with large economic and societal impacts. Since SHARE's (research) topics are often of high societal relevance, there is continuous and reasonable interest by the media and the general public in SHARE's impact, which SHARE as an ERIC naturally strives to satisfy.

METHODOLOGY

Qualitative and quantitative methodologies are employed. On the one hand, SHARE is maintaining KPIs to continuously keep track of its development and impact. On the other hand, an extensive research is made throughout the preparation of SHARE's Annual Activity Report, which is published every year and contains a chapter about SHARE's policy impact throughout the last year. For this research, also SHARE's country teams as well as policy makers are contacted to get a comprehensive picture of SHARE's impact on the regional, national, European and international level.

KEY INDICATORS

Media appearance
Number of employees
Number of publications
Social Media Followers
Number of student assistants
Number of SSCI-ranked publications
Website Visitors
Number of PhD students
Open-access publications (own)
Number of questionnaire languages
Gender Balance
Countries covered in Publications
Number of users
International Staff
European Coverage
Number of user countries
Number of Conferences and seminars
Network of Global Sister Studies
User Support (number of processed user requests)
Trainings and Professional development undertaken
Number of countries per wave
Number of User Workshops
Contribution to policy/Policy Impact
Number of countries with national funding per wave
Use of data by scientists (number of users with scientific affiliation)
Use of data by policy actors
Countries on time
Users from non-SHARE countries
Public procurement and contracts (e.g. contracts with agencies)
Projects granted
Funding sources

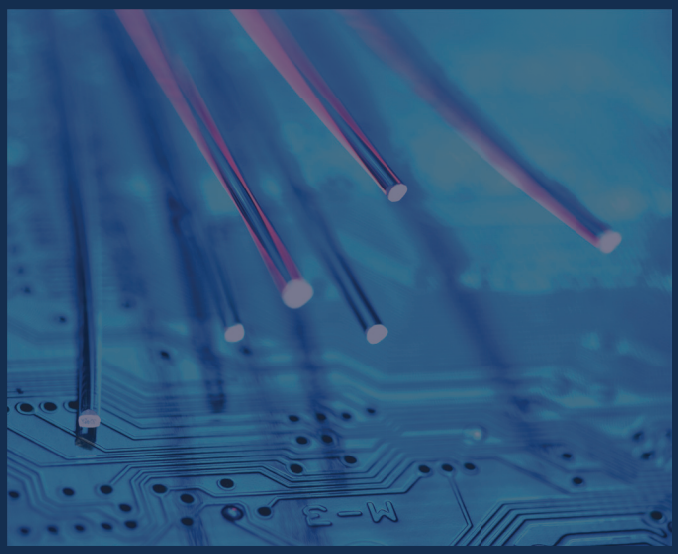
KEY FINGINDS

Key findings are presented every year in the SHARE-ERIC Annual Activity Report: Chapter "Policy Impact" presents selected examples of SHARE's policy impact in the past year. Chapter "SHARE in Numbers" gives an overview over the most striking KPIs, including their change compared to previous years.
By June 2022, SHARE counted more than 15,000 registered users from 76 countries. Around 600 policy actors use SHARE data to base their decisions on. More than 3,500 publications based on SHARE data have been published so far. In the past year, we registered one new publication per day.
Further, since 2017 SHARE has reached full European coverage. From 2004 until today, 530,000 in-depth interviews with 140,000 people aged 50 or older from 28 European countries and Israel have been conducted.

LEARNINGS CAPTURED IN THIS PROCESS

Other than communicating the results of SHARE's SEI assessment (e.g. through SHARE's Annual

Activity Reports), SHARE tries to follow-up on especially relevant findings of this assessment to track future developments. This may open up new possibilities for research or cooperation. However, since SHARE's SEI is quite diversified, it is difficult to provide a uniform answer to this question.



CHALLENGES UNDERTAKING SEIA

Since SHARE is a quite large, distributed infrastructure, which is also working on national levels in different languages, it can be quite challenging to measure/assess SEI on the regional and national level. Through close cooperation with the country teams we try to minimize this obstacle.
SHARE is a very large distributed infrastructure, operating all over Europe and Israel. Thus, tracking SHARE's SEI is connected to extensive research and may never be 100% complete. Further, much of SHARE's impact becomes visible only in long-term since political decisions/processes often take time and are bound to further factors.

LESSONS FOR OTHER ERICS

Be continuous: this is the only way to capture as much SEI as possible, and needed to track developments over time. We prefer to compare SHARE with itself rather than with other RIs, since KPIs with the same names often have fundamentally different meanings for different RIs. (Example: Financial volume of business with external contractors, which is obviously very different between RIs with mainly digital services and e.g. physical RIs that operate heavy machinery in large facilities. The construction/maintenance costs they require cannot be compared to those of social surveys.)
Documentation is Key: Very helpful to answer various surveys and questionnaires, as well as requests by stakeholders. Saves a lot of work.

ERIC Case Study 5 EATRIS European Infrastructure for Translational Medicine

Cluster: H&F
Distributed RI: 145 Member institutes
Status: ESFRI landmark
Established (year): ERIC status since November 2013
Formal Impact Assessment carried out and references links: EATRIS has not carried out a formal impact assessment yet. However, it has taken important steps towards establishing a robust impact assessment framework. In 2019-2020, EATRIS was offered the opportunity to take part in the pilots supported by the H2020-funded RI-PATHS coordinated by The European Future Innovation System (EFIS). The pilots were aimed to support several RI's with getting started with their impact pathways. EATRIS benefited from the expertise and support of the European Science Foundation. The pilot allowed EATRIS to identify three preliminary key impact pathways and design methodologies to collect impact evidence. In 2022, EATRIS has been building further from this initial experience and has been working on formalizing its own impact assessment framework, therefore capturing all relevant EATRIS impact pathways and associated impact indicators, in collaboration with EFIS[11].
Reasons for undertaking SEIA/stated goal: The reason for undertaking these activities was to empower EATRIS to report to its members, funders, and the public at large, on the results of its activities and provide evidence that it is adequately and successfully fulfilling its long-term mission and ambition to accelerate the translation of scientific discoveries into patient benefit. Besides the accountability that any publicly funded organization shares, it was also important for EATRIS to identify short to mid-term impact milestones and be able to capture impact evidence throughout the long journey of medicines development (usually, 10 to 15 years). In order to show EATRIS' impact on medicines development, assessing and monitoring impact had to start as soon as possible.

METHODOLOGY

EATRIS explored possible methodologies during the pilot conducted with RI-PATHS. Those include: user feedback surveys (short and mid-term), bilateral interviews and case studies.

KEY INDICATORS

EATRIS developed a KPI framework in 2020; impact indicators are still underway.

KEY FINDINGS

Thanks to the external support provided through RI-PATHS and earlier this year by EFIS, EATRIS has now clearly identified eight main impact pathways. These pathways will form a strong base for future impact work, including the definition of indicators and methologies for collecting data and evidence, foreseen in 2023.

LEARNINGS CAPTURED IN THIS PROCESS & CHALLENGES UNDERTAKING SEIA

Impact assessment is time and human resource-intensive and can easily be "deprioritised".

Although an important process, impact assessment-related activities can be challenging to carry out for infrastructures with relatively small teams.
Impact assessment requires a collective effort across teams – active internal communication is key. Many teams members will have to be included in the process of designing methodologies and collecting data, impact assessment is always a team effort that requires a deep understanding of the infrastructure's operations and workflows.
Measuring impact on industry users is the most challenging, especially in the long-term. EATRIS has been serving many SME's over the years; tracing the impact of those collaborations has been challenging due to the high turnover of smaller enterprises or even their disappearance or merging with other companies. When EATRIS undertook user interviews with SME, 90% of the staff who was in touch with EATRIS at the time of the service delivery was no longer in their position.
Incentivise all departments of the research infrastructure operation to actively compile evidence of impact.
Impact assessment requires the involvement of multiple staff members from training, IT, communications, business development, etc. and methodologies for monitoring and collection need to be integrated throughout. Each impact pathway is unique. A particular methodology that may work for a particular pathway may not be the most appropriate for another. Each pathway requires a tailor-made approach for collecting evidence.
Assessing impact is also a very rewarding journey, as it helps reflect on the multiple positive outcomes that the RI has on society at large, and take a step back from day to day operations. This can also be an important tool to attract and retain staff.

11 https://www.efiscentre.eu/

LESSONS FOR OTHER ERICS

Do not do it alone. Impact assessment is challenging, it is important to reach out to external experts as well as to other RI's to collect as much insight and guidance as possible.

Start early. It is never too early to start thinking and drawing impact pathways and reflect from the start of the operations, how long-term impact of the RI on its users and society can be collected and evidenced.

Incorporate impact in your narratives. One should not underestimate the importance of regularly communicating and highlighting the impact (current or future) of the RI and the reasons why the RI contributes to a better society. Have your users, close collaborators, external partners reflect and share their views on why your RI has impact.

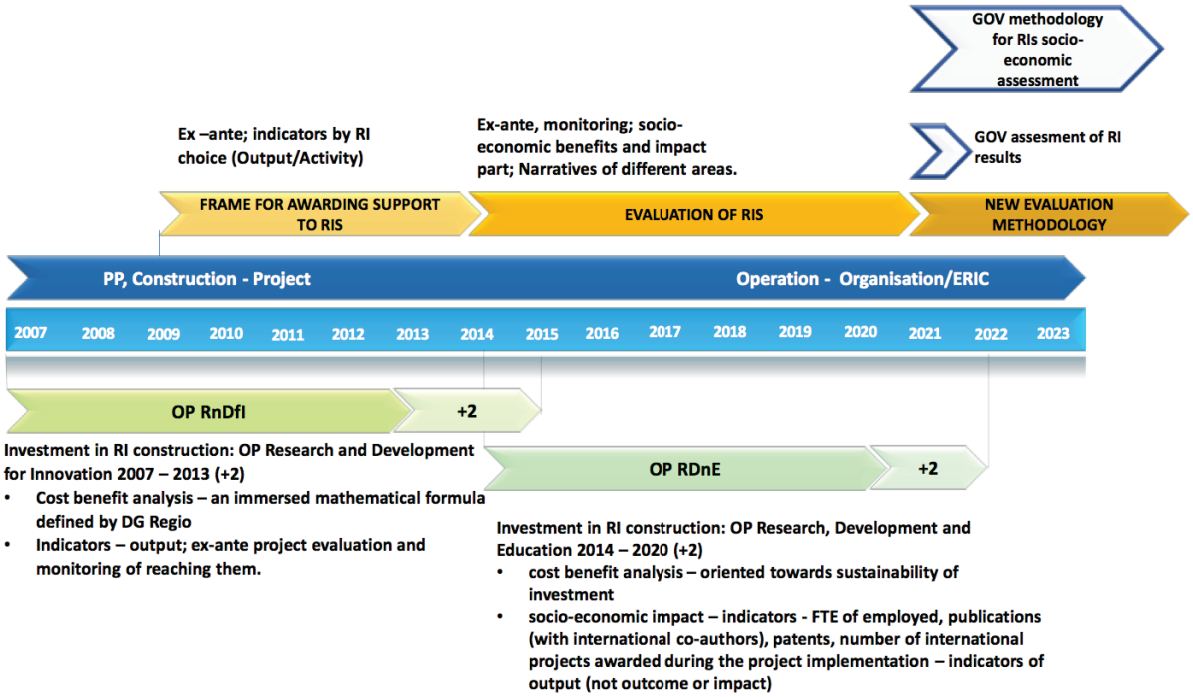
STAKEHOLDERS' PERSPECTIVE

European Commission overview of the current policy context for the Research Infrastructures and the ERICs in the new European Research Area (ERA).

The new ERA shaped in November 2021 consists of three different elements: **1)** The Pact for Research and Innovation (R&I) which sets out the fundamental values and principle for the new ERA and indicates the priority areas where ERA actions must be adopted, **2)** the ERA Governance sets up the governance structures of the European Research Area and **3)** the ERA Policy Agenda, which is the most important in the context of the socioeconomical impact, translates the areas indicated by the Pact for R&I into concrete actions, which Member States may join on a voluntary basis. These actions are identified to ensure the impact, credibility, and effectiveness of the new ERA. The most relevant action for ERICs and Research Infrastructures is Action 8, which aims to strengthen the sustainability, the accessibility and the resilience of Research Infrastructures in the new ERA. Action 8 is translated in activities for the next two to three years dealing with socioeconomical aspects and foreseen as a strategic analysis of the European infrastructure landscape. A broader and more sustainable access shall be granted to all countries to the Research Infrastructures, also to the services provided by Research Infrastructures.

There is a plan to update the ESFRI roadmap and also the monitoring framework for the Research Infrastructures. Moreover, the report on the ERIC framework is forseen by the end of this year. Among the activities there is the promotion of an increased cooperation among Research Infrastructures, e-infrastructures and stakeholders, also through EOSC. The priority for the European Commission is the long-term sustainability of the ERIC System through the development of a strategic harmonized landscape; actions increasing complementarity and clustering are encouraged in order to achieve the goals of the new ERA. Concrete actions are mainly related to the socioeconomical impact the Commission has committed to be included in the EGERIC report. The EGERIC Expert group provided very important inputs regarding the ERIC System and an in-depth analysis of the ERIC Regulation. Among the outputs, there are the recommendations on how to improve the links with society, economy and competitiveness; for example the harmonization and synergies among ERICs to provide a better service to the research communities, as well as dedicated investments to enhance some aspects related to the socioeconomical impacts, such as technology transfer and communication. Starting from the EGERIC Report and in view of the report on the ERIC framework foreseen by the end of 2022, the Commission has consulted individual experts to explore the key elements that are relevant for research infrastructures and have a role in the socioeconomical assessment. These key aspects are the long-term sustainability and financial models of Research Infrastructures, the development of dedicated and strategic services focusing on the ERICs, the access to Research Infrastructures, focusing on the ERICs and covering different aspects related to the technical, legal and regulatory matters of this analysis, the outcomes of which shall be shared with the ERIC Community.

Member State evaluation of RIs: a learning experience of the Czech Republic



The experience of the Czech Republic is shared to underscore that the evaluation of RIs and their impact is a learning, developing experience at Member State level. In 2009, the Czech Republic set up for the first time the framework for awarding operational cost for research infrastructures and included the definition of a large research infrastructure in the Research and Development Act. At that time, only output or activity indicators were used for the ex ante evaluation of RIs, which was at the time a novelty for the researchers. At the same time the opportunity to use EU Structural Funds[12], in-kind investments in building, was conditioned by providing a cost-benefit analysis. However at the time the cost-benefit analysis was not directed to impact and was more focused on the value for money. Later on this cost-benefit analysis evolved and became more focused on the sustainability of the investment. In 2014 a new evaluation framework for Research Infrastructures as a whole was prepared and continues in progress since then. Recently in 2021, the RIs' socioeconomic impact and how it can be measured are under consideration. The initial plan of the Government Council to have the impact measured using the results, which means outputs and outcomes, was not feasible due to the numerous bottlenecks and challenges. One example is how the provision of services by a Research Infrastructure can be tracked and monitored within an open access policy framework? This implies the need and the conditions to collect the affiliations in the publications generated by this collaboration. However if the user/scientist comes from a project funded by a different provider, there are around nine target-oriented providers in the Czech Republic and there may be several more funders from other countries, then collecting even the output indicator becomes a bottleneck due to the lack of alignment of the funders.

12 https://ec.europa.eu/regional_policy/en/funding/

There is also the lack of clear boundaries inside the hosting institution of a node. Which means who is the node? Who measures the inputs? What are the inputs into the Research Infrastructure, the ERICs? This issue was also raised within the EGERIC expert group particularly for distributed research infrastructures. The strong emphasis on economic revenue in impact assessment is another bottleneck. Some government officials consider a research infrastructure to be enterprise whereas it is not the case. The fragmentation of providers is another additional bottleneck.

The point which should be underscored is that ERICs have evolved from projects, preparatory phase projects, construction projects into organizations and even corporations. The needs and behaviours of a corporation are very distinct from those of a project and this should be taken into account when setting up the framework for measuring ERIC performance and impact assessment.

From the perspective of ELI ERIC, setting-up organizational KPI's is the responsibility of the management and the Assembly of Members of the ERIC in the General Assembly. The KPI measures the performance of an organization as progress towards its objectives and shorter term goals. That means that the organization has to set up a long-term objective, implemented via shorter term goals and then choose the KPI; which is a different task from responding to the monitoring indicators of ESFRI and socioeconomic impact assessment. Given the multiple evaluations an RI is subject to, further clarifications are needed regarding the purpose these evaluations really fulfill. If the ERICs are European Union legal persons we need pathways to progress towards the socioeconomic impact assessment as a holistic exercise and to give a holistic view of the area. For example, if we have as an output indicator the number of students trained at the research infrastructure, the outcome could be how many Master thesis were completed while using access to this research infrastructure and then the impact would be how successful these people were on the job market: did they find a job in the field they studied or did they dropout after two years? Or did they really remain there? Which means the impact is a long-term assessment and a five-year interval for monitoring impact would be a good idea. There is also a need to unify definitions, and methodologies. Measuring performance is different from measuring socioeconomic impact. This is the task of ESFRI and ERIC Forum to work together.

The role of ESFRI in coherent policy-making in the field of Research Infrastructures, goes far beyond providing support for roadmapping. There are various activities which have immediate effect on research infrastructures on the funders and the policymakers. For example, currently ESFRI has produced a draft workplan for the next two years (2023-24), which includes a number of relevant activities. ESFRI has also produced KPIs[13], some of which are outcome indicators more on the impact side, for example the top 10% of cited papers or publications or references by policymakers in their publications. In addition to the KPI framework, ESFRI is currently developing the monitoring of performance of RIs so that all the ESFRI landmarks can be monitored within in the near future. Currently a meta impact analysis is included in the ESFRI draft workprogram. This consists of a review through the past analyses of impact assessments carried out by research infrastructures to collect the kind of impacts registered across different infrastructures and the kind of data used to demonstrate this impact. This approach, once published in a report, will be helpful for the future impact assessments of research infrastructures particularly those research infrastructures within the ERIC Forum who have not yet carried out an impact analysis. The objective of ESFRI is to support Research Infrastructures in the development of their methodology, and the preparation of the impact assessment in order to provide the data in relation with the kind of impacts that will be demonstrated. ESFRI would like to provide support with the demonstration of various impacts across the different Clusters. Versatility is very important as well as communication to promote the various impacts registered.

13 https://arxiv.org/ftp/arxiv/pa-

The mid to long-term outcome foreseen is to increase the sustainability of Research Infrastructures and also to be able to further develop Research Infrastructures to ensure collectively the funding for the new projects such as those that enter the Roadmap. So far with a 24 billion euro investment agenda ESFRI is aware of the need to demonstrate the impacts that this funding has produced. Currently this work is at a very early stage and will be supported by the University of Ljublijana specialized in impact assessment and funded by the Slovenian Ministry, given the MS support provided to the ESFRI chair. Stakeholders shall be involved at an early stage to collect inputs, and the ERIC Forum is of key relevance, especially regarding the impacts of distributed Research Infrastructures.

CERN/EIRO Forum: Lessons learned

The challenge faced when planning a SEI assessment for Research Infrastructures is the variation of the definition of SEI across stakeholders and their expectations thereof. For example the targets and perspectives of a CERN user are very different from those of a journalist or a politician, and indeed their timelines and their horizons vary tremendously. Also internally, certain staff researchers as well the user community may be very passionate about SEI, others may share this interest but are subject to resource and schedule pressures for their activities and have less priority for SEI assessment.

Although obvious, it is important to consider why research is being undertaken. For example the CERN has become one of the world leading centers on superconductivity and large magnets, and the research has a clear use case with the Large Hadron Collider. Carrying out research for institutional purposes is different from blue sky research. Both being equally valid, it is nevertheless worth classifying the reasons when selecting a new direction against the overall strategy of the organization with SEI in mind. What are our objectives? What are the financial and environmental implications?

There is a push and a pull to the research and technology activities at CERN: the Knowledge Transfer Department is where certain technologies are pushed out to society for environmental benefits. However, many of the best ideas come from the outside, where specialists in another field, for example cancer therapy, request to use CERN technology on controlling subatomic particles in an innovative way to tackle brain tumors. Therefore finding the balance between pushing in-house technologies and pulling in ideas is key. Another example is how to use CERN-developed superconductivity in zero emission aircraft to generate an evident positive environmental impact. Again this was not foreseeable in the original research use case for superconductivity for magnets. Given the competition for funding, Research Infrastructures need to assess where they can add value and use the available resources intelligently taking into consideration the scalability of the ideas and their value proposition. It is also important to avoid a positive cognitive bias by talking only to our own user community. Going forward CERN is considering independent assessments to better guide the roadmap towards what actually is useful to wider society. EC calls are a learning opportunity in this respect to inform about impacts against their goals and policy instruments. CERN has carried out a variety of studies over the years on technology transfer spillover in procurement activities, looking closely on how companies develop patents and win additional work worldwide after that. In addition to the OECD cost-benefit analysis

on social impact, the socioeconomic impact of our of Big Science through knowledge transfer has been the object of a PhD thesis. In view of a future Circular Collider for CERN, a range of studies is currently running looking at the financial return on investment in terms of contracts to Industry and the spinoff of jobs, environmental impacts and technology development opportunities. It is absolutely critical for us to have a holistic view on these indicators. Currently in our procurements we look at the coefficient of return to our Member States. This is a measurable mathematical number which is valuable but can be misinterpreted as an indicator for comparison between MS, and mey lead to losing sight of all the other benefits such as the number of students trained per year, the number of citations and the patents derived. Detailed knowledge transfer reports are prepared on an annual basis and data collected on alumni, staff and research students covering diversity, gender and sexuality issues. Environmental impact reports are produced most notably on CO2 given CERN's massive electricity consumption and taken forward working on sustainability and the supply chain. Another relevant indicator tracked at CERN, also of relevance for RIs, is the success rate of proposals to EU framework programmes. During the first year of Horizon Europe compared with Horizon 2020, we saw significant reduction in the number of proposals submitted due to a combination of greater focus on our mission as well workload challenges across the lab, which reflects the need to find the right balance based on shared priorities.

ERICs at the interface with their user communities: the experience of Euro-BioImaging

Public discussions by Euro-BioImaging ERIC, as partner in the international network of Global BioImaging in 2021[14] on open access, quality-managed imaging facilities, identified our added value provided to our most important group of stakeholders: the scientists: EuroBioImaging provides transparent and coordinated access to quality-managed infrastructure services for the acquisition of FAIR image data, expert data management and analysis to facilitate publication of results and open science, as well as the provision of an environment for new research projects, expanding collaborations and offering training opportunities at the level of PhD students as well as experts.

In addition to our scientist users, the staff working at the infrastructure are also part of our stakeholder groups. Open access RIs can often provide new and longer term career perspectives to the staff, as well as opportunities for networking and sharing experiences, standards and new applications across the different infrastructures and in close collaboration with incoming users.

Furthermore, open access imaging facilities provide added value to Industry by providing a direct contact with the academic sector to develop, for example, novel applications by opening up new markets. The RI are regarded as sites for early adoption of new technologies by Industry. Industry appreciates not only the expert feedback provided by the infrastructures for continuous improvement of their products but also the facilitating environment for startup company creation.

Last but not least, funders recognise the minimized duplication of efforts, the coordination of common investment into coordinated infrastructure, and the possibility of leveraging research funding opportunities.

The second exercise conducted in the Global BioImaging international working group on "Impact" was a literature search, including the ESFRI KPIs, RI PATHs and then identifying key performance indicators and socioeconomic indicators relevant for imaging facilities[15]. This work resulted in international recommendations that can be used by imaging facilities when reporting on their performance or to demonstrate their added value. This recommendations document is a very valuable tool for the communities to present themselves to their funders, their hosting institutions and their communities regarding their performance and socioeconomic impact.

14 https://tinyurl.com/FacilitiesAddedValue
15 https://tinyurl.com/ImagingImpact

IMPACTFUL BY DESIGN: SEI ASSESSMENT METHODOLOGIES

In management in general, and for Research Infrastructures in this particular case, being relevant and able to generate a measurable impact is a core issue. When linking impact and stakeholders' perspective we tend, based on previous models and approaches, to think that we need to consider a stakeholder scorecard to identify the contributions of each entity, their type of engagement and the benefits generated and end up with different types of results depending on the categories. We can also consider a slightly different perspective where impact is intentional and stems from upstream decisions that start from the mission, vision and strategy. The results achieved based on the environment and the business model, generate an impact which can be measured. These results can be revised, as the mission and vision evolve over time and then change and evolve the structure.

Impact is rooted in mission, vision and purpose. A RI can be impactful if it is designed so from the very beginning. The circularity of impact begins with designing the mission and vision, as something that makes the Research Infrastructure relevant and generates an impact. Measuring the impact and identifying the indicators is thereafter more of a technical issue. Another analogy is the idea of skyrocketing impact, by generating an impact relevant for a huge number of subjects where the mission, values and vision are aligned. The vision indicates how research infrastructure will create impact and change the ecosystem.

How can we link the mission, the strategy,and the impact? Communication can be seen as a bridge between mission strategy and impact, to transform real impact into perceived impact by communicating it to all the stakeholders in an effective way.

The first point is to create a meaningful shared language at the threshold of scientific, managerial, political, economic languages. This shared language serves as a bridge that can put all the people on the same page and and try to decode also some of the words and jargon used. The second point is sharing experience, involving and engaging stakeholders on a continuous basis on projects and activities to create a regular interaction that is not only in specific moments where the different stakeholders are somehow activated. This is a way to powerfully communicate the type of activity and the relevance of the activity and also get inputs from stakeholders because the piece that very often is missing is how to get feedback and guidance from stakeholders that shape the mission and nurture impact.

The last point is the importance of using communication to build the perception, so investing in communication is key. Scientific communication is at the core of a Research Infrastructure's activity. But very often, investing in communicating RI activities, how they are carried out and trying to create a strong link between the activities and the type of information provided to a broader set of stakeholder and contributing to creating a very positive loop, is neglected by Research Infrastructures. Research infrastructures would benefit from nurturing actively such positive feedback loops with their stakeholders.

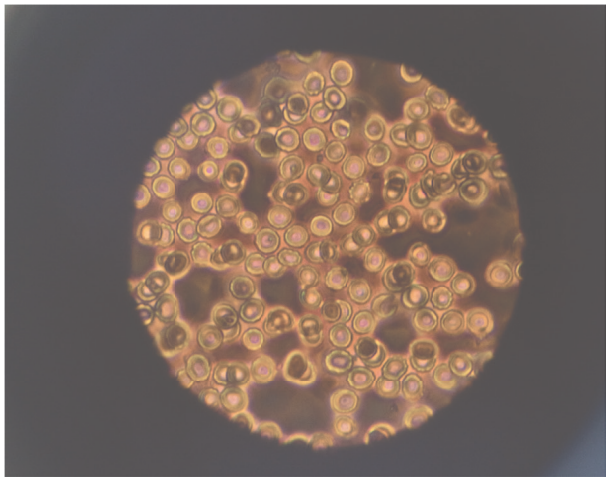
RI PATHS: UNDERSTANDING THE LONG-TERM IMPACT PATHWAYS OF RIs

RIs, particularly the newly established ones, are all faced with the same question: what are the steps that need to be taken on their impact assessment journey? What elements are required to undertake impact assessment, what processes and data RIs already have and what are the missing bits? How do we start this process from scratch? Horizon 2020 funded project RI-PATHS was a dedicated initiative that aimed to provide concrete tools for research infrastructures that started the impact journey[16]. The project results provided a conceptual map that helps research infrastructures to cut through the complexity of socio-economic impact assessment. RI-PATHS project identified thirteen high-level impact pathways whose logic can be observed in the operations of various types of research infrastructures. The RI-PATHS toolkit is publicly available as an inspirational learning material not only for research infrastructure managers, but also policy makers and evaluation practitioners. Yet it is not a ready-made recipe for individual research infrastructures to carry out their assessments.

Four major steps are essential when considering a SEI assessment process. The first step for each research infrastructure is to understand their areas of impact and the respective impact pathways taking into account the aims, objectives and strategy of the research infrastructure. Research infrastructures hold all the knowledge needed in order to construct such an impact framework through the coded and tacit knowledge of its staff members as well as other stakeholder views and perceptions on impact. What is missing though is the facilitation of this process. Many research infrastructures do not hold in-house the required social science expertise. It appears that RIs do not always have a clear understanding of how the impact scoping process should be organized, so there is frequently a need for facilitation of this conceptual impact mapping process. The ESFRI initiative to perform a meta level analysis of RI evaluations would provide useful support in this process. Secondly, once an impact framework is defined, it is essential to think about the indicators. How do the indicators collected map against the identified impact pathways? Which KPIs are collected? Which KPIs are requested by the stakeholders? Research Infrastructures tend to be very good at collecting and reporting on KPIs, which are output indicators. Yet it is the outcome indicators which are strategic for advancing impact assessment efforts and these indicators in many cases are simply missing and need to be defined. Thirdly, when there is a good understanding of the indicators and how they relate to the conceptual impact framework, then the real work of rolling out the monitoring system be launched. It is essential to determine within the organistion how indicators are collected, whether the reasons these indicators are needed are understood and how they will be reported. The rollout of the impact monitoring system needs to start already at the design or construction phase of the infrastructure. It is a good practice to not wait too late into the operational phase to think about what the system will look like. Lastly, once a dedicated monitoring system is in place, the next step is to consider what kind of impact analyses can be done internally by research infrastructure staff, e.g. short summaries reported to the funders on a regular basis, and what support may be required from external consultants, e.g. for analyzing more more in-depth the complex and difficult impact questions that RIs may not be able to address with their internal knowledge and tools. It is important to underscore that any external provider of analytical services relies on the depth and relevance of the indicators that RIs have collected throughout the years.

16 https://ri-paths-tool.eu/en

There are some novel methodologies to create data, especially, using data mining and webscraping tools and that is what external providers can provide additionally. Yet, in order to achieve relevant and impactful findings, the internal monitoring system needs to be well-established and cater reliable data which can be further analyzed by external providers to gain relevant insights into the impact assessment questions.



OECD perspective on Research Infrastructure mobilisation in response to COVID-19

The Global Science Forum is a structure dedicated to science policy and created to contribute to Research Infrastructure policy. One of the many reports related to Research Infrastructure, published in 2019, is a reference framework for assessing SEI[17] which is a very practical tool which can be adapted to many different cases.

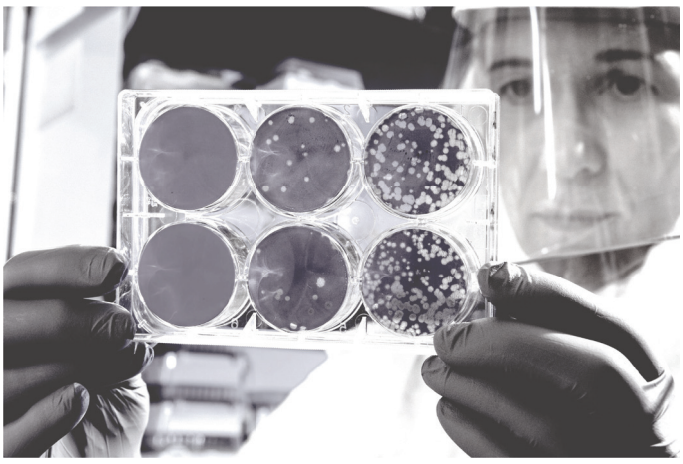
A key pivotal impact of RIs revealed by the recent COVID crisis has been their significant role in pandemic preparedness[18].RIs, thanks to their flexibility, preexisting expertise, equipment, collaboration and networks, were used extensively to provide data and to support policies during the crisis. This led to many Research Infrastructures being perceived as national assets for crisis management whereas this was not anticipated as a potential impact, except maybe in the environmental domain.

There will be new expectations from stakeholders after the COVID crisis, because many people at the decision-making level have realized that Research Infrastructures may play a much stronger role in addressing those type of societal changes that can emerge during crises. This raised stakeholder expectation will impact the RI strategic objectives and the indicators linked thereto, for instance by a stronger emphasis on providing scientific support to public policies as well as on data policy production and use, and assuming a more direct social responsibility towards the society. These are very strategic level impacts that may have been partially hidden in the original creation of the Research Infrastructure, but are now more important for the decision-makers. The COVID crisis showed that the potential impact of a Research Infrastructure can be much more important than initially anticipated. Hence the need to adapt socioeconomic indicators to these new strategic objectives, for instance the networking capacities which can increase dramatically the impact of a RI and the production of trustworthy data resources and advice. Given the broad indiscriminate circulation of fake news and misinformation during the crisis, the truthworthiness of data and advice for public policies is extremely important. The issue of data accessibility and openness to non-expert users or to new ones also emerged dramatically during the crisis. Providing this broader access was a complex challenge for many Research Infrastructures, used to working with a smaller set of users already familiar with their tools, and can be considered as a new impact and contribution to crisis management.

17 OECD (2019), "Reference framework for assessing the scientific and socio-economic impact of research infrastructures", OECD Science, Technology and Industry Policy Papers, No. 65, OECD Publishing, Paris, https://doi.org/10.1787/3ffee43b-en.

18 OECD Global Science Forum Workshop on "Research Infrastructure mobilisation in response to COVID-19: lessons learned" Draft summary 11 May 2021, virtual workshop via Zoom https://one.oecd.org/document/DSTI/STP/GSF(2021)12/FINAL/en/pdf

Synergies between RI can dramatically increase impact based on shared objectives, particularly when the indicators are linked to these objectives and to the tools for impact assessment between all the infrastructure of a similar network or cluster. Such synergies can further benefit from stakeholder feedback. It is important to underscore that assessment frameworks are tools, not models to develop Research Infrastructures, and they have to be adapted to each case. They are not designed for direct comparative assessment of different Research Infrastructures, despite the will of certain policymakers. Each RI has a different set of objectives and that means a different set of indicators for their impact assessment. According to our experience at the OECD, cost-benefit analysis and financial return on RI investment are usually not adapted and should not be used for SEI assessment.



GAPS AND CHALLENGES IN SOCIOECONOMIC IMPACT ASSESSMENT

The survey carried out within the ERIC community by the ERIC Forum Implementation Project emphasised the fact, given the heterogeneity of ERICs which impacts science and societies in diverse ways, that direct comparisons do not produce a comprehensive idea about their capabilities, capacities and impact. Moreover the impacts of the ERICs' activities can only be validated after a long time period, as the result of a complex assemblage of scientific and societal processes.

The survey also revealed a relatively unified feeling within the ERIC community about the complexity of SEI assessment, mainly due to the challenges in defining SEI contextually, applying a suitable methodology, and finding the right indicators. Differentiating between performance and impact has proven to be difficult. Currently used indicators being a mixture of both performance and impact indicators further blur the ability to clearly identify what the longer-term socio-economic impacts of the ERICs' performance actually are or are expected to be.

The ERIC community is keen to develop ways to ensure that it is possible to better track the data it generates in a way that would enable crediting the ERIC, since this is seen as a crucial aspect in being able to assess the SEI of ERICs. Also highlighted was the need for more guidance about defining the indicators and the methodology to assess impact ideally with case studies. Sharing best practice about SEI assessments, including the EC and other stakeholders in the dialogue related to this process have been deemed critical.

Indeed an important prerequisite for the consulted ERICs for the SEI assessment was that stakeholders share their expectations with ERICs early in the lifecycle of the RI, acknowledging that assessing the SEI is important and it should be monitored during regular intervals. A continuous dialogue with the stakeholders in this regard was seen as crucial. Respondents also pointed out that the ERICs themselves also need to invest in maintaining communication about their SEI with their stakeholders, to keep the discussion about their societal relevance ongoing. ERICs would welcome a continuous dialogue with stakeholders to establish a consensus about what the SEI of individual ERICs are expected to be, how they should be assessed, and how performance and impact are linked to funding decisions. Many survey respondents requested examples showing how improving impact links to funding. Dedicated resources and funding were also requested for assessing the impacts distributed equally across an RI particularly in the case of distributed RIs. It should be clear which part of the RI would conduct an assessment and also that all those involved would have access to adequat funding and resources (for example not only at national level, but at the level of the whole RI).
Furthermore, better communication, explaining and narrating the SEI to funders and to the general public was seen as important, as well as promoting and enabling the use of the data and services produced by the RIs to their cross-sectoral user communities.
Finally, it was also highlighted that multinational cooperation is important to reduce duplication of resources, and to better understand the impact landscape of the RIs.

The most challenging aspects shared by that ERICs having assessed their SEI impact and apprehended by those that had not yet done so are the following:

- Defining what 'societal' and 'economic' impacts actually mean in the specific context of an RI. The clarification about what kind of impact is expected from the ERIC at societal and economic levels.
- Difficulty defining indicators; as some impacts are intangible (such as community building); moreover criteria are difficult to determine as not all components of the RI are part of the ERIC. Distinguishing between performance and impact indicators and the selection of those relevant to monitor impact required further guidance.
- Lack of unified method for assessing impacts. Defining the correct methods that are not too resource-intensive, selection of the right indicators that would measure relevant aspects, data collection within the RI, and differentiating between KPIs and impact indicators.
- Lack of dedicated resources and funding, as well as the relevant distribution of funding inside the infrastructure.
- Early and sustained dialogue with the stakeholders regarding SEI expectations, the need to assess and also to evaluate what impacts are and also to mention how data policies and data and services are used?
- Geographical dimension particularly in the case of distributed RIs and the subsequent multi-scalar SEI, considering local, regional, pan-European levels; multi-linguistic environments, country-specific regulations and decision-making/funding structures.
- Traceability: how to link data generated in the RI and its later use, especially in a longer timeframe; following the generation of indirect impacts. Data collection was considered difficult to organize particularly to dedicate the resources and time required. Traceability of the data, the timescale and the many levels of impact would need to be defined and recognized in order to make sure that the credit for the data goes back to the RI.
- The importance of multinational cooperation was also emphasized, to go beyond assessing the impact on a national level to see the bigger picture. How can that impact be assessed together with the whole landscape in which the RI operates?

These challenges, present across the RI lifecycle, are further underscored both by the case studies presented by ERICS from different domains as well as by the participating SEI stakeholders and SEI assessment facilitators.

CONCLUSIONS

The European RIs and ERIC System are integral components of ERA. During the COVID crisis the critical added value of ERICs as pivotal assets for robust rapid response to the pandemic was revealed to national and regional stakeholders. It is key for all these stakeholders to join their efforts to capture the diversity of RIs and provide the required support for the assessment of their value and impact.

The first step towards building a framework for RI SEI assessment is to recognize and take into account the diversity of the Research Infrastructures and the individual purpose of each RI. There is a need in this diverse RI landscape to jointly identify common denominators in terms of socioeconomic metrics for qualitative and quantitative impact assessment through the narratives, feedback systems and user experiences. In order to be impactful by design, ERIC stakeholders should be engaged at an early stage to provide input and resources as well as to facilitate the selection of suitable indicators and the joint definition of the expected impact.

A key point raised is the need for dedicated resources to be allocated for the assessment of SEI. The integration of SEI as a strategic component of the Research Infrastructure both for understanding how to link the objectives and the resources needed to implement the activities and generate impact, but also to convey it in the different formats necessary, warrants better communication with the General Assembly of Founders and across all stakeholders. The ERIC Forum bottom-up approach increases awareness and provides support identifying best practices to help those who have not yet started this process to sidestep the identified hurdles.

For single-site high investment RI such as the CERN there is a real clarity that socioeconomic impacts are a must assessment. For example currently the CERN is very focused on the feasibility study for the Future Circular Collider, to show impact beyond particle physics including industrial and environmental benefits to Member States, the European Commission and cooperating agencies in other countries. The internal challenge is being aware that SEI should be integrated in the RI activities at all levels. RIs should become ambassadors of the socioeconomic impact that their infrastructures produce. There is an increased awareness at the level of the individual facility managers and hands-on staff in RIs regarding the importance of SEI and that quality can't be added at the end of the process but needs to be integrated into the strategy upstream. It is indeed the responsibility of RIs to always keep in mind what the research planned will achieve for the wider societal, economic and non-academic domains. This responsibility comes with using public funding. It is very important to ensure that everyone across the RI value chain from the researcher to the policy and decision-makers is aware of the fact that the SEI of a RI may be indirect over a long timescale.

Also finding a balance between pushing technologies and pulling in ideas from the user community is key. Given the competition for funding, Research Infrastructures need to assess where they can add value and use the available resources taking into consideration the scalability of the ideas and their value proposition. It is also important to avoid a positive cognitive bias by expanding the user community to involve other players including Industry.

From the European Commission point of view, the attention on the social economic impact is very high and is demonstrated by the active collaboration with ESFRI and the ERIC Forum in this direction to provide guidelines, support and also funding for these activities in the future. The integration of a SEI outline in Horizon Europe proposals is open for consideration for the future. Furthermore the new ERA will be tracked against its 10 year priorities with results indicators. These priorities which encompass all fields of activity from research and innovation relevant for Research Infrastructures, including a gender dimension, will be monitored with their own results indicators. This framework is now being designed by an expert group and will be finalized by 2023. The foreseen call for an ERIC Observatory within the Research Infrastructure programme in Horizon Europe for 2023-4 shall consider the points raised in this report to enable ERICs with the tools and resources to carry out SEI assessments regularly and efficiently for the benefit of the ERA.

RECOMMENDATIONS

Suggestions for the ERIC Forum, EC and stakeholders for supporting ERICs in SEI assessments:

1. Recognition of the diversity of the ERIC community and the individual purpose of each ERIC. Comparing them to each other is not considered beneficial. The ERICs require support to develop the most suitable indicators (both qualitative and quantitative) and impact pathways,

2. Early Mapping at the RI level of all the RI stakeholders across the value chain,

3. An institutional shared forum for regular exchanges and discussions with cross-sectoral stakeholders since the design phase throughout the RI lifecycle,

4. Joint definition with all the stakeholders of the SEI objectives in the ERIC/RI strategic documents starting at the planning and design phase and the establishment of a monitoring framework,

5. Continued guidance in relation to assessing SEI, refining the indicators, the methodology and periodic M&E. Case studies would be especially helpful for mutual learning and best practice,

6. Earmarked dedicated resources for SEI monitoring and assessment as well as facilitation support,

7. Examples of how to improve SEI and how impact is linked to funding,

8. Support in developing ways to ensure that ERICs are properly credited for the data they generate.

TERMS & ABBREVIATIONS USED

Sources used include OECD and RI-PATHS

Cost-benefit analysis Cost-Benefit Analysis (CBA) is a framework largely adopted by international institutions (e.g. the European Commission, the European Investment Bank and the World Bank) and governments in public decision-making to assess the socio-economic profitability of investment projects in other fields.

Economic impact The economic impact refers to the direct and indirect economic activities and returns created by the RI or its presence at a defined scale.

ERIC The European Research Infrastructure Consortium is a specific legal form that facilitates the establishment and operation of Research Infrastructures with European interest.

ESFRI European Strategy Forum on Research Infrastructures, is a strategic instrument to develop the scientific integration of Europe and to strengthen its international outreach.

Lifecycle phases The different phases of a RI's lifecycle, i.e. preparatory, construction, operation, upgrade and decommission.

Impact direct and indirect effects of the RIs' activities and outputs over its lifecycle.

Impact pathway An impact pathway is a mechanism by which causal links between inputs, activities, outputs and outcomes, and their direct impacts can be mapped.

Indicator Quantity or value of a RIs' activities and outputs, which provides an indication of its impact. Indicators are a way to measure if the intended outcomes have been realised/achieved. An indicator relies on being able to collect adequate data to be meaningful.

Input The resources mobilised by the RI to perform its activities relatives to an objective. Resources may come from multiple sources and include in-kind support.

KPI Key Performance Indicators are project-management tools used to monitor the performance of an RI, vis-à-vis its objectives and the efficient use of resources. They may include a diversity of indicators including many that are not directly linked to impact (for example on how the budget is respected, on safety records, etc.).

Local Immediate geographical area around an RI, i.e. an administrative region.

Mission of an RI The mission defines the purposes and activities of an RI, the services and products delivered and which communities of users are served. The mission is normally described in the statutes of an organization and provides the framework or context within which the RI's strategy and strategic objectives are formulated.

Outcome Longer-term effects that stem from the stakeholder uptake of or interaction with Research Infrastructure outputs.

Output Immediate direct effects and products attributable to an activity performed on a Research Infrastructure or by Research Infrastructure staff.

Qualitative indicator People's perceptions and judgements on a selected topic. Qualitative indicators are non-numerical and are assessed through case studies, surveys and in-depth interviews.

Quantitative indicator Measure of quantities or amount based on objective and available data. Quantitative indicators can be a number, an index, a ratio or a percentage.

Regional Refers to one or several administrative/geographical subnational entities within the territory of a country or partly covering several neighbouring countries.

RI Research Infrastructure An organisational structure dedicated to facilitate or conduct research, provide scientific equipment, data or services for use in basic or applied research.
Scoreboard Representation of the progress over time of the RI toward a specified goal used to track performance indicators and designed to provide a framework to manage resources.
SEI Socioeconomic impact The effect of the RI's activities on the economy as well as on the social fabric and well-being of communities, individuals and families, and on society as a whole.
Strategic objective of a RI The strategic objectives are what a RI aims to achieve in the medium or long-term future. Strategic objectives guide current and future courses of action.

APPENDIX

ANNEX 1 WP4 Deliverable 4.3:
https://www.eric-forum.eu/wp-content/uploads/ANNEX-1_WP4_Deliverable-D4.3_with-annex.pdf

ANNEX 2 CASE STUDY CERIC_List of indicators used:
https://www.eric-forum.eu/wp-content/uploads/Annex-2_CERIC_ESFRI-KPIs-2021.pdf

ANNEX 3 EF Seminar on SEI of ERICs
https://www.eric-forum.eu/wp-content/uploads/ANNEX-3_EF-Policy-Seminar-SEI-of-ERICs_Agenda-and-Speakers.pdf

ERIC FORUM

ERIC Forum Policy Report

ASSESSING THE SEI OF ERICs:

Paving the way towards evaluating the full value and contribution of RIs to resilient knowledge-based economies

October 2022

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