General societal impact protocol (final draft)
A light on societal impact of ERICs and RIs

Revised version January 2019– Leonie van Drooge & Isabelle van Elzakker - Rathenau Instituut, Den Haag, the Netherlands

Deliverable 1.3 for task 1.2

Project Deliverable Information Sheet

ACCELERATE Project	Project Reference No. 731112	
	Project Title: ACCELERATing Europe's Leading Research Infrastructures	
	Project Website: www.accelerate 2020.eu	
	Deliverable No: 1.3	
	Deliverable Type: R	
	Dissemination Level: PU	Contractual Delivery Date: M20
		Actual Delivery Date: 22.02.2019
	EC project Officer: Patricia Postigo-McLaughlin	

Document Control Sheet

Document	Title: General societal impact protocol (final draft) - A light on societal impact of ERICs and RIs
	Version: 28 January 2019
	Available at:
	Files:
Authorship	Written by: Leonie van Drooge and Isabelle van Elzakker
	Contributors: comments by Ute Gunsenheimer and Florian Gliksohn addressed in this version
	Reviewed by: Steering Commettee
	Approved: 15.02.2019

ACCELERATE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 731112

Contents

1. Introduction

This protocol describes an approach to societal impacts of a research infrastructure (RI), including of those of European Research Infrastructure Consortia (ERIC). The protocol is developed for the members of the H2020-funded project ACCELERATE (CERIC, ESS, ELI-DC, HZG, FRM II), by ACCELERATE member KNAW-RI. Use of this protocol improves the possibility to anticipate, manage and monitor societal impacts and it enables the evaluation of societal impacts. It is the final draft version and it will be validated by 5 members of ACCELERATE, after which the final version will be published.

> *"The determination of SEI [socio-economic impacts] is complicated further by the difficulty of establishing causality between the activities or research enabled by a RI and its value or potential value to society, quite possibly with a very long time delay or induction period, though there are cases where this has been attempted. The benefits of the activity at RIs may also be much broader or very different from the original motivation or intention – for example the invention of the world wide web at CERN[1]."*

1.1 Context of the protocol and process: ACCELERATE

The Rathenau Instituut develops this protocol in the context of task 1.2 of the ACCELERATE project. The project runs from 1-1-2017 until 31-12-2020. Task 1.2 runs from 1-1-2017 to 31-12-2019.

The Rathenau Instituut has organised a number of workshops and meetings with ACCELERATE members in order to identify (1) the needs of the members, including (2) the requirements regarding societal impact and evaluation; (3) their current practices regarding impact monitoring. Also, the Rathenau Instituut dedicated attention to (4) the governance, formal status and span of control of each of the members.

The deliverables of task 1.2 are:

- D 1.3: a draft societal impact protocol (the present document), delivered to the project members in November 2018;
- D 1.4: a societal impact report from every member, based on the protocol, to be delivered mid 2019 by the members, with support from the Rathenau Instituut, and
- D 1.5: a revised and validated societal impact protocol, based on the feedback from the partners, to be delivered in December 2019.

[1] European Strategy Forum on Research Infrastructures (ESFRI) (2017). Long-Term Sustainability of Research Infrastructures. *ESFRI SCRIPTA Volume II.* Milan: Dipartimento di Fisica - Università degli Studi di Milano

Each of the partners will develop a societal impact report (D1.4), with the assistance of KNAW-RI. A societal impact report is dedicated to either:

- A specific evaluation by a specific funder or stakeholder
  In most (but not all) cases, a procedure is available from the organisation or agency that commissions the evaluation, with specific evaluation questions and requirements or formats for evidence (for instance a self-evaluation report). Pathways provide an opportunity to present the impact strategy and evidence in a coherent way.

- A specific reporting obligation, such as an annual report
  This enables the RI to fully develop and present a number of narratives regarding societal impact, collect and present relevant quantitative as well as qualitative evidence.

- The design of a systematic monitoring process for societal impact
  This is ideally based on the impact strategy of an RI and on requirements and realistic expectations of funders and other stakeholders. The pathways provide an opportunity to identify relevant information to collect and vice versa – they provide context to the information. The articulation of assumptions enables to discuss deviations from what was expected.

- The development of a societal impact strategy
  Given the context of the RI, its statutes and other contractual obligations, requirements and realistic expectations of funders and other stakeholders, the RI can develop an overall impact strategy. Pathways provide a way to articulate visions and narratives. The pathways provide an opportunity to identify relevant information to collect and vice versa – they provide context to the information he pathways.

Each report shall contain information on:

- the specific situation (evaluation, report, monitor, strategy): 1-2 pages;
- the context of the RI (relevant missions and goals, requirements and realistic expectations of funders and stakeholders, including in some cases the home institute): 1-3 pages;
- the section on societal impact itself (the text as presented for the evaluation; the text for the annual report; the design of the monitor; the description of the strategy): depending on requirements, between 10-30 pages;
- a short reflection on the protocol and improvements deemed necessary: 1-2 pages.

1.2 Scope and goal of the protocol

The protocol is designed to support RIs in anticipating, managing and monitoring their societal impacts and to support them when preparing for a specific evaluation.

Target users are the members of ACCELERATE. The final protocol will be shared with other RIs, stakeholders involved in evaluation, EC, ESFRI, ERIC-Forum and OECD.

This protocol is NOT an evaluation protocol. It does not describe the procedure of an evaluation. But it does allow an RI to provide relevant and necessary evidence in a given evaluation and to provide context to the information. It does not identify what role, function, impact or evidence is important for a specific RI or in a given evaluation. But by addressing these issues, it allows an RI to present coherent evidence that suits the evaluation. It is also not a monitoring document, rather it describes what evidence to collect.

1.3 The issue

Each and every RI is unique. This is true for the members of ACCELERATE as well. The differences are considerable, in terms of governance, scope of control, size or phase. In addition, requirements regarding societal impact, including the evaluation of societal impact, differ between funders, organisations and countries, they change over time and they are not always clearly communicated. Last but not least, the expectations regarding the added value or impact tend to be high and varied. The expectations often relate to other functions, roles or ideas of an infrastructure than that of an organisation that enables excellent research.

> *"SESAME fosters science and technology in the Middle East and neighboring countries. It provides a basis for scientific cooperation across political divides[2]".*

RIs and ERICs operate in different contexts and they relate to a variety of stakeholders, funders and expectations, such as the European Research Area, local economies, regional collaborations, national industry policies, excellent science. The different contexts shed different lights on an RI. Each RI has a number of roles or functions. A wide variety of impacts is expected from an RI, such as impact on economic growth, contributions to solving societal challenges and furthering the integration of Europe. Some impacts go above and beyond the mission or primary goal of an RI, such as impact that is not research-related: establishing the region of the RI as an international knowledge hub or increased tourism in the region. Also, some well-known examples of impacts of RIs were not expected nor foreseen, such as

[2] Tweet by Tutti Johannson Falk, ESOF 2018

the development of WWW at CERN, or the development of accelerators and detectors for use in medical applications.

Societal impact and its evaluation are challenging. There are no common agreements on what societal impact is, what value to attach to an impact or how to evaluate societal impact. An impact is a result of a complex process, to which organizations and factors outside of the sphere of influence of an RI play a role, have a responsibility, contribute in a positive or a negative way. It takes time before an impact becomes manifest. Often years, if not decades. And it is quite possible the impact initiates again other changes and impacts in an even more distant future. Even if and when an impact becomes manifest, it is near impossible to undisputedly attribute the impact to the RI. Finally, impact is context-dependent. There are no ready-made blueprints or implementation schemes for impacts. There are no tested formulas or conversion factors to predict an impact.

Yet, RI management, their funders, members and other stakeholders feel an increased need to identify, monitor and evaluate societal impact of RIs. This is not an easy task. There are efforts to describe the societal impact of a specific RI, some looking forward and calculating potential future impacts, others looking backwards and capturing impacts that have become manifest. However, a general approach that can be applied to a number of RIs, is not available. Organisations such as the OECD[3] and the ESFRI[4] have articulated the need for such a harmonized societal impact approach, yet it is also clear that a standard set of impacts and indicators does not do justice to the complex situations and differences between RIs.

1.4 The novelty of the ACCELERATE approach

The approach presented here is in line with other approaches[5] in that it is flexible, relates objectives and expectations of an RI to impacts, and describes a mix of quantitative and qualitative indicators and case studies. An approach cannot be too prescriptive given the diversity of RIs and the diversity of contexts. There needs to be a relation between the RI, its goals and objectives, inputs and activities, the outcome and the indicators. A mix of quantitative indicators, case studies, and a narrative are necessary given the variety of impacts, the time lag before an impact becomes manifest and the complex process it involves.

However, the approach described in this protocol differs from others in that it explicitly addresses the variety of contexts in which an RI operates. Stakeholders have different perceptions of what an RI is,

[3] OECD Global Science Forum (2018). *Draft Assessment Framework Initial Consensus Indicators as of 13 March 2018.* Paris: OECD

[4] See note 1

[5] See note 3; studies by Technopolis, such as Kolarz, P. et al. (2017). *Comparative impact study of the European Social Survey (ESS) ERIC. Final report.* Brighton: Technopolis Group; RI-Paths (https://ri-paths.eu/) and ResInfra@DR (http://www.interreg-danube.eu/approved-projects/resinfra-dr)

expect different contributions and impacts. The approach addresses this aspect in response to the requirement to take the variety of funders, members and stakeholders and their expectations into account. It therefore does not provide a standard list of impacts; rather it presents archetypical pathways that relate to one or more of the ACCELERATE members, but not necessarily to all members, to each part of the lifecycle and to every funder.

This approach also differs in that it does not use or start from a taxonomy of RIs (single-sited / virtual; building phase / in operation; etc.). These differences are clearly there, of importance, and should not be ignored. The impacts from a building project differ from an RI in full operation. Yet there are other compelling differences that the individual RIs need to deal with on a day-to-day basis: the organisational context, the variety of funders, the expectations of the local community.

The approach also takes into account that there are not yet sets of indicators for societal impacts agreed upon. Of course, some indicators are often used, such as number of industrial users, number of outreach activities, or number of jobs created, and we advise to make use of them. But without the context and without a bigger picture, the information the indicator provides has little meaning. In this approach, the relation between the impact – either the process towards the impact, or the impact itself – and the indicator is articulated. Indicators only provide information, when what they indicate is understood.

> *"Impact is what matters, impact is not just what counts"*[6]
> *Who decides what matters? And who decides on value?*

> *"We count number of PhD theses and number of bachelor theses; of course, bachelor theses are of lesser value." "We put effort into attracting young students. The number of bachelor theses is highly relevant to indicate success; the number of PhD theses far less*[7]*."*

The approach does present a number of example narratives or pathways. Each relates the RI (as enabler of excellent science, or as coordinator) with a certain goal or impact (to contribute to societal challenges, or to contribute to the ERA). Quantitative data and qualitative descriptives, including case studies, provide evidence of the pathway. This is in response to the often expressed need to relate indicators in a meaningful way to goals and impacts.

---

[6] Matthias Reiter-Pázmándy, Austrian EU Council Presidency Conference on the Impact of Social Sciences and Humanities (SSH), Vienna, 28 November 2018
[7] Conversation at ResInfra@DR WP3 concluding consultation meeting, 27–28 November 2018, Budapest

1.5 The structure of the protocol

The protocol consists of a number of sections. Sections 2 & 3 provide background information regarding impact and evaluation.

- Context of evaluation: This section addresses some core issues regarding evaluation. How impact is understood and what to report depends partially on the goal of an evaluation, the specific evaluation questions, or the target audience.
- Impact as a process: This section describes core issues regarding societal impact and agreed upon solutions. It provides background information regarding the choices made in this protocol. Impact is a verb, a process to which an RI contributes. The impact process can be modelled.

The next sections, 4 through 6, address the multifaceted nature of an RI and the variety of roles expected of an RI, the impacts expected, what evidence to use and how to present. It supports the RI when preparing for a specific evaluation.

- Societal impact of what? "In what light": This section addresses the different ways in which an RI can be presented, seen or understood. It is as if an RI is seen from different angles and in different lights.
- Societal impact of an RI: This section addresses the issue of "impact on what?" Impact, contributions and objectives are closely related.
- Evidence of societal impact: This section addresses what is commonly known as indicators: the information that serves as evidence of an impact.

Section 7 briefly summarizes the main issues made in the previous sections.

Section 8 presents archetypical pathways to impacts and indicators. It illustrates how to relate impacts to evidence. It presents archetypical pathways and forms of evidence for a number of impacts.

Finally, section 9 provides a more in-depth a methodological background, with a reference to several impact and evaluation projects.

The revised protocol will be published in December 2019 (D1.9).

"It seem[s] research infrastructures are a panacea for all global malaise. They could fix anything from geopolitical tensions, brain drain and limp economic growth, whilst bolstering the EU's diplomatic relations with the rest of the world.

"Science diplomacy can solve global challenges," said EU commissioner for research and innovation Carlos Moedas. Most problems facing humanity are international and science and research infrastructures are neutral tools for bringing people who normally do not talk to each other, around the table. "Research infrastructures are the assets for science diplomacy," said Moedas.

For Sanja Damjanovic, minister of science in Montenegro, research infrastructures could be a route to "mitigate tensions" in the Balkans, reverse the brain drain and recover the tradition of technology development in southern and eastern Europe. "The only way to bring back our people is to have a first-class research facility," Damjanovic said.

Similarly, Yuri Balega, vice president of the Russian Academy of Sciences said, "The world is not in good shape, but science can break walls created by politicians."

Mikhail Popov, deputy director at the Kurchatov Institute in Moscow agreed, saying, "Science collaborations can secure bridges between Russia and the EU." That would help overcome tensions spawned by economic sanctions, he said.

Meanwhile, Wolfgang Burtscher, deputy director general for research and innovation at the European Commission said, "Research infrastructures are a key [requirement] to compete in a globalised world.[8]" "

[8] Zubascu, Florin (2018). Are research infrastructures the answer to all our problems? *Science Business* Retrieved September 19, 2018 from: https://sciencebusiness.net/news/are-research-infrastructures-answer-all-our-problems

2. Context of evaluation

An evaluation is, in a nutshell, an assessment of some form of evidence. Evaluations differ, and as a consequence, requirements regarding the evidence vary. This section addresses the context of evaluation for which the RI needs to provide evidence of societal impact.

RIs are involved in many evaluations. From the ex-ante impact assessment by a region that might host an RI, through the decision of a country to join an RI or an ERIC and become member, to the statutorily required evaluation of an ERIC and the standard evaluation at academic institutes. What and how to report depends on the goal of an evaluation, the specific evaluation question, and the target audience[9].

2.1 The goal of an evaluation

Evaluations can be aimed at learning and improving, at deciding and selecting, or at accounting for. Different goals require different types of evidence.

- Formative evaluations are aimed at learning and improving. The central question is what improvements are necessary or desirable based on what has been achieved or presented so far. There are, in principle, no strict consequences prescribed for these evaluations. *A midterm evaluation between two major evaluations, with the central question whether and how the proposed improvements of the previous evaluation have been followed up.*
  This type of evaluation allows for narratives and evidence that provide insight, assumptions and choices and learning processes.
- Summative evaluations are aimed at deciding and selecting. The central question is whether the proposal or achievement is good enough. In many cases there are thresholds *(a H2020 proposal)*, but in other cases the procedure is less transparent (*the decision of a country to become a member, based on evidence provided by an RI*).
  This type of evaluation asks less for reflexivity, and more for evidence that the RI is or has been capable to perform at a certain level: numbers, concrete examples and specific measures.
- Some evaluations are neither formative, nor summative; accountability is the main goal. The central question is what has been done by the RI. The consequences are not always clear. In some cultures, this type of evaluation is highly symbolic (*the annual talk with a supervisor in certain organisations*); in other cultures, there are rules and formats and benchmarks (*In some organisations, researchers need a formal document to prove collaboration with an external party, participation at a stakeholder workshop or ad-hoc advise to a small NGO; without this, they are*

[9] An overview of evaluation methodologies is discussed in: Giffoni, F. et al (2018b). *Task 3.2 State of play – literature review.* Retrieved September 24, 2018 from https://ri-paths.eu/

not allowed to include the activity in their formal CV and it does not count as evidence in their annual appraisal).

2.2 The organization of the evaluation

Every evaluation is organised differently. Those differences have to do with:

- The organisation that commissions or requests the evaluation – this varies from the board of an organisation, to an agency, to a ministry.
- The procedure – some evaluations follow a standard procedure, with guidelines, forms and formats, prescribed timeframes and known consequences; other evaluations follow ad-hoc procedures, some more transparent than others.
- The evidence – in most evaluations, the evaluated organisation is asked or expected to provide evidence, such as a socio-economic impact report, a project proposal or a self-evaluation report. In some cases, the assessor uses only the evidence provided, in other cases there are interviews with representatives of the organisation that is evaluated, or third parties are interviewed.
- Those who actually assess and formulate a judgement, the assessor – in some cases there is an external body that assesses the evidence, for instance an ad-hoc evaluation committee or a professional consultancy or audit organisation, in other cases the assessment is done internally. In some cases, a professional organisation is included to provide specific evidence, make analyses, or ensure that the evaluation follows certain rules and protocols.

2.3 The assessment

The assessor comes to a conclusion based on the information provided. The evidence provided should lead to a clear judgement, given the evaluation question and the expertise of the assessors. However there are difficulties when assessing societal impact. It is not always clear what type of impact to expect, at what costs, how to judge or value an impact, how to compare impacts and what counts as evidence of impact. The assessors, the organisation that commissions or requests an evaluation and the RI can all have different expectations regarding impact. The RI can clarify its interpretation and approach in the evidence it brings into an evaluation.

> *"There seems to be no "silver bullet" for capturing the impacts of RI. Accordingly, the only pragmatic and affordable approach is to combine a conventional economic impact assessment (money in, money out) with a more descriptive and qualitative view of technological achievements. The former provides a positive return on investment to re-assure finance ministries while the latter provides the insight that science and industry ministries look for."*[10]

[10] Van Belle, J. et al (2018). *ICOS Impact Assessment Report*. Amsterdam: Technopolis Group

3. Impact as a process

This section describes core issues regarding societal impact and agreed upon solutions. Impact is a process to which an RI contributes. The impact process can be modelled.

> *"Impact is a powerful effect that something, especially something new, has on a situation or person" according to Cambridge Dictionary.*[11] *"Impact is a significant or major effect" according to Merriam-Webster Dictionary.*[12] *Followed by an illustration of the use of the word: "the impact of science on our society." Even more important is the observation that impact is originally a verb, not a noun. 'To impact', instead of 'Have an impact on.' However, Merriam-Webster advises to consider the audience when using impact as a verb, since the audience might consider this use problematic.*

In evaluation literature, impact is understood as either or both the change, as well as the process leading towards the change, and the contributions to the change. Impact is an improved situation or practice in the future, and in specific evaluations it also includes all actions, actors and factors that contribute to that change. An impact process is sometimes complex, is context-dependent and unique. It might not be linear, there can be iterations, failures and long pauses before results are used, if at all. Understanding impact as verb, as activities, enables to understand, identify, manage, monitor and evaluate impact.

The ultimate impact is sometimes the focus of an evaluation, for instance in a socio-economic return on investment report. However, there is growing consensus that the process is no less important. It is often advised to use a narrative, or a description of the process. Such a narrative can be based on a model.

3.1 Model

There are a number of basic models to describe the impact process. They consist of building blocks. For each building block, commonly used indicators are mentioned (*in italics*):

- inputs to the RI: *funding, staff*
- activities of the RI: *select users, tender the development of a cooling system, write a business plan*
- outputs: *# of users, an event that has been organised, a signed contract*
- outcome or uptake of the outputs: *increased # of highly skilled technical staff in the region*; *example of use of a novel technique or procedure*

[11] https://dictionary.cambridge.org/dictionary/english/impact
[12] https://www.merriam-webster.com/dictionary/impact#note-1

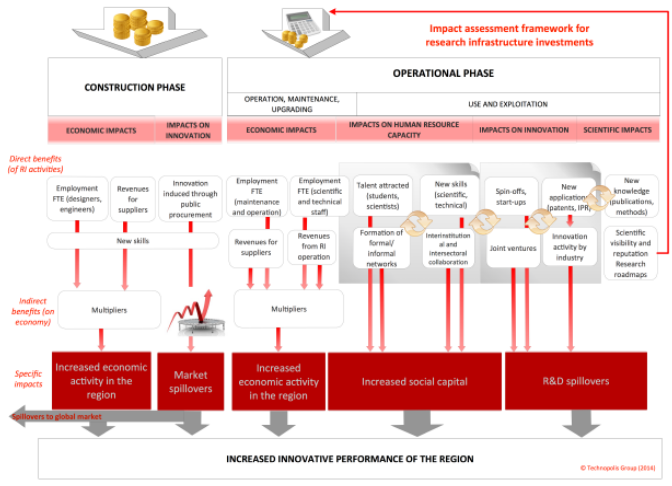
- impact or change in behaviour or wellbeing as a result of the uptake: *decrease in mortality rate due to use of a drug or treatment; reduced dependence on fossil fuel due to increased use of solar power; a new balance between countries.*

An impact is not a fixed endpoint; it can lead to impacts further in time: *the geopolitical impact as a result of a massive shift from fossil fuel towards solar power.*

There are several basic models:

- Logical Framework depicts inputs, activities, outputs, outcomes and impacts. It provides a clear picture of the building blocks, but it provides limited insight into causality, other than input and activities lead to output, outcome and impact.
  The underlying assumption is that of a linear cause and effect relationship. However this relationship is (or these relationships are) less clear and often not linear in more complex situations. In the case of RIs for instance, a series of diverse activities can contribute to a single impact and a single activity can contribute to several impacts. This is difficult to accommodate in a log frame.
  The activity to hire staff can contribute to the regional economy, as well as to gender balance; the activities to hire staff as well as entrepreneurial activities (spin-out and spin-off companies) contribute to the regional economy.

Figure 3: Logical framework for socio-economic impact assessment of investment in research infrastructure



Evaluating the socio-economic impact of research infrastructure
© Technopolis Group, 2015 5

13

[13] Picture from Griniece, E. et al. (2015). *Evaluating and Monitoring the Socio-Economic Impact of Investment in Research Infrastructures.* Tallinn: Technopolis Group

- Impact pathways are more detailed than a logical framework. They show links between outcomes and impacts and provide information regarding causality. They provide more of a narrated vision and can be based on a Theory of Change.

- Theory of change is detailed in that it addresses assumptions. It explains the links between the building blocks. It makes assumed change mechanisms explicit: the theory of change.
  A full theory of change is developed with all actors involved and affected: the research organisation, its funders, users, other stakeholders and those affected. It is often used in development research projects:

  "Impact pathways and theories of change are program models. As with other types of program model they are most useful when built and tested by stakeholders in the change process that's being mapped out. Building ToC helps those involved better understand the processes that the model is attempting to describe, and then testing the model deepens or challenges this understanding. In each of the initiatives described here we have built first drafts of these models, based on the authors' collective experience and the cumulative insight gleaned from early scoping and diagnosis. The discipline of agreeing and writing out our theory and then subjecting it to critical review is a form of test that we expect to help build both our own and stakeholders' understanding of how we expect to achieve impact and how working with ToC will help."[14]

Studies dedicated to societal impact of RIs often use a logical framework. *An RI organised dedicated business events (activities). A certain number of participants attended these events (result). There was a stable use by industry of the facility (result).* A theory of change is often the basis for internal procedures, decisions and changes, although it usually remains implicit. It narrates how (theory) the RI aims to contribute to an impact (change). It addresses assumptions and preconditions. *In order to attract more users from industry, an RI organised business events (theory). Such events are a suitable way to attract industry (assumption). Few participants attended the events; there was no increase or improvement of business use (result). The RI changed its approach and developed dedicated outreach strategies and activities for specific companies (activities).*

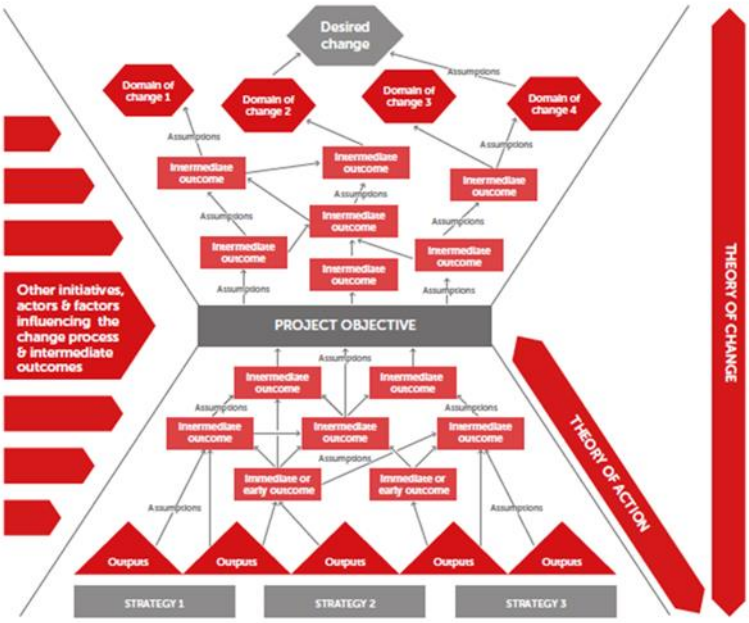
3.2 Accountability ceiling and contribution

In some, if not most cases, an RI is not solely and only partially responsible for an impact. An impact often becomes manifest after a long period of time, due to the involvement of a variety of actors, or as a result of, or despite, unforeseen circumstances. The accountability ceiling marks the extent to which an RI is

[14]Douthwaite, Boru et al. (2013). Using theory of change to achieve impact in AAS. *AAS Working paper*

responsible, as well as the limits of the responsibility. In some cases, the expected contribution of an RI to a change is only marginal, when an RI is not fully and solely responsible for an impact to occur.

> *An ERIC is currently asked to contribute to the gender balance in the ERA (an ERA priority). It can be held accountable for the gender balance of its staff, as well as for the gender balance of its users. And it can be held accountable for preconditions, or the measures it takes (or the lack thereof): specific hiring policies (for staff), outreach activities (for certain user groups), day-care facilities or safety at night (for staff and users). It is near impossible to argue or prove that its gender policies contribute to a changed gender balance in the ERA.*



15

In other cases, the accountability ceiling is not clearly defined. In some cases, the RI can (be expected to) contribute to processes beyond its own organisation.

> *An RI can stimulate the possibility of further use of research results by facilitating interactions between researchers and industry, by reaching out to industry, by developing specific facilities for industry, by hiring a business developer or an industrial liaison officer.*

[15] Picture from Van Es, Marjan et al (2015) *Theory of change thinking in practice* Den Haag: Hivos

3.3 Predicting impacts

The development of the World Wide Web at CERN was not expected. This is true for almost each and every example of further use and regardless of its origin. Whether developed in the context of building or operating an RI, such as the development of the touch screen at CERN[16], or based on improved observation methods by radio astronomers, which led to the development of Wi-Fi. However, RIs intend (and are also expected) to contribute to specific solutions. RIs take measures to increase opportunities. The appointment of industrial liaison officers and business developers can be considered as a precondition for further use. So, whereas specific use cannot be predicted, RIs can (and do) actively stimulate further use.

[16] RCUK Strategic Framework for Capital Investment

4. Perceptions and expectations of an RI

When addressing societal impact, the question "impact of what?" comes to mind. There are many answers to this question.

> *Be an enabling facility to support Science and Technology. Be the hub to facilitate regional collaborations. Promote education outreach and knowledge transfer. Promote international relationships and global diplomacy. (Self-reported strategic objectives of RIs)*[17]

The legitimation for the establishment of an RI or an ERIC, or become a member, is that it is a game changer in a region, or that it enables to compete on a global level, or that it prevents or inverts brain drain. And that it contributes to global challenges by enabling excellent research with state-of-the-art equipment. These legitimations relate to different images of a RI. It is as if every legitimation sheds a different light from another angle on the RI. Just as the use of X-ray and IR result into different images that show different aspects of the same object.

An RI is always an organisation that enables excellent research. At least in the operational phase. Different aspects, roles, goals or expectations of the RI are: *build capacity; be a testing ground for industry; make a difference in the regional economy*. Some of these are more important than others. Formal agreements, primary goals and mission statements are key, as well as explicit and implicit expectations of members, funders and stakeholders.

Some characteristics of an RI seem unbiased. *Each member of ACCELERATE enables materials research – some other RIs enable social science research*. *Some members of ACCELERATE are a building project – the other members are not*. But, in other cases, it is less clear and less obvious. *CERN is a model for global cooperation.*[18]

What an RI is, is defined through the perceptions and expectations of the beholder, as well as written down in formal texts.

- Agreements, statutes and contracts describe important goals of an RI*: an enabler of excellent research; a coordinator; a capacity builder*.
- The content of some formally agreed upon aspects can change over time: *be an added value for the ERA – in other words be an added value for priorities that change every few years.*

[17] See note 3

[18] www.unesco.org/new/en/media-services/single-view/news/cern_and_unesco_60_years_of_science_for_peace/

- Mission and vision statements highlight specific aspects of an RI: *the game changer in a specific discipline.*
- A specific sub goal does the same: *developer of innovative ways of working.*
- Some bycatches become visible when highlighted: *provider of medical isotopes.*
- Certain roles are important for specific stakeholders and this sheds yet another light on the RI: *enable companies to test and improve products; an opportunity for national high-tech industry; a dominant player in the regional innovation ecosystem.*

Of course, basic characteristics play a role as well. The members of ACCELERATE differ greatly in terms of scope, governance and financial requirements. *One member is a centre within an institute that is part of a larger research organisation; the centre operates a limited number of beamlines. Another is a consortium of member states, that will operate a source and a datacentre. Instruments are operated by third parties.*

There is a large range of aspects. What aspects are relevant depends on the specifics of the evaluation:

- In case of an evaluation by a scientific organisation (research council, host institute), the primary goal is important: *an enabler of excellent research.*
- In case of the decision of a certain country to become a member, other aspects might be more relevant: *the opportunity for national industry; the image of the region, the developer of human capacity*

5. Societal impact of an RI

The previous section addressed the question impact *from* what. This section addresses the question: impact *on* what? Impact, contributions and objectives are closely related.

> *"CERIC-ERIC shall proceed to the periodical evaluation of the quality of its scientific activities, and the assessment of its impact on the European Research Area, on the Regions hosting its Partner Facilities and at international level. This shall take into account both the performance of CERIC-ERIC as a consortium and of the single Partner Facilities."*[19]

Societal impact can refer to a variety of impacts. Some are often mentioned; some are very generic:

- Economic impacts
- Innovation impacts
- Impact on industry
- Social impacts
- Impacts on human resource capacity.

Whereas others are more specific:

- Increased trust in science
- Increased economic activity / improved job opportunities in a region
- Contribution to a specific societal challenge
- Higher educated population / prevention from brain drain.

In many instances, impacts and objectives are closely related. The objective 'to contribute to' is part of the impact process. See for instance the quote at the start of this section and the objectives of CERIC:

> *"CERIC-ERIC's objective shall be to contribute to European top-level research and technological development and demonstration programs and projects, thus representing an added value for the development of the European Research Area (ERA)."*

To what extent the RI has to provide evidence of a changed situation depends on the evaluation. In case of an ex-ante socio-economic impact assessment, it is desired and required. The first quote in this section suggests that it is required as well in this particular instance. In many evaluations, the accountability

[19] Statutes of CERIC-ERIC 2014/392/EU

ceiling is taken into account, in other words the extent to which an RI is accountable for changes beyond its scope of control. It is asked of an RI to provide evidence of its contribution to an impact.

6. Evidence of societal impact

This section addresses what is commonly known as indicators: the information that serves as evidence of impact. It addresses types of information as well as sources of information. Requirements regarding information depend on the purpose (to monitor, to evaluate ex ante, ex post), and on the needs, practices and requirements of the user (RI, funder, evaluator).

> *"New or renewed funding commitments from European member states, is an indicator for the relevance as perceived by stakeholders – those external to ICOS or climate science."*[20]

6.1 Quantitative evidence

Impact is difficult to measure, however numbers provide relevant information. They are concrete and highlight certain aspects.

- Numbers indicate the absolute volume: *employees, funding, contracts with local companies, beamlines in operation, users, visits of pupils, articles published, occurrence in media, patents applied for.*
- Number series and time series indicate a change. This refers to all the above-mentioned, for instance: *increase of specific users that were identified as underrepresented; increase in earned income; decrease in rejection rate due to a new beamline.*
- Percentage of a target or reference value, to indicate the relative value: *production capacity of medical isotopes as a proportion of global demand; gender ratio of users and employees; percentage of contracts or of monetary volume with a specific country, region or industry.*

Most RIs use target values in their day-to-day activities: *a certain rejection rate is acceptable; a minimum annual earned income is necessary*. In some evaluations, baselines, thresholds, target values and benchmarks play a role. *Whether a growth from 0 industrial users to 10% in a period of two years is assessed as insufficient, good enough or excellent depends on agreements, expectations and common practice.*

Quantitative evidence is available at different departments of an RI:

- User administration: *user information*
- Financial administration: *contracts, earned income*
- HR administration: *staff information*
- Communications and outreach department*: visits, outreach activities organised, website visits, media appearances.*

[20] See note 8

Some information is available outside of the RI, such as in databases from third parties: *publications, citations, patents, regional economic statistics*. In case of benchmarks or relative shares, data form third parties are necessary.

6.2 Qualitative evidence

Descriptions provide qualitative evidence. Again, this information does not show the complete picture, yet it can provide more detailed information:

- Internal processes provide insight into what and how. They relate in many cases to inputs and activities: *policies, strategies, procedures, guidelines, practices, activities*
- Examples and case studies provide even more specific and detailed information: *a case study of further use of research results, a detailed description of a policy change*
- Feedback provides insight into how stakeholders appreciate an RI: *a user complaint; an acknowledgement in a PhD thesis; a survey.*

Some qualitative evidence is available at an RI, but again might not be recognized as relevant. However, most evidence needs to be collected specially for the purpose:

- Internal documents: *policies, strategies*
- Correspondence with customers and users; specially-designed questionnaires; interviews with specific target groups: *feedback, user satisfaction, career tracks of users or former employees*
- For the development of a case study, a variety of sources is used, such as an interview, an article, a webpage.

6.3 Availability of evidence

There are concerns regarding the reliability and availability of evidence. Some information is available, such as generic data regarding staff or users, however access to some of these data might be restricted due to data protection laws. Some data are inconsistent, for instance Open Access publications. Some data are difficult, if not impossible to collect.

> *RIs in social sciences and humanities provide online access to users. Users need to register once, after which they have unlimited access to data and tools. The number of unique users is known, not whether users return, how and why they use the infrastructure, what organisation they represent.*

6.4 Standard sets of indicators

Several members of ACCELERATE have developed a standard set of indicators; from a short list of Key Performance Indicators (CERIC) to an extensive list of indicators and metrics of socio-economic impact

(ESS). A number of organisations have developed lists of indicators. They can be used as a reference source when developing a suitable set of indicators, varying from the extensive FenRIAM guide[21] to the concise list of the OECD[22].

The sets differ, yet they are remarkably similar at the same time. They describe data (quantitative as well as qualitative) regarding users and their outputs, projects, staff, outreach and contracts. CERIC and OECD group the indicators per objective. Some of the indicators of ESS reflect specific objectives of ESS, such as those relating to sustainability or to innovative ways of working.

Some data provide evidence in more than one narrative or pathway. User data can provide evidence regarding type of organisation (academia, industry), country, gender, discipline. Contracts can provide evidence regarding the size of a contribution to the local economy, as well as to cost effective operation, or the contribution to a specific type of industry.

6.5 Narrative

The narrative ties the information together. The quantitative and qualitative information still provide a scattered picture of the RI and its impact. The narrative explains how and what the RI does or has done, in a specific light and with an eye on certain impacts. The next section describes some common narratives.

[21] Roschow, R. et al. (2014). *FenRIAM full guide. Proposal for a Foresight-enriched Research Infrastructure Impact assessment Methodology*. Retrieved September 9, 2017 from http://www.fenriam.eu/overview.html
[22] See note 3

7. Recap

The previous sections provided general background information regarding impact and evaluation, as well more specific information regarding the evaluation of impact of RIs. To summarize:

(section 2)
Evaluation = evidence + assessment
Q: What is the goal of the evaluation and what the central evaluation question?
Q: How is the evaluation organised?
Q: What evidence is required, or what evidence does the RI want to present?

(section 3 and 5)
It lacks a shared understanding of impact, both conceptually as well as concrete.
Q: What is meant by impact? In an evaluation, by a stakeholder, by the RI itself?

In general, impact is a major effect, or a change, that is preceded by a complex and iterative process.
Q: Is the focus of the evaluation on the effect/change, or on the process?
Q: What is expected of an RI regarding an impact; a small contribution to a bigger change, a substantive contribution to a change that the RI is responsible for? What is the accountability ceiling?

Societal impact relates to a wide range of societal sectors. Impacts often, but not always, relate to goals or missions of an RI.
Q: What sort of impacts are intended by the RI and expected of the RI? Are these generic or specific?

(section 4)
An RI is always a research enabling facility.
Q: what other perceptions or expectations of the RI are important, given the organisations/stakeholders involved in or addressed by the evaluation? Given the goal of the evaluation?

(section 6)
Information that provides, or is accepted as, evidence, is commonly referred to as an indicator.
Q: What information (quantitative, qualitative) is already collected by the RI? What evidence does it provide?
Q: What extra information needs to be collected? To provide evidence for what?

(section 3 and 6)

Every impact process can be modelled. An impact narrative can be based on the model. The model provides meaning to indicators.

Q: Is there an (explicit or implicit) impact model?

If so:

Q: What is the overarching impact narrative? What assumptions are included in the narrative?

Q: What indicators provide evidence? What evidence do these indicators provide?

8. Archetypical impacts, pathways and evidence

This section combines the previous sections. It illustrates how to relate an RI (its statutes, inputs, activities) to impact and how evidence provides insight into this relation. It presents some archetypical pathways of impact for the members of ACCELERATE.

> *"Societal value is complex to assess (subjective notion and intangible asset). Societal value depends on objectives/core missions of RI and perspectives of stakeholders."(ICRI2018)*

A pathway relates an objective of a RI or a perspectives of a stakeholder to inputs, activities and results, to indicators. Assumptions are part of this narrative. It is a model, that provides insight into how a RI intends to impact, or has intended to, what and how it contributes. Whether to present the full narrative depends on the evaluation. In some cases, some indicators only are required; in other cases the narrative provides information that is necessary for the committee to come to a verdict.

In some cases, the relation between objective or expectation and impact is quite straightforward. *A RI as a hub in a regional innovation ecosystem, is expected to have an impact on the regional innovation capacity*. In other cases there are more potential pathways. *Impact on innovation can be the result of research done at an RI (RI as an enabler of research); the result of the development of high-tech devices (RI as a contractor), or the result of the introduction of new forms of governance (RI as a complex international organisation).* And there are cases where the pathway is short, where the impact equals the contribution and where targets are known. *The pathway regarding the contribution to the ERA priority on gender, contains some specific activities and results only.*

A limited number of pathways is presented. The goal of these "archetypical" impact pathways is to illustrate how to develop a pathway. During the validation phase, when members of ACCELERATE use the protocol, the pathways will be extended, filled, fine-tuned, harmonized if possible and new pathways can be developed when needed.

A very basic narrative is presented for each of the pathways. When choosing and using indicators, it is advised to articulate assumptions, at least for internal monitoring purposes. In the pathway "Impact on a specific societal challenge", some assumptions are formulated.

8.1 Impact on a specific societal challenge

Impact of: RI as a research enabling facility
Impact on: a specific societal challenge or societal goal
Goal or vision: a certain new material or processes that has been developed and is used

Narrative: The RI enables specific research and actively reaches out to certain user groups, whether academic or industrial, with an eye on specific further use.
The impact pathway narrates how the RI intends to contribute and what it does to do so. The RI enables research in a relevant field and / or provides services to specific companies. Further use and uptake are beyond the scope of control of the RI.
Some RIs intend to impact "societal challenges" in general. The elements provided below can be used to develop a narrative, but the narrative will become very generic.

Elements of the narrative / indicators:

- RI provides certain equipment of interest to industry (input)
  (assumption: there is a need to use this type of equipment; RI has the right equipment; is a trusted partner)
  - description of specific beamline or equipment and assumption
- RI develops procedures and policies for specific user groups, i.e. industry (activity)
  (assumption: specific user groups need specific attention; the procedures developed respond to the needs)
  - description the procedures and policies, of changes and assumptions
  - description of examples, numbers, feedback: specific outreach events, dedicated calls, dedicated staff
- RI signs non-disclosure agreements (result)
  (assumption: a non-disclosure agreement is a sign of interest for further use by industry)
  - # agreements; case description (for internal purposes); description of follow-up activities; satisfaction of user
- Industrials users use equipment, beamline (result)
  (assumption: a certain # or % or growth is desired)
  - #, %, growth of users, returning users and target values; earned income from industry; satisfaction of users
- RI co-authors papers (result)
  (assumption: co-authored papers indicate the value for industry and are predictor for further use)
  - # articles

Accountability ceiling.

- The users share the results (result)
  (assumption: sharing of results happens in such a way that it can be observed(!))
  - # articles, # patents, case description
- The results are used for the development of new materials (outcome)
  (assumption: again, the further development of new materials can be observed and is known to the RI)
  - description, license of patent, income, case description
- These materials are introduced on the market and bought by health / energy companies (impact)
  (assumption: it is known that the RI has contributed to the development of the product or process; it is observable that the product or process used)
  - description, monetary value, case study
- Due to the use of these new materials, other changes occur (secondary impact)
  (assumption: again, it is known that the RI has contributed to the development and it is clear that the secondary impacts occur due to the use of the new material or process)
  - description

8.2 Impact of an industrial service provider

Impact of: a facility that provides services to specific industries
Impact on: the performance of the industry/sector
Goal or vision: improved production processes or products in specific industries

Narrative: The RI can contribute with its unique equipment and measuring facilities services to industry that will enable innovations that are otherwise not possible. Industry might not be aware of this potential promise, so it is necessary to reach out to specific companies, with specific measures.
The impact pathway narrates what industry the RI intends to reach out to and what it does to do so. The RI enables innovation in specific companies. Further use and uptake are beyond the scope of control of the RI.
Some RIs intend to impact industrial innovation in general. The elements provided below can be used to develop a narrative, but the narrative will become very generic.

Elements of the narrative / indicators:
(similar to previous)

- RI develops procedures and policies for specific user groups, i.e. industry (activity)
    - description the procedures and policies, of changes and assumptions
    - description of examples, numbers, feedback: specific outreach events, dedicated calls, dedicated staff
- RI provides certain equipment of interest to industry (input)
    - description of specific beamline or equipment and assumption
- RI signs non-disclosure agreements (result)
    - # agreements; case description (for internal purposes); description of follow-up activities; satisfaction of user
- Industrials users use equipment, beamline (result)
    - #, %, growth of users, returning users; earned income from industry; case description; satisfaction of users
- RI co-authors papers (result)
    - # articles

Accountability ceiling.

- The results are used by the company (outcome)
    - description, case study

- The company has developed new materials or methods (impact)
    - description, monetary value, case study
    - description

8.3 Impact on the ERA

Impact of: RI as a research organisation / as coordinator
Impact on: the ERA, in particular specific priorities, such as gender balance
Goal or vision: a joint, shared European Research Area, with equal opportunities for all researchers
Narrative: In order for the European Research Area to become a reality, all research organisations need to contribute and join. There are agreements, targets and priorities (open labour market / open access / gender) that provide guidance and goals for an RI.
This is a pathway where a research organisation contributes to a specific goal, with known benchmarks and targets.
Specific choices and considerations are part of the narrative. The contribution of the RI equals in most cases the impact on the ERA.

There are several narratives, that are all limited, given the relative small contribution:

- RI develops procedures to hire staff according to ERA (activity)
    - description of procedure, rationale, target
- Staff hired (result)
    - # staff, relative share hired according to ERA, certain characteristics of staff, staff satisfaction, staff mobility

- RI develops open access selection procedures according to ERA (activity)
    - Description of procedures, rationale, target
- Users selected (result)
    - # users, % granted under open access procedures, change, certain characteristics of users, user satisfaction

- RI develops specific policies dedicated to stimulate gender balance (activity)
    - description of policies for staff / for users
- Gender balance of staff (result)
    - gender ratio, ratio as compared to benchmark, change, staff satisfaction
- Gender balance of users (result)
    - gender ratio, ratio as compared to benchmark, change, user satisfaction

8.4 Impact on the public image of science

Impact of: RI as a representative of science / RI as a local scientific institute
Impact on: public image of science
Goal or vision: science in general, and the RI in particular, are appreciated as relevant and important (and not as a threat), as potential future career opportunity
Narrative: The RI represents science, or the scientific community. It has the possibility, or the responsibility, to reach out to the local population. Reasons can be to get a wider audience interested in science in general, to attract future students, to account for taxpayers money, or to manage perceptions and expectations.
The impact pathway narrates what the goals are and why these are relevant, the measures taken, the types of activities and the number of visits and, if possible, the outcome. In most cases, the latter might not be possible. In some cases the perception of local interest groups might change over time.

Elements of the narrative / indicators:

- RI decides on goals, target groups and sets targets for outreach (input)
    - Description of rationale of the policies
    - Dedicated space on site, Dedicated staff
- RI develops policies and activities for outreach (activity)
    - description of the policies
- RI organises outreach events (output)
    - description of activities: examples, numbers, feedback from survey, media announcements

Accountability ceiling.

- The perception of the audience is changed (outcome)
  (this is very difficult to capture; however, a change in attitude of local groups might be observable)
    - Survey, dedicated focusgroups
    - Media appearances
    - local media reporting on the RI

8.5 Impact on the regional innovation ecosystem

Impact of: a high-tech organisation / employer / contractor / network
Impact on: the regional innovation ecosystem
Goal or vision: the region hosts a number of high tech organisations (research organisations, companies)
Narrative: An organisation that performs and enables state-of-the-art research has a positive influence on the region. It provides the opportunity to collaborate, it attracts companies to the region and it provides jobs for skilled technicians and scientists. This has a positive influence on the attractiveness of the region. There are several narratives or pathways:

- RI enables innovation of local companies, by reaching out and providing access
- Companies relocate to the region, due to the presence of the RI
- RI increases the number of innovative companies and jobs through spin-offs and spin-outs
- The RI hires highly trained and skilled staff that relocates to the region

Each of the narratives can be developed in a similar way:

- Target or vision
- Specific policies the RI develops in order to reach the target
- Measures and activities the RI takes
- Results

Given that others either need to respond, or that others take actions as well, it is advised to monitor this, such as:

- Original situation
- Developments or factors that are of influence
    - developments or image of the region; economic developments that influence entrepreneurship, etc.

8.6 Impact on a specific research community

Impact of: a facility that enables or coordinates research in a specific field or discipline
Impact on: a specific research community
Goal or vision: the research community has adapted innovative tools and practices
Narrative: The introduction and availability of new techniques can result into innovation in one or more research communities. This pathway narrates about the potential and promise of the new techniques, tools, practices, the measures taken by the RI in order to stimulate use, and the resulting changes in the research community.

Elements of the narrative / indicators:

- Description of the potential of the innovation and vision
- RI develops policies and activities that stimulate the use (activity)
    - description of the policies and activities, including description of user groups, targets
- RI puts the policies into practice (output)
    - description of activities: examples, numbers, feedback from survey
- Interested users advocate the use of the specific technique (outcome)
    - Collection of quotes from users
- There is a growing need for use, with both returning users, as well as new users that have developed in interest in the new possibility (outcome)
    - # users; % new; % returning; growth; set goals; user satisfaction

Accountability ceiling.

- The innovation becomes a regular standard in the field or leads to practices and possibilities (impact)
    - Description of old and new situation; of other organizations developing similar possibilities

8.7 Impact of a coordinating organization

Impact of: an ERIC or other coordinating organisation
Impact on: its members
Goal or vision: improved operation of the member facilities
Narrative: A coordinating organisation ensures that members improve or harmonize their operation; a range of actions is available (coordinating staff, exchange of practices, collaboration). The pathway narrates about the specific subgoals, means and results.

Elements of the narrative / indicators:

- Description of the overarching vision or goal
- RI develops specific policies for specific issues and to realise specific goals (activities)
    - Description and rationale of the specific goals; targets, situation at the beginning;
    - Description of activities for the goals
- RI puts the policies into practice (output)
    - For the different activities: description, number of attendees, satisfaction
- Members follow up (outcome)
    - Description of changes: changed practices, improved collaboration
- RI adapts goals or activities, based on feedback from members, in order to improve (outcome)
    - In order to ensure effective operation, changes based on feedback can be implemented; if so: description, rationale
- Improved operation of the member facilities (impact)
    - In case targets have been set: report on this

Accountability ceiling

8.8 Impact of the excellent science enabler

Impact of: an organisation dedicated to enabling excellent science
Impact on: science, its workforce as well as society
Goal or vision: the primary mission of the RI in operation, is to enable excellent science. This has a positive effect on progress in science, on its workforce and on society.
Narrative: Enabling excellent science is the primary goal of the RI, and thus to have impact in/on science and on the scientific community or workforce. Furthermore, excellent science has proven to be of great value outside of the peer community. Examples of further use will be captured and illustrate how science contributes to other societal fields. This includes use in other scientific fields than the own peer community.
There are three different pathways:

- "classic" science on science impact
- Impact on capacity/scientific workforce
- Impact on society

Elements of the narrative / indicators:
(In the context of this socio-economic protocol, the impact on society narrative is briefly described; the other two impact pathways are expected to be known, and should not be forgotten to be reported upon)

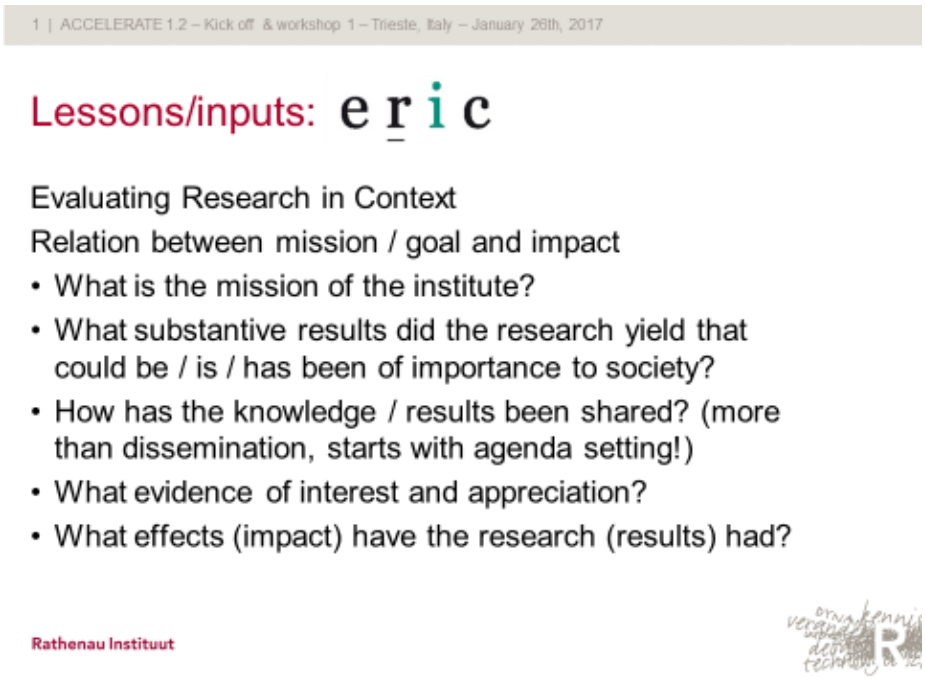
- RI enables scientists to use state of the art facilities
    - Description of facilities and the potential for specific further uptake
- The use has value for certain societal sectors (output)
    - Description of the value, of the collaboration of the scientific user with a societal partner; number of instances this happens in relation to total
- Users share the results and acknowledge the use (outcome)
    - Through academic articles: # articles
    - Through other media: collection of articles, videos, websites etc

Accountability ceiling.

- The results lead to further use or uptake, with societal relevance
    - Description of case

9. Background information on impact and evaluation

During the kick-off meeting of ACCELERATE, January 2017 in Trieste, KNAW-RI presented lessons from previous impact projects and reports. The slides are copied from this presentation. They contain the main lessons; the reference to the report or article is provided.



Drooge, L. et al (2010) *Evaluating the societal relevance of academic research: A guide* Den Haag: ERiC-Evaluating Research in Context

Lessons/inputs s i a m p i

SIAMPI (FP7-Social Impact Assessment Methods...Productive Interactions)

- Focus on contribution
- Focus on process
- Interactions:
  - Personal: joint projects, advisory, consultancy, double functions, mobility
  - Media, such as texts (articles, books, catalogues, protocols, new diagnostics) or artifacts (instruments, exhibitions, models, protocols, devices, designs)
  - Support: contracts, licensing, facility sharing

Rathenau Instituut

J.B. Spaapen & L. van Drooge (2011) Introducing 'productive interactions' in social impact assessment. *Research Evaluation* 2011, 20(3): 211-8

Waardevol / Valuable: 4 dimensions

- Various actors are responsible: the knowledge provider, the knowledge user and the intermediary
- The responsibility is held at different levels within an organisation
- There are appropriate forms of valorisation for each discipline
- Valorisation is a process where awareness and interaction at all stages and levels of research are important: from the formulation of a mission and policies, through the development of research, agenda setting, and execution of research and dissemination of results, to implementation

Rathenau Instituut

Leonie van Drooge, Rens Vandeberg et al (2011): *Valuable – Indicators for valorisation*. Den Haag, Rathenau Instituut