European Commission

Monitoring the Evolution and Benefits of Responsible Research and Innovation (MoRRI)

Synthesis report on existing indicators across RRI dimensions

Progress report D3.1

This report is one of a series of documents produced as part of the European Commission's service contract RTD-B6-PP-00964-2013,"Monitoring the evolution and benefits of responsible research and innovation".

The following deliverables have been produced so far:

- **Citizen engagement and participation of societal actors in research and innovation,** Task 2, Analytical report, Deliverable D2.1, April 2015
- **Science literary and scientific education**, Task 2, Analytical report, Deliverable D2.2, April 2015
- **Gender equality,** Task 2, Analytical report, Deliverable D2.3, April 2015
- **Open access**, Task 2, Analytical report, Deliverable D2.4, April 2015
- **Ethics,** Task 2, Analytical report, Deliverable D2.4.1, April 2015
- **Governance,** Task 2, Analytical report, Deliverable D2.4.2, April 2015
- Synthesis report on existing indicators across RRI dimensions, Task 3, Progress report, Deliverable D3.1, May 2015
- **Metrics and indicators of Responsible Research and Innovation**, Task 3, Progress report, Deliverable D3.2 September 2015

Authors

Tine Ravn, Mathias W. Nielsen, Niels Mejlgaard, Ralf Lindner

Contributors:

Suzanne Bührer, Rodrigo Costas, Kerstin Goos, Erich Griessler, Andrea Leitner, Bea Mahieu, Nikos Maroulis, Ingeborg Meijer, Ed Noyons, Viola Peter, Xavier Potau, Ismael Rafols, Jack Stilgoe, Andrew Stirling, Larissa Talmon-Gros, Thomas Teichler, Richard Woolley, Angela Wroblewski

Executive Summary

This deliverable is the first of two reports within task 3 of the MoRRI project. In short, task 3 has been defined to construct, identify and specify relevant metrics and indicators to be used in the subsequent RRI monitoring. The objective of this report (D.3.1) will be to synthesise and assess the existing indicators and secondary data as delineated across the six RRI dimensions, whereas the subsequent report (D.3.2) will pin down and specify the primary data to be collected as part of the following project tasks.

More specifically, this report synthesises a comprehensive amount of data with the purpose of reducing the complexity of the available approaches to measuring aspects of RRI. It provides a systematised and structured assessment of the capacity, coverage and applicability of the available indicators and data sources in measuring and capturing core RRI aspects at various dimensions and levels of aggregation.

As a first step of this "assessment exercise", the 98 promising indicators highlighted in the six initial analytical reports have been assessed and classified with respect to their *relevance*/*proximity* and *robustness*/*quality* as individual measures of RRI at specified dimensions and levels of analysis. As a second step, an aggregate assessment and classification have been conducted of the overall *relevance*/*proximity*, *robustness*/*quality*, and *richness of data* of the available indicators with respect to coverage of [a] the dimensions of the intervention logic model, and [b] the six analytical levels of aggregation.

On the basis of these analytical steps, it can be concluded, that the *input* and *output* dimensions of *the intervention logic model* comprise the most comprehensive and saturated indicators and data on RRI, and based on the available data, it could be worthwhile considering, whether the forthcoming project activities related to the collection of primary data and identification of additional secondary data, should delimit their scope to the input and output dimension of the intervention logic model.

Moreover, a glance at the distribution of relevant, robust and data-rich RRI indicators across the six analytical levels of aggregation, indicates that the most saturated set of indicators across the six RRI dimensions is available at the *national level*, therefore once could also consider to limit the scope of the following data collection to this particular level of aggregation.

Furthermore, within the context of MoRRI and the field of RRI at large, internal and external interlinkages among and between dimensions and sub-dimensions call for specific considerations in order to capture the full potential of data coverage with regard to existing secondary data and the future collection of primary data. The report specifies a number of existing and potential interrelations for further exploration in subsequent tasks.

In terms of the pillars of RRI, the dimension of governance – while still constituting a separate dimension – also functions as an overarching dimension or 'umbrella' concept for the remaining dimensions (European Union, 2012). In this regard, a great number of indicators identified within the five other dimensions relate directly to the governance of research and innovation, further indicating that this dimension can be

treated as an overarching umbrella dimension (D.2.4.1, p. 31). Thus, the governance dimension is indirectly represented in the report at hand, albeit no separate and existing quantitative indicators for this dimension have been identified at this stage in the research process.

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1. Introduction – descriptions of RRI metrics and indicators

The report at hand is the first deliverable of two within task 3 of the MoRRI project. In general, the objective of task 3 is to identify, define, and specify the metrics and indicators that will be used in the RRI monitoring. Furthermore, task 3 will present and assess existing RRI indicators as detailed in the six analytical reports (D.2.1-2.4.2 [for specifications see European Commission 2015a, 2015b, 2015c, 2015d, 2015e, 2015f]) in task 2. Finally, task 3 will identify and specify the need for the collection of supplementary primary data through the development of systematic data collection fiches. As regards content, the two deliverables within task 3 are divided according to the progression of determining RRI indicators. Whereas the deliverable at hand (D.3.1) will synthesise and assess existing indicators and secondary data as delineated across the six RRI dimensions, the subsequent deliverable (D.3.2) will specify the primary data to be collected in task 4.

Specifically, the main objectives with the current report are to:

- Outline the concept of RRI, i.e. the policy context, terminology, defining dimensions, existing knowledge and research efforts related to the concept and field of RRI, in order to provide a contextual framework for mapping and assessing existing secondary data and indicators (Chapter 2)
- In the analytical reports of task 2, sub-dimensions/classifications/ typologies are provided to conceptualise and operationalise each RRI dimension. This allows for a systematic and functional approach for the monitoring of RRI. The extent of data availability within separate dimension categorisations/typologies will be assessed through a cross-reading of data explorations vis-à-vis functional vocabularies (Chapter 3)
- Through a cross-reading of the six analytical reports and the list of promising indicators outlined in these reports, an initial effort will be made in the subsequent chapter (Chapter 4) to assess these indicators in terms of robustness, richness and RRI relevance – the latter as defined within the context of MoRRI. Furthermore, data quality, coherence and availability will be considered according to the intervention logic model as well as the levels of aggregation of these promising indicators (for specifications see below). For a simplified and visual overview, indicator assessments will also be presented in tables and Venn diagrams (Chapter 4 and Appendix 7.1)
- The last chapter will summarise and discuss the selection of the most promising indicators based on a systematic assessment of each indicator and the coverage of indicator clusters. Additionally, the chapter will open a discussion of data gaps and required data collection at different intervention- and data levels to guide and direct the primary data specification in D.3.2 (Chapter 5)

Overall, this report aims to synthesise a great amount of data and reduce complexity by providing a systematic, yet simplified assessment of data coverage and related implications for the set of promising indicators in general and within each dimension.

Besides the three quality parameters described below (robustness, richness and relevance), this report specifically considers data coverage in terms of the availability of data across dimensions relating to their characteristics in terms of the intervention logic model, i.e. data describing the context, input, output, and outcome of RRI. More specifically, **context** relates to the environment and overall situation in a country, region or at the international level; **input** relates to the activities carried out, measures taken, structures created or resources provided to address what is done to address issues of RRI and whether it is done in a systematic manner; **outputs** to the immediate or direct results of activities and **outcomes** relate to the achievements (MoRRI Proposal 2014:64).

Additionally, availability of data is described according to its level of aggregation. More specifically, a distinction will be made between data that describe the global level, the national level, the regional level, the institutional level, the programme/project level and the individual level.

The synthesis and quality assessment is not propounded as a validated or final version. Rather, the objective is to provide a qualified appraisal of existing data accounting for variations across analytical levels. This appraisal calls for further verification from the experts within the respective dimensions. For instance, the four main categories of the intervention logic model can, in some cases, be interpreted differently. Cases of doubt, for instance, arise as to whether an indicator characterises measures taken to describe the status quo (input) or the particular achievements within a specific dimension (outcome). Such data quality complications can be referred to as 'data attribution bias' (den Hertog et al. 2014: 10, 15). In such instances, the initial classifications will be maintained, but possible implications are emphasised in the assessment process (see chapter 4).

In cases of general doubt, for instance in the efforts to establish certainty with regard to data robustness, the existing data descriptions and related data sources will be consulted to perform as qualified an assessment as possible. To ensure processual transparency, the quality criteria applied in the assessment procedure are specified below. Furthermore, the specific analytical steps taken in the assignment of quality classifications are specified in chapter 4. Still, it is important to emphasise that further expert verifications are required before the final selection and definition of relevant RRI metrics and indicators takes place.

In terms of the pillars of RRI, the dimension of governance – while representing a separate dimension – also functions as an overarching dimension or 'umbrella' concept for the remaining dimensions (European Union, 2012). In this regard, a great number of indicators identified within the other five dimensions relate directly to the governance of research and innovation, hereby affirming that this dimension can be treated 'as an overarching consideration across the other dimensions of responsible research and innovation' (D.2.4.2, p. 31). In this sense, the governance dimension is indirectly represented, albeit no separate and existing quantitative indicators have been identified at this stage in the research process. As specified in report D.2.4.2.

'there are a set of meta-governance considerations that demand further attention and for which indicators at the moment are patchy if not absent' (p.29). A comparably large amount of qualitative data exist that could be of relevance as secondary data for the subsequent construction of indicators; but at this stage no applicable 'indicators for governance that are quantifiable' (D.2.4.2, p.31) have been identified.

1.1. Assessment of indicators on three parameters:

As mentioned, this report introduces three main parameters of assessment: **[a]** Relevance/Proximity, **[b]** Robustness/Quality and **[c]** Richness of data. The three parameters have been developed with the purpose of providing a systematic assessment of the identified indicators (and data sources), in terms of their capacity, coverage and applicability in measuring and capturing aspects of RRI at various dimensions and levels of analysis. The following paragraphs provide a brief introduction to each of these parameters.

1.1.1. Relevance/proximity:

The question of *relevance/proximity* concerns the relevance of the identified indicators and data sources in measuring RRI related aspects, as well as their proximity to the core content of the RRI concept (for specifications on the RRI concept see Chapter 2). The assessment of the *relevance/proximity* parameter has been conducted at two separate steps of analysis. As a first step, the relevance/proximity of each of the altogether 98 indicators has been assessed (Nb. Specific governance indicators are not included, see introduction).

As a second analytical step, an aggregate assessment of the overall relevance of the available indicators with respect to **[1]** the coverage of the four dimensions of the intervention logic (i.e. context, input, output, and outcome), and **[2]** the coverage of the six analytical levels (i.e. global, national, regional, institutional, programme/project, and individual) have been made. Each analytical step will be further explicated in Chapter 4. The assessment of relevance/proximity is based on the following three-point colour scale:

- Red (Weak relevance)
- Blue (Medium relevance)
- Green (strong relevance)

1.1.2. Robustness

The parameter of *robustness/quality* concerns the validity and reliability of the identified indicators to measure specified dimensions/analytical levels of RRI. The parameter represents a composite measure of the four aspects of robustness/quality outlined below.

1) *Content validity* concerns the extent to which the content or theoretical construct of the indicator matches the content domain it has been defined to measure (Hertog et al. 2014). The Gender Equality indicator GE15 represents an illustrative example of the importance of accounting for content validity, when assigning an indicator to a particular dimension of the intervention logic model. GE15 provides an overview of developments in the share of FP7 projects with specific gender

equality actions and in this sense it can be viewed as a relevant measure of developments in the priority of GE in science. One may, however, question whether GE15 is a valid indicator of the *input* dimension of the intervention logic model, or whether this type of information is more suitable as a complementary indicator of *output.* The uncertainty arises because the GE15 indicator can be interpreted in two ways: 1) As an indicator of how the FP7 project applicants respond to specified programme requirements related to gender issues (i.e. the *output* dimension), and 2) as an indicator of the interventions taken by project participants to promote a certain outcome (e.g. a higher degree of female participants in the projects) (i.e. the *input* dimension). The issue of indicator attribution (see section 1), in other words, constitute a crucial element in ensuring the content validity of the identified measures.

2) *Reliability* concerns the quality, consistency and comparability of the underlying data constituting the basis of the identified indicators. As mentioned by Hertog et al. (2014: 8), one major issue, when drawing on secondary data is that "each country uses its own specific data sets, measurement methods, and definitions. Although supranational organisations such as the OECD and EU have made great progress in unifying international data collection, substantial differences exist between countries. The basic problem is that it is sometimes difficult to tell whether (or to what extent) the differences in a model between countries are real or rather constructs due to differences in measurements". In other words, it is crucial to account for the actual consistency and comparability of the available aggregate data derived from country-specific data sets.

3) *Indicator coverage bias* aims to clarify whether a bias exists in the structure of the data itself (Hertog et al. 2014, p. 9). The lack of coverage of the humanities and parts of the social sciences in Thomson Reuters' Web of Science, may for instance lead to structural bias in otherwise highly relevant measures of developments in Open Access publications across scientific disciplines and countries.

4) *External validity* addresses the extent to which the data collected on the basis of the 98 indicators provides information that is generalisable to a broader population of cases, situations or people.

The aggregate assessment of *robustness* is based on the following three-point scale:

- "no sign" (Weak robustness)
- + (Medium robustness)
- ++ (Strong robustness)

1.1.3. Richness of data

The parameter of *richness of data* concerns the potential capacity of the available data collected on the basis of the 98 indicators in covering the identified "sub-dimensions" (i.e. dimensional construct; elements; categories) for each of the six RRI dimensions. In opposition to the above-mentioned parameters (i.e. *relevance* and *robustness*), this assessment is only performed at aggregated levels (i.e. the four dimensions of the

intervention logic [Table 4.8] and the six levels of analysis [Table 4.9]). In this regard, it is crucial to note that the *richness of data* parameter does not address questions of sample size and external validity of the available data, but merely concerns the indicators' capacity to capture the RRI dimensions at aggregated levels. The assessment of richness is based on the following three-point scale:

- 0 (Weak data richness)
- 1 (Medium data richness)
- 2 (Strong data richness)

Table 1.1, below, recaptures the three parameters of assessment employed throughout the analysis.

Table 1.1. Parameters of assessment

Parameter of assessment	***Relevance/Proximity* of indicator(s) as measure(s) RRI related aspects**	***Robustness/Quality* of indicator(s) in measuring RRI**	***Richness of data* in capturing aspects of RRI**
Three-point assessment scale:	• Red (Weak) • Blue (Medium) • Green (Strong)	• "no sign" (Weak) • + (Medium) • ++ (Strong)	• 0 (Weak) • 1 (Medium • 2 (Strong)

2. The concept of RRI

Responsible research and innovation (RRI) is becoming an increasingly important ambition in science and innovation policy practices. Yet, while a number of new initiatives are being deployed, notably in the European Horizon 2020 programme, the contours of the concept of RRI are still in a formative stage, and a broadly accepted definition is lacking. In abstract terms, RRI can be characterised as a hybrid concept linking (a) normative aspects (such as societal objectives, values and ethics) with (b) systemic factors of research and innovation systems and (c) procedural arrangements of R&D policy and governance (e.g., public engagement mechanisms, forms of stakeholder participation and deliberation). In essence, RRI aims to improve the alignment of research, technology and innovation with societal objectives and values. In particular, RRI focuses on the so called "emerging technologies and innovations" that are associated with a high potential of societal benefit but also risk, conflict and societal transformation.

This chapter aims to provide a brief introduction to the concept of RRI, thereby setting the scene for the ensuing parts of this report. The concept of RRI and its implementation and enactment at various levels are in a process of dynamic development. Thus, the objective of monitoring the evolution and benefits of RRI is extremely challenging. In the first section, a sketch of the broader policy context in which RRI is situated in will be presented, followed by an overview of common definitions and conceptual underpinnings of RRI. Finally, section 2.3 provides a descriptive overview of current and ongoing research activities in the field of RRI.

2.1 The policy context of RRI

The rapid progress of science, research and innovation has challenged prior positive, largely contested, understandings of science and technology and spawned increasing interest in the relationship between science and society throughout the world. European citizens have, in many cases, proved sensitive when referring to the scientific crisis of legitimacy and technology. Generally, the requirements facing science, technology and innovation are becoming increasingly demanding – not only in terms of economic benefits and impacts on public welfare, but also with regard to issues of legitimacy.

Partly in response to these developments, the European Union has raised its RRI ambitions in the context of science, technology and innovation (STI) policy making. In parallel to increasing emphasis on research, the Europe 2020 strategy outlines the societal challenges confronting Europe for which actions must be taken. Europe 2020 also identifies R&I as key in addressing these societal challenges, while at the same time generating smart, inclusive and sustainable economic growth for Europe. The EU initiatives are bound to fail, if they do not build on a societal environment that is receptive and conducive to science and innovation, and if they do not realise that there are important barriers to social uptake of R&I. Consequently, EU policy makers are realising that sustainable R&I solutions for societal needs, require that all societal actors (researchers, citizens, policy makers, business, civil society organisations) must

work together during the whole R&I process aligning the R&I outcomes to the values, needs and expectations of European society.

These policy developments are part of, and embedded in, an ongoing paradigm shift in the strategic direction of STI policies which can also be observed in many highly industrialised countries as well as on the international level. This changing strategic shift might best be characterised as a "normative turn" in STI policy (Daimer, S. et al. 2012). In essence, the emerging STI policy paradigm increasingly seeks to complement traditional goals of economic competitiveness and innovation capacity with an ambition of addressing the so-called "Grand Challenges" such as health, sustainability and well-being. For instance, the Lund Declaration of 2009 stated that these "challenges must turn into sustainable solutions in areas such as global warming, tightening supplies of energy, water and food, ageing societies, public health, pandemics and security" (Lund Declaration 2009). Hence, in an attempt to address the Grand Challenges by the means of R&I, STI policy is increasingly pursuing a new type of mission orientation, which focuses on societal demands and needs instead of pre-defined, mainly technological goals.

Currently, the European Commission and a number of national governments and institutions (e.g., in The Netherlands and UK) are promoting the evolving concept of RRI to ensure that investments in research and technology development contribute to a set of (politically) defined, normative goals, typically encompassing the so-called Grand Challenges. Science, technology and innovation can offer some solutions to these complex and interdependent problems, but at the same time will most likely create new inequities, uncertainties and controversies. In this context concepts of responsible (research and) innovation are being proposed, which emphasises the need for transparency, responsiveness, inclusive interaction and anticipation.

2.2 Concepts, definitions and terms of RRI and the role of the EC's SiS dimensions

The RRI concept is currently gaining momentum. Yet, despite its rapid adoption and dissemination in the European Commission and in the scientific community, there is still disagreement on its definition, content and details.

In the academic literature, "responsible innovation" started to emerge about ten years ago (see e.g. Hellström 2003; Guston 2004). However, this novelty should not mislead us to draw lopsided conclusions. To a large extent, RRI builds on a number of key concepts, approaches and scholarly traditions that have been influential in the area of STI-policy discourse for decades. These include different variants of technology assessment, risk assessments, foresight, anticipatory governance, ethic reviews, science education and communication, public engagement, CSR schemes, etc. Arguably, one of the distinguishing characteristics of RRI is the attempt to productively integrate many of these approaches and instruments into an overriding concept.

2.2.1 Definitions

The broad range of understandings, interpretations, intentions and visions of what RRI is or should be is reflected by the different definitions of responsible (research and)

innovation currently available in the literature. In the following, a selection of frequently cited definitions, which are influential in academia and in policy, will be presented:

The most cited RRI definition was suggested by René von Schomberg in 2011:

> "Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)."

Von Schomberg's contribution to the RRI debate was quite influential, both in various academic communities dealing with the interfaces of science and society, but also at the level of the European Union. The former European Commissioner for Research, Innovation and Science, Geoghegan-Quinn, spelled out an early official EC understanding of RRI in 2012:

> "Responsible Research and Innovation means that societal actors work together during the whole research and innovation process in order to better align both the process and its outcomes, with the values, needs and expectations of European society" (ec.europa.eu).

This brief definition is also the current understanding promoted by the Science with and for Society unit (SWAFS) of the Directorate-General for Research and Innovation (DG RTD).

In the final report of the expert group on RRI, which was initiated by DG RTD, the following definition was presented:

> "RRI refers to ways of proceeding in Research and Innovation that allow those who initiate and are involved in these processes at an early stage (A) to obtain relevant knowledge on the consequences of the outcomes of their actions and on the range of options open to them and (B) to effectively evaluate both outcomes and options in terms of ethical values (including, but not limited to well-being, justice, equality, privacy, autonomy, safety, security, sustainability, accountability, democracy and efficiency) and (C) to use these considerations (under A and B) as functional requirements for design and development of new research, products and services"(European Commission 2013).

More recently, the European Council officially adopted the Rome Declaration of Responsible Research and Innovation, which was drafted during and endorsed by the Italian Presidency of the Council of the European Union in 2014. The Declaration's understanding of RRI is reads as follows:

> "RRI requires that all stakeholders including civil society are responsive to each other and take shared responsibility for the processes and outcomes of research and innovation. This means working together in: science education; the definition of research agendas; the conduct of research; the access to research results; and the application of new knowledge in society in full respect of gender equality, the gender dimension in research and ethics considerations1. More than a decade of research and pilot activities on the

> interplay between science and society points to three main findings. First, we cannot achieve technology acceptance by way of good marketing only. Second, diversity in research and innovation as well as the gender perspective is vital for enhancing creativity and improving scientific quality. And third, early and continuous engagement of all stakeholders is essential for sustainable, desirable and acceptable innovation. Hence, excellence today is about more than ground-breaking discoveries – it includes openness, responsibility and the co-production of knowledge. The benefits of Responsible Research and Innovation go beyond alignment with society: it ensures that research and innovation deliver on the promise of smart, inclusive and sustainable solutions to our societal challenges; it engages new perspectives, new innovators and new talent from across our diverse European society, allowing to identify solutions which would otherwise go unnoticed; it builds trust between citizens, and public and private institutions in supporting research and innovation; and it reassures society about embracing innovative products and services; it assesses the risks and the way these risks should be managed" (Rome Declaration 2014).

In parallel to the RRI definitions developed mainly within the context of the institutions of the EU, a number of contributions to the debate have been made by researchers and academics.

One of the most widely cited definitions of RRI has been suggested by Owen et al. (2013):

> "Responsible innovation is a collective commitment of care for the future through responsive stewardship of science and innovation in the present"

Van den Hoven (2013), one of the key academic actors in the RRI debate, contributed this definition:

> "Responsible Innovation is an activity which may give rise to previously unknown designs either pertaining to the physical world (e.g. designs of buildings and infrastructure), the conceptual world (e.g. conceptual frameworks, mathematics, logic, theory, software), the institutional world (e.g. social and legal institutions, procedures and organisation) or combinations of these, which when implemented expand the set of relevant feasible options regarding solving a set if moral problems."

In the UK context, Stilgoe and colleagues have characterised RRI as having four dimensions, nicely summarised by the UK's Engineering and Physical Sciences Research Council (the largest government funder of scientific research) as 'Anticipate, Reflect, Engage, Act' (www.epsrc.ac.uk).

2.2.2 Science-in-Society Dimensions

As outlined above, the RRI concept has many conceptual roots and draws on a broad range of research traditions and communities. Likewise, the specific understanding of RRI as it is currently being promoted by parts of the European Commission emerged to a large extent from the objectives and experiences in the Framework Programmes 6

(2002-2006) and 7 (2007-2013) and the respective work programmes Science and Society and Science in Society (SiS). The successor within the current Horizon 2020 programme (2014-2020) is called Science with and for Society, and provides funding for a number of dedicated RRI projects (see section 2.3). The stated aim of the Commission's work on 'Science with and for society' is "to build effective cooperation between science and society, to recruit new talent for science and to pair scientific excellence with social awareness and responsibility" (European Commission, a).

A common characteristic of these three work programmes is that they are organised around a set of key dimensions, each focusing on specific aspects of the science-society interface (including issues of public engagement, ethics, gender, science literacy).

The key dimensions currently put forward by the EC are:

1. "Engagement: It implies that societal challenges should be framed on the basis of widely representative social, economic and ethical concerns and common principles on the strength of joint participation of all societal actors - researchers, industry, policymakers and civil society.
2. Gender Equality: Addresses the underrepresentation of women, indicating that human resources management must be modernized and that the gender dimension should be integrated in the research and innovation content.
3. Science Education: Faces the challenge to better equip future researchers and other societal actors with the necessary knowledge and tools to fully participate and take responsibility in the research and innovation process.
4. Open Access: States that RRI must be both transparent and accessible. Free online access should be given to the results of publicly funded research (publications and data).
5. Ethics: Requires that research and innovation respects fundamental rights and the highest ethical standards in order to ensure increased societal relevance and acceptability of research and innovation outcomes.
6. Governance: Addresses the responsibility of policymakers to prevent harmful or unethical developments in research and innovation. The latter is a fundamental basis for the development of the rest of the dimensions" (European Union 2012)

To a large extent, the current and official understanding of RRI within DG RTD rests on these six key action points. Accordingly, the project funding of the SWAFS work programmes largely reflects these dimensions.

2.3 Overview of research activities focusing on RRI in Europe and beyond

The project funding provided by the European Union is currently the single most important driver of the conceptual development, refinement and implementation of RRI. Since about 2010, RRI has been increasingly funded by DG RTD and has now become a cross-cutting element in Horizon 2020. But already during the EU's Seventh Framework Programme, a number of dedicated RRI projects received funding. Table 2.1 provides an overview of these projects.

Table 2.1: Overview of RRI projects funded by the EU

Project Name	Overview and objectives	Project period and funding
Responsible Research and **Innovation in a Distributed Anticipatory Governance Frame. A Constructive Socio-normative Approach Res-AGorA**	The EU seeks to become a genuine Innovation Union in 2020 striving for excellent science, a competitive industry and a better society without compromising on sustainability goals as well as ethically acceptable and socially desirable conditions. Europe thus needs to develop a normative and comprehensive governance framework for Responsible Research and Innovation (RRI). This is the major goal of Res-AGorA. The Res-AGorA framework will build on existing RRI governance practices across and beyond Europe. It will be reflexive and adaptable to enable the inherent tensions in all governance of RRI to be actively addressed by procedural means aiming to facilitate constructive negotiations and deliberation between diverse actors. The project will achieve these objectives through a set of work packages providing an empirically grounded comparative analysis of a diverse set of existing RRI governance arrangements and their theoretical/conceptual underpinnings across different scientific technological areas (WP2 and WP3), a continuous monitoring of RRI trends and developments in selected countries (WP5) and, based on the cumulative insights derived from these work packages, co-construct with stakeholders the central building blocks and procedures of an overarching future governance framework for RRI (WP4).This governance framework will deliver cognitive and normative guidance that can be applied flexibly in different contexts. Res-AGorA will thus have direct impact on RRI practices (science, industry, policy), and strategic impact in terms of the political goals and competitiveness. Res-AGorA will ensure intensive stakeholder interaction and wide dissemination of its tangible and intangible outputs in order to maximise impact, including comprehensive and interactive stakeholder engagement, liaisons with other ongoing RRI activities funded by the SiS Work Programme, and a final conference.	02-01-2013 to 01-31-2016 EU-contribution: EUR 3 003 406
PROmoting Global REsponsible research and Social and Scientific innovation PROGRESS	Delivering European Renewal relies heavily on the advancement of Responsible Research and Innovation (RRI) that is, research and innovation which is: - is ethically acceptable, - is sustainable by avoiding significant adverse effects and - drives towards the common good, i.e. societal desirability. To achieve maximum impact where it is most needed, ProGReSS concentrates on the underexplored and least converging part of RRI, namely achieving societal desirability. The project will link existing international networks of RRI from all continents with European partners and policy-makers, policy-advisors, funders, industry and non-governmental organisations. In interactive discussions with relevant societal actors as well as innovators, we will move RRI debates from the national or regional to the global level and achieve the following objectives: 1. Link existing international networks of RRI with relevant societal actors on a global scale to focus innovation on societal desirability.	02-01-2013 to 01-31-2016 EU-contribution: EUR 1 486 664

Project Name	Overview and objectives	Project period and funding
	2. Complete a major fact-finding mission comparing science funding strategies and innovation policies in Europe, the US, China, Japan, India, Australia, and South Africa. 3. Advocate a European normative model for RRI globally, using constitutional values as a driver to inform societal desirability. 4. Develop a strategy for fostering the convergence of regional innovation systems at the global level.	
Global Model and Observatory for International Responsible Research and Innovation Coordination RESPONSIBILITY	The RESPONSIBILITY project aims to create a network of stakeholders that would adopt and diffuse a common understanding in Responsible Research and Innovation between different actors in Europe and around the globe. In doing so it will develop a model and provide a tool for international cooperation, the RESPONSIBILITY Observatory, involving the societal, policy and research stakeholders to these activities. It intends to provide practical means and structure a crucial interaction between society and research, providing a set of recommendations and tools to policy makers and active RRI stakeholders in order to take the necessary measures to nest responsible research and innovation into products and services from the very beginning (efficient RRI by design).	02-01-2013 to 01-31-2016 EU-contribution: EUR 1 484 427
Governance of REsponsible innovATion GREAT	The GREAT project will develop an empirically based and theoretically sound model of the role of responsible research and innovation governance. The project will explore the dynamics of participation in research and innovation, and investigate the characteristics of responsible practices. It will investigate the nature of new partnerships among various stakeholders, researchers and policymakers that are developing within innovation networks and the influence that these developments have on knowledge production and policy. This will be done a. by determining the characteristics of research and innovation b. involving diverse groupings and c. determining the social processes involved in responsible research and innovation practices. In doing so, the GREAT project will address all three issues requested in the call: a. It will explore the knowledge and research potential of multi-stakeholder approaches in research; b. it will investigate how responsible innovation is involved in research processes and c. it will use this knowledge to inform policy makers on how to integrate responsible innovation in further research activities.	02-01-2013 to 01-31-2016 EU-contribution: EUR 1 780 571
Neuro-Enhancement: Responsible Research and Innovation (NERRI)	The project aims to contribute to the introduction of Responsible Research and Innovation in neuro-enhancement (NE) in the ERA and to the shaping of a normative framework underpinning the governance of NE technologies. These will be achieved through mobilization and mutual learning (MML) activities engaging scientists, policy-makers, industry, civil society groups and the wider public. To structure this complex socio-technical domain we propose Analytic Classification of NE technologies into currently available methods, experimental and hypothetical	03-01-2013 to 02-29-2016 EU-contribution: EUR 3 312 430

Project Name	Overview and objectives	Project period and funding
	technologies. Each of the types raises some fundamental ethical, legal, social and economic issues, which have different relevance to various societal groups point to different methods of stakeholder engagement, and require different regulatory approaches. Over the course of the project the Analytic Classification will be developed and extended in the work packages. Mobilization will form the central commitment of the project from the outset to the conclusion. WP2 starts with a reconnaissance of the field of NE and the mobilisation of scientists and other stakeholders. Based on the Analytic Classification WP3 will stimulate and organize a broad societal dialogue employing state-of-the-art engagement methodologies tailored to specific issues and stakeholders. A particular focus will be the hopes, fears and expectations of the wider public. WP4 will synthesise the national experiences, map the contours of a normative framework as it emerges from societal engagement and dialogue and elaborate the concept of RRI in Europe. WP5 aims through a variety of dissemination strategies to maximise the impact of the project outcomes throughout Europe. The consortium comprises experts in the neurocognitive sciences, the social sciences and humanities and science communication. Many have prior experience of EC projects and of successful collaborations with other members of the consortium.	
Synthetic biology – Engaging with New and Emerging Science and Technology in Responsible Governance of the Science and Society Relationship (SYN-ENERGENE)	Synthetic biology (SynBio) offers huge potential for applications in energy, health and the environment. It also brings with it various challenges such as regulatory issues of biosafety, biosecurity and intellectual property rights, as well as potential environmental and socioeconomic risks in developing countries. As yet, however, there is scant public knowledge about the technology. It is thus essential to establish an open dialogue between stakeholders concerning SynBio's potential benefits and risks and to explore possibilities for its 'collaborative shaping' on the basis of public participation. SYN-ENERGY will organise a wide range of mobilisation and mutual learning processes relating to these challenges. Besides a number of well-established European and international networks, the sortium encompasses and can mobilise a wide variety of stakeholders from science, industry, civil society, policy, education, art and other areas. Learning processes will tribute to a better understanding of SynBio research and innovation and to enhanced public engagement, while at the same time stimulating reflection on novel approaches to an inclusive governance framework that is capable of fostering responsible research and innovation. The processes will involve citizens and specific publics through well-established and innovative means of engagement, and will support the vergence of stakeholders and perspectives. Activities will be structured by four platforms, highlighting SynBio's future, public, cultural and research & innovation perspectives. The iterative mutual learning process within SYN-ENERGY will be open to change in order to accommodate the dynamics of an emergent field. By dint of its approach, design and sortium,	07-01-2013 to 06-30-2016 EU-contribution: EUR 3 960 810

Project Name	Overview and objectives	Project period and funding
	SYN-ENERGY will be a Science in Society activity with significant impact, raising public awareness of SynBio and yielding benefits for involved stakeholders, public discourse and European policy making in an international text.	
Including Responsible Research and innovation in cutting Edge Science and Inquiry-based Science education to improve Teacher's Ability of Bridging Learning Environments (IRRESISTIBLE)	In the project partners work together to make young people more aware about Responsible Research and Innovation issues. Universities and science centres will cooperate in the project using the expertise they have in linking formal and informal learning. For a long term effect the project focusses on teacher training. Each partner will form a Community of Learners in which teachers work together with formal education experts and informal education experts. The topics they will work on are derived from cutting edge research taking place at the partners' university. Researchers and people from industry will complement the Community of Learners. The Community of Learners will develop material to be used both in the classroom as well as in the science centres. During the first part content knowledge about the research will be introduced using the well-established IBSE methodology. In the second part students will discuss and work on Responsible Research and Innovation issues regarding the research they have studied. Each partner will develop one module to be used in the classroom During the module students will be developing exhibits about the RRI issues that they have studied. These exhibits will be presented in the science centres. The best exhibits from each partner will be brought together during the yearly conferences of the project. By using new techniques like digital fabrication (ie. 3D printing) the exchange of exhibits will be easy between partners. In the second round of the project the teachers from the first Community of Learners will work in a new Community with 4 to 5 new teachers. They will help these teachers introduce the developed modules in their own classroom. This way the number of teachers involved grows. After receiving feedback from the first two rounds the 10 modules will be published and disseminated using www.scientix.eu and through workshops at local and (inter)national conferences	11-01-2013 to 10-31-2016 EU-contribution: EUR 2 498 840
Public Involvement with Exhibition on Responsible research and innovation (PIER)	PIER is a project to engage the public on the Responsible Research and Innovation in society. The project will develop an exhibition with a participatory programme to engage the large public on the concrete achievements of the European scientific research and innovation today, enhancing the responsible approach in the implementation of research and highlighting its implications for the territorial development and for the quality of life of citizens. The exhibition will include different means of communication and participation such as hands-on exhibits, prototypes and demonstrators, videos and multimedia products; it will be supported by public programs, which will use dialogue formats in order to engage the public in the RRI dimensions of science and technology.	01-01-2014 to 01-31-2015 EU-contribution: EUR 500 000

Project Name	Overview and objectives	Project period and funding
	The exhibition will be addressed to and implemented with representatives of societal actors of the Research and Innovation process of implementation: researchers, businesses, media, educators, civil society organizations and policy-makers as well as citizens, who will be involved in different times and formats during the project. In order to address better the interest of the public, the beneficiary proposes to focus the exhibition on ocean research which is a relevant theme for citizens of the Neapolitan region, as the Mediterranean Sea is a prior element of the natural environment to preserve and a source for the economic development. The topics tackled in ocean research are part of the key priorities of Horizon 2020 tackling societal challenges and citizens' concerns today in the European Research agenda. The exhibition will be opened during the Italian European Semester 2014 in November in order to give a greater relevance to the project by involving representatives and policy makers at the highest level, and to enhance the European dimension of the event and to reinforce its visibility.	
RRI TOOLS	This project will develop and use a Training and Dissemination Toolkit on Responsible Research and Innovation (RRI). It will be addressed and designed by all the stakeholders of the Research and Innovation (RI) chain of value, including Researchers, Civil Society, Industry and Education but will specially focus on Policy Makers in order to impact significantly in the future governance of RI. The Consortium that will carry out the project is a 26 multi-stakeholder group of institutions with experience in different key components of RRI. The project envisages the creation of 19 RRI Hubs covering 30 countries of the European Research Area. The Consortium and the RRI Hubs will carry out a process of development of the toolkit that will be collaborative and inclusive, this way fostering methods and channels of dialogue in order to increase creativity and shared ownership of the process. Ultimately, the process will lead to a Community of Practice in RRI which will assure the use, evolution and enrichment of the toolkit. The RRI Toolkit will be an innovative and creative set of tools comprising practical digital resources and actions aimed at raising awareness, training, disseminating and implementing RRI. The RRI Hubs will be responsible for training on the use of the toolkit throughout Europe, of advocating policy makers at a national and regional level and of disseminating the concept of RRI to a wide audience. Bridging the gap between Science and Society has been a challenge for decades. Today, there is evidence that we need to involve wider society in decisions about the form and direction of research and innovation to contribute to a smart, inclusive and sustainable growth of our societies. RRI TOOLS will help transform Research and Innovation in Europe into a process targeted at the grand challenges of our time (science for society) where deliberation and reflection are coupled with	01-01-2014 to 12-31-2016 EU-contribution: EUR 6 942 031

Project Name	Overview and objectives	Project period and funding
	action (science with society).	
Equipping the Next Generation for Active Engagement in Science (ENGAGE)	ENGAGE (European Network for Genetic and Genomic Epidemiology) has, as its central objective, the translation of the wealth of data emerging from large-scale research efforts in molecular epidemiology into information of direct relevance to future advances in clinical medicine. ENGAGE will do this through the integration of very large-scale genetic and phenotypic data already available from a substantial number of large and well-characterised European (and other) sample sets of various types. The initial focus will be an integrated analysis of >80,000 genomewide association scans available to the consortium, thereby identifying the large number of novel disease-susceptibility variants undetectable in individual studies. Early studies will concentrate on metabolic and cardiovascular phenotypes, with subsequent expansion to apply the methods developed and lessons learned in other disease areas. The ENGAGE framework has been designed to be adaptable to advances that enable global analyses of other sources of genomic variation (e.g. structural and epigenetic variants), and to broadening of the phenotypic spectrum (to genomic endophenotypes in particular).	01-01-2014 to 12-31-2016 EU-contribution: EUR 12 000 000
Responsible Research and Innovation in Business and Industry in the Domain of ICT for, Health, Demographic Change and Wellbeing (RESPONSIBLE-INDUSTRY)	The project will design an Exemplar Implementation Plan of RRI in Industry to demonstrate how industry can work productively together with societal actors and integrate principles and methodologies of Responsible Research and Innovation (RRI) into research and innovation processes. To achieve maximum impact where it is most needed, the implementation plan will focus on the grand challenge of health, demographic change and wellbeing. More specifically the project will focus on the role that research and innovation in ICT can play in addressing this challenge. Responsible-Industry will guide interactive discussions between leading industry partners, established RRI experts, policy advisors and civil society organisations to drive the research and innovation process with the principles of RRI in mind. In doing so, Responsible-Industry will achieve the following objectives: - Synthesis of current discourses on RRI in the industrial context, based on an extensive literature review, 30 in-depth interviews with industry thought leaders, 5 bottom-up case studies and 2 Horizon Scanning reports. - Investigation, through practical cases and in depth dialogue with stakeholders, of processes, challenges and opportunities leading to responsible innovation along specific value chains of products and applications. - International Delphi Study of RRI in industry involving 130-150 stakeholders and an international Multi-Stakeholder workshop. - Development of a implementation plan to be tested in at least 4 pilot projects. - Reflection on the viability of the implementation plan,	02-01-2014 to 07-31-2017 EU-contribution: EUR 1 496 992

Project Name	Overview and objectives	Project period and funding
	supported by least 15 industry-driven focus groups. - Development of models of RRI in industry as a basis of specific recommendations to be disseminated to the stakeholders through an Exemplar Implementation Plan	
Promoting Attainment of Responsible Research and Innovation in Science Education (PARRISE)	The overall aim of the EC call is building up a scientifically literate society, which enables its citizens to participate in the research and innovation process as part of Responsible Research and Innovation (RRI). This calls for democratic citizenship education, in which two educational approaches, often presented independently in schools, are integrated, viz. Inquiry-Based Science Education (IBSE) and Socio-Scientific Issues-Based Learning (SSI). We call this integrated approach Socio-Scientific Inquiry-Based Learning (SSIBL). The aim of the project is to collect and share existing best practices across Europe and develop learning tools, materials and in/pre-service training courses for science teachers based on the SSIBL approach. This educational methodology promotes democratic citizenship through the integration of social issues and related scientific knowledge. Our aim is to empower and facilitate science teachers and teacher educators, by in-service and pre-service professional development courses, based on reshaped best practices available among the partners. These shared selected best practices will be reflected on from an RRI perspective and improved by an international 'community of learners' who incorporate RRI in their teaching and learning processes. The project will establish a multidisciplinary team and facilitate networking activities among teachers, teacher educators and educational researchers of 18 institutions in 11 countries. In addition, the project will build on recently developed IBSE insights and foster implementation of IBSE in educational practice	01-01-2014 to 12-31-2017 EU-contribution: EUR 2 498 125
RRI-ICT Forum	The RRI-ICT Forum project aims at analysing, supporting and promoting the contribution of Social Sciences and Humanities (SSH) to, and the Responsible Research and Innovation (RRI) approach in ICT research and innovation under H2020.	01-01-2015 to 12-31-2018
NanoDiode	NanoDiode establishes an innovative, coordinated programme for outreach and dialogue throughout Europe so as to support the effective governance of nanotechnologies. The project integrates vital engagement activities along the innovation value chain, at the levels of research policy, research & development (R&D), and the use of nanotechnological innovations throughout society. Importantly, NanoDiode combines 'upstream' public engagement (by way of dialogues that integrate societal needs, ideas and expectations into the policy debate) with 'midstream' engagement (by organising innovation workshops at the level of the R&D practices that are at the	07-01-2013 to 06-30-2016

Project Name	Overview and objectives	Project period and funding
	heart of the research and innovation enterprise) and 'downstream' strategies for communication, outreach, education and training.	

3. Data availability within separate dimension categorisations/typologies

In the analytical reports of task 2 (European Commission 2015a, 2015b, 2015c, 2015d, 2015e, 2015f), analytical lenses/classifications/typologies/ were identified to conceptualise and operationalise each RRI dimension to allow for a systematic and functional approach to the monitoring of RRI. Whereas the analytical reports provide information on data availability across dimension categories based on a general assessment of the respective dimension at large (cf. sections 5.1), including commissioned reports, scholarly articles etc., this report aims to specify, characterise and assess the promising indicators outlined in the reports in order to provide a systematised overview of the availability of – primarily - exiting indicators/secondary data.

This chapter provides an overview/summary of data availability within these dimension classifications based on data extracted from the set of promising indicators suggested within the individual reports of task 2. The purpose is to present a collected overview of data availability across sub-dimensions guiding the subsequent assessment of the need for primary data, whereas the individual indicators will not be discussed in detail. Nevertheless, it is important to bear in mind that such classifications are analytical constructs and represent particular analytical lenses. Further, existing empirical material might internally relate to other categories and/or externally intersect with other dimensions. Such reflections are included in the assessment below but have to be revisited, when data are reassessed by dimension experts establishing the need for primary data collection.

3.1. Data availability across public engagement categories

Within the public engagement dimension, PE mechanisms and initiatives have been classified according to 1) their aim/objective and 2) the direction of the flow of information. The five categories are outlined in table 3.1. below. Apart from tapping into the distinction between horizontal (culture-oriented activities) and vertical (policy-oriented) engagement, the typology is also indicative of possible intersections with other RRI dimensions. For instance, PE activities that 'aim to inform and/or educate citizens' (*public communication*) often share objectives and features with those related to the dimension of science literacy and scientific education. Furthermore, the categories *public activism*, *public deliberation* and *public activism* interrelate with aspects of participatory governance of research and innovation (D.2.1., p.14-15).

The promising PE indicators unequally cover the sub-categories. Due to the large number of indicators on third mission activities at the institutional level, the *public communication* category is well populated. It is important to notice that the science communication aspect of research institution's 'public relations activities' are excluded from the science communication definition in the science literacy and scientific education dimension (see definitions in section 3.2), which reduces the interrelatedness among the two dimensions. Still, PE2 (also included as SLSE6), PE7, PE12, PE13 and PE 14 bear clear relevance to the SLSE dimension. *Public activism* and

public deliberation are the least populated categories. The modest coverage of *public deliberation* may, however, reflect that this typology only to some extent captures the highly complex PE field. Several indicators, especially among the composite measures included in the public participation category, however, feature aspects of deliberation. The *public participation* category is relatively well covered. In this regard, the need for additional primary data also needs to be assessed in correlation to available indicators within the governance dimension.

Table 3.1 Public engagement categorisations

Categorisations
Public communication – *the aim is to inform and/or educate citizens*. The flow of information constitutes one-way communication from sponsors to public representatives, and no specific mechanisms exist to handle public feedback (examples include public hearings, public meetings and awareness raising activities).
Public activism – *the aim is to inform decision-makers and create awareness in order to influence decision-making processes.* The information flow is conveyed in one-way communication from citizens to sponsors but not on the initiative of the sponsors, which characterised the 'public consultation' category (examples include demonstrations and protests).
Public consultation – *the aim is to inform decision-makers about public opinions on certain topics.* These opinions are sought from the sponsors of the PE initiative and no dialogue is implemented. Thus, in this case, the one-way communication is conveyed from citizens to sponsors on the initiative of sponsors (examples include citizens' panels, planning for real, focus groups and science shops).
Public deliberation – *the aim is to facilitate group deliberation on policy issues where the outcome may impact decision-making.* Information is exchanged between sponsors and public representatives and a dialogue is facilitated. The flow of information constitutes two-way communication (examples include 'mini publics' such as consensus conferences, citizen juries, deliberative opinion polling).
Public participation – *the aim is to assign partly or full decision-making-power to citizens on policy issues.* Information is exchanged between sponsors and public representatives and a dialogue is facilitated. The flow of information constitutes two-way communication (examples include co-governance and direct democracy mechanisms such as participatory budgeting, youth councils and binding referendums).

Source: Report D. 2.1, p. 14-15, categorisation emerges from the PE2020 project (www.pe2020.eu)

Table 3.2 Data availability across public engagement categories

	Public communication	Public activism	Public consultation	Public Deliberation	Public participation
Indicators	PE2 (SLSE6), PE7, PE8, PE10 PE12, PE13, PE14, PE19, PE20, PE21, PE22, PE23, PE24, PE25, PE26, PE27, PE28, PE29, PE32	PE11,	**PE30**, PE31, PE33	**PE30**	PE1, PE3, PE4, PE5, PE6, PE9, PE15, PE16, PE17, PE18,

3.2. Data availability across science literacy and scientific education categories

The science literacy and scientific education dimension applies a tripartite categorisation to operationalise the multifaceted field of science literacy. Three aspects are identified within this general notion; *science education, science communication* and *co-production of knowledge* (see table 3.3 below). As specified in the analytical report covering this dimension, 'science literacy as it is defined in the context of the MoRRI project is generated through activities, which aim at providing citizens with a deeper understanding of science, to shape their attitudes towards science and to develop their abilities to contribute to science and science-related policy making. Including the co-production of knowledge in the dimension of SLSE alters the way we think about the public and its role in science and innovation, from a mere receiver and customer to an active agent of change' (D.2.2). The aspect of *co-production of knowledge* is clearly interlinked with mechanisms and activities carried out within the field of public engagement. Crowd-sourcing, science shops, open innovation (e.g. co-creation spaces) are examples of PE mechanisms with co-production of knowledge as distinct objectives.

Table 3.3 Science literacy and scientific education categorisations

Categorisations
Science education: Science education aims at educating (especially young) citizens about scientific facts (textbook knowledge), the norms of science and the way science is 'done' as well as at conveying a positive 'image' of sciences. However, it also provides the opportunity to reflect and question science and the 'truths' it produces critically. It takes place in institutions in early childhood education and care, the school system, higher education, vocational education and training as well as in lifelong-learning. Science education is the basis for science literacy.
Science communication: Science communication activities aim to educate citizens of all ages about science as well as at generating awareness of science-related issues and a positive image of/attitude towards science. These activities can take direct forms, for instance through open days, museums or science centres, or be more indirect with mediators between the scientists and the public, e.g. via science journalists and their

products such as TV programmes or media articles etc.[1] Generally, a large number of different institutions is involved in science communication. Science communication produces linkages between science and society by creating or enabling transmission of knowledge about science and technology. This transmission can be both one-way for instance in pure information formats as well as two-way e.g. in dialogue-oriented formats.
Co-production of knowledge: Co-production of knowledge is a relatively new aspect of science literacy. It is characterised by a co-creation of knowledge through cooperation of scientific experts and non-experts. One well-known example for the co-production of knowledge is Citizen Science. It has been defined as "research collaborations between scientists and volunteers, particularly (…) to expand opportunities for scientific data collection and to provide access to scientific information for community members" (The Cornell Lab of Ornithology, 2015). In addition there are other ways of co-production, for instance discussed under terms such as open-innovation, crowd science, or user-driven innovation.

Source: Report D.2.2, p.15

The available indicators within the SLSE dimension vary greatly in coverage. At large, the aspect of *science education* is best represented. Secondary data available within this category covers large-scale trans-national data sets such as PIAAC, OECD data, TIMSS and PISA. The category of *science communication* is primarily covered by Eurobarometer data as well as MASIS data. When taking into account that this category can be populated with secondary data available in the set of PE indicators (see above), one could argue that the aspect of science communication is fairly well covered. None of the promising indicators directly cover the aspect of co-production of knowledge, and primary data is needed for this sub-field in particular.

Table 3.4 Data availability across science literacy and scientific education categories

	Science education	Science communication	Co-production of knowledge
Indicators	SLSE2, SLSE 3, SLSE4, SLSE 5,	SLSE 1, SLSE 6, SLSE 7	

3.3 Data availability across gender equality categories

The dimension of gender equality is defined according to a 'three dimensional construct' relating to 1) the (under) representation of women in research and innovation with the objective to reduce gender segregation, 2) the structural and organisational changes in research institutions with the aim to break down structural gender barriers by means of action plans, gender budgeting, among others actions, and 3) the inclusion of gender in R&I content (D. 2.3, p. 2, 17-18, and see table 3.5).

1 One activity that is often mentioned in the context of science communication is public relations activities of research institutions. For this project, however, we explicitly exclude this type of activities for our definition of science communication.

As the analytical report within this dimension specifies, gender equality has been perceived as closely connected with the ethics and governance dimension, moderately interlinked with science education and non-reciprocally connected to public engagement, whereas no connection exists to the open access dimension (D.2.3., p.20). Across dimensions and the comprised indicators, gender often appears as an available variable in large-scale data sets which can be taken into consideration, whereas explicit gender issues are rarely included in the content (e.g. gender differences in stem research as an indicator). Potential interlinkages among dimensions will be explored further in chapter five, and more systematically in the design of the primary data collection in the following report D.3.2.

Table 3.5 Gender equality categorisations

Categorisations
Horizontal and vertical participation of women in research: The first pillar comprises measures to promote women in fields where they are under-represented as well as to increase female participation in management and decision-making positions. The goal here is to reduce gender segregation.
Structural change in institutions: The second pillar comprises structural measures aimed at revising existing organisational arrangements in order to progressively eliminate barriers for women on their path to top positions or factors which induce women to drop out of science.
Gender in research content: The third pillar of gender equality – the integration of a gender dimension in research and innovation content – is legitimised by the gender mainstreaming strategy on the one hand and by quality standards in science and research on the other (Caprile et al. 2012). Gender studies and gender and sex analysis are now either well-established or at least partly in place in almost all fields of research. Indeed, it is argued that research results are not valid or reliable if they only consider male research subjects.

Source: Report D.2.3, p.17-18, 44 – see this report for complete definitions

Promising RRI indicators have been assigned to all of the three sub-categories within the GE-dimension. However, as a result of the available large-scale cross-national data-sets including variables on female representation in science, the issue of horizontal and vertical participation is more widely covered than the other categories. The *structural change in institutions* category comprises seven indicators derived from ERA data, projects under the EU FP7 programme and information on the 48 CESAER member institutions. Three indicators have been assigned to the sub-dimension of *gender in research content*. However, as mentioned in the initial analytical report on GE, the available data from ERA and projects under the EU FP7 programme cannot be viewed as satisfying in covering this emerging theme.

Table 3.6 Data availability across gender equality categories

	Horizontal and vertical participation of women in research	Structural change in institutions	Gender in research content
Indicators	GE1, GE2, GE3, GE4, GE5, GE6, GE7, GE8, G17,	GE9, G10, G11, G12, G15, G18,	G13, G14, G16,

3.4 Data availability across ethics categories

Within the dimension of research and innovation ethics, three conceptual aspects have been identified that relates to 1) *ethical governance*, with the main instruments being ethical commissions, ethical codes and soft law 2) *ethical deliberation*, where a central instrument constitutes Technology Assessment (TA) (or ethical constructive Technology Assessment (eCTA)) and 3) *ethical reflection* that stresses the public engagement aspect in deliberations on S&T ethics (D. 2.4.2 and see table 3.7).

Table 3.7 Ethics categorisations

Categorisations
Ethical governance: I.e. "institutionalising ethics debate in terms of the implementation of standards in research ethics in science, technology and innovation policies" (Brom et al. 2015: 15)
Ethical deliberation: I.e. "institutionalising ethics debate that raise issues in science and technological developments in science, technology and innovation policies" (ibid.)
Ethical reflection: I.e. "institutionalising ethics debate that support critical reflection and engagement in debates on research standards, emerging technology issues and social justice in science, technology and innovation policies" (ibid.).

Source: D. 2.4.2, p. 6

When applying the tripartite definition of ethics in science, technology and innovation as specified in table 3.7, the available ethics indicators predominantly cover the category of *ethical governance*. A large share of the indicators categorised as *ethical reflection* (marked in blue in table 3.8) among others concern public perceptions of ethics in relation to GM foods, nanotechnology, animal cloning, and involve the representation of public attitudes towards science and technology. The focal point for the tripartite definition however primarily concerns the 'institutionalisation' of debate. Thus, the 'public perceptions' or 'public ethics' indicators do not fall directly within any of the ethics categories. One could however argue for a broader conceptualisation of *ethical reflection* that would allow for an inclusion of data relating to the aspects of citizens' perceptions of research and innovation.

Table 3.8 Data availability across Ethics categories

	Ethical governance	Ethical deliberation	Ethical reflection
Indicators	E1, E2, E12, E13, E14, E15, E18, E19, E20, E21, E22, E23,	E24, E26	E3, E4, E5, E6, E7, E8, E9, E10, E11,E16, E17, E25, E27,

3.5 Data availability across open access categories

The open access dimension can broadly be categorised according two sub-dimensions, *Open Access (OA)* and *Open Data (OD),* (see table 4.9).

Table 3.9 Open access categorisations

Categorisations
Open Access (OA): Open access is the idea of making research results freely available to anyone that wants to access and re-use them. One of the main drivers of the OA idea is to make publicly funded research accessible to the general public. In the academic sense, the term Open Access referred originally to the provision of free access to peer-reviewed academic publications.
Open Data (OD): Presently, the term [open access] also encompasses the free access to the research data that underpins publications or research projects, also referred on its own as Open Data (OD). Open Data is usually distributed with requirements of attribution and share-alike (copies or adaptations of the data need to be shared using the same principles as the source).

Source: Report D. 2.4, p. 18

Open Data is a relatively new and growing field of interest for researchers, and systematized data sources are still fairly scarce compared to data availability on *Open Access*. Research on open data and data sharing have mainly been conducted as case studies, but growing efforts are made to systematise such sources with the objective of developing data metrics (D.2.4, p.35-36). This disproportion in data availability is also represented in the set of promising open access indicators. Whereas the category of *Open Access* is fairly well populated, *Open Data* remains less extensively covered.

Table 3.10 Data availability across open access categories

	Open Access (OA):	Open Data (OD):
Indicators	OA1, OA2, OA3, OA4, OA5, OA6, OA8, OA9, OA10	OA7, OA11, OA12,

4. Classification and assessment of indicators

This section outlines the results of the classification and assessment of the altogether 98 promising indicators identified in the six initial analytical reports. The classification and assessment have been conducted on the basis of two separate analytical steps.

As a first step, the 98 indicators have been assessed and classified with respect to their *relevance*/*proximity* and *robustness*/*quality* as individual measures of RRI at specified dimensions and levels of analysis (see Tables 4.1 to 4.5).

As a second step, an aggregate assessment and classification have been conducted of the overall *relevance*/*proximity*, *robustness*/*quality*, and *richness of data* of the available indicators with respect to **[1]** coverage of the four dimensions of the intervention logic model (i.e. context, input, output, and outcome), and **[2]** coverage of the six analytical levels (i.e. global, national, regional, institutional, programme/project, and individual) (see Tables 4.8 and 4.9).

The following pages briefly account for the main results of each of these analytical steps.

4.1 Step one: Assessing and classifying each of the 98 indicators

As mentioned, Tables 4.1 to 4.5 account for the initial assessment and classification of the 98 promising indicators with respect to *relevance*/*proximity* and *robustness*. The individual assessment of each indicator is presented in the right side of the tables. For a detailed presentation of each of the promising indicators see Appendix 7.2.

Table 4.1: Summary table capturing promising indicators for public engagement

INDICATOR	ANALYTICAL MODEL (Logic model) CONTEXT (1) INPUT (2) OUTPUT (3) OUTCOME (4)	ANALYTICAL LEVEL (aggregation) GLOBAL (1) NATIONAL (2) REGIONAL (3) INSTITUTIONAL (4) PROGRAMME/ PROJECT (5) INDIVIDUAL (6)	UNIT OF ANALYSIS COUNTRIES (1) INSTITUTIONS (2) INDIVIDUALS (3) PUBLICATIONS (4) OTHER (PLEASE SPECIFY) (5)	NUMBER OF OBSER-VATIONS	TIME SERIES Y (1) N (2)	YEAR OF DATA, MOST RECENT	ASSESSMENT OF INDICATOR
PE 1: Models of public involvement in S&T decision making	2	2	1	37	2	2011	+
PE 2: Science communication culture	1	2	1	37	2	2011	+
PE 3: Horizontal + vertical participation in science	3	2	1	32	1	2010	++
PE 4: Horizontal only participation in science	3	2	1	32	1	2010	++
PE 5: Non-participation in science	3	2	1	32	1	2010	++
PE 6: Preferences for participation in decision making concerning S&T	1	6	3	30000	1	2013	++
PE 7: Visiting science museums	3	6	3	30000	1	2005	++
PE 8: Attending public meetings or debates about science	3	6	3	30000	1	2010	++
PE 9: Petitions and street demonstrations	3	6	3	30000	1	2010	++
PE 10: Donating money to science	3	6	3	30000	2	2010	++
PE 11: Participation in NGOs related to scientific issues	3	6	3	30000	2	2010	++
PE 12: Talking about science	3	6	3	30000	2	2005	++
PE 13: Reading	3	6	3	30000	2	2005	++

about science							
PE 14: Heard, talked and searched for information about GM food (+ other tech.)	3	6	3	30000	2	2010	++
PE 15: PE performance at national level	2	2	1	37	2	2011	+
PE 16: Activity in 'SIS' environment and debate	2	2	1	26	2	2011	+
PE 17: Citizen involvement in science	2	2	1	26	2	2011	+
PE 18: Stimulating society's interest in science policy	2	2	1	26	2	2011	+
PE 19: Dedicated resources for PE at institutional level	2	4	2	40	2	2008	
PE 20: Information about research activities made publicly available	2	4	2	40	2	2008	+
PE 21: Availability of a press and/or PR office	2	4	2	40	2	2008	+
PE 22: Availability of publications addressed to the public	2	4	2	40	2	2008	+
PE 23: Participation in EU projects/networks about PE	2	4	2	40	2	2008	+
PE 24: Specific activities with schools at research institutions	2	4	2	40	2	2008	+
PE 25: Visits to laboratories aimed at the general public	2	4	2	40	2	2008	+
PE 26: Open days aimed at the general public	2	4	2	40	2	2008	+
PE 27: Collaboration with NGO's and local government bodies	2	4	2	40	2	2008	+
PE 28: Organisation of meetings/conferences addressed to the	2	4	2	40	2	2008	+

public							
PE 29: Action plan for PE	2	4	2	?	2	2010	
PE 30: Community representatives in boards and committees	2	4	2	?	2	2010	
PE 31: Research projects in partnership with non-academic organisations	2	4	2	?	2	2002	
PE 32: Academics' participation in non-academic conferences	2	4	2	?	2	2002	
PE 33: Mobilizing public support	2	2	1	30	1	2009	+

Table 4.2: Summary table capturing promising indicators for science literacy and scientific education

INDICATOR	ANALYTICAL MODEL (Logic model) CONTEXT (1) INPUT (2) OUTPUT (3) OUTCOME (4)	ANALYTICAL LEVEL (aggregation) GLOBAL (1) NATIONAL (2) REGIONAL (3) INSTITUTIONAL (4) PROGRAMME/ PROJECT (5) INDIVIDUAL (6)	UNIT OF ANALYSIS COUNTRIES (1) INSTITUTIONS (2) INDIVIDUALS (3) PUBLICATIONS (4) OTHER (PLEASE SPECIFY) (5)	NUMBER OF OBSER-VATIONS	TIME SERIES Y (1) N (2)	YEAR OF DATA, MOST RECENT	ASSESSMENT OF INDICATOR
SLSE 1: Interest, informedness and textbook knowledge about science and technology (three indicators)	3	6 2	6	Around 125 country observations (5 obs., 32 countries) Around 150.000 individual responses (5 obs. 30.000 people)	1	2013	++

SLSE 2: Competence of general population with regard to numeracy	4	2	1	19 (19 countries 1 obs – 2013)	1	2013	++
SLSE 3: Share of STEM graduates	3	2	1	Around 400 (30 countries, 15 years, some missing values)	1	2012	++
SLSE 4: Science competence in subject matters and cognitive domains of primary school pupils	4	2	1	Around 150 (25 countries, 6 obs)	1	2011	++
SLSE 5: Science competence in subject matters of secondary school pupils	4	2	1	Around 175 (35 countries, 5 obs)	1	2012	++
SLSE 6: Science Communication Culture	1	2	1	37 (37 countries, 1 obs)	2	2011	+
SLSE 7: Importance of science communication as an evaluation criterion	1	2	1	36 (36 countries, 1 obs)	2	2011	x

Table 4.3: Summary table capturing promising indicators for gender

INDICATOR	ANALYTICAL MODEL (Logic model) CONTEXT (1) INPUT (2) OUTPUT (3) OUTCOME (4)	ANALYTICAL LEVEL (aggregation) GLOBAL (1) NATIONAL (2) REGIONAL (3) INSTITUTIONAL (4) PROGRAMME/ PROJECT (5) INDIVIDUAL (6)	UNIT OF ANALYSIS COUNTRIES (1) INSTITUTIONS (2) INDIVIDUALS (3) PUBLICATIONS (4) OTHER (PLEASE SPECIFY) (5)	NUMBER OF OBSER-VATIONS	TIME SERIES Y (1) N (2)	YEAR OF DATA, MOST RECENT	ASSESSMENT OF INDICATOR
GE 1: Women's participation in paid work	1	2	1	33 EEA countries	Yes	2013	++
GE 2: Share of female researchers by	4	2	1	33 EEA countries	Yes	2011	++

sector							
GE 3: Years to achieve gender equality in research participation	4	2	1	33 EEA countries	Yes	2011	++
GE 4: Dissimilarity Index	4	2	1	28 EEA countries	Yes	2011	++
GE 5: Glass Ceiling Index	4	2	1	29 EEA countries	Yes	2011	++
GE6: Female graduates and academic staff by grade	4	2	1	31 EEA countries	Yes	2011	++
GE 7: Gender Wage Gap	4	2	1		Yes	2010	++
GE 8: Share of female heads of RPOs	4	2	1	1,265 RPOs in 28 EU countries	Not yet	2013	+
GE 9: Share of gender-balanced recruitment committees of RPOs	2	2	1	1,265 RPOs in 28 EU countries	Not yet	2013	+
GE 10: Share of gender-balanced research evaluation panels in RFOs	2	2	1	RFOs covering about 20% of total GBAORD in 28 EU countries	Not yet	2013	+
GE 11: Share of RPOs with gender equality plans	2	2	1	1,265 RPOs in 28 EU countries	Not yet	2013	+
GE 12: Share of RPOs with female recruitment and promotion policies	22	2	1	1,265 RPOs in 28 EEA countries	Not yet	2013	+
GE 13: Share of RFOs promoting gender content in research	Input	National	Countries	RFOs covering about 20% of total GBAORD in 28 EU countries	Not yet	2013	+
GE 14: Share of RPOs promoting gender content in research	Input	National	Countries	1,265 RPOs in 28 EU countries	Not yet	2013	+
GE 15: Share of research projects with specific gender equality actions	Input	Projects	Research Projects	737 projects	No	2007-2012	+
GE 16: Share of research projects with gender dimension in content	Output	Project	Research projects	737 projects	No	2007-2012	+
GE 17: Gender of individual participants with	Output	Projects	Research Projects	737 projects	No	2007-2012	+

contact person roles in signed grant agreements							
GE 18: Share of organisations with organisational structures for gender equality	Input	Institutional	Institutions	48 universities	Not yet	2013/ 2014	++

Table 4.4. Summary table capturing promising indicators for open access

INDICATOR	ANALYTICAL MODEL (Logic model) CONTEXT (1) INPUT (2) OUTPUT (3) OUTCOME (4)	ANALYTICAL LEVEL (aggregation) GLOBAL (1) NATIONAL (2) REGIONAL (3) INSTITUTIONAL (4) PROGRAMME/ PROJECT (5) INDIVIDUAL (6)	UNIT OF ANALYSIS COUNTRIES (1) INSTITUTIONS (2) INDIVIDUALS (3) PUBLICATIONS (4) OTHER (PLEASE SPECIFY) (5)	NUMBER OF OBSER-VATIONS	TIME SERIES Y (1) N (2)	YEAR OF DATA, MOST RECENT	ASSESSMENT OF INDICATOR
OA 1: Public perception of online free availability of the results of the publicly funded research	1	EU	1	3	2	2013	++
OA 2: Freely available peer-reviewed papers	3	1	1	4	1	2013	++
OA 3: Institutional perception of OA strategies	2/3	1	1	3	2	2013	
OA 4: Stakeholders' perception of access to digital resources	1	EU	1	4	2	2012	+
OA 5: FP7 project coordinators' perception of self-archiving	3	EU	3	2	2	2012	
OA 6: FP7 project coordinators' perception of open access publishing	3	EU	3	4	2	2012	
OA 7: Open Data Barometer	1	1	1	4	2	2013	
OA 8: Existing funder mandates	2	EU	1	1	2	2011	

for open access publishing							
OA 9: Number of open access journals in 2011	3	EU	1	1	2	2011	
OA 10: Number of open access repositories	3	EU	1	1	2	2011	
OA 11: Metric model of data publishing	3	1	1,2,3,4	1	possible	2013	++
OA 12: Metric model of data usage	4	1	1,2,3,4	1	possible	2013	++

Table 4.5. Summary table capturing promising indicators for ethics

INDICATOR	ANALYTICAL MODEL (Logic model) CONTEXT (1) INPUT (2) OUTPUT (3) OUTCOME (4)	ANALYTICAL LEVEL (aggregation) GLOBAL (1) NATIONAL (2) REGIONAL (3) INSTITUTIONAL (4) PROGRAMME/ PROJECT (5) INDIVIDUAL (6)	UNIT OF ANALYSIS COUNTRIES (1) INSTITUTIONS (2) INDIVIDUALS (3) PUBLICATIONS (4) OTHER (PLEASE SPECIFY) (5)	NUMBER OF OBSER-VATIONS	TIME SERIES Y (1) N (2)	YEAR OF DATA, MOST RECENT	ASSESSMENT OF INDICATOR
Ethics 1: A typology of public ethics	3	2	1	33	2	2010	++
Ethics 2: Ethics over science	1	6	3	32.000	2	2010	++
Ethics 3: Gm foods helps people in developing countries	1	6	3	32.000	2	2010	++
Ethics 4: GM food benefits some people but puts others at risk	1	6	3	32.000	2	2010	++
Ethics 5: GM food is fundamentally unnatural	1	6	3	32.000	2	2010	+
Ethics 6: Nanotechnology helps people in developing countries	1	6	3	32.000	2	2010	++
Ethics 7: Nanotechnology benefits some people but put others at risk	1	6	3	32.000	2	2010	++
Ethics 8: Nanotechnology is fundamentally unnatural	1	6	3	32.000	2	2010	+
Ethics 9: Animal cloning in food production helps people in developing countries	1	6	3	32.000	2	2010	++
Ethics 10: Animal cloning in food production benefits some people but puts others at risk	1	6	3	32.000	2	2010	++

Ethics 11: Animal cloning in food production is fundamentally unnatural	**1**	**6**	**3**	**32.000**	**2**	**2010**	+
Ethics 12: Research involving human embryos should be forbidden	1	6	3	32.000	2	2010	++
Ethics 13: It is ethically wrong to use human embryos in research	1	6	3	32.000	2	2010	++
Ethics 14: Research involving human embryos should be allowed	1	6	3	32.000	2	2010	++
Ethics 15: Mixing animal and human genes is unacceptable even if it helps medical research for human health	1	6	3	32.000	2	2010	++
Ethics 16: Regenerative medicine and inequality	1	6	3	32.000	2	2010	++
Ethics 17: Regenerative medicine and distributional equality	1	6	3	32.000	2	2010	++
Ethics 18: Regenerative medicine and risks to future generations	1	6	3	32.000	2	2010	++
Ethics 19: Scientific or moral decision making regarding synthetic biology	1	6	3	32.000	2	2010	++
Ethics 20: Delegation or democracy in decision making about synthetic biology	1	6	3	32.000	2	2010	++
Ethics 21: Scientific or moral decision	1	6	3	32.000	2	2010	++

making regarding animal cloning							
Ethics 22: Delegation or democracy in decision making about animal cloning	1	6	3	32.000	2	2010	++
Ethics 23: Infrastructure of ethical governance	2	4	2	32	2	2015	
Ethics 24: Infrastructure for ethical deliberation	2	4	2	32	2	2015	
Ethics 25: Infrastructure for ethical reflection	2	4	2	32	2	2015	
Ethics 26: Public engagement in ethical infrastructure	2	2	1	32	2	2011	
Ethics 27: Publication	3	2	1	32	2	2011	x+
Ethics 28: Output	3	2	1	23	1	2015	

4.2. Step two: Assessing and classifying the 98 indicators at aggregate levels

Tables 4.8 and 4.9 account for the second step of the analysis. More specifically, the tables represent the aggregate assessment and classification of the overall *relevance*/proximity, *robustness*/*quality*, and *richness of data* of the available indicators with respect to **[1]** coverage of the four dimensions of the intervention logic model (Table 4.8), and **[2]** coverage of the six analytical levels (Table 4.9). Each indicator has been assigned to a specific dimension and analytical level in the tables, thus providing a visual overview of the available indicators at each level of aggregation. Moreover the indicators are represented in colours to account for their *relevance/proximity* as measures of RRI. In the bottom of each row/column the aggregate assessment of *richness of data* and *robustness* is indicated on the basis of the three point parameters reintroduced below (see Table 4.7).

For visual purposes the relevance/proximity parameter is also displayed in Venn diagrams (Appendix, Figure 7.1-7.11). The Venn diagrams provide the reader with an opportunity to orient her/himself about the availability of relevant RRI indicators

within each of the four dimensions of the intervention logic model as well as the six levels of analysis. Moreover, they visualise their relative proximity to the core concept of RRI.

Table 4.7 Parameters of assessment

Parameter of assessment	***Relevance/Proximity* of indicator(s) as measure(s) RRI related aspects**	***Robustness* of indicator(s) in measuring RRI**	***Richness of data* in capturing aspects of RRI**
Three-point assessment scale:	• Red (Weak) • Blue (Medium) • Green (Strong)	• "no sign" (Weak) • + (Medium) • ++ (Strong)	• 0 (Weak) • 1 (Medium • 2 (Strong)

4.3 Availability of indicators and data across the dimensions of the intervention logic model

Context (for Venn-diagram see Figure 7.1, Appendix)

As illustrated in the first row of Table 4.8, context related indicators exist for all of the RRI dimensions. Since the available **PE** indicators assigned to the context dimension only cover part of the five PE sub-dimensions (i.e. public communication and public participation), the aggregate richness of data is considered weak. Two **SLSE** indicators are available at the context level. These indicators have been assigned a data richness value of 0, due to their lack of capacity to tap into the SLSE sub-dimensions. Merely one **GE** indicator has been identified as promising at the context level, and this indicator has likewise been assigned an assessment value of 0 in terms of data richness as a result of its lacking coverage of the GE sub-dimensions of *structural change* and *gender in research content*. The **OA** and **ETH** dimensions comprise the most robust and data rich context-related indicators. While most of the ETH indicators derived from the Eurobarometer on this dimension merely cover partial aspects of the three sub-dimensions, their aggregate coverage is quite broad.

Input (for Venn-diagram see Figure 7.2, Appendix)

The **PE dimension** can be viewed as the most saturated category in terms of data richness at the input level. The dimension comprises three highly relevant composite indicators and a number of indicators covering partial elements of the PE sub-dimensions at institutional level. No promising **SLSE** indicators have been categorised at the input level. The data richness of the **GE** indicators is also quite good at this level of analysis. However, with the exception of the *ERA report*, the available input-related indicators only partially cover the sub-dimensions and scope of the GE dimension. Only two **OA** indicators have been assigned to the input-level. The data richness of these indicators is limited and the robustness of the collected data is unclear. The **ETH** dimension comprises 4 (apparently) highly relevant indicators at the input-level. However, it is difficult to assess the robustness and richness of the available data.

Output (for Venn-diagram see Figure 7.3, Appendix)

While altogether 11 indicators have been assigned to address output-related aspects of the **PE-**dimension, most of the available data are derived from the Eurobarometer, which only covers a limited spectrum of the PE dimension (i.e. the sub-dimensions related to horizontal and vertical involvement). Two **SLSE** indicators provide data on the output dimension, and both of these are considered highly relevant. The data coverage is also relatively strong due to SE1's composite three-part measure of *interest*, *informedness* and *textbook knowledge about science and technology*. While clearly relevant, the two **GE** indicators assigned to the output-dimension merely concern research projects under the EU-FP7 programme, and the overall coverage in this sense can be viewed as weak. Moreover, with reference to the discussion of content validity presented in Section 1.1, one may question whether GE16 is a valid *output* indicator of *gender in research content*, since EUFP7 projects are subject to specific evaluation criteria concerning gender content. Seven highly relevant **OA** indicators have been assigned to the output dimension, and in spite of OA2's lacking coverage of humanities and social science related fields, the overall data richness is considered to be quite good. The **ETH** dimension comprises three indicators at the output level. The composite Eurobarometer indicator ETH1 is considered quite strong in terms of both relevance and coverage. However, several of the ETH sub-dimensions are not addressed in the Eurobarometer survey. Moreover, the additional indicators are difficult to assess in terms of scope and data richness.

Outcome (for Venn-diagram see Figure 7.4, Appendix)

No **PE** and **ETH** indicators are available at the outcome level, and the **OA**-dimension merely holds one indicator at this level of aggregation. While the available OA-indicator is quite robust and highly relevant, it is difficult to assess its coverage in terms of data richness. The three outcome-related **SLSE** data sets covering developments in science competence of school pupils and of general populations together comprise a quite robust and data rich set of indicators. However, the science communication aspect is lacking in the SLSE coverage of this dimension. Finally, seven **GE** indicators are available at the outcome-level. While the data richness of the GE sub-dimension of *Horizontal and Vertical Segregation* is quite strong, no indicators on the outcome of *gender in research content* are available.

Table 4.8. Data across the intervention logic model

Dimensions/ Components	PE	SLSE	GE	OA	Governance	Ethics
Context	PE2, PE6,	SLSE 6, SLSE 7	GE1,	OA1, OA4, OA7,		E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13, E14, E15, E16, E17, E18, E19, E20, E21, E22
Richness and robustness of data?	**1+**	**0+**	**0++**	**2++**		**2++**
Input	PE1, PE15, PE16, PE17, PE18, PE19, PE20, PE21, PE22, PE23, PE24, PE25, PE26, PE27, PE28, PE29, PE30, PE31, PE32, PE33		GE9, GE10, GE11, GE12, GE13, GE14, GE15, GE18	(OA3), OA8		E23, E24, E25, E26
Richness and robustness of data?	**3+**		**2+**	**1+**		**1?**
Output	PE3, PE4, PE5, PE7, PE8, PE9, PE10, PE11, PE12, PE13, PE14,	SLSE1, SLSE3,	GE16, GE17	OA2, (OA3), OA5, OA6, OA9, OA10, OA11,		E1, E27, E28
Richness and robustness of data?	**1++**	**2++**	**1+**	**2+**		**1+**
Outcome		SLSE 2, SLSE 4, SLSE 5	GE 2, GE3, GE4, GE5, GE6, GE7, GE8	OA12		

Dimensions/ Components	PE	SLSE	GE	OA	Governance	Ethics
Richness and robustness of data?		**2++**	**2+**	**1++**		

4.4 Availability of data across the different levels of analysis

Global (for Venn-diagram see Figure 7.5, Appendix)

As appears from the first row of Table 4.9, the **OA**-dimension holds the only available indicators at the global level. In terms of aggregate assessment, these indicators, which among others comprise data derived from Scopus and Eurobarometer, are considered highly relevant, quite robust and high on data richness.

National (for Venn-diagram see Figure 7.6, Appendix)

As displayed in the second row of table 5.6., the national level represents the most comprehensive set of indicators available at the six aggregation levels. While highly relevant, the data richness and robustness of the ten **PE** indicators included in this category are moderate. Similarly, the seven **SLSE** indicators assigned to the national level represents a moderate coverage in terms of data richness, whereas the robustness of the available data seems quite good. As regards **GE**, the national level also holds the most robust and data rich composite of indicators (altogether 14 indicators). The seven available **OA** indicators at the national level have been assessed as moderate in terms of both data richness and robustness, whereas the available information on two of the three **ETH** indicators makes it difficult to evaluate the aggregate richness and robustness of the available indicators at this level of analysis.

Regional (for Venn-diagram see Figure 7.7, Appendix)

No indicators have been assigned to the regional level of analysis.

Institutional (for Venn-diagram see Figure 7.8, Appendix)

14 **PE** indicators have been assigned to the institutional level. The robustness and data richness of the available **PE** data at this level of analysis are considered moderate. No **SLSE** and **OA** indicators exist at the institutional level and the available **GE** indicator only covers the GE sub-dimension of *Structural change* for 48 European technology and engineering schools/faculties. The available information on the three **ETH** indicators makes it difficult to evaluate the aggregate richness and robustness of the available data at this level of analysis.

Project/Programme (for Venn-diagram see Figure 7.9, Appendix)

The **GE-**dimension represents the only available composite of indicators at the project/programme level, and since the available data is demarcated to project-related activities of the EU FP7 Programme, the overall coverage in terms of data richness is considered weak.

Individual (for Venn-diagram see Figure 7.10, Appendix)

Finally, quite robust and data rich Eurobarometer-based data are available at the individual level for the RRI dimensions of **PE** and **ETH**. Additionally, Eurobarometer data covers limited aspects of **SLSE** dimension in terms of data richness, at this level of analysis.

Table 4.9: Data across the aggregation levels

Dimensions/ Components	PE	SLSE	GE	OA	Governance	Ethics
Global Richness and robustness of data?				OA2, OA3, OA7, OA11, OA12 **2++**		
National Richness and robustness of data?	PE1, PE2, PE3, PE4, PE5, PE15, PE16, PE17, PE18, PE33, **2+**	(SLSE1), SLSE 2, SLSE3, SLSE4, SLSE5, SLSE6, SLSE7, **2++**	GE1, GE2, GE3, GE4, GE5, GE6, GE7, GE8, GE9, GE10, GE11, GE12, GE13, GE14, **3++**	OA1, OA4, OA5, OA6, OA8, OA9, OA10 **2+**		ETHICS 1, E27, E28 **?**
Regional Richness and robustness of data?						
Institutional	PE19, PE20, PE21, PE22, PE23, PE24,		GE18			ETHICS 23, E24, E25,

Dimensions/ Components	PE	SLSE	GE	OA	Governance	Ethics
Richness and robustness of data?	PE25, PE 26, PE27, PE 28, PE29, PE30, PE31, PE 32 **2+**		**0+**			**?**
Project/Programme Richness and robustness of data?			GE15, GE16, GE17, **1++**			
Individual Richness and robustness of data	PE6, PE7, PE8, PE9, PE10, PE11, PE12, PE13, PE14 **2++**	(SLSE1) **1++**				ETHICS 2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13, E14, E15, E16, E17, E18, E19, E20, E21, E22 **2++**

5. Data selection for RRI monitoring – data gaps and required data collection across RRI dimensions

Based on the preceding assessment of individual and collective indicators, this chapter summarises and discusses data availability according to the two main analytical classifications/characteristics specified within the framework of the MoRRI project:

- *The intervention logic model*, i.e. data describing the context, input, output, and outcome of RRI dimensions
- *Data at different levels of aggregation*, i.e. distinguishing data that describe the global level, the national level, the regional level, the institutional level, the programme/project level and the individual level.

Furthermore, within the context of MoRRI and the field of RRI at large, internal and external interlinkages among and between dimensions and sub-dimensions call for specific considerations in order to capture the full potential of data coverage with regard to existing secondary data and the subsequent collection of primary data.

The following paragraphs assess the extent to which the above-mentioned categories are sufficiently covered at a more general level and discuss the implications of available data for future data collection and the mapping of new indicators in terms of data gaps, data quality and dimension interlinkages.

5.1 Indicator/data availability across the intervention logic model

As displayed in table 4.8 (see also Figure 7.1 to 7.4 in Appendix), the *input* and *output* dimensions of the intervention logic model comprise the most comprehensive and saturated indicators of RRI. Particularly the PE and GE dimensions contain highly relevant, robust and data rich **input level** indicators, whereas the available OA and ETH indicators, while relevant, are more difficult to assess in terms of robustness and data richness. Moreover a data gap exists for the SLSE dimension at the input level.

Particularly the OA dimension comprises a saturated set of RRI indicators at the **output level**. Relevant, but less robust and data rich indicators also exist for the other dimensions. The overall robustness of the SLSE, GE and OA dimensions, could however be further enhanced by reassigning the available *outcome level* indicators to the *output* level. As stated in the MoRRI proposal document, the *output* dimension refers to the immediate or direct results of the activities taken at the input level, whereas the *outcome* dimension is epitomised by the more long-term societal benefits and achievements (MoRRI Proposal 2014). Against this backdrop it seems reasonable to contend that it would be more analytically meaningful (and fruitful) to categorise the available outcome indicators (i.e. [a] SLSE indicators concerning science competence, [b] GE indicators concerning female participation in science, and [c] an OA indicator concerning the usage and availability of open data) as immediate or direct results of RRI interventions rather than as long term societal benefits. Such a

reassignment would also be in line with the logical progression of the MoRRI project, limiting the focusing at this stage to the monitoring of indicators and metrics that involve the question of what is being done in a systematic fashion (input) and the direct result of such actions (output) while leaving out the question of RRI benefits until later stages in the project that specifically address this issue.

Consequently, based on the available data, it could be worthwhile considering whether the forthcoming project activities related to the collection of primary data and identification of additional secondary data, should delimit their scope to the input and output dimension of the intervention logic model.

5.2 Indicator/data availability at different levels of aggregation

MoRRI distinguishes between the following levels of data aggregation: the global level, the national level and the sub-national level (including regional, institutional and individual level data). These analytical categories do, however, not sufficiently capture the actual coverage of each indicator. For instance, data pertaining to the national level may only cover a sub-set of European countries (report D.2.1, p.41). Further, as outlined in table 4.9 and visualised in the Venn figures 7.5-7-10 (see appendix), the data availability is unequally distributed across the analytical levels. The global level, for instance, merely encompasses open access data, which nevertheless are highly relevant, rich and robust.

The national level encompasses the most comprehensive set of indicators, including data entries from all RRI dimensions. In general, the available data are considered highly relevant and medium-to-strong in robustness and richness. At this level, data gaps primarily exist for the ethics dimension.

For the sub-national level, no data entries pertain to the regional category. The institutional level is mainly populated by public engagement indicators, of which approximately half are considered only moderately relevant. The project/programme level is populated by relevant GE indicators. The data richness of these indicators is, however, not strong. The individual level is fairly well covered by the PE and Ethic dimensions, but some indicators pertaining to these dimensions are only of moderate relevance to the objective of RRI monitoring.

In sum, the most saturated set of indicators across the six RRI dimensions is available at the **national level**. Moreover, existing data pertaining to the individual level will be harvested from the Eurobarometer surveys, which can also be aggregated at the national level. Further, it is presumed that open access data at the global level could be reported at the national level as well. Thus, it seems relevant to consider limiting the scope of the following data collection process to this particular level of aggregation.

When considering the implications of such a limitation, issues of data coverage with regard to number of countries (see above) and the availability of time-series data must be taken into account. Further, RRI related policies and funding activities, still differ by region in some European countries which highlights the importance of maintaining some degree of attention to the sub-national level.

5.3 Interlinkages among RRI (sub)dimensions

The brief survey presented in section 3, highlighting both internal and external interlinkages among and between (sub)dimensions, raises several questions calling for further systematic consideration and analysis:

- Are the analytical sub-dimensions within each RRI dimension sufficiently covered?
- When considering internal overlaps between sub-dimensions, and the relevance of each sub-dimension, do all sub-dimensions need to be equally well covered?
- Do sub-dimensions need to be equally represented at all levels in the intervention logic model and across the aggregated levels of analysis?
- To what extent do RRI dimensions and the respective sub-dimensions externally intersect and how do such intersections influence data coverage?

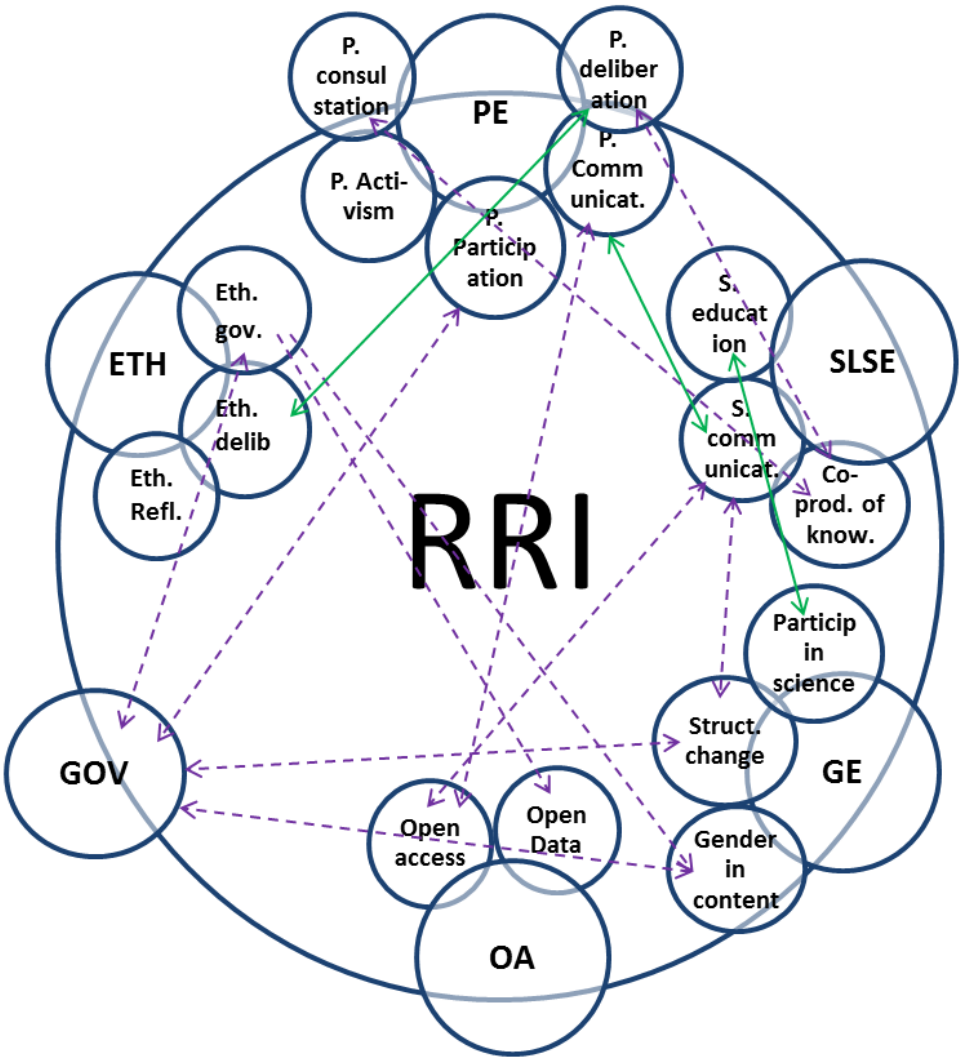
These issues will be further explored and discussed in the subsequent report (D.3.2.), which specifies the primary data to be collected in task 4.

To guide this discussion and prepare the ground for a deeper understanding of how the RRI dimensions are connected, existing and potential interlinkages between dimensions and sub-dimensions are proposed in figure 5.1. The green arrows in the figure reflect proposed interlinkages addressed in the six initial analytical reports. The purple arrows display potential interlinkages (proposed by the main authors of this report) that could be further explored. The direction of arrows indicates whether the interrelations are presumed to be reciprocal or non-reciprocal. Please bear in mind that this diagram does not visualize *de facto* interlinkages. In fact, its main purpose is to raise questions and stimulate reflection among the project partners. A more systematic account of the associations between dimensions and sub-dimensions will be provided in Deliverable 3.2.

As mentioned earlier, no specific indicators have been provided for the governance dimension. However, several indicators populating the other five dimensions involve a governance aspect, wherefore this dimension is included in the model. In this regard, it also seems relevant to reemphasize the dual role of the governance concept in MoRRI. As mentioned earlier, this concept both represents a separate and an overarching dimension. However, for visual purposes, it is depicted as a separate dimension on equal footing with other dimensions in the diagram.

As described in chapter 3, several PE indicators concerning *public communication* bear clear relevance to, and have actual overlaps with, the sub dimension of *science communication* within SLSE. With regard to potential, yet unexplored interconnections, the science communication aspect (within PE and SLSE), likewise appears relevant for the open access sub-dimension and the idea of making 'publicly funded research accessible to the general public' (see definition, chapter 3). As illustrated in the figure, a range of other potential interrelations could also be pursued more explicitly in the following steps of the project.

Figure 5.1. Existing and potential interlinkages/overlaps *between* RRI dimensions/sub-dimensions



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7. Appendix

7.1 Venn diagrams

FIGURE 7.1. Intervention logic model: Context

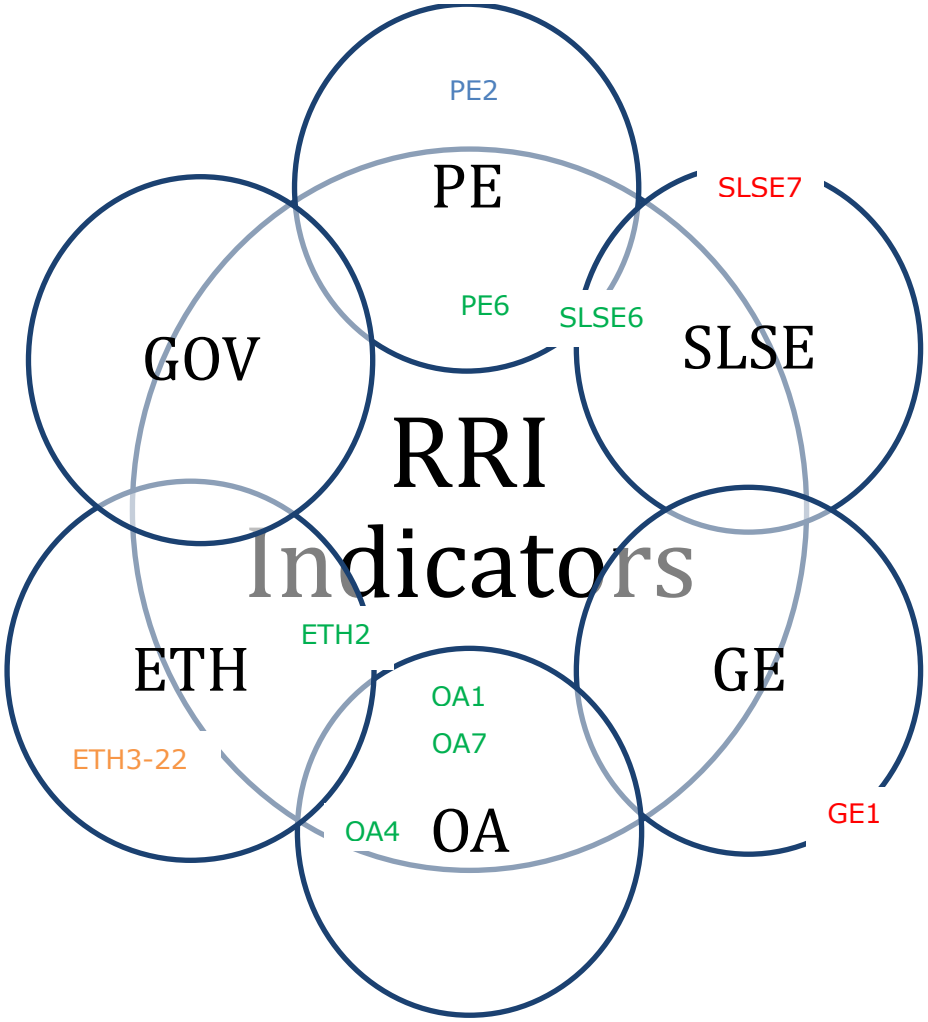


FIGURE 7.2. Intervention logic model: Input

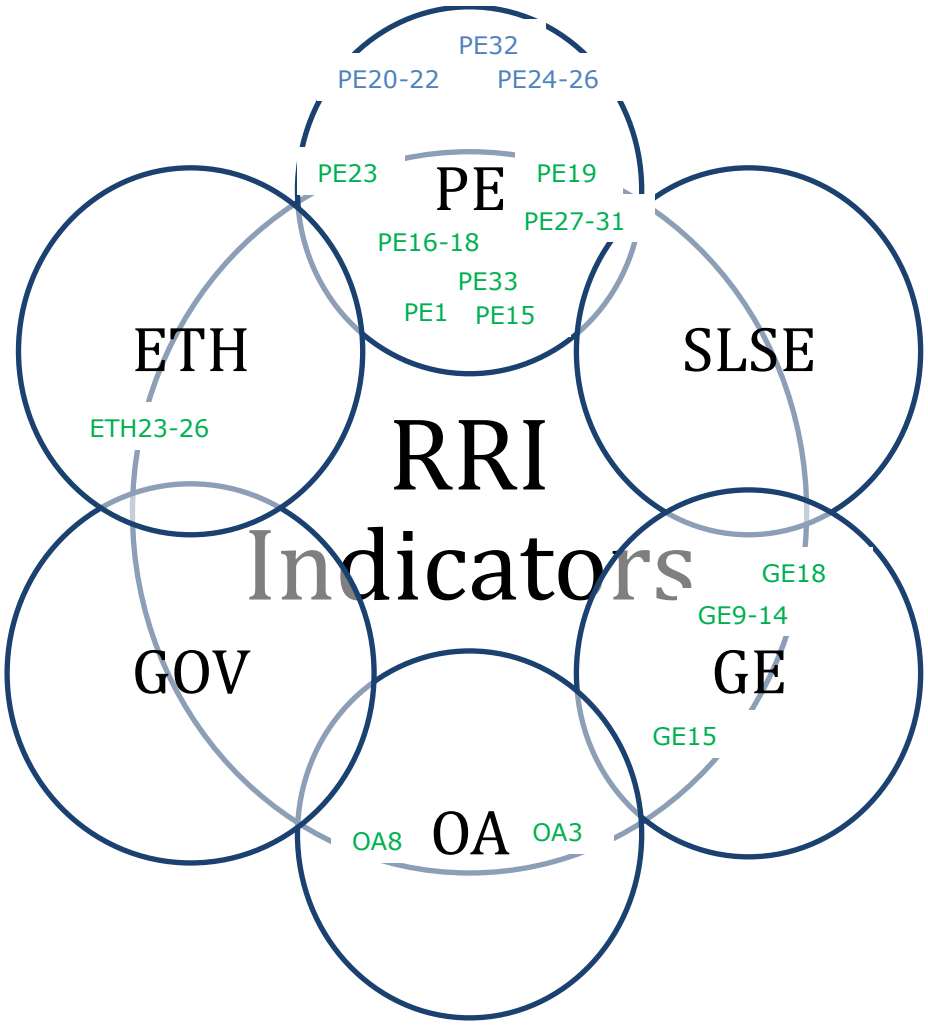


FIGURE 7.3. Intervention logic model: Output

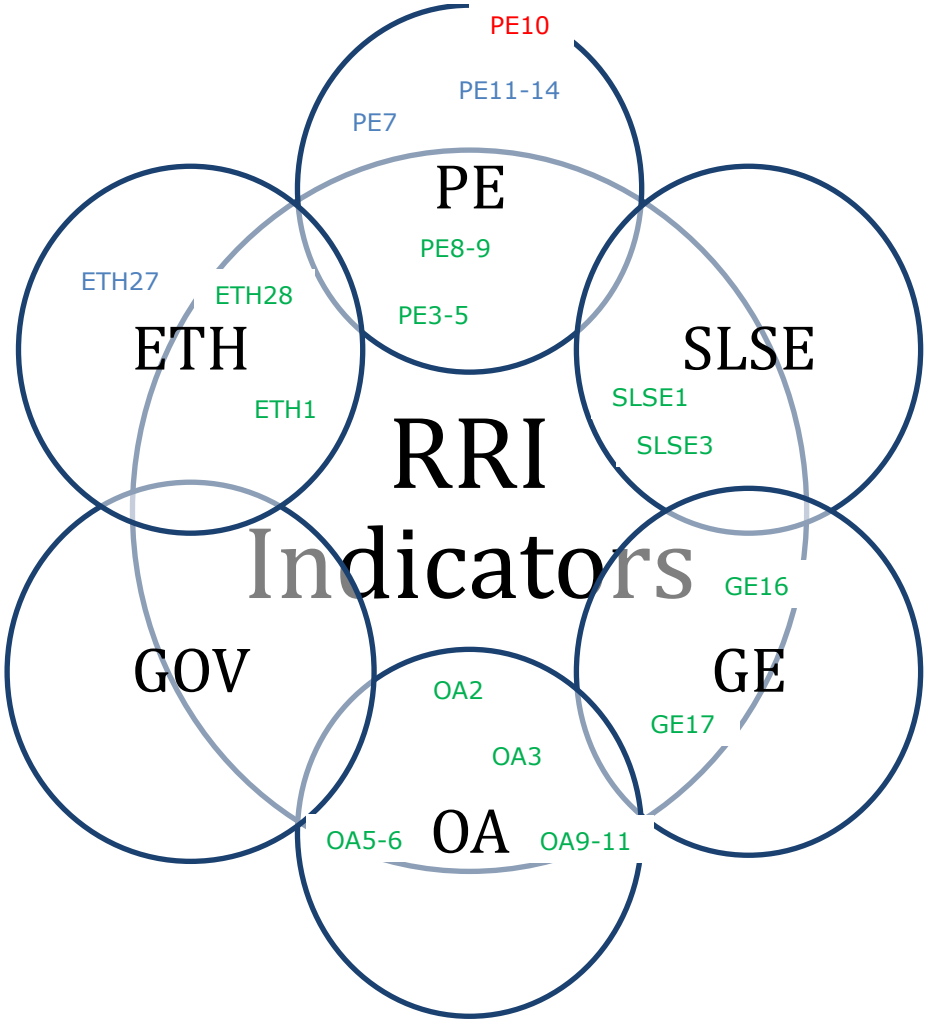


FIGURE 7.4. Intervention logic model: Outcome

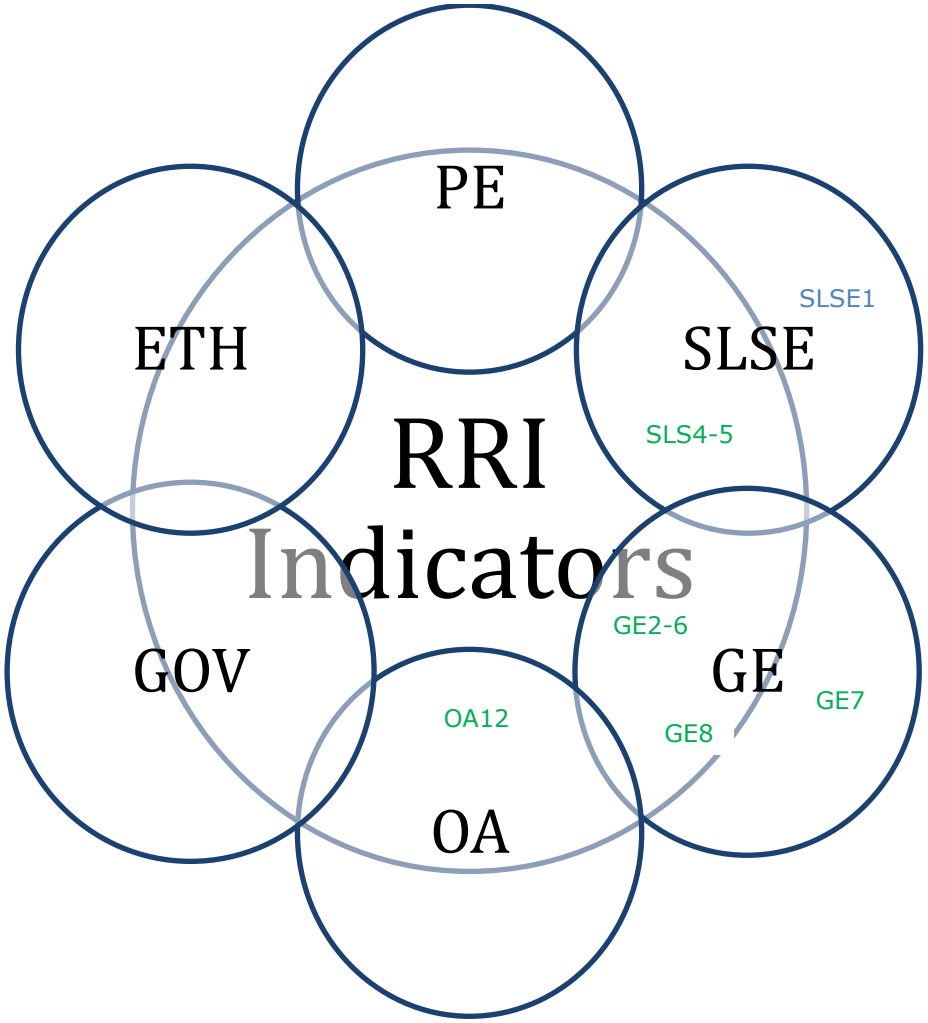


FIGURE 7.5. Aggregation level: Global

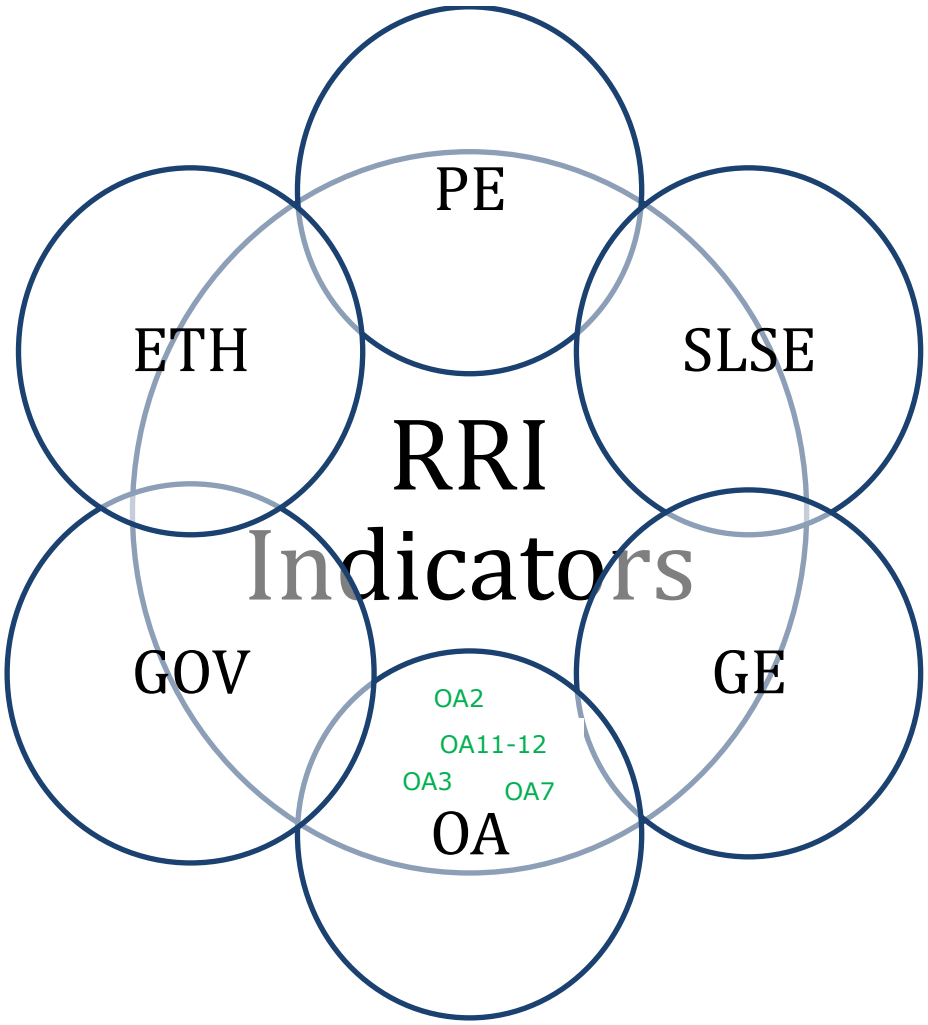


FIGURE 7.6 Aggregation level: National

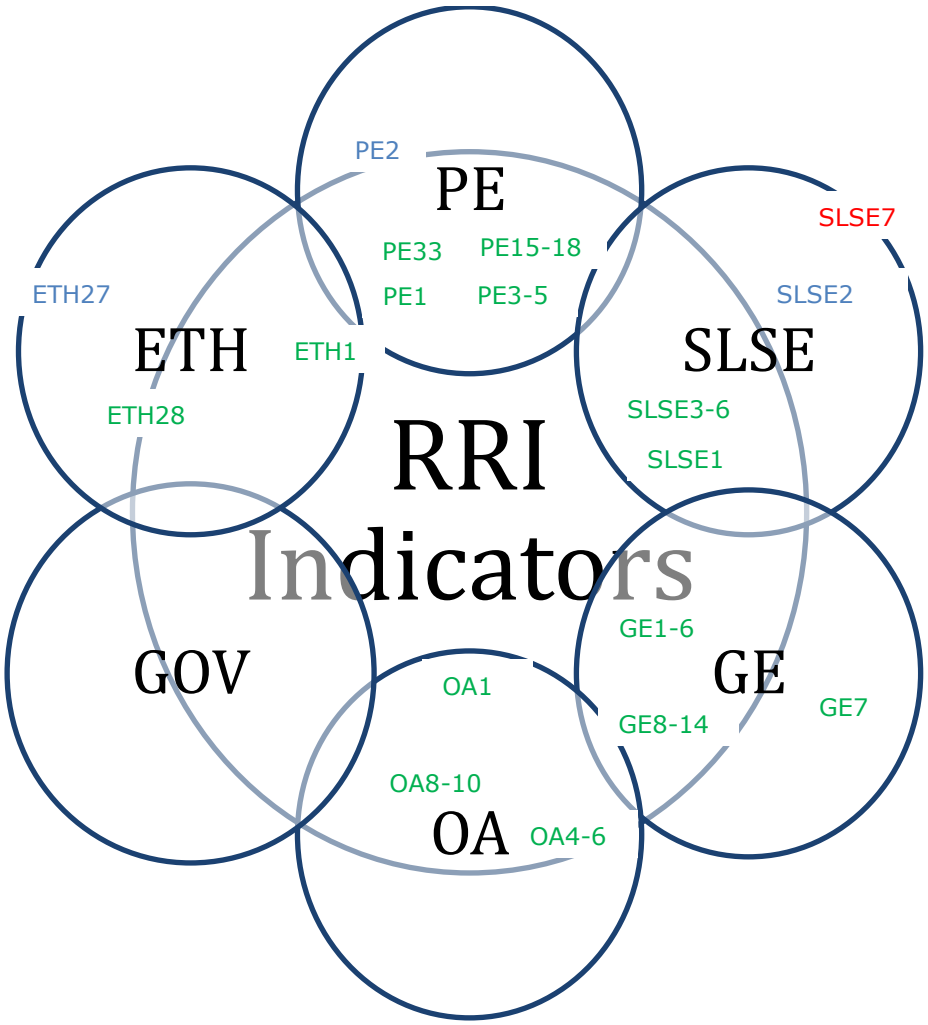


FIGURE 7.7. Aggregation level: Regional (No entries)

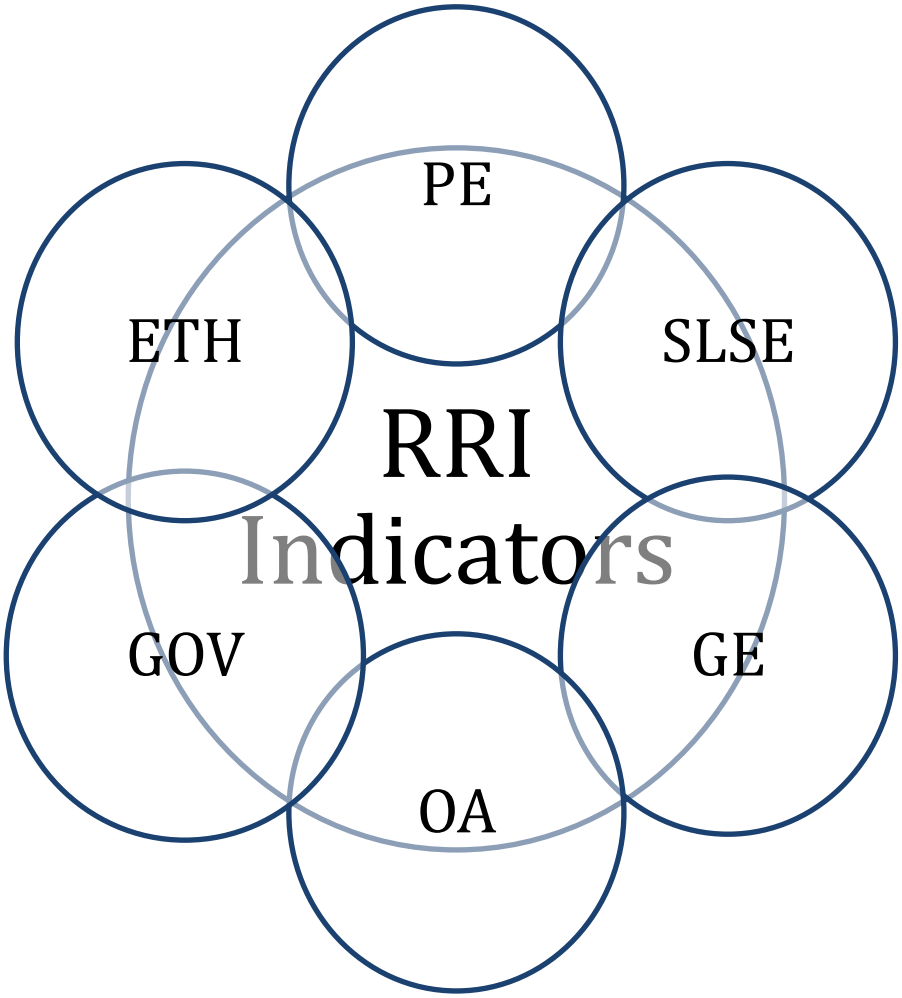


Figure 7.8. Aggregation level: Institutional

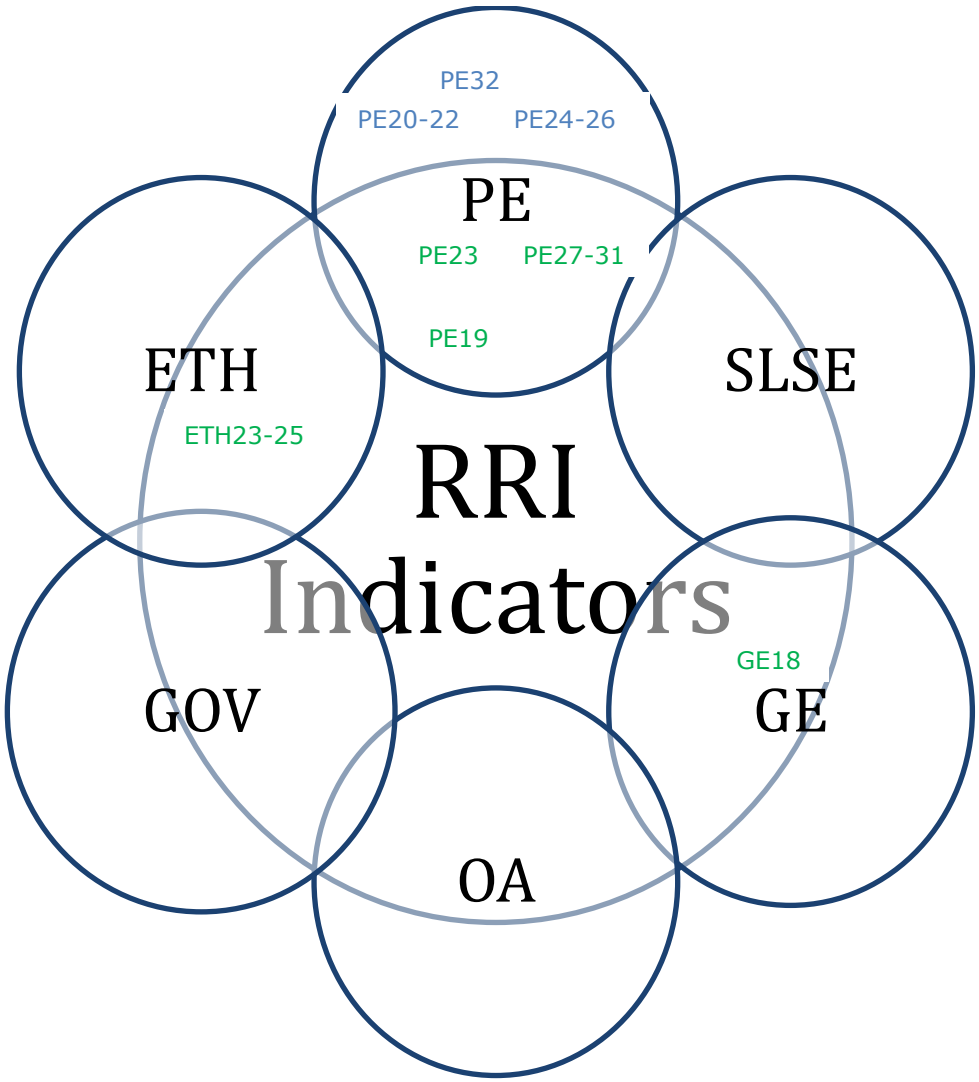


Figure 7.9. Aggregation level: Project/Programme

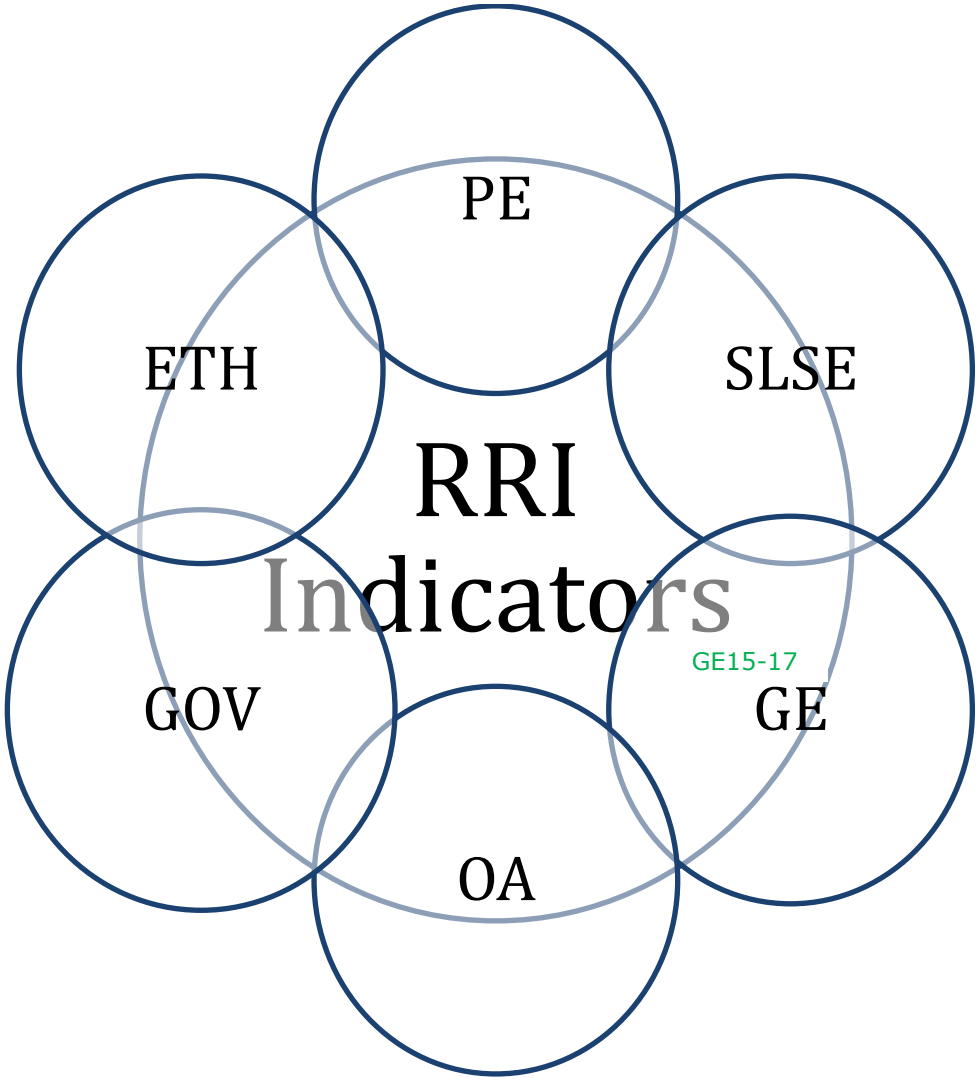
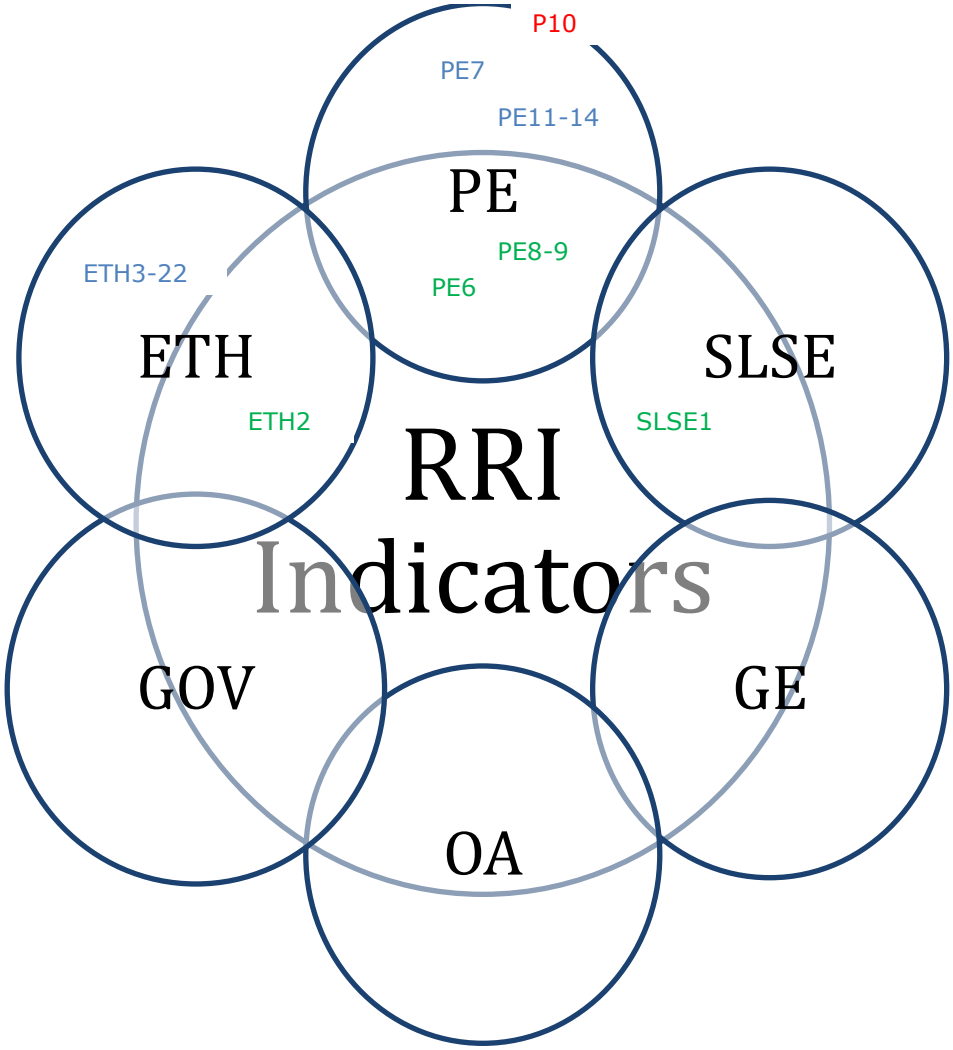


Figure 7.10. Aggregation level: Individual



7.2 Compilation of promising indicators within each RRI dimension

7.2.1 Promising indicators within the RRI dimension of PE

Table 7.2.1.1. Potential indicator for PE, PE1

Information Item	PE1
Name of indicator	Models of public involvement in science and technology decision making
Brief description	Two-dimensional indicator that identifies existence of formal procedures for citizen involvement in national context on the one hand and the actual degree of citizen involvement in science and technology decision making on the other.
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Country level
Qual / Quant	Quantitative (derived from qualitative primary data)
Source of data	Indicator presented in Mejlgaard et al 2012; primary data developed in the MASIS project
Date	Primary data from 2011
Time-series	No
Measurement level	Nominal
Unit of analysis	Countries
Coverage	37 European countries included
Attributes	• Formalized / high involvement • Formalized / low involvement • Not formalized / high involvement • Not formalized / low involvement

Table 7.2.1.2. Potential indicator for PE, PE2

Information Item	PE2
Name of indicator	Science communication culture
Brief description	Indicator summarising overall national science communication culture. Builds on six parameters that collectively form a framework for describing the science communication culture of a specific country. These include the degree of institutionalization (e.g. the presence of popular science magazines, regularity of science section in newspapers, dedicated science communication in television etc.), political attention to the field, the scale and diversity of actor involvement, traditions for popularization within academia, public interest in science and technology, and finally the training and organizational characteristics of science journalism in the country.
Analytical level (logic model)	Context-related
Analytical level (aggregation)	Country level
Qual / Quant	Quantitative (derived from qualitative primary data)
Source of data	Indicator presented in Mejlgaard et al 2012; primary data developed in the MASIS project
Date	Primary data from 2011
Time-series	No
Measurement level	Ordinal
Unit of analysis	Countries
Coverage	37 European countries included
Attributes	• Fragile science communication culture • Developing science communication culture • Consolidated science communication culture

Table 7.2.1.3. Potential indicator for PE, PE3

Information Item	PE3
Name of indicator	Horizontal+vertical participation in science
Brief description	Captures Horizontal+vertical participation in science. Builds on four specific items from EB 63.1 on participatory practices. Two items (reading articles and talking with friends about science) indicate horizontal participation, while two others (attend meetings and sign petitions) indicate vertical participation (see below). **How often do you...?** *Responses recoded: Regularly/occasionally/hardly ever into 'Yes', and Never into 'No'* *% respondents* | Yes | No | Don't know Read articles on science in newspapers, magazines or on the Internet | 78.3 | 21.3 | 0.4 Talk with your friends about science and technology | 70.8 | 28.7 | 0.5 Attend public meetings or debates about science or technology | 28.4 | 71.0 | 0.6 Sign petitions or join street demonstrations about nuclear power, biotechnology or the environment | 24.3 | 74.8 | 0.9 The indicator expresses the share of the population involved both vertically and horizontally
Analytical level (logic model)	Outpu-related
Analytical level (aggregation)	Country level (aggregated from individual level)
Qual / Quant	Quantitative
Source of data	Indicator presented in Mejlgaard and Stares 2010; primary data collected as part of EB 63.1
Date	Primary data for the composite indicator from 2005
Time-series	2005 (could be reconstructed for 2010)
Measurement level	Interval
Unit of analysis	Countries (aggregated from individual level primary data)
Coverage	32 European countries included
Attributes	Share (%) of population involved in 'horizontal and vertical' participation

Table 7.2.1.4. Potential indicator for PE, PE4

Information Item	PE4
Name of indicator	Horizontal only participation in science
Brief description	Captures horizontal participation in science. Builds on four specific items from EB 63.1 on participatory practices. Two items (reading articles and talking with friends about science) indicate horizontal participation, while two others (attend meetings and sign petitions) indicate vertical participation (see below). **How often do you...?** *Responses recoded: Regularly/occasionally/hardly ever into 'Yes', and Never into 'No'* *% respondents* | Yes | No | Don't know Read articles on science in newspapers, magazines or on the Internet | 78.3 | 21.3 | 0.4 Talk with your friends about science and technology | 70.8 | 28.7 | 0.5 Attend public meetings or debates about science or technology | 28.4 | 71.0 | 0.6 Sign petitions or join street demonstrations about nuclear power, biotechnology or the environment | 24.3 | 74.8 | 0.9 The indicator express share of population only involved horizontally in science and technology contexts.
Analytical level (logic model)	Output-related

Information Item	PE4
Analytical level (aggregation)	Country level (aggregated from individual level data)
Qual / Quant	Quantitative
Source of data	Indicator presented in Mejlgaard and Stares 2010; primary data collected as part of EB 63.1
Date	Primary data for the composite indicator from 2005
Time-series	2005 (could be reconstructed for 2010)
Measurement level	Interval
Unit of analysis	Countries (aggregated from individual level primary data)
Coverage	32 European countries included
Attributes	Share (%) of population involved in 'horizontal only' participation

Table 7.2.1.5. Potential indicator for PE, PE5

Information Item	PE5
Name of indicator	Non-participation in science
Brief description	Captures degrees of non-participation at the national level. Builds on four specific items from EB 63.1 on participatory practices. Two items (reading articles and talking with friends about science) indicate horizontal participation, while two others (attend meetings and sign petitions) indicate vertical participation (see below). **How often do you...?** *Responses recoded: Regularly/occasionally/hardly ever into 'Yes', and Never into 'No'* *% respondents* — Yes / No / Don't know Read articles on science in newspapers, magazines or on the Internet — 78.3 / 21.3 / 0.4 Talk with your friends about science and technology — 70.8 / 28.7 / 0.5 Attend public meetings or debates about science or technology — 28.4 / 71.0 / 0.6 Sign petitions or join street demonstrations about nuclear power, biotechnology or the environment — 24.3 / 74.8 / 0.9 The indicator express share of population not participating in science and techhology contexts.
Analytical level (logic model)	Output-related
Analytical level (aggregation)	Country level (aggregated from individual level data)
Qual / Quant	Quantitative
Source of data	Indicator presented in Mejlgaard and Stares 2010; primary data collected as part of EB 63.1
Date	Primary data for the composite indicator from 2005
Time-series	2005 (could be reconstructed for 2010)
Measurement level	Interval
Unit of analysis	Countries (aggregated from individual level primary data)
Coverage	32 European countries included
Attributes	Share (%) of population not participating in science and technology

Table 7.2.1.6. Potential indicator for PE, PE6

Information Item	PE6
Name of indicator	Preferences for participation in decision making concerning science and technology
Brief description	The indicator taps into the desired degree of citizen inclusion in decision making concerning science and technology. It does not capture actual behaviour. At the individual level, it reveals individual preference for participation. At the aggregated level, it can be considered an indicator for the 'climate' for participation at the national level. The exact survey item reads: 'What is the level of involvement citizens should have when it comes to decisions made about science and technology'?
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data, can be aggregated
Qual / Quant	Quantitative
Source of data	Eurobarometers, most recently Special EB 401
Date	2013
Time-series	Yes, 2013, 2010 (2010 slightly different in attributes)
Measurement level	Ordinal (strictly speaking nominal)
Unit of analysis	Individual European citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• Citizens do not need to be involved or informed • Citizens should only be informed • Citizens should be consulted and their opinion should be considered • Citizens should participate and have an active role • Citizens' opinions should be binding • Don't know

Table 7.2.1.7. Potential indicator for PE, PE7

Information Item	PE7
Name of indicator	Visiting science museums
Brief description	Measures engagement through visits to science and technology museums. Questionnaire-based item has been somewhat modified through the time-series, but can still be used for dichotomous classification. Has the respondent visited or not visited a science museum over the last year. The most recent item formulation reads: 'Which of the following have you visited in the last 12 months: Science and technology museum'?
Analytical level (logic model)	Output
Analytical level (aggregation)	Individual level, can be aggregated
Qual / Quant	Quantitative
Source of data	Eurobarometers, most recently EB 63.1
Date	2005
Time-series	Yes, 2005, 2001, 1992
Measurement level	Nominal
Unit of analysis	Individual citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• Have visited • Have not visited • Don't know

Table 7.2.1.8. Potential indicator for PE, PE8

Information Item	PE8
Name of indicator	Attending public meetings or debates about science
Brief description	Captures citizen engagement in terms of attendance at public meetings or debates about science and technology. Survey based, and the specific item reads: 'Do you attend public meetings or debates about science and technology'
Analytical level (logic model)	Output
Analytical level (aggregation)	Individual level, can be aggregated
Qual / Quant	Quantitative
Source of data	Eurobarometers, most recently EB73.1
Date	2010
Time-series	2005, 2010
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• Yes, regularly • Yes, occasionally • No, hardly ever • No, never • Don't know

Table 7.2.1.9. Potential indicator for PE, PE9

Information Item	PE9
Name of indicator	Petitions and street demonstrations
Brief description	Captures vertical, policy-oriented citizen engagement in terms of signing petitions or joining street demonstrations on matters of nuclear power, biotechnology or the environment. Survey based, and the specific item reads: 'Do you sign petitions or join street demonstrations on matters of nuclear power, biotechnology or the environment'
Analytical level (logic model)	Output
Analytical level (aggregation)	Individual level, can be aggregated
Qual / Quant	Quantitative
Source of data	Eurobarometers, most recently EB73.1
Date	2010
Time-series	2005, 2010, slight change of wording between the two years
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• Yes, regularly • Yes, occasionally • No, hardly ever • No, never • Don't know

Table 7.2.1.10. Potential indicator for PE, PE10

Information Item	PE10
Name of indicator	Donating money to science
Brief description	Captures citizen engagement in terms of donating money to medical research. Survey based, and the specific item reads: 'Do you donate money to fundraising campaigns for medical research into cancer'
Analytical level (logic model)	Output
Analytical level	Individual level, can be aggregated

(aggregation)	
Qual / Quant	Quantitative
Source of data	Eurobarometer EB73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• Yes, regularly • Yes, occasionally • No, hardly ever • No, never • Don't know

Table 7.2.1.11. Potential indicator for PE, PE11

Information Item	PE11
Name of indicator	Participation in NGOs related to scientific issues
Brief description	Captures citizen engagement in terms of participation in NGOs dealing with science and technology. Survey based, and the specific item reads: 'Do you participate in the activities of a non-governmental organisation dealing with science and technology related issues'
Analytical level (logic model)	Output
Analytical level (aggregation)	Individual level, can be aggregated
Qual / Quant	Quantitative
Source of data	Eurobarometer EB73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• Yes, regularly • Yes, occasionally • No, hardly ever • No, never • Don't know

Table 7.2.1.12. Potential indicator for PE, PE12

Information Item	PE12
Name of indicator	Talking about science
Brief description	Captures citizen engagement in terms of talking about science and technology. Survey based, and the specific item reads: 'How often do you talk with your friends about science and technology'
Analytical level (logic model)	Output
Analytical level (aggregation)	Individual level, can be aggregated
Qual / Quant	Quantitative
Source of data	Eurobarometer 63.1
Date	2005
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• Regularly • Occasionally • Hardly ever

	• Never • Don't know

Table 7.2.1.13. Potential indicator for PE, PE13

Information Item	PE13
Name of indicator	Reading about science
Brief description	Captures citizen engagement in terms of reading the news about science and technology. Survey based, and the specific item reads: 'How often do you read articles about science in newspapers, magazines or on the internet'
Analytical level (logic model)	Output
Analytical level (aggregation)	Individual level, can be aggregated
Qual / Quant	Quantitative
Source of data	Eurobarometer 63.1
Date	2005
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• Regularly • Occasionally • Hardly ever • Never • Don't know

Table 7.2.1.14. Potential indicator for PE, PE14

Information Item	PE14
Name of indicator	Heard, talked and searched for information about GM food (+ other controversial technologies)
Brief description	This is a composite measure based on three individual items from the 2010 eurbarometer on biotechnology. It divides respondents into three categories depending on their responses to background items concerning 'having heard about', 'having talked with friends and family about' and 'having searched for information about' GM food. The indicator taps into degrees of horizontal engagement with controversial technologies. It should be noted that the exact same measure is available for four other technologies, namely animanl cloning for food production, nanotechnology, biobanks, and synthetic biology.
Analytical level (logic model)	Output
Analytical level (aggregation)	Individual level, can be aggregated
Qual / Quant	Quantitative
Source of data	Composite indicators presented in Gaskell et al 2010, primary data collected as part of Eurobarometer wave 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• Have heard and talked and/or searched for information • Have heard but not talked or searched for information • Have not heard

Table 7.2.1.15. Potential indicator for PE, PE15

Information Item	PE15

Information Item	PE15
Name of indicator	PE performance at national level
Brief description	A model of 'participatory performance is constructed to classify countries according to identifiable parameters/indicators of participation. The coding resulted in a 6 class classification of countries' 'participatory performance' at ordinal level of measurement (from B to AAA), combined with indicators of developmental pattern (+/-). The four main components in the model are: **1.Participatory resources:** regulations supporting PE activities, community of practitioners such as professional participatory agencies, institutional infrastructures supporting participation, e.g. e-governance portals, links to educational institutions and research programmes, upgrading of participatory skills and procedures, funding opportunities **2**. **Demand conditions:** national culture of public debate and criticism, level of public education, stage of a nation's institutional development saturation of a participatory market, level of techno-scientific controversy, social capital. **3 Related and supportive factors:** activity of non-governmental organizations (NGOs) and civil society movements, networking and coordination between participative actors, availability of examples of success **4** .**Governmental strategies and approaches:** strategies and ideas of PE, history of deliberative and participatory processes, competing national priorities, international pressure It should be noted that no explicit criteria for each level have been specified.
Analytical level (logic model)	Input-related
Analytical level (aggregation)	National level
Qual / Quant	Quantitative (derived from qualitative primary data)
Source of data	Rask, Mikko, Saule Maciukaite-Zviniene and Jurgita Petrauskiene (2012): Innovations in public engagement and participatory performance of the nations. *Science and Public Policy* 39, pp. 710–721. Primary data developed in the MASIS project
Date	Primary data from 2011
Time-series	No
Measurement level	Ordinal
Unit of analysis	Countries
Coverage	37 European countries included
Attributes	• Level of performance: • AAA • AA • A • BBB • BB • B • Going forward/opposite • +/-

Table 7.2.1.16. Potential indicator for PE, PE16

Information Item	**PE16**
Name of indicator	Activity in 'Science in Society environment and debate'
Brief description	The indicator is constructed to measure performance in the EU member states with regard to 'Activity in SiS environment and debate'. Each member country is rated on a 1-3 scale.
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Countries
Qual / Quant	Quantitative (derived from qualitative primary data)
Source of data	Tsipouri, Lena (2012): Comparing innovation performance and science and society in the European member states. Science and Public Policy 39 (2012), pp. 732-740.

	Primary data developed in the MASIS project
Date	Primary data from 2011
Time-series	No
Measurement level	Ordinal
Unit of analysis	Countries, EU 26 (no data from Malta)
Coverage	European member states
Attributes	• Sis top performers • Sis-average performers • Sis-developing capabilities

Table 7.2.1.17. Potential indicator for PE, PE17

Information Item	PE17
Name of indicator	Citizen involvement in science
Brief description	The indicator is constructed to measure performance in the EU member states with regard to 'citizen involvement in science'. Each member country is rated on a 1-3 scale.
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Countries
Qual / Quant	Quantitative (derived from qualitative primary data)
Source of data	Tsipouri, Lena (2012): Comparing innovation performance and science and society in the European member states. Science and Public Policy 39 (2012), pp. 732-740. Primary data developed in the MASIS project
Date	Primary data from 2011
Time-series	No
Measurement level	Ordinal
Unit of analysis	Countries, EU 26 (no data from Malta)
Coverage	European member states
Attributes	• Sis top performers • Sis-average performers • Sis-developing capabilities

Table 7.2.1.18. Potential indicator for PE, PE18

Information Item	PE18
Name of indicator	Stimulating society's interest in science policy
Brief description	The indicator is constructed to measure performance in the EU member states with regard to performance levels concerning the stimulation of citizens' involvement in science policy and interest in its dissemination
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Countries
Qual / Quant	Quantitative (derived from qualitative primary data)
Source of data	Tsipouri, Lena (2012): Comparing innovation performance and science and society in the European member states. Science and Public Policy 39 (2012), pp. 732-740. Primary data developed in the MASIS project
Date	Primary data from 2011
Time-series	No
Measurement level	Ordinal
Unit of analysis	Countries, EU 26 (no data from Malta)

Coverage	European member states
Attributes	• Sis top performers • Sis-average performers • Sis-developing capabilities

Table 7.2.1.19. Potential indicator for PE, PE19

Information Item	PE19
Name of indicator	Dedicated resources for PE at institutional level
Brief description	Indicator measuring the amount of resources allocated for PE activities in research institutions
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative (survey data)
Source of data	Neresini, F. and Bucchi, M. 2011: Which indicators for the new public engagement activities? An exploratory study of European research institutions. In: Public Understanding of Science, 20, 1, 64-79.
Date	Primary data from 2007-2008
Time-series	No
Measurement level	Interval
Unit of analysis	Research institutions (physics and biomedicine)
Coverage	40 European Research institutions
Attributes	€

Table 7.2.1.20. Potential indicator for PE, PE20

Information Item	P20
Name of indicator	Information about research activities made publicly available
Brief description	Captures the practices of research institutions with regard to presenting information about research activities to the public online. It is not entirely clear from the paper, how this is operationalized.
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative (survey data)
Source of data	Neresini, F.. Bucchi, M. 2011: Which indicators for the new public engagement activities? An exploratory study of European research institutions. In: Public Understanding of Science, 20, 1, 64-79.
Date	Primary data from 2007-2008
Time-series	No
Measurement level	nominal
Unit of analysis	Research institutions (physics and biomedicine)
Coverage	40 European Research institutions
Attributes	• Yes • No Note: it is uncertain whether the indicator is dichotomous or stretches across several (ordinal) categories

Table 7.2.1.21. Potential indicator for PE, PE21

Information Item	P21
Name of indicator	Availability of a press and/or PR office
Brief description	Indicator that identifies whether a research institution has a press and/or PR office
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative (survey data)
Source of data	Neresini, F.. Bucchi, M. 2011: Which indicators for the new public engagement activities? An exploratory study of European research institutions. In: Public Understanding of Science, 20, 1, 64-79.
Date	Primary data from 2007-2008
Time-series	No
Measurement level	Nominal
Unit of analysis	Research institutions (physics and biomedicine)
Coverage	40 European Research institutions
Attributes	Yes No

Table 7.2.1.22. Potential indicator for PE, PE22

Information Item	P22
Name of indicator	Availability of publications addressed to the public
Brief description	Indicator that identifies to which extent a research institution provide publications that are specifically tailored for public audiences
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative (survey data)
Source of data	Neresini, F.. Bucchi, M. 2011: Which indicators for the new public engagement activities? An exploratory study of European research institutions. In: Public Understanding of Science, 20, 1, 64-79.
Date	Primary data from 2007-2008
Time-series	No
Measurement level	Interval
Unit of analysis	Research institutions (physics and biomedicine)
Coverage	40 European Research institutions
Attributes	Number of publications (numerical values)

Table 7.2.1.23. Potential indicator for PE, PE23

Information Item	P23
Name of indicator	Participation in EU projects/networks about PE
Brief description	Indicator that identifies to which extent a research institution participates in EU-funded PE related projects/networks
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative (survey data)
Source of data	Neresini, F.. Bucchi, M. 2011: Which indicators for the new public engagement activities? An exploratory study of European research institutions. In: Public Understanding of Science, 20, 1, 64-79.
Date	Primary data from 2007-2008

Time-series	No
Measurement level	Interval
Unit of analysis	Research institutions (physics and biomedicine)
Coverage	40 European Research institutions
Attributes	Number of projects/networks (numerical values)

Table 7.2.1.24. Potential indicator for PE, PE24

Information Item	P24
Name of indicator	Specific activities with schools at research institutions
Brief description	Indicator that identifies to which degree the research organisation organises specific activities with schools
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative (survey data)
Source of data	Neresini, F.& Bucchi, M. 2011: Which indicators for the new public engagement activities? An exploratory study of European research institutions. In: Public Understanding of Science, 20, 1, 64-79.
Date	Primary data from 2007-2008
Time-series	No
Measurement level	Interval
Unit of analysis	Research institutions (physics and biomedicine)
Coverage	40 European Research institutions
Attributes	Number of specific activities with schools (numerical values)

Table 7.2.1.25. Potential indicator for PE, PE25

Information Item	P25
Name of indicator	Visits to laboratories aimed at the general public
Brief description	Indicator that identifies to which degree the research organisation organises visits to laboratories aimed at the general public
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative (survey data)
Source of data	Neresini, F.& Bucchi, M. 2011: Which indicators for the new public engagement activities? An exploratory study of European research institutions. In: Public Understanding of Science, 20, 1, 64-79.
Date	Primary data from 2007-2008
Time-series	No
Measurement level	Interval
Unit of analysis	Research institutions (physics and biomedicine)
Coverage	40 European Research institutions
Attributes	Number of visits (events, not visitors) to laboratories (numerical values)

Table 7.2.1.26. Potential indicator for PE, PE26

Information Item	P26
Name of indicator	Open days aimed at the general public
Brief description	Indicator that identifies to which degree the research organisation organises open

	days aimed at the general public
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative (survey data)
Source of data	Neresini, F.. Bucchi, M. 2011: Which indicators for the new public engagement activities? An exploratory study of European research institutions. In: Public Understanding of Science, 20, 1, 64-79.
Date	Primary data from 2007-2008
Time-series	No
Measurement level	Interval
Unit of analysis	Research institutions (physics and biomedicine)
Coverage	40 European Research institutions
Attributes	Number of open days (numerical values)

Table 7.2.1.27. Potential indicator for PE, PE27

Information Item	P27
Name of indicator	Collaboration with NGO's and local government bodies
Brief description	Indicator that identifies whether the research organisation collaborates with NGO's and local government bodies
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative (survey data)
Source of data	Neresini, F.. Bucchi, M. 2011: Which indicators for the new public engagement activities? An exploratory study of European research institutions. In: Public Understanding of Science, 20, 1, 64-79.
Date	Primary data from 2007-2008
Time-series	No
Measurement level	Nominal
Unit of analysis	Research institutions (physics and biomedicine)
Coverage	40 European Research institutions
Attributes	• Yes • No

Table 7.2.1.28. Potential indicator for PE, PE28

Information Item	P28
Name of indicator	Organisation of meetings/conferences addressed to the public
Brief description	Indicator that identifies whether a research institution organises meetings/conferences addressed to the general public
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative (survey data)
Source of data	Neresini, F.. Bucchi, M. 2011: Which indicators for the new public engagement activities? An exploratory study of European research institutions. In: Public Understanding of Science, 20, 1, 64-79.
Date	Primary data from 2007-2008
Time-series	No
Measurement level	Nominal
Unit of analysis	Research institutions (physics and biomedicine)
Coverage	40 European Research institutions
Attributes	• Yes

	• No

Table 7.2.1.29. Potential indicator for PE, PE29

Information Item	P29
Name of indicator	Action plan for PE
Brief description	This indicator measures the existence of an actual implementation plan for social engagement (SE) in the HEI (organizational and administrative arrangements as well as the allocation of financial/intellectual resources). It is a composite measure derived from background qualitative material. The operationalization is not entirely clear.
Analytical level (logic model)	Input- related
Analytical level (aggregation)	Institutional
Qual / Quant	Qualitative (Institutional documentation)
Source of data	• Vargiu, Andrea. 2014: Indicators for the Evaluation of Public Engagement of Higher Education Institutions. In: Journal of Knowledge Economy, 5, 3, 562-584. • This particular indicator is primary based on the source: • E3M (2011). Final report of Delphi Study. TheE3MProject—European Indicators and Ranking Methodology for University Third Mission, p. 28 (through the • Delphi technique a set of third mission indicators were analysed according to relevance, validity, reliability, feasibility and comparability)
Date	Primary data from 2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Higher education institutions
Coverage	?, not specified
Attributes	• Yes • No (not entirely clear from sources if an ordinal scale exists)

Table 7.2.1.30. Potential indicator for PE, PE30

Information Item	P30
Name of indicator	Community representatives in boards or committees
Brief description	The indicator identifies the number of community representatives on the boards of HE boards or committees. If a community representative participates in more than one committee, the participation in each committee is counted.
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Qualitative (Institutional documentation)
Source of data	• Vargiu, Andrea. 2014: Indicators for the Evaluation of Public Engagement of Higher Education Institutions. In: Journal of Knowledge Economy, 5, 3, 562-584. • This particular indicator is primary based on the source: • E3M (2011). Final report of Delphi Study. TheE3MProject—European Indicators and Ranking Methodology for University Third Mission, p. 28 (through the • Delphi technique a set of third mission indicators were analysed according to relevance, validity, reliability, feasibility and comparability)
Date	Primary data from 2010
Time-series	No
Measurement level	Interval
Unit of analysis	Higher education institutions

Information Item	P30
Coverage	?, not specified
Attributes	Number of representatives (numerical values)

Table 7.2.1.31. Potential indicator for PE, PE31

Information Item	P31
Name of indicator	Research projects in partnership with non-academic organisations
Brief description	The indicator identifies to which extent higher education institutions collaborate in research projects with non-academic organisations.
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative
Source of data	Vargiu, Andrea. 2014: Indicators for the Evaluation of Public Engagement of Higher Education Institutions. In: Journal of Knowledge Economy, 5, 3, 562-584. This particular indicator is primary based on the sources: 1. Hart A., Northmore S., & Gerhardt C. (2009). Briefing paper: auditing, benchmarking and evaluating public engagement. Bristol, UK: National Co-ordinating Centre for Public Engagement Research Synthesis n° 1. 2. Molas-Gallart J., Salter A., Patel P., Scott A., & Duran X. (2002). Measuring third stream activities. Final report to the Russell Group of University, Brighton: UK, SPRU—Science and Technology Policy Research, University of Sussex.
Date	Primary data from 2000 (Hart el al. 2009, literature review), primary data from 2002 (Molas-Gallart et al, 2002)
Time-series	No
Measurement level	Interval
Unit of analysis	Higher education institutions
Coverage	?, not specified
Attributes	Number of research projects in collaboration with non-academic partners (numerical values))

Table 7.2.1.32. Potential indicator for PE, PE32

Information Item	P32
Name of indicator	Academics' participation in non-academic conferences
Brief description	The indicator identifies the number of times academics have participated in professional, non-academic conferences (where the majority were non-academics)
Analytical level (logic model)	Input-activities
Analytical level (aggregation)	Institutional
Qual / Quant	Quantitative
Source of data	Vargiu, Andrea. 2014: Indicators for the Evaluation of Public Engagement of Higher Education Institutions. In: Journal of Knowledge Economy, 5, 3, 562-584. This particular indicator is primary based on the source: • Molas-Gallart J., Salter A., Patel P., Scott A.,

	& Duran X. (2002). Measuring third stream activities. Final report to the Russell Group of University, Brighton: UK, SPRU—Science and Technology Policy Research, University of Sussex.
Date	Primary data from 2002 (Molas-Gallart et al, 2002)
Time-series	No
Measurement level	Interval
Unit of analysis	Higher education institutions
Coverage	?, not specified
Attributes	Number of participation in non-academic conferences (numerical values)

Table 7.2.1.33. Potential indicator for PE, PE33

Information Item	P33
Name of indicator	Mobilizing public support
Brief description	The indicator taps into the extent to which government consults with trade unions, employers' associations, leading business associations, religious communities, and social and environmental interest groups to support its policy. The indicator assesses how successful the government is in consulting economic and social actors in preparing its policies. Successful consultation is conceived here as an exchange of views and information that increases the acceptance of government policies in society and induces economic and social actors to support them.
Analytical level (logic model)	Input-related
Analytical level (aggregation)	National
Qual / Quant	Quantitative
Source of data	PASSO, Participatory Assessment of Sustainable Development indicators on good Governance from the Civil Society perspective (2009): Deliverable 3.2 Report on the outcomes of the CSO consultation, p.12. + D2.2 + D2.3 Report on the protocol for the selection of indicators / Report on the development of a new list of indicators, p.22. Available at: http://www.passo-project.org/index.php?option=com_docman&Itemid=3 The indicator was developed through Delphi and national CSO workshops. Thus, this particular indicator primarily has its origin in data from the Bertelsmann Foundation and the 2009 Sustainable Governance Indicators. In the report, Bertelsmann Stiftung (2009): SGISteering Capabilility Societal consultation Sustainable Governance Indicators 2009, 30 OECD countries are ranked according to performance (see attributes)
Date	Primary data – sustainable governance indicators from 2009
Time-series	Yes (data from 2011 and 2014 – slightly changed indicator, see http://www.sgi-network.org/2014/Governance/Executive_Capacity/Societal_Consultation)
Measurement level	Ordinal
Unit of analysis	countries
Coverage	30 OECD countries
Attributes	10-9 = The government successfully motivates economic and social actors to support its policy. 8-6 = The government facilitates acceptance of its policy among economic and social actors. 5-3= The government consults with economic and social actors. 2-1 = The government rarely consults with economic and social actors.

7.2.2 Promising indicators within the RRI dimension of SLSE

Table 7.2.2.1. Potential indicator for SLSE, SLSE1

Information Item	SLSE1
Name of indicator	Interest in science and technology
Brief description	The indicator taps into citizen interests in science and technology. Interest in science and technology is among the most common aims for SLSE activities, and can be considered an output indicator. The measure presented here is survey-based and the survey item reads: 'How interested are you in developments in science and technology'.
Analytical level (logic model)	Output
Analytical level (aggregation)	Individual level data, can be aggregated
Qual / Quant	Quantitative
Source of data	Eurobarometers, most recently Special EB 401
Date	2013
Time-series	2013, 2010, 2005, 2001, 1989 (slightly different wordings and attributes across EB waves)
Measurement level	Ordinal
Unit of analysis	Individual European citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• Very interested • Fairly interested • Not very interested • Not at all interested • Don't know

Table 7.2.2.2. Potential indicator for SLSE, SLSE1

Information Item	SLSE1
Name of indicator	Informedness about science and technology
Brief description	The indicator taps into the degree to which citizen feel well-informed about science and technology. Feeling well-informed about science and technology can be considered a proxy for individual (internal) efficacy in matters of science and technology, i.e. believing to have competence in matters of science and technology. The measure presented here is survey-based and the survey item reads: 'How informed do you feel about developments in science and technology'.
Analytical level (logic model)	Output
Analytical level (aggregation)	Individual level data, can be aggregated
Qual / Quant	Quantitative

Source of data	Eurobarometers, most recently Special EB 401
Date	2013
Time-series	2013, 2010, 2005, 2001, 1989 (slightly different wordings and attributes across EB waves)
Measurement level	Ordinal
Unit of analysis	Individual European citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• Very well informed • Fairly well informed • Not very well informed • Not at all informed • Don't know

Table 7.2.2.3. Potential indicator for SLSE, SLSE1

Information Item	**SLSE1**
Name of indicator	Textbook knowledge about science and technology
Brief description	Through four Eurobarometer waves, a battery of questions measuring 'text book knowledge' of science has been employed. 8 core items have been maintained in all four waves. The items, 13 in total, tap into the basic, traditional, notion of science literacy. The items are presented as a knowledge quiz, and have been applied in different combinations as composite measures of text book knowledge of science. Instead of presenting the 13 items separately, they are presented together below.

	EB 1989	EB 1992	EB 2001	EB 2005-1
1. The centre of the earth is very hot	+	+	+	+
2. The oxygen we breath comes from plants	+	+	+	+
3. Radioactive milk can be made safe by boiling it	+	+	+	+
4. Electrons are smaller than atoms	+	+	+	+
5. The earliest humans lived at the same time as the dinosaurs	+	+	+	+
6. Antibiotics kill viruses as well as bacteria	+	+	+	+
7. Lasers work by focusing sound waves	+	+	+	+
8. All radioactivity is man-made	+	+	+	+
9a. The continents are moving slowly about on the surface of the earth	+			
9b. The continents on which we live have been moving for millions of years and will continue to move in the future		+	+	+
10a. It is the father's gene which decides whether the baby is a boy or a girl	+	+		
10b. It is the father's genes that decide whether the baby is a boy or a girl			+	
10c. It is the mother's genes that decide whether the baby is a boy or a girl				+
11. Human beings, as we know them today, developed from earlier species of animals		+	+	+
12a. Does the earth go around the sun or does the sun go around the earth*		+		
12b. The Sun goes around the Earth			+	+
13a. How long does it take for the earth to go around the sun**		+		
13b. It takes 1 month for the Earth to go around the Sun			+	+

Items 1-11, 12b, and 13b:
'Here is a quick quiz. For each thing I say, tell me if it is true or false. If you don't know, say so, and we will skip to the next'.
Response categories: 1) True; 2) False; 3) DK.
Item 12a:
'Does the earth go around the sun or does the sun go around the earth?'
Response categories: 1) The earth goes around the sun; 2) The sun goes around the earth; 3) DK.
Item 13a:
'How long does it take for the earth to go around the sun?'
Response categories: 1) One day; 2) One month; 3) One year; 4) Other answers; 5) DK

Analytical level (logic model)	Output
Analytical level (aggregation)	Individual level data, can be aggregated
Qual / Quant	Quantitative
Source of data	Eurobarometers, most recently EB 63.1
Date	2005
Time-series	2005, 2001, 1992, 1989 (see above for differences in item wording across EB waves)
Measurement level	Interval, when used as composite indexes
Unit of analysis	Individual European citizens
Coverage	Across Europe, around 32 countries, 30.000 respondents
Attributes	• False • True Scores attributed to correct answers

Table 7.2.2.4. Potential indicator for SLSE, SLSE2

Information Item	SLSE2
Name of indicator	Competence of general population with regard to numeracy
Brief description	Indicator capturing the competence of the general population with regard problem solving in technology-rich environments.
Analytical level (logic model)	Outcome
Analytical level (aggregation)	Country-level
Qual / Quant	Quantitative
Source of data	OECD Programme for the International Assessment of Adult Competencies (PIAAC)
Date	Primary data from 2013
Time-series	No
Measurement level	Ordinal
Unit of analysis	Countries
Coverage	19 European countries
Attributes	• Average numeracy score: • Low numeracy (below level 1 and level 1) • Medium-low numeracy (level 2) • Medium high numeracy (level 3) • High numeracy (level 4 and level 5)

Table 7.2.2.5. Potential indicator for SLSE, SLSE3

Information Item	SLSE3
Name of indicator	Share of STEM graduates
Brief description	The indicator presents the share of graduates in STEM in relation to all graduates in a country
Analytical level (logic model)	Output
Analytical level (aggregation)	Country-level
Qual / Quant	Quantitative
Source of data	OECD Education Statistics (Graduates by field of education)
Date	Primary data since 1998
Time-series	yes
Measurement level	Interval
Unit of analysis	Country-level
Coverage	OECD countries
Attributes	High share of STEM graduates Low share of STEM graduates

Table 7.2.2.6. Potential indicator for SLSE, SLSE4

Information Item	SLSE4
Name of indicator	Science competence in subject matters and cognitive domains of primary school pupils
Brief description	Indicator describing science competence of primary school pupils in science subjects (life science, physical science, earth science)
Analytical level (logic model)	Outcome
Analytical level (aggregation)	Country-level
Qual / Quant	Quantitative
Source of data	TIMSS study
Date	1995, 1999, 2003, 2007, 2011, (2015 available 2016)
Time-series	yes
Measurement level	Interval
Unit of analysis	Countries
Coverage	25 European countries covered
Attributes	Overall average score over the science subjects

Table 7.2.2.7. Potential indicator for SLSE, SLSE5

Information Item	SLSE5
Name of indicator	Science competence in subject matters of secondary school pupils
Brief description	Indicator describing science competence of secondary school pupils in science subjects (biology, chemistry, physics and earth science)
Analytical level (logic model)	Outcome
Analytical level (aggregation)	Country level
Qual / Quant	Quantitative
Source of data	PISA
Date	2000,2003, 2006, 2009, 2012 (PISA)
Time-series	Yes
Measurement level	Interval
Unit of analysis	Countries
Coverage	35 European countries
Attributes	Mean PISA score for science

Table 7.2.2.8. Potential indicator for SLSE, SLSE6

Information Item	SLSE6
Name of indicator	Science communication culture
Brief description	Indicator summarizing overall national science communication culture. Builds on six parameters that collectively form a framework for describing the science communication culture of a specific country. These include the degree of institutionalization (e.g. the presence of popular science magazines, regularity of science section in newspapers, dedicated science communication in television etc.), political attention to the field, the scale and diversity of actor involvement, traditions for popularization within academia, public interest in science and technology, and finally the training and organizational characteristics of science journalism in the country.
Analytical level (logic model)	Context-related
Analytical level (aggregation)	Country level
Qual / Quant	Quantitative (derived from qualitative primary data)
Source of data	Indicator presented in Mejlgaard et al 2012; primary data developed in the MASIS project
Date	Primary data from 2011
Time-series	No
Measurement level	Ordinal
Unit of analysis	Countries
Coverage	37 European countries included

Table 7.2.2.9. Potential indicator for SLSE, SLSE7

Information Item	SLSE7
Name of indicator	Importance of science communication as an evaluation criterion
Brief description	Indicator informing about the degree to which activities related to science communication and dissemination are evaluation criteria for project assessment.
Analytical level (logic model)	Context related
Analytical level (aggregation)	Country level
Qual / Quant	Quantitative (derived from qualitative data)
Source of data	MASIS country reports
Date	2011
Time-series	No
Measurement level	Nominal
Unit of analysis	Countries
Coverage	36 European countries (+ Turkey)
Attributes	Presence of science communication as evaluation criterion Absence of science communication as evaluation criterion

7.2.3 Promising indicators within the RRI dimension of Gender equality

7.2.3.1. Potential indicator for gender, G1

Information Item	G1
Name of indicator	Women's participation in paid work
Brief description	Quantitative indicator on women's participation in paid work to illustrate the context of female employment in science and research
Analytical level (logic model)	Context-related
Analytical level (aggregation)	Country level
Qual. / Quant.	Quantitative
Source of data	Labour Force Survey
Date	2013
Time series	Yearly
Measurement level	Metric - share of women in total working population
Unit of analysis	Country
Coverage	33 EEA countries
Attributes	

7.2.3.2. Potential indicator for gender, G2

Information Item	G2
Name of indicator	Share of female researchers by sector
Brief description	The percentage of female researchers depicts the (under-)representation of women in research. Its differentiation by sectors indicates different opportunities and barriers.
Analytical level (logic model)	Context or outcome-related
Analytical level (aggregation)	Countries
Qual. / Quant.	Quantitative
Source of data	She Figures
Date	2011
Time series	Most countries biennial – but data availability differs according to countries
Measurement level	Metric – share of female researchers
Unit of analysis	Countries
Coverage	33 countries, EU 28 and EU 15
Attributes	• Female researchers in Higher education sector • Female researchers in Government sector • Female researchers in Private non-profit sector • Female researchers in Business enterprise sector

7.2.3.3. Potential indicator for gender, G3

Information Item	G3
Name of indicator	Years to achieve gender equality in research participation
Brief description	Estimation of the years required to reach equal participation (50%) of women and men in research, based on the average growth rate of female participation in research between 2003-2011 and the share of female in researchers in 2011. This indicator is very responsive to progress and refers to the status quo in female participation.
Analytical level (logic model)	Input-related
Analytical level (aggregation)	National
Qual. / Quant.	Quantitative
Source of data	She Figures
Date	2003-2011
Time series	Biennial
Measurement level	Metric – estimated time to reach equal participation of women and men in research in years
Unit of analysis	Countries
Coverage	31 countries; EU 28
Attributes	Annual growth rate of female participation between 2003 and 2011 Years to achieve 50% women in research

7.2.3.4. Potential indicator for gender, G4

Information Item	G4
Name of indicator	Dissimilarity Index
Brief description	The Dissimilarity Index provides a theoretical measurement of the percentage of women and men who would have to move to another field of science to ensure a gender balanced distribution across fields. It measures the distance from balanced gender distribution across fields for horizontal segregation in research.
Analytical level (logic model)	Outcome
Analytical level (aggregation)	National
Qual. / Quant.	Quantitative
Source of data	She Figures 2012
Date	2011
Time series	SHE FIGURES: all 3 years (at least up to now) However, the indicator could be computed based on Eurostat statistics (WTS database) on research and development which is more frequently available.
Measurement level	Metric – share of men and women for the distance of balanced gender distribution across fields
Unit of analysis	Countries
Coverage	29 countries; EU 27
Attributes	Higher education sector and government sector

7.2.3.5. Potential indicator for gender, G5

Information Item	G5
Name of indicator	Glass Ceiling Index
Brief description	The Glass Ceiling Index measures the relative chance for women, as compared with men, of reaching a top position for vertical segregation. It compares the proportion of women in grade A positions to the proportion of women in academia (grades A, B and C).
Analytical level (logic model)	Outcome
Analytical level (aggregation)	National
Qual. / Quant.	Quantitative
Source of data	SHE FIGURES 2012. Updated data could be used depending on the time of publication of SHE FIGURES 2015
Date	2010
Time series	SHE FIGURES: all 3 years (at least up to now) However, the indicator could be computed based on Eurostat statistics (WTS database) on research and development which is more frequently available.
Measurement level	Metric – share of women in grade A in relation to share of women in academia
Unit of analysis	Countries
Coverage	29 countries; EU 27
Attributes	A Glass Ceiling Index of 1 indicates equality between women and men being promoted, a score below 1 means an over-representation of women in grade A level and a score above 1 an under-representation of women in grade A.

7.2.3.6. Potential indicator for gender, G6

Information Item	G6
Name of indicator	Female graduates and academic staff by grade
Brief description	The proportion of female academic staff by grade illustrates the share of women in different hierarchical positions in the higher education sector
Analytical level (logic model)	Outcome
Analytical level (aggregation)	National
Qual. / Quant.	Quantitative
Source of data	She Figures 2012
Date	2011
Time series	SHE FIGURES: all 3 years (at least up to now) However, the indicator could be computed based on Eurostat statistics (WTS database) on research and development which is more frequently available.
Measurement level	Metric – share of women in different grades
Unit of analysis	Countries
Coverage	26 EU countries
Attributes	Grade A: The single highest grade/post at which research is normally conducted Grade B: Researchers working in positions not as senior as top positions (A) but more senior than newly qualified PhD holders (ISCED 6) Grade C: The first grade/post into which a newly qualified PhD graduate would

	normally be recruited Grade D: Postgraduate students not yet holding a PhD degree who are engaged as researchers Graduates ISCED 5A: First stage of tertiary education Graduates ISCED 6: Second stage of tertiary education

7.2.3.7. Potential indicator for gender, G7

Information Item	G7
Name of indicator	Gender Wage Gap
Brief description	The Gender Wage Gap illustrates the observed unadjusted difference in average gross annual earnings of male and female paid employees as a percentage of the average gross annual earnings of male paid employees. Persons with tertiary education corresponding to the ISCED codes 5 and 6 who are employed in occupations in the major groups 2 ("Professionals") and 3 ("Technicians and Associate Professionals") of the ISCO classification are used as a proxy for defining researchers in the non-academic sector. The Gender Wage Gap can be interpreted as a synthetic indicator of multiple inequalities between men and women. It is determined by differences in educational attainments, labour market experience and tenure, sectoral affiliation and occupations, etc., as well as wage discrimination etc.
Analytical level (logic model)	Outcome-related
Analytical level (aggregation)	National
Qual. / Quant.	Quantitative
Source of data	MORE2 on the basis of the structural earnings survey
Date	2006
Time series	Y – 2002, 2006, 2010
Measurement level	Metric – difference in gross annual earnings between women and men in relation to male gross annual earnings
Unit of analysis	Countries
Coverage	17 EU countries
Attributes	

7.2.3.8. Potential indicator for gender, G8

Information Item	G8
Name of indicator	Share of female heads of research performance organisations
Brief description	Proportion of organisations headed by women. This can be interpreted as an indicator for gender balance in decision-making and, therefore, structural setting for gender equality. Information obtained from responses to ERA RPOs survey question 35: Please specify the gender of the person who was head of your organisation at the end of the calendar year in 2013 (Head of organisation: highest decision-making official in the organisation (e.g. rector or equivalent in the academy, president or equivalent in non-academic research organisations)
Analytical level (logic model)	Input- and outcome-related
Analytical level (aggregation)	National on the basis of information about organisations

Qual. / Quant.	Quantitative
Source of data	ERA facts and figures 2014 on the basis ERA Survey data RPOs
Date	2013
Time series	Not yet
Measurement level	Metric – share of organisations
Unit of analysis	Countries
Coverage	Research performing organizations in 28 EU countries, covering about 31.6% of staff (headcount) in research organisations in the EU
Attributes	

7.2.3.9. Potential indicator for gender, G9

Information Item	**G9**
Name of indicator	Share of gender-balanced recruitment committees at RPOs
Brief description	This indicator depicts the share of recruitment committees for internationally recognised researchers (e.g. team leaders, management positions, full professors, etc.) which are gender balanced (i.e. reach the threshold of 40% of the under-represented gender). It can be interpreted as an indicator for women in decision-making process. The data is obtained from responses to ERA RPOs survey question 39: How many recruitment committees for leading researcher positions did your organisation set up in 2013 for the recruitment of researchers? and question 40: Amongst them, how many recruitment committees for leading researcher positions reached the threshold of 40% of the under-represented sex?
Analytical level (logic model)	Input-related
Analytical level (aggregation)	National on the basis of information about organisations
Qual. / Quant.	Quantitative
Source of data	ERA facts and figures 2014 on the basis of data from ERA RPOs Survey
Date	2013
Time series	Not yet
Measurement level	Metric – share of committees
Unit of analysis	Countries
Coverage	Research performing organisations in 28 EU countries, covering about 31.6% of staff (headcount) in research organisations in the EU
Attributes	

7.2.3.10. Potential indicator for gender, G10

Information Item	**G10**
Name of indicator	Share of gender-balanced research evaluation panels in RFOs
Brief description	The indicator measures the share of evaluation panels which reach the threshold of 40% of the under-represented gender in RFOs. It relates to panels which are responsible for the evaluation of research projects and programmes as well as performance at the institutional or individual level. The outcome of the evaluation

	may be linked to the allocation of research funding and/or other resources. The data is obtained from responses to ERA RFOs survey question 27: How many research evaluation panels did your organisation set up in 2013? and 28: Amongst those, how many panels reached the threshold of 40% of the under-represented sex?
Analytical level (logic model)	Input-related
Analytical level (aggregation)	National on the basis of information about organisations
Qual. / Quant.	Quantitative
Source of data	ERA facts and figures 2014 on the basis of data from ERA RFOs Survey
Date	2013
Time series	Not yet
Measurement level	Metric - share of panels
Unit of analysis	Countries
Coverage	Research performing organisations in 28 EU countries, covering about 31.6% of staff (headcount) in research organisations in the EU
Attributes	

7.2.3.11. Potential indicator for gender, G11

Information Item	**G11**
Name of indicator	Share of RPOs with gender equality plans
Brief description	The existence of a gender equality plan indicates institutionalised activities for gender equality. A gender equality plan is a consistent set of provisions and actions aimed at ensuring gender equality. The information is obtained from responses to ERA RFOs survey question 36: In 2013, has your organisation implemented a gender equality plan or equivalent?
Analytical level (logic model)	Input- and outcome-related
Analytical level (aggregation)	National on the basis of information about organisations
Qual. / Quant.	Quantitative
Source of data	ERA facts and figures 2014 on the basis of data from ERA RPOs Survey
Date	2013
Time series	Not yet
Measurement level	Metric – share of organisations
Unit of analysis	Countries
Coverage	Research performing organisations in 28 EU countries, covering about 31.6% of staff (headcount) in research organisations in the EU
Attributes	Existence of Gender Equality Plans Yes / No / Not known / Not applicable

7.2.3.12. Potential indicator for gender, G12

Information Item	G12
Name of indicator	Share of RPOs with female recruitment and promotion policies
Brief description	The indicator depicts the share of research organisations that have implemented recruitment and promotion policies for female researchers. This is an indicator of special actions to increase the participation of women in research. The information is obtained from responses to ERA RPOs survey question 37: As part of the gender equality plan or equivalent, which of the following measures or actions have been implemented by your organisation in 2013? Recruitment and promotion measures / Targets to ensure gender balance in recruitment committees / Flexible career trajectory (e.g. provisions for interruptions of career, returning schemes after career breaks, gender aware conditions, provisions on dual careers) / Work-life balance measures (e.g. parental leave, flexible working arrangements) / Support for leadership development (e.g. mentoring or networking opportunities for female researchers) / Other
Analytical level (logic model)	Input- and outcome-related
Analytical level (aggregation)	National, on the basis of information about organisations
Qual. / Quant.	Metric – share of organisations
Source of data	ERA facts and figures 2014, on the basis of data from ERA RPOs Survey
Date	2013
Time series	Not yet
Measurement level	Metric – share of organisations with female recruitment and promotion policies
Unit of analysis	Countries
Coverage	28 EU Member States, the respondents in the ERA RFOs survey 2014 account for about 34% of total GBAORD in the EU.
Attributes	

7.2.3.13. Potential indicator for gender, G13

Information Item	G13
Name of indicator	Share of RFOs promoting gender content in research
Brief description	This indicator illustrates the integration of gender as part of the research design and process. It entails sex and gender analysis being integrated into basic and applied research. The information is obtained from responses to ERA RFOs survey question 26. When allocating research and development funding in 2013, did your organisation include the gender dimension in research content? (Yes, in half or more of the projects/ programmes / Yes, in less than half of the projects/ programmes / No / Not known / Not applicable)
Analytical level (logic model)	Input- and outcome-related
Analytical level (aggregation)	National on the basis of information about organisations
Qual. / Quant.	Quantitative
Source of data	ERA facts and figures 2014 on the basis of data from ERA RFOs Survey

Date	2013
Time series	Not yet
Measurement level	Metric - share of organisations
Unit of analysis	Countries
Coverage	28 EU Member States, the respondents in the ERA RFOs survey 2014 account for about 34% of total GBAORD in the EU.
Attributes	Existence of gender content in research Yes / No / Not known / Not applicable

7.2.3.14. Potential indicator for gender, G14

Information Item	**G14**
Name of indicator	Share of RPOs with gender in research content
Brief description	This indicator summarizes activities to integrate the gender dimension in research content that can address research design and process gender analysis. The information is obtained from responses to ERA RPOs survey question 38: Does your organisation include a gender dimension in research and innovation content of programmes, projects and studies? (Yes / No / Not known / Not applicable)
Analytical level (logic model)	Input- and outcome-related
Analytical level (aggregation)	National on the basis of information about organisations
Qual. / Quant.	Quantitative
Source of data	ERA facts and figures 2014 on the basis of data from ERA RPOs Survey
Date	2013
Time series	Not yet
Measurement level	Metric – share of organisations
Unit of analysis	Countries
Coverage	Research performing organisations in 28 EU countries covering about 31,6% of staff (headcount) in research organisations in the EU
Attributes	

7.2.3.15. Potential indicator for gender, G15

Information Item	**G15**
Name of indicator	Share of research projects with specific gender equality actions
Brief description	This indicator asks for the existence of specific gender equality actions and whether these actions are perceived as effective or non-effective. Three types of gender action types are differentiated: design and implementation of an equal opportunity policy; set targets to achieve a gender balance in the workforce; actions to improve work-life balance
Analytical level (logic model)	Input
Analytical level (aggregation)	Project level of cooperation projects within completed FP7 projects (by June 2013) that reported specific gender equality actions and gender action types
Qual. / Quant.	Qualitative

Source of data	EC Sixth Monitoring Report 2012
Date	Published 2013 for the time period 2007-2012
Time series	No
Measurement level	Metric – share and number of projects
Unit of analysis	FP7 Cooperation programme
Coverage	FP7 Projects
Attributes	Number and share of projects according to priority areas with specific gender equality actions; assessment of the gender action types as effective / non effective

7.2.3.16. Potential indicator for gender, G16

Information Item	**G16**
Name of indicator	Share of research projects with gender dimension in content
Brief description	This indicator asks for the existence of a gender dimension associated with the research content.
Analytical level (logic model)	Output Indicator
Analytical level (aggregation)	Project level of cooperation projects within completed FP7 projects (by June 2013) that reported gender aspects and with specific gender equality actions and gender action types.
Qual. / Quant.	Qualitative
Source of data	EC Sixth Monitoring Report 2012
Date	Published 2013 for the time period 2007-2012
Time series	No
Measurement level	Metric – share and number of projects
Unit of analysis	FP7 Cooperation programme
Coverage	Final Reports of FP7 projects mentioning gender aspects (N=737)
Attributes	Number and share of projects according to priority areas which report gender aspects; number of projects where gender dimension was associated with the research content, per priority area and total

7.2.3.17. Potential indicator for gender, G17: Women as contact persons for FP7 projects

Information Item	**G17**
Name of indicator	Gender of individual participants with contact person roles in signed grant agreements
Brief description	This indicator depicts the gender of individual participants with contact person roles in signed grant agreements of FP7 during the period 2007-2012
Analytical level (logic model)	Input Indicator
Analytical level (aggregation)	Project level
Qual. / Quant.	Quantitative
Source of data	EC Sixth Monitoring Report 2012
Date	Published 2013 for the time period 2007-2012

Time series	No
Measurement level	Metric – share of women and men in grants
Unit of analysis	Signed grant agreements
Coverage	Final Reports of FP7 projects mentioning gender aspects (N=737)
Attributes	The roles of the contact persons differentiate between coordinators and participants on the one hand and seven other individual contact roles on the other (contact person, contact person for legal aspects, contact person for scientific aspects, Marie Curie individual fellows, first administrative officer, principal investigator, secondary administrative officer)

7.2.3.18. Potential indicator for gender, G18

Information Item	**G18**
Name of indicator	Share of organizations with organisational structures for gender equality
Brief description	This indicator describes the existence of implemented formal organisational structures for gender equality issues in universities/faculties of science and technology. These personnel resources can be interpreted as engagement for gender equality by the institutions.
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Institutional
Qual. / Quant.	Quantitative
Source of data	CESAER survey data
Date	2013/2014
Time series	Not yet
Measurement level	Metric - number and share of institutions with specific gender equality units
Unit of analysis	Institutions
Coverage	48 CESAER member institutions at leading European universities of technology and engineering schools/faculties at full universities and university colleges
Attributes	Number and share of institutions with special unit for gender equality; gender equality part of other responsibilities of a unit; one person dealing full-time with gender equality; one person dealing part time with gender equality; no unit or person dealing with gender equality; other ways of supporting gender equality

7.2.4 Promising indicators within the RRI dimension of OA

Table 7.2.4.1. Potential indicator for OA, OA1

Information Item	OA1
Name of indicator	Public perception of online free availability of the results of the publicly funded research
Brief description	The indicator showcases what is the public perception of online free availability of the results of the publicly funded research in the EU Member States. Data are collected on the EU-level, but can be disaggregated by individual Member States or by various socioeconomic profile (gender, age, level of education, attitude to science).
Analytical level (logic model)	Context-related
Analytical level (aggregation)	EU-level, Country level, Socioeconomic profile level
Qual / Quant	Quantitative
Source of data	Indicator presented at European Commission. Special Eurobarometer 401. Responsible Research and Innovation (RRI), Science and Technology
Date	2013
Time-series	No
Measurement level	Ordinal
Unit of analysis	Countries, socioeconomic profile
Coverage	28 Member States
Attributes	Results of publicly funded research should be made available online free of charge (MULTIPLE ANSWERS POSSIBLE): • Yes, to the general public • Yes, to other researchers • Yes, to industries • No • Don't know

Table 7.2.4.2. Potential indicator for OA, OA2

Information Item	OA2
Name of indicator	Freely available peer-reviewed papers
Brief description	The indicator shows the proportion of freely available peer-reviewed papers in Scopus over 2004 – 2011. The indicator uses a method of calculation developed by Science-Metrix. The data can be disaggregated by scientific fields and countries (the data are available only for 2008 – 2011).
Analytical level (logic model)	Output-related
Analytical level (aggregation)	Global level, Country level, Field level
Qual / Quant	Quantitative
Source of data	Eric Archambault, Didier Amyot, Philippe Deschamps, Aurore Nicol, Lise Rebout & Guillaume Roberge Proportion of Open Access Peer-Reviewed Papers at the European and World Levels—2004-2011 August 2013
Date	2013
Time-series	2004 – 2011 (No for country-level and field-level data)
Measurement level	Ratio
Unit of analysis	Countries, fields (aggregated from individual article level primary data)
Coverage	28 Member States + other ERA Member States + USA, Japan, Canada and Brazil
Attributes	• Per cent of freely available peer-reviewed papers, 2004-2011 • Proportion of OA per field, 4-year non-weighted sampling, 2008-2011 • Number of papers indexed in Scopus available in OA, 2008-2011 • Proportion of OA per country, 4-year non-weighted sampling, 2008-2011

Table 7.2.4.3. Potential indicator for OA, OA3

Information Item	OA3
Name of indicator	Institutional perception of OA strategies

Brief description	The indicator is a set of questions to institutions' (universities and other research performing organisations) on their perception of open access strategies.
Analytical level (logic model)	Input-related / Output-related
Analytical level (aggregation)	Country level
Qual / Quant	Quantitative
Source of data	Julie Caruso, Aurore Nicol & Eric Archambault Open Access Strategies in the European Research Area August 2013
Date	2013
Time-series	No
Measurement level	Ratio
Unit of analysis	Countries (aggregated from institutional level primary data)
Coverage	EU28 + USA, Japan, Canada, Brazil
Attributes	• Institutional, multi-institutional, sub-institutional, and thesis mandates within the ERA and in selected countries • Types of repositories used to archive open access scholarly publications • Incentives used to promote open access archiving and publication of scholarly publications

Table 7.2.4.4. Potential indicator for OA, OA4

Information Item	OA4
Name of indicator	Stakeholders' perception of access to digital resources
Brief description	The indicator is formed by a set of questions to various stakeholders (national governments, regional and local governments, research funding organisations, university/research institutes, libraries, publishers, international organisations, individual researchers, citizens and respondents identified as 'other', among which there were NGOs, industries, charities, learned societies and scientific and professional associations) on their perception of access to digital resources.
Analytical level (logic model)	Context-related
Analytical level (aggregation)	Country level
Qual / Quant	Quantitative
Source of data	European Commission. Directorate-General for Research and Innovation. Report on the online survey on scientific information in the digital age held from July-September 2011.
Date	2012
Time-series	No
Measurement level	Ordinal
Unit of analysis	Countries (aggregated from individual level primary data)
Coverage	28 Member States
Attributes	• Should publications resulting from publicly funded research be available OA • Does OA increase access to and dissemination of scientific publications • Can OA coexist with the traditional publication system • Preferred way in which public policy can increase OA to scientific publications

Table 7.2.4.5. Potential indicator for OA, OA5

Information Item	OA5
Name of indicator	FP7 project coordinators' perception of self-archiving
Brief description	The indicator represents a set of questions on the issue of self-archiving.
Analytical level (logic model)	Output-related
Analytical level (aggregation)	EU-level
Qual / Quant	Quantitative
Source of data	European Commission. Directorate-General for Research and Innovation. Survey

	on open access in FP7.
Date	2012
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual level primary data
Coverage	States participating in FP7

Attributes	• Opinion on the implementation of Special Clause 39
	  ○ Having time/manpower to self-archive
	  ○ Getting enough external support (e.g. toolkits)
	  ○ Identifying a new, satisfactory publisher (journal)
	  ○ Changing publishers/journals
	  ○ Negotiating with the publishers/journals
	• Articles deposited in a repository
	• Open AIRE

Table 7.2.4.6. Potential indicator for OA, OA6

Information Item	OA6
Name of indicator	FP7 project coordinators' perception of open-access publishing
Brief description	The indicator represents a set of questions on the issue of open-access publishing.
Analytical level (logic model)	Output-related
Analytical level (aggregation)	EU-level
Qual / Quant	Quantitative
Source of data	European Commission. Directorate-General for Research and Innovation. Survey on open access in FP7.
Date	2012
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual level primary data
Coverage	States participating in FP7
Attributes	• Knowledge of the possibility of reimbursement • Use of reimbursement of open access publishing • Future use of reimbursement of open access publishing • Views on open access publishing

Table 7.2.4.7. Potential indicator for OA, OA7

Information Item	OA7
Name of indicator	Open Data Barometer
Brief description	The indicator is a composite index indicator showing to what extent countries make date open to various socioeconomic groups. It combines peer-reviewed expert survey data and secondary indicators to look at open data readiness, implementation and emerging impacts.
Analytical level (logic model)	Context-related
Analytical level (aggregation)	Country-level
Qual / Quant	Quantitative
Source of data	Tim Davies et al. Open Data Barometer. 2013 Global Report. World Wide Web Foundation
Date	2013
Time-series	No
Measurement level	Ordinal / Ratio
Unit of analysis	Country
Coverage	Global (77 countries)
Attributes	• Readiness sub-index • Implementation sub-index • Impact sub-index • Open Data Barometer Overall

Table 7.2.4.8. Potential indicator for OA, OA8

Information Item	OA8
Name of indicator	Existing funder mandates for open access publishing
Brief description	The indicator presents if and how many funder mandates for open access publishing there are in the EU Member States.
Analytical level (logic model)	Input-related
Analytical level (aggregation)	Country-level
Qual / Quant	Quantitative
Source of data	Commission Staff Working Document Impact Assessment Accompanying the document Commission Recommendation on access to and preservation of scientific information in the digital age {C(2012) 4890 final} {SWD(2012) 221 final} based on openaire.eu
Date	2011
Time-series	No
Measurement level	Ratio
Unit of analysis	Country
Coverage	Member States (excluding Croatia)
Attributes	• Number of funder mandates (if applicable)

Table 7.2.4.9. Potential indicator for OA, OA9

Information Item	OA9
Name of indicator	Number of open access journals in 2011
Brief description	The indicator how many open access journals there are in the EU Member States (as of 2011).
Analytical level (logic model)	Output-related
Analytical level (aggregation)	Country-level
Qual / Quant	Quantitative
Source of data	Commission Staff Working Document Impact Assessment Accompanying the document Commission Recommendation on access to and preservation of scientific information in the digital age {C(2012) 4890 final} {SWD(2012) 221 final} based on www.doaj.org
Date	2011
Time-series	No
Measurement level	Ratio
Unit of analysis	Country
Coverage	Member States (excluding Croatia)
Attributes	• Number of open access journals as of 2011

Table 7.2.4.10. Potential indicator for OA, OA10

Information Item	OA10
Name of indicator	Number of open access repositories
Brief description	The indicator presents how many open access repositories there are in the EU Member States.
Analytical level (logic model)	Output-related
Analytical level (aggregation)	Country-level
Qual / Quant	Quantitative
Source of data	Commission Staff Working Document Impact Assessment Accompanying the document Commission Recommendation on access to and preservation of scientific information in the digital age {C(2012)

	4890 final} {SWD(2012) 221 final} based on www.opendoar.org
Date	2011
Time-series	No
Measurement level	Ratio
Unit of analysis	Country
Coverage	Member States (excluding Croatia)
Attributes	• Number of open access repositories

Table 7.2.4.11. Potential indicator for OA, OA11,

Information Item	OA11
Name of indicator	Metric model of data publishing
Brief description	Indicators based on the data publication models aimed to measure the presence of data publications. Two dimensions of metrics are proposed: size dependent (these are metrics that capture the raw performance, in terms of data outputs) and size independent indicators(metrics capturing relative performance of outputs and units of analysis, e.g. through means or medians; and they can also capture an indicator on the publication venues, e.g. data journals or data repositories)
Analytical level (logic model)	Output-related
Analytical level (aggregation)	Multi-level (e.g. data publication level, data creator, institutional indicators, countries, publication venues, etc.)
Qual / Quant	Quantitative
Source of data	Costas et al (2013)
Date	2013
Time-series	Possible
Measurement level	Total counts, ratios, medians, and other statistics (e.g. percentiles, correlations, etc.)
Unit of analysis	Multi-level (data publications, individuals, groups, institutions, geographical entities, data venues, etc.)
Coverage	Global (but dependent on the coverage of the different repositories and sources providing the metrics)
Attributes	• Number of open data repositories

Table 7.2.4.12. Potential indicator for OA, OA12,

Information Item	OA12
Name of indicator	Metric model of data usage
Brief description	Indicators based on the data publication models aimed to measure the usage of data publications (e.g. citations). Two dimensions of metrics are proposed: size dependent (these are metrics that capture the raw performance, in terms of data citations) and size independent indicators (metrics capturing relative performance of citations and units of analysis, e.g. through means or medians;
Analytical level (logic model)	Outcome related
Analytical level (aggregation)	Multi-level (e.g. data publication level, data creator, institutional indicators, countries, publication venues, etc.)
Qual / Quant	Quantitative
Source of data	Costas et al (2013)
Date	2013
Time-series	Possible
Measurement level	Total counts, ratios, medians, and other statistics (e.g. percentiles, correlations, etc.)
Unit of analysis	Multi-level (data citations, individuals, groups, institutions, geographical entities,

Information Item	OA12
	data venues, etc.)
Coverage	Global (but dependent on the coverage of the different repositories and sources providing the metrics)
Attributes	• Number of open data repositories

7.2.5 Promising indicators within the RRI dimension of Governance

No specific indicators have been provided for the governance dimension at this stage in the research process. Yet, many of the potential cross-dimensional interlinkages depicted in Figure 5.1 relate to the governance dimension. In this sense, the monitoring of Governance may be partly covered by indicators connected to other RRI dimensions. Primary data indicators are, however, needed to fully capture the Governance aspect. Both of these issues will be systematically addressed in Deliverable 3.2.

7.2.6 Promising indicators within the RRI dimension of ETH

7.2.6.1. Potential indicator for Ethics, ETH1

Information Item	Ethics 1
Name of indicator	A typology of public ethics
Brief description	This indicator is a composite measure building on the following parameters: 1) the percentage of respondents who think that in a disagreement between science and ethics in the context of regenerative medicine, the ethical view should prevail (ethics over science or science over ethics), 2) for GM food, nanotechnology and animal cloning, the average level of concern about distributional fairness – whether 'it will benefit some people but put others at risk' and whether 'it will help people in developing nations', which is referred to as distributional fairness, 3) the percentage of respondents who would want to know about the moral and ethical issues involved in synthetic biology if they were deciding how to vote in a referendum, which is referred to as interest in ethics, 4) the percentage of respondents who think that the governance of science, in relation to synthetic biology, and separately, animal cloning, should be based on moral and ethical considerations rather than scientific evidence (moral governance versus scientific governance). The typology is based on the Eurobarometer on biotechnology in 2010, and divides 33 countries into 5 clusters.
Analytical level (logic model)	Output
Analytical level (aggregation)	Country level (aggregated from individual level data)
Qual / Quant	Quantitative
Source of data	EB 73.1, typology developed in the STEPE project
Date	2010
Time-series	No
Measurement level	Nominal
Unit of analysis	Countries
Coverage	33 European countries
Attributes	• Cluster 1: interest in ethics/science first • Cluster 2: Distributional fairness/science first • Cluster 3: Science first/low to moderate interest in ethical issues • Cluster 4: Distributional fairness/science second • Cluster 5: Moral governance/science second

7.2.6.1. Potential indicator for Ethics, ETH2

Information Item	Ethics 2
Name of indicator	Ethics over science
Brief description	This indicator taps into the relative importance of ethical concerns vis-à-vis scientific evidence. It is based on Eurobarometer data collection, and the specific item reads: 'should ethical and scientific viewpoints on regenerative medicine differ, the scientific viewpoint should prevail.
Analytical level (logic model)	Context/output?
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree

	• Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.3. Potential indicator for Ethics, ETH3

Information Item	Ethics 3
Name of indicator	GM Food helps people in developing countries
Brief description	This indicator taps into public perceptions of ethics in relation to GM foods. It is based on Eurobarometer data collection, and the specific item reads: 'GM food helps people in developing countries'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.4. Potential indicator for Ethics, ETH4

Information Item	Ethics 4
Name of indicator	GM Food benefits some people but puts others at risk
Brief description	This indicator taps into public perceptions of ethics in relation to GM foods. It is based on Eurobarometer data collection, and the specific item reads: 'GM food benefits some people but puts others at risk'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal

Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.5. Potential indicator for Ethics, ETH5

Information Item	Ethics 5
Name of indicator	GM Food is fundamentally unnatural
Brief description	This indicator taps into public perceptions of ethics in relation to GM foods. It is based on Eurobarometer data collection, and the specific item reads: 'GM food is fundamentally unnatural'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.6. Potential indicator for Ethics, ETH6

Information Item	Ethics 6
Name of indicator	Nanotechnology helps people in developing countries
Brief description	This indicator taps into public perceptions of ethics in relation to nanotechnology. It is based on Eurobarometer data collection, and the specific item reads: 'Nanotechnology helps people in developing countries'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No

Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.7. Potential indicator for Ethics, ETH7

Information Item	Ethics 7
Name of indicator	Nanotechnology benefits some people but puts others at risk
Brief description	This indicator taps into public perceptions of ethics in relation to nanotechnology. It is based on Eurobarometer data collection, and the specific item reads: 'nanotechnology benefits some people but puts others at risk'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.8. Potential indicator for Ethics, ETH8

Information Item	Ethics 8
Name of indicator	Nanotechnology is fundamentally unnatural
Brief description	This indicator taps into public perceptions of ethics in relation to nanotechnology. It is based on Eurobarometer data collection, and the specific item reads: 'nanotechnology is fundamentally unnatural'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010

Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.9. Potential indicator for Ethics, ETH9

Information Item	Ethics 9
Name of indicator	Animal cloning in food production helps people in developing countries
Brief description	This indicator taps into public perceptions of ethics in relation to animal cloning for food production. It is based on Eurobarometer data collection, and the specific item reads: 'Animal cloning for food production helps people in developing countries'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.10. Potential indicator for Ethics, ETH10

Information Item	Ethics 10
Name of indicator	Animal cloning in food production benefits some people but puts others at risk
Brief description	This indicator taps into public perceptions of ethics in relation to animal cloning for food production. It is based on Eurobarometer data collection, and the specific item reads: 'Animal cloning for food production benefits some people but puts others at risk'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1

Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.11. Potential indicator for Ethics, ETH11

Information Item	Ethics 11
Name of indicator	Animal cloning in food production is fundamentally unnatural
Brief description	This indicator taps into public perceptions of ethics in relation to animal cloning for food production. It is based on Eurobarometer data collection, and the specific item reads: 'Animal cloning for food production is fundamentally unnatural'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.12. Potential indicator for Ethics, ETH12

Information Item	Ethics 12
Name of indicator	Research involving human embryos should be forbidden
Brief description	This indicator taps into public perceptions of ethics in relation to regenerative medicine. It is based on Eurobarometer data collection, and the specific item reads: 'Research involving human embryos should be forbidden, even if this means that possible treatments are not made available to ill people'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)

Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.13. Potential indicator for Ethics, ETH13

Information Item	Ethics 13
Name of indicator	Ethically wrong to use human embryos in research
Brief description	This indicator taps into public perceptions of ethics in relation to regenerative medicine. It is based on Eurobarometer data collection, and the specific item reads: 'It is ethically wrong to use human embryos in medical research even if it might offer promising new medical treatments'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.14. Potential indicator for Ethics, ETH14

Information Item	Ethics 14
Name of indicator	Research involving human embryos should be allowed
Brief description	This indicator taps into public perceptions of ethics in relation to regenerative medicine. It is based on Eurobarometer data collection, and the specific item reads: 'We have a duty to allow research that might lead to important new treatments, even when it involves the creation or use of human embryos'.

Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.15 Potential indicator for Ethics, ETH15

Information Item	Ethics 15
Name of indicator	Mixing human and animal genes
Brief description	This indicator taps into public perceptions of ethics in relation to regenerative medicine. It is based on Eurobarometer data collection, and the specific item reads: 'Mixing animal and human genes is unacceptable even if it helps medical research for human health'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.16. Potential indicator for Ethics, ETH16

Information Item	Ethics 16
Name of indicator	Regenerative medicine and inequality
Brief description	This indicator taps into public perceptions of ethics in relation to regenerative

	medicine. It is based on Eurobarometer data collection, and the specific item reads: 'You do not support developments in regenerative medicine if it only benefits rich people'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.17. Potential indicator for Ethics, ETH17

Information Item	Ethics 17
Name of indicator	Regenerative medicine and distributional equality
Brief description	This indicator taps into public perceptions of ethics in relation to regenerative medicine. It is based on Eurobarometer data collection, and the specific item reads: 'Research on regenerative medicine should be supported, even though it will benefit only a few people'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.18. Potential indicator for Ethics, ETH18

Information Item	Ethics 18
Name of indicator	Regenerative medicine and risks to future generations
Brief description	This indicator taps into public perceptions of ethics in relation to regenerative medicine. It is based on Eurobarometer data collection, and the specific item reads: 'Research into regenerative medicine should go ahead, even if there are risks to future generations'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Ordinal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Totally agree • Tend to agree • Tend to disagree • Totally disagree • Don't know

7.2.6.19. Potential indicator for Ethics, ETH19

Information Item	Ethics 19
Name of indicator	Scientific or moral decision making regarding synthetic biology
Brief description	This indicator taps into public perceptions of decision making in relation to synthetic biology, targeting specifically the weight of scientific and moral/ethical issues respectively in decision making. It is based on Eurobarometer data collection, and the specific item reads: 'Which of the following views are closest to your own?'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Nominal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Decisions about synthetic biology should be based primarily on scientific evidence • Decisions about synthetic biology should be based primarily on the moral and ethical issues • Don't know

7.2.6.20. Potential indicator for Ethics, ETH20

Information Item	Ethics 20
Name of indicator	Delegation or democracy in decision making about synthetic biology
Brief description	This indicator taps into public perceptions of decision making in relation to synthetic biology, targeting specifically the weight of expert-based and democratic principles respectively in decision making. It is based on Eurobarometer data collection, and the specific item reads: 'Which of the following views are closest to your own?'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Nominal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Decisions about synthetic biology should be based mainly on the advice of experts • Decisions about synthetic biology should be based mainly on what the majority of people in a country thinks • Don't know

7.2.6.21. Potential indicator for Ethics, ETH21

Information Item	Ethics 21
Name of indicator	Scientific or moral decision making regarding animal cloning
Brief description	This indicator taps into public perceptions of decision making in relation to animal cloning, targeting specifically the weight of scientific and moral/ethical issues respectively in decision making. It is based on Eurobarometer data collection, and the specific item reads: 'Which of the following views are closest to your own?'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Nominal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Decisions about animal cloning should be based primarily on scientific evidence • Decisions about animal cloning should be based primarily on the moral

	and ethical issues • Don't know

7.2.6.22. Potential indicator for Ethics, ETH22

Information Item	Ethics 22
Name of indicator	Delegation or democracy in decision making about animal cloning
Brief description	This indicator taps into public perceptions of decision making in relation to animal cloning, targeting specifically the weight of expert-based and democratic principles respectively in decision making. It is based on Eurobarometer data collection, and the specific item reads: 'Which of the following views are closest to your own?'.
Analytical level (logic model)	Context
Analytical level (aggregation)	Individual level data (could be aggregated)
Qual / Quant	Quantitative
Source of data	EB 73.1
Date	2010
Time-series	No
Measurement level	Nominal
Unit of analysis	Individual citizens
Coverage	Around 32.000 citizens across 33 countries
Attributes	• Decisions about animal cloning should be based mainly on the advice of experts • Decisions about animal cloning should be based mainly on what the majority of people in a country thinks • Don't know

7.2.6.23. Potential indicator for Ethics, ETH23

Information Item	Ethics 23
Name of indicator	Infrastructure of ethical governance
Brief description	Indicates the existence or lack of institutions of ethical governance.
Analytical level (logic model)	Input
Analytical level (aggregation)	Institutional (can be aggregated)
Qual / Quant	quantitative
Source of data	EPOCH, MASIS, SATORI
Date	2010, 2011, 2015
Time-series	
Measurement level	rational
Unit of analysis	Institutions, countries
Coverage	32 countries
Attributes	• Existence of bodies governing ethics in R&I

7.2.6.24. Potential indicator for Ethics, ETH24

Information Item	Ethics 24
Name of indicator	Infrastructure for Ethical Deliberation
Brief description	Indicates the existence or lack of institutions of ethical deliberation.
Analytical level (logic model)	Input
Analytical level (aggregation)	Institutional (can be aggregated)
Qual / Quant	Quantitative
Source of data	MASIS, SATORI, PACITA (?)
Date	2010, 2014, 2015
Time-series	
Measurement level	Rational
Unit of analysis	Institutions, countries
Coverage	32 countries
Attributes	• Existence of bodies deliberating ethics in R&I

7.2.6.25. Potential indicator for Ethics, ETH25

Information Item	Ethics 25
Name of indicator	Infrastructure for Ethical Reflection
Brief description	Indicates the existence or lack of institutions of ethical deliberation.
Analytical level (logic model)	Input
Analytical level (aggregation)	Institutional (can be aggregated)

Qual / Quant	Quantitative
Source of data	MASIS, SATORI (?)
Date	20110, 2014, 2015
Time-series	
Measurement level	Rational
Unit of analysis	Institutions, countries
Coverage	32 countries
Attributes	• Existence of institutions reflecting ethics in R&I

7.2.6.26. Potential indicator for Ethics, ETH26

Information Item	Ethics 26
Name of indicator	Public Engagement in Ethical Infrastructure
Brief description	Indicates how deeply and in what way the public is involved in institutions of ethical deliberation. Indicates process quality. Broad inclusion and interdisciplinarity could increase validity and legitimacy.
Analytical level (logic model)	Input
Analytical level (aggregation)	countries
Qual / Quant	Qualitative
Source of data	EPOCH
Date	2010
Time-series	
Measurement level	Qualitative
Unit of analysis	countries
Coverage	32 countries
Attributes	• Public discussion (never, sometimes, always)) • Organising public events (no, presentation of findings, education, dialogue & debate) • Specific public participation mechanism • Involving particular target groups • Public involvement mechanism (communication, consultation, participation)

7.2.6.27. Potential indicator for Ethics, ETH27

Information Item	Ethics 27
Name of indicator	Publication
Brief description	Are results published? Indicates process quality. Public involvement could increase validity and legitimacy.
Analytical level (logic model)	Output
Analytical level (aggregation)	Institutional, national
Qual / Quant	Qualitative

Source of data	EPOCH, SATORI (?), NEC-Forum
Date	2010, 2015
Time-series	no
Measurement level	Qualitative
Unit of analysis	Institutions, countries
Coverage	32 countries
Attributes	• Publish the work results (always, sometimes)

7.2.6.28. Potential indicator for Ethics, ETH28

Information Item	Ethics 28
Name of indicator	Output
Brief description	What is the output of the ethics advisory bodies. Number of opinions produced indicates at the activity of an organisation.
Analytical level (logic model)	output
Analytical level (aggregation)	Institutional, national
Qual / Quant	Quantitative
Source of data	NEC-Forum
Date	2015
Time-series	yes
Measurement level	qualitative
Unit of analysis	Institutions, countries
Coverage	Members of the NEC Forum
Attributes	• Numbers of publications