EFFORTI

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A Conceptual Evaluation Framework for Promoting Gender Equality in Research and Innovation

Toolbox I - A synthesis report

EFFORTI - Deliverable 3.3

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General Information on EFFORTI

EFFORTI (Evaluation Framework for Promoting Gender Equality in R&I) seeks to analyse and model the influence of measures to promote gender equality on research and innovation outputs and on establishing more responsible and responsive RTDI (research, technology, development, innovation) systems. For this purpose, EFFORTI will:

- develop an evaluation framework which enables evaluators, science managers, policy-makers and programme owners to conduct a sound analysis of the research and innovation outputs, outcomes and impacts of gender equality measures across Europe, with a focus on the national level;
- design a differentiated concept to analyse a variety of policy measures and assess their performance, taking into account the diversity in the national policies as well as organisational contexts;
- derive general lessons for evidence-based and thus "good" policy-making in the field of gender equality within RTDI systems. This means that not only has progress towards more gender equality in RTDI been achieved, but also that RTDI has been able to benefit from this progress through enhanced scientific and innovation outputs and productivity, as well as through a higher responsiveness to societal needs and challenges.

Terms of use

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1. Introduction

The introduction provides a brief overview of the objectives of the EFFORTI project. It is followed by a description of the aims of WP3, as well as an introduction to the EFFORTI Intervention Logic Model. Finally, the introduction clarifies the aims of the conceptual evaluation framework report for relevant stakeholders.

1.1. EFFORTI objectives

EFFORTI – *Evaluation Framework for Promoting Gender Equality in Research and Innovation* – is a project funded under the European Commission's (EC) Research and Innovation Action programme (RIA), as part of Horizon 2020 *Science with and for Society* (SWAFS). The aim of the project is to systematise and deepen knowledge on the scope, relevance, effectiveness and efficiency of gender equality policies with regard to research, technology, development and innovation (RTDI) by designing a common analytical framework.

The overall objective of the EFFORTI project is to provide tools that are both sophisticated and practical for the evaluation of gender equality (GE) policies across European countries. This will be done by developing a novel and detailed evaluation framework, including a model for analysis and evaluation of possible impacts of GE measures on RTDI. The model will include a toolbox with measurable indicators at team, organisation and system levels. The toolbox will be tested in selected case studies in seven countries. The EFFORTI evaluation framework will include tools for analysis and modelling of the influence of measures aimed at promoting gender equality in research and innovation (R&I) outputs, thereby supporting the establishment of a more responsible and more responsive RTDI system, which is in line with the current concept of responsible research and innovation (RRI) and targets societal needs and grand societal challenges of our time in the European context.[1]

EFFORTI contains three distinct objectives:

- Developing an *evaluation framework* that enables European RTDI stakeholders, such as evaluators, science managers, policy-makers, and programme owners, to conduct sound analyses of projects or initiatives within R&I, using the most adequate gender equality measures;
- Designing a *differentiated concept* which includes a broad variety of policy measures and assesses their performance taking contextual perspectives, i.e. national or local perspectives, into consideration;
- Deriving general *lessons for evidence-based policy-making* in the field of gender equality in the RTDI system, emphasising both responsiveness to societal challenges and needs, including gender equality, and to specific RTDI measures.

[1] For an overview of the currently prioritised grand challenges in the EU, see *Societal Challenges* (European Commission n.d.-b).

1.2. WP3 objectives

The main objective of WP3, which deliverable D3.3 belongs to, is to identify patterns and links between GE-promoting initiatives and impacts on R&I, through meta-analyses of performed evaluations of gender equality policies and other existing approaches from RTDI evaluations. WP3 comprises three main tasks and will deliver three main results:

- D3.1: Collection of quantitative and qualitative indicators for the three studied levels (micro – individuals/teams; meso – organisations; macro – national innovation systems/contexts)
- D3.2: Development of a tentative conceptual evaluation model on how measures can affect output and other outcomes
- D3.3: Draft proposal of the evaluation framework that can be tested and refined in the validation phase of WP4 (EFFORTI 1.0.)

WP3 is based on the insights gained through WP2 (mapping and context analysis) and contributes to WP4 (case studies and evaluation framework validation) and, in particular, to WP5 (toolbox development and valorisation).

In the first deliverable of WP3 (D3.1), we identified and collected quantitative and qualitative indicators at three studied levels (micro – teams; meso – organisations; macro – system/country). This collection served as a review of different important GE and (responsible) research and innovation studies as well as smart practices. This provided a basis for elaborating, improving and refining the pool of indicators that meet the needs of the EFFORTI project. The indicators collected in D3.1 constitute a starting point and will be reviewed and adapted throughout the project, according to the evidence delivered by the case studies in WP4 or by new insights from academic literature and the workshops organised in the frame of the project. The input provided by the stakeholders will be incorporated in the project results.

The aim of the second report (D3.2) was to present a tentative conceptual evaluation model of GE effects and impacts of GE measures on output and outcomes in R&I/RRI. The focus of D3.2 was on the EFFORTI evaluation logic model that laid the groundwork for the conceptualisation, selection and construction of GE in R&I indicators, and the methodological steps taken in the development of the conceptual model. Moreover, contextual factors were discussed in this report.

The aim of the report at hand is to discuss the process, starting at the systematic review of the literature to the description of the evaluation model and further development of the overall tentative proposal of the evaluation framework of EFFORTI. This report summarises the work carried out in the entire WP. The point of attention in D3.3 is the core set of indicators developed based on the EFFORTI logic model for the conceptualisation and construction of the framework and the EFFORTI Toolbox 1.0. The core set of indicators is described and the use of indicators for different types of stakeholders is clarified. Besides the contextual issues, the focus lies on the theory-based impact models that are the point of departure for the design of the conceptual evaluation framework.

The content, aim and structure of the present report are described in more detail in 1.4 and 1.5 below.

1.3. The EFFORTI point of departure and Intervention Logic Model

In EFFORTI, the gender equality objectives defined in the European Research Area (ERA) constitute the starting point of the intervention logic model. Within the scope of Horizon 2020, gender equality is a cross-cutting issue. Three objectives for fostering GE in research and innovation are promoted: (1) the number of women in RTDI, (2) the number of women in leadership positions, and (3) the integration of the gender dimension in research and curricula (European Commission 2014b). The objectives are briefly discussed in the following as they constitute the point of departure for the development of the conceptual evaluation framework.

1.3.1. More women in R&D

The European Union (EU) aims to make full use of its human capital in RTDI. Promoting gender equality contributes to higher research performance (European Commission 2012a), and research reveals that mixed-gender teams work more efficiently (if they are well-managed), are more creative and demonstrate better quality in terms of decision-making (European Commission 2014a, 12).

Improving women's participation in research requires impartial selection and recruitment processes conscious about gender biases, involving open job advertisements, and considering atypical career patterns. To increase the attractiveness of RTDI for women, equal payment, opportunities for growth and progression, as well as access to grants and funding must be ensured (European Commission 2014a, 10-14).

Moreover, it is essential that employers of researchers follow national and EU legislation on anti-discrimination and equal treatment. Research performing organisations (RPOs) and research funding organisations (RFOs) are encouraged to consider gender in connection with faculty recruitment, promotion, leaves and absences, and work climate, among other things (Lipinsky 2014, 11).

1.3.2. More women in leadership positions

A competitive global RTDI economy depends on involving female scientists also in leadership and decision-making positions. Excluding women from top positions in research may provoke social distrust, followed by reduced support for science and its institutions (European Commission 2012b).

The goal of having more women in decision-making positions addresses these problems and risks. This goal can be achieved by increasing the visibility of women who already work at the institution, for example, by nominating women for prizes and awards to provide role models for students and other female staff. Moreover, holding a decision-making position means having the possibility to influence research agenda and careers of young (female) researchers, to design curricula and be visible, for example, by participating in conferences as a (keynote) speaker (European Commission 2012b).

Getting more women into leadership positions in RTDI goes along with structural changes – EU-wide, nation-wide and, in particular, within research organisations and teams. For instance, gender-balancing committees and boards in RPOs and RFOs require that criteria, nominations and elections to committees and boards must become more transparent (European Commission 2012b) .

1.3.3. Integration of the gender dimension in research content and curricula

The third ERA goal, integrating the gender dimension in research content, means considering biological as well as evolving social and cultural characteristics of both women and men throughout the research process. The results of such consideration are the so-called gendered innovations, capable of identifying gender biases and recognising how they operate in science and technology (European Commission 2014b; Schiebinger & Schraudner 2011). Society benefits from gendered innovations because research becomes more responsive to societal needs, and business gets higher value through new ideas, patents, and enhanced technology (European Commission 2013c).

The report *Gendered Innovations: How Gender Analysis Contributes to Research* (European Commission 2013c) offers concrete case studies and methods of sex and gender analysis. Relevant subjects when developing gendered innovations include, for instance, rethinking research priorities and outcomes, analysing how sex and gender interact, and using participatory research designs. Enabling scientists and engineers to analyse sex and gender criteria in basic and applied research produces excellence in research, policy and practice in the fields of science, health and medicine, and engineering (Ovseiko et al. 2016).

The third ERA goal further requires that the gender dimension is integrated in teaching and curricula. A gender-sensitive curriculum addresses the needs of women and girls with regard to how developments in RTDI may constitute a benefit or disadvantage for them. It also addresses the horizontal segregation between males and females in education and the labour market by portraying both groups in non-stereotypical ways and by making science and technology classes more attractive to girls and women (UN Women 2011, 5, 8).

1.3.4. The EFFORTI Intervention Logic

As seen in Figure 1, the Intervention Logic Model considers inputs, throughputs, and outputs, as well as results and impacts of the former two, and does so by differentiating between three levels (team, organisation, country). The Intervention Logic Model goes beyond the state of the art in evaluating GE initiatives by also focusing on outputs or effects related to RTDI. More specifically, the model aims at providing both theory and tools for analysing how GE-related measures contribute to the achievement of the three main objectives stated in the model below (more women in research and development (R&D), women in leadership, and integrating the gender dimension in research). The model also aims at showing how, once achieved, these objectives or effects can further affect desired RTDI effects, such as the number of patents and number of publications and citations, but also new RTDI effects, such as providing answers to grand challenges and further promoting RRI. Additionally, the model includes three levels, i.e. team level (research quality, productivity, innovative outputs, and other RRI effects), organisational/institutional level (workplace quality, recruitment capacity, efficiency, RRI orientation, competitiveness), and country/system/policy level (intensity, productivity, ERA orientation, etc.). However, some measures will most likely overlap between different levels, which will be taken into account in the development of the toolbox.

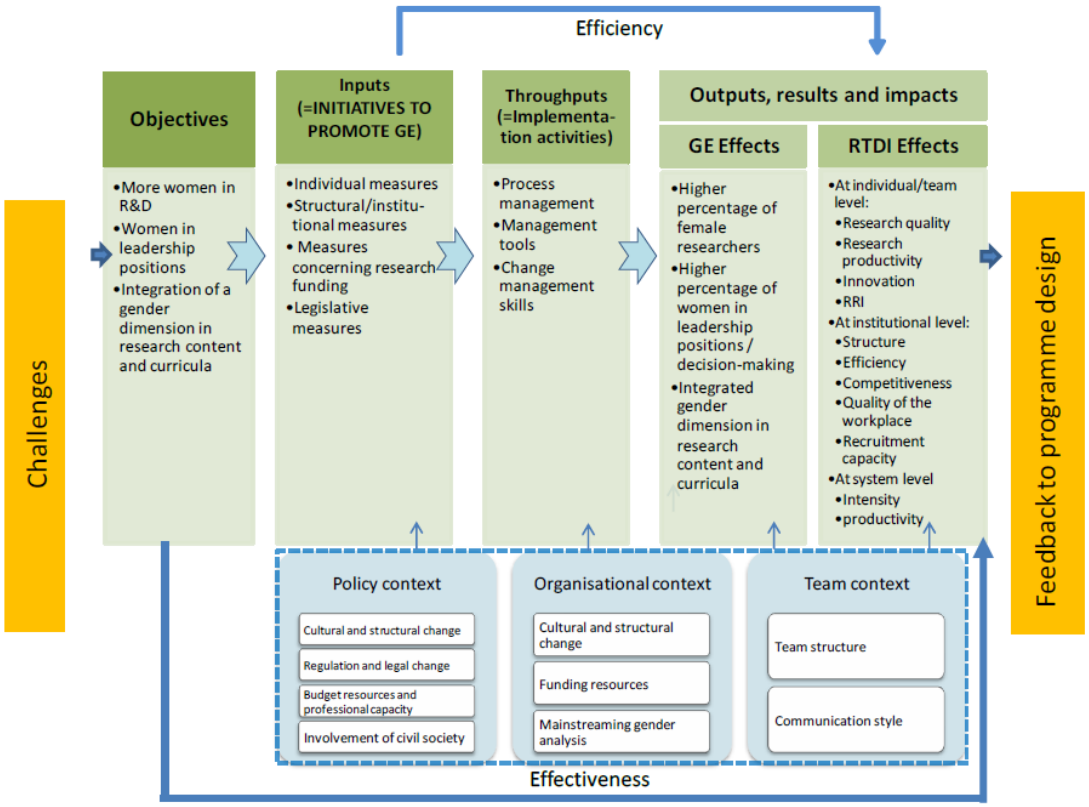

Figure 1: The EFFORTI Intervention Logic Model

1.4. Aims of the report and target users

As mentioned earlier, the final deliverable of WP3 (D3.3) presents a tentative proposal of the evaluation framework with a pool of indicators that will be tested in selected cases in seven European countries and will be refined in the validation phase of WP4 and in the course of WP5. It must be emphasised, however, that testing, elaborating, and improving the collection of indicators is a continuous task during the whole duration of the EFFORTI project as indicated in Figure 2.

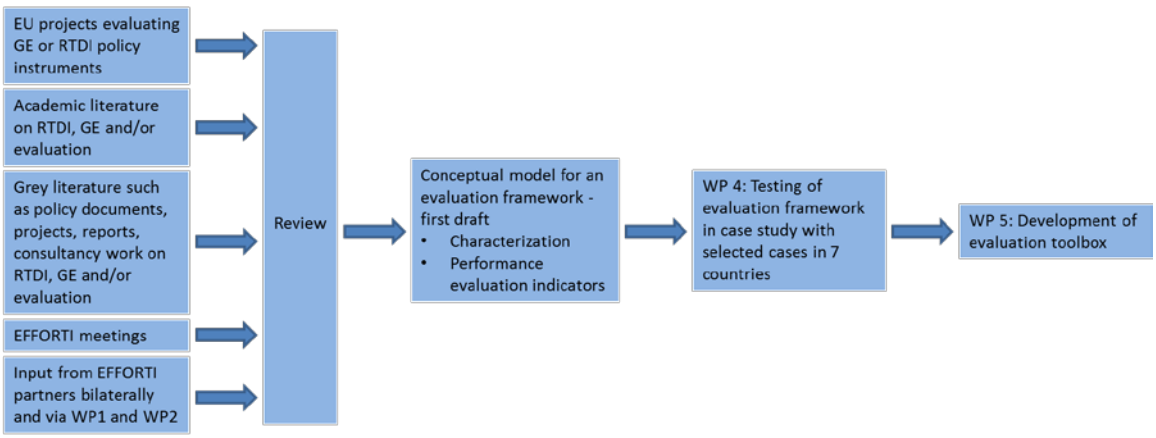

Figure 2: Graphical overview of WP3 process and contribution to WP4 and WP5

The target users of the EFFORTI project are ministries, research councils and other policy-makers, funding agencies, programme owners in the public and business sector, non-governmental organisations (NGOs), evaluators and other stakeholders interested in GE and RTDI.

1.5. Structure and focus of the report

The report at hand is a synthesis report and further development of reports D3.1. and D3.2, which were distributed exclusively among partners and to the European Commission and were hence of restricted character. In this report (D3.3), the content of some chapters is further developed based on the insights elaborated mainly in D3.2. However, some parts of the report are original D3.2 texts. Using content from D3.2 has, on the one hand, been necessary in order to describe in detail the philosophy and process of EFFORTI, and, on the other hand, to make the overall evaluation framework available to the public in its entirety. As the aim of the synthesis report is to reflect the entire process in developing the EFFORTI evaluation framework, the necessity to incorporate parts of D3.1 and D3.2 in D3.3 has been pertinent to understand the progress made and present it in the form of an independent, publicly available publication.

D3.3 comprises 6 chapters. First, in chapter 2, we discuss issues beyond the state of the art in RTDI evaluation research. The emphasis lies on the fact that EFFORTI is not limited to measuring only gender equality effects – it goes further and considers the effects of gender equality on RTDI. Chapter 2 hence focuses on the evaluation logic model for the conceptualisation, identification, selection and construction of GE in RTDI indicators and the methodological steps taken in the development of the conceptual evaluation framework, starting by elaborating on the key concepts that constitute the point of departure for the framework. Challenges, limitations and constraints of the adopted approach are also discussed in this chapter.

Chapter 3 sets the scene for the following chapters by focusing on the theoretical aspects of change and the conditions that must be present for the different links to be realised in order to achieve GE effects on RTDI, i.e. how interventions are expected to bring about the desired results. Based on the state of the art and the existing evidence at different intervention levels (team, organisation, system/country), this chapter focuses on the context of GE measures and elaborates on how contextual issues influence GE evaluations of measures implemented in RTDI. Chapter 3 also offers a discussion of how data and indicators can be used and understood in their context.

Chapter 4 identifies the links between GE and RTDI by focusing on the possible impacts of GE measures on RTDI, including RRI, and describes how GE can produce RTDI effects.

Chapter 5 presents the core set of indicators and describes each indicator in detail based on a common template. The description contains the logic model applied (based on the inputs, outputs, outcomes and impact (I-O-O-I) chain), level of observation (team, organisation, country/system), data collection methods, source of data, feasibility issues, limitations, links to literature and best practices, etc.

Finally, chapter 6 identifies and outlines generic theory-based impact models but also some models for the concrete cases that will be studied in the frame of the EFFORTI project.

2. From concepts to indicators

EFFORTI aims at contributing to a better understanding of the impacts of current GE initiatives from the science-management and policy-making perspectives and providing evidence of good practice along with concepts and tools for monitoring and evaluating GE initiatives and their effects on RTDI. This section first describes how the notion of impact is conceptualised and addressed. Second, the development of a typology of GE interventions in RTDI is presented. Third, a description is provided of the methodological steps undertaken to develop the EFFORTI Toolbox and its indicators along with its visualisation. Finally, limits and constraints are discussed.

2.1. Impact

A variety of models and contextualisations has been offered to evaluate the impact of projects, programmes, and policies in the field of RTDI. Impact can be construed as an overall term that sometimes includes indicators and assessments of performance, effectiveness, efficiency, output, outcome, along with short- and long-term effects of the evaluand; in other instances, impact is considered to cover a narrower spectrum of the above (Pedersen 2017; Klatt & Sandström 2016; Boekholt et al. 2014; Hansen & Jørgensen 1995).

The I-O-O-I (Inputs, Outputs, Outcomes and Impact) model constitutes the underlying analytical framework of EFFORTI which guides the understanding of the intervention logic in a linear, easily communicable manner. This necessarily involves a simplification of a complex process. In theory, establishing a causal link between a policy intervention and an observed impact requires the attribution of the observed change to the policy intervention. In practice, however, complex social contexts make such pursuits problematic (Cartwright & Hardie 2012; Dahler-Larsen 2012; Albæk 1989; Larsen & Lassen 2001). Therefore, rather than attributing effects, outcomes and impact, in EFFORTI, these concepts are dealt with by means of evaluative approaches that pursue contributions to achieve impact. As underlined in the literature, the ability of programmes to foster the right conditions for change is central in complex interventions (Reale et al. 2014), and impact assessment has to account for whether adequate "conditions for impact" are in place (Kalpazidou Schmidt & Cacace 2017).

Therefore, the following section focuses on the challenges and practices within the field of RTDI impact assessment.

2.1.1. RTDI impact assessment

Evaluation and assessment of impacts are important parts of the policy process, also with respect to gender equality. However, establishing causal relationships between policy interventions and observed changes poses a theoretical challenge as well as empirical and methodological problems. Based on the work done by the European Court of Auditors (2008), we can summarise the most important challenges as follows:

attribution problems: In the context of gender equality, attribution problems are highly relevant when evaluating structural measures focused on changing organisational behaviour and cultures. It is often difficult to say which effects are directly related to the intervention and its actions and how change has occurred, because interventions are implemented in complex environments.

measurement problems:

- data availability: Although assessing the status quo of gender equality is considered a prerequisite for developing and implementing GE initiatives, there is hardly any detailed data describing the ex-ante status besides some general indicators regarding the number of women researchers at different hierarchical levels. Therefore, the assessment of effects, benefits or outcomes must be based on ex-post perceptions by people involved in these initiatives.
- understanding the dynamics: Given the apparent difficulty to model the relations between inputs and outputs, the inner workings of research and innovation processes and the role gender equality can play here is unclear. Too narrow a perspective on outputs overlooks the complex interactions between these initiatives/measures and their environments, and the potentially unintentional effects stemming from these interactions.
- comparability of results: As gender inequalities are quite different between disciplines, measures to promote gender equality need to take the specific disciplinary, organisational and national contexts into account. This also applies to evaluation studies.
- aggregation: Simplistic extrapolation of evaluation results in terms of outputs, outcomes and impacts attained at the lower level to the next higher level is challenging, if not impossible.
- adequacy of indicators: A crucial question is whether evaluators are measuring the right thing. Institutions or organisations need to be confident that these indicators are appropriate and truthful. Therefore, it is extremely important to involve stakeholders like programme managers and owners, but also RTDI and gender equality experts, during the whole EFFORTI process. Furthermore, a "measurable" indicator for output does not necessarily permit conclusions on outcomes or impacts to be drawn.

timing problems: Typically, there is a considerable time lag from the research or GE activity until the generation of outputs and outcomes so that impact can be assessed. Data needs to be collected over the long term so that meaningful and robust conclusions can be drawn.

A range of hybrid approaches seeks to address these challenges. Such approaches aim to bridge the divide between effects studies struggling to pursue a "strict" notion of causal mechanisms that provide meaning in actual practice, on the one side, and a range of more interactive and process-oriented evaluation models that are closer to practice, but further distanced from generalisability and transferability, on the other side. As earlier discussed, according to these approaches, causality is often dealt with as a problem of contribution rather than attribution (Leeuw 2012; Patton 2012; Krogstrup 2016). An example is theory-based impact evaluation[2] (TBIE): in TBIE, "why and how" questions are asked instead of "how things would have been without" like counterfactual approaches do. The goal is to answer the "why it works" question by identifying the theory of change ("how things should logically work to produce the desired change") behind the

[2] TBIE bears some resemblance to theory-based evaluation (Chen 1990), realistic evaluation (Pawson & Tilley 1997), and the intervention theory method (Vedung 2009).

programme and assessing its success by comparing theory with actual implementation (Leeuw 2003; Leeuw & Vaessen 2009; Leeuw 2012; European Commission 2013a).

The main elements of theory-based impact evaluations are thus (i) an *intervention or programme theory,* i.e. an action and change theory that makes implicit or explicit assumptions on how and why an intervention should work, identifying impact pathways and mechanisms, and (ii) an *empirical investigation* of the programme/intervention theory. For this purpose, a contribution analysis is frequently used (Mayne 2015), addressing attribution through contribution analysis, using performance measures sensibly (Leeuw 2012; European Commission 2013a).

2.1.2. Assessing impact of GE initiatives in RTDI

In the EFFORTI project, a great deal of thought is given to how impact assessment should be performed, what concepts and methods appear to be adequate, and how to deal with theoretical and methodological challenges such as counterfactual reasoning, quantification, or time lags of effects. For evaluation in the field of RTDI policies, there is already a number of toolbox-like approaches that address these questions (Miles & Cunningham 2005; Fahrenkrog et al. 2002; Rhomberg, Steindl & Weber 2006; SQW Consulting 2009), which we can build upon in this more specific field of interest – GE instruments for science and innovation systems.

The effects of policy measures can occur at different points in time (short-, mid-, and long-term) and spread differently (at the direct level of participants or at the indirect level, i.e. beyond the participants). The effects can be distinguished between the following terms: outputs (short-term (measurable) results of funded projects); outcomes (effects on the programme's participants); and impacts (mid- or long-term indirect effects beyond the programme's participants, also known as spill-overs). Impacts can be further differentiated between direct and indirect, intended and unintended, and types of impacts, such as scientific, economic, social, environmental, etc. (Horvat 2011; European Commission 2009c; European Commission 2005), or constitutive effects (Dahler-Larsen 2014; Dahler-Larsen 2012; Dahler-Larsen & Krogstrup 2001a).

2.1.3. Impact assessment in context

Economic impacts are at the core of conventional RTDI impact assessment, but public policy's recent orientation towards grand challenges implies that public funding must better integrate different impact dimensions. In the EFFORTI context, social impacts seem particularly important: they include, for instance, acceptance of GE measures, changes in the gendered substructures of organisations or attitudes towards better integration of gender in the innovation system.

Impact assessments require that out of the complex set of programme goals, one has to state clearly the relevance and rank of different impact dimensions and whether a large set of impact dimensions can realistically be achieved by one single measure (see Kalpazidou Schmidt & Cacace 2017). With regard to policy design, this means that programme objectives must correspond to an appropriate mix of policy instruments. Therefore, the EFFORTI evaluation framework will dedicate a lot of attention to context variables like the national policy context as well as organisational incentive structures, as outlined in chapter 3.

2.2. Intervention typology

In advance of the development of the EFFORTI Toolbox offering indicators and methods useful for assessment of GE interventions in the RTDI field, we briefly provide a broad overview of such interventions. Synthesising the typologies developed by Kalpazidou Schmidt and Cacace (2017) and the issues promoted by the GENERA project and building on partner input made on the basis of theoretical and empirical experiences, we developed the intervention typology presented in Tab. 1 below.

Tab. 1: Overview of the developed intervention typology

Type of intervention	Intervention format	Level
Policies	Mainstreaming actions	Structural/organisational level and policy level
	Gender equality/action plan	Structural/organisational level and policy level
	Gender budgeting	Policy level
Non-discrimination	Gender-sensitive practices for the attribution of tasks	Structural/organisational level
	Gender-sensitive study and working conditions (e.g. alternative study plans for pregnancy during laboratory work period)	Individual/team level and structural/organisational level
	Guidelines regarding gender specifics	Structural/organisational level
Composition & integration	Definition of targets regarding gender balance in decision-making positions	Structural/organisational level and policy level
	Definition of targets regarding gender balance in research groups	Structural/organisational level and policy level
	Institution of quotas	Structural/organisational level
Advancement	Mentoring programmes	Individual/team level
	Gender-sensitive practices for assessment	Structural/organisational level
	Introduction of chairs and positions reserved to women	Structural/organisational level and policy level
	Support to career development (counselling)	Individual/team level
	Empowerment schemes	Individual/team level
Recruitment	Campaigns for inspiring women for MINT[3] subjects	Structural/organisational level
Monitoring	Monitoring appointments, promotions, or attributions of tasks	Structural/organisational level and policy level
Deconstructing excellence	Revision of internal policies regarding promotions	Structural/organisational level and policy level
	Revision of internal policies regarding staff appointments	Structural/organisational level and policy level
Gender awareness and bias	Training courses (different targets)	Individual/team level
Leadership accountability	Implementation of gender-sensitive leadership and personnel development	Structural/organisational level

[3] Mathematics, information technology, natural sciences and technology.

Funding	Targeting funding practices to improve women's access to research funding	Structural/organisational level
	(Targeted) funding to improve the integration of gender dimension in research	Structural/organisational level
	Special funding for women researchers	Structural/organisational level
Research	Gendered user involvement	Structural/organisational level
Knowledge	Dissemination of information material	Structural/organisational level
	Revision of teaching curricula and texts	Structural/organisational level
	Introduction of single-sex degree and specialisation courses	Structural/organisational level
	Provision of Gender and Women Studies or modules	Individual/team level and structural/organisational level
Visibility	Networking	Individual/team level
	Activities to make women (and their research) visible (e.g. introduction of awards reserved for women)	Individual/team level and structural/organisational level
	Role models	Individual/team level and structural/organisational level
Care & family life	Support in period of absence for family needs	Individual/team level
	Schemes for women returners	Individual/team level
	Care services and facilities (for children, the elderly, and others)	Structural/organisational level
	Support to mobility, including spouse relocation schemes	Individual/team level and structural/organisational level
Work-life balance	Inclusion of and monitoring the integration of the gender dimension and impact	Structural/organisational level
	Introduction of flexible working hours	Individual/team level and structural/organisational level

Drawing on the developed typology, the interventions of each of the case studies of the EFFORTI project were analysed and mapped accordingly. Examples of impact stories were developed for a broad spectrum of these intervention types in order to provide examples of the mechanisms regarding intervention intentions (see also chapter 3 for more on theory of change and chapter 6 on the impact stories) and to provide a common framework for understanding the multi-faceted interventions of the cases that will serve as a testing ground for the further EFFORTI Toolbox development in the next phases of the project.

2.3. Development of indicators

The collection of existing knowledge and practices of initiating and evaluating GE and RTDI policy measures took place through a review of relevant research publications and a range of evaluations of GE and/or RTDI measures/interventions. The review focused on smart practices within the field of GE and RRI. Furthermore, progress and recommendations of previous projects undertaken within EU programmes were taken into consideration.

Both qualitative and quantitative indicators are included in the tentative conceptual model for the toolbox. The collected indicators cover all three levels of policy interventions, namely micro (dealing with individuals or teams), meso (focusing on organisational issues such as institutional rules, incentives, structures, and processes), and macro (referring to rules, incentives, structures, and processes at regional, national or supranational level). In practice, the distinction between micro, meso and macro levels may not be entirely clear-cut, since the levels are interrelated and many indicators can be applied at more than one of these levels.

Indicators aiming at assessment at all stages (inputs, throughputs, outputs, outcomes and impact) of an intervention are included. The distinction between different policy stages is analytically derived. This means that the applied I-O-O-I model (Inputs, Outputs, Outcomes and Impact) is the underlying analytical framework guiding the understanding of the intervention logic in a linear, easily communicable manner. In practice, however, any single GE measure interacts with other interventions in a dynamic and adaptive system of complex interwoven mechanisms. Thanks to its inclusivity and flexibility, the EFFORTI Toolbox aims at enhancing evaluation procedures that collect rich data in new ways that are better suited to assess GE interventions in RTDI in complex contexts, where experiment-based knowledge may not be adequate or meaningful and easily transferable.

The indicators are obviously not mutually exclusive. Identification and labelling of the indicators and methods used to characterise and assess RTDI/GE policy measures took place in several steps as an extraction process with an increasing number of indicators included at a decreasing level of detail. Several specific examples of GE policy analyses were selected, representing a large variation in terms of geographical and institutional/organisational contexts as well as in scope and type of policy instrument and evaluation methods. These examples include the smart practices collected by all EFFORTI partners.

From a dense list of dimensions and subdimensions, five main categories have been identified and presented in an indicator scheme to support the design, instrumentation and assessment of future evaluations of the link between GE and RTDI (Kalpazidou Schmidt et al. 2017c). An overview of the indicator categorisation with different dimensions and subdimensions is presented in the following section.

All in all, based on the existing evidence and knowledge, the project team undertook the following steps:

- First, identifying the most relevant indicators according to a systematic literature review.
- Second, clustering these indicators into different categories, dimensions and sub-dimensions which are based on GE-related literature and smart practice examples implemented in different organisations and contexts.
- Third, substantiating and conceptualising these indicators according to an evaluation logic model differentiating between input, throughput, output, outcome and impact aspects.
- Fourth, illustrating the indicators at micro/individual or team level, meso/organisational level and macro/policy or country level. Contextual indicators are treated as cross-cutting indicators that have comprehensive influence on indicators from input to outcome.

Due to our acknowledgement of the complex connections between inputs, throughputs, outputs, outcomes and impacts in relation to evaluations of interventions and GE measures, a linear understanding of causalities is challenging (Kalpazidou Schmidt & Cacace 2017). The interventions and measures for which the EFFORTI Toolbox aims to provide evaluation support are embedded in different contexts with regard to socio-

economic and political systems and organisational settings and thus develop differently within their contexts. For this purpose, seven country notes have been written (for Austria, Denmark, France, Germany, Hungary, Spain and Sweden) where contextual framework conditions (such as the structure and performance of the innovation systems, gender equality in the labour market, welfare policies related to childcare and governance of gender equality in RTDI) structuring the situation of women in RTDI, their career opportunities and relevance of gender equality in RTDI have been described. These reports also mapped the existing evaluations of initiatives and programmes to promote gender equality in RTDI and the dominant evaluation culture in each country (Bührer et al. 2017; Füleki et al. 2016; Kalpazidou Schmidt et al. 2017a; 2017b; Muller 2017; Reidl et al. 2017a). Hence, the collection and determination of GE-related indicators which form the evaluation framework is based on a literature review of mainly process and implementation, output, outcome and impact evaluations that were embedded in various contexts and differed in their core objectives.

Moreover, the indicators are based on the collection and review of "smart practices" implemented in Europe and beyond. The smart practices demonstrate practices and experiences in methodologies or techniques that seek to measure the link between gender equality and RTDI at different levels, implemented by different kinds of actors. The methodology of identifying the smart practices is described in the following section.

2.3.1. Smart practice methodology

The identification of smart practices was based on an assessment of the practices that are relevant, effective and efficient in the context that they operate in as to their quality of both evaluation and measurement (Kalpazidou Schmidt et al. 2017c). Smart practice examples evaluated measures of different nature and length: some constituted large national programmes with a long-term perspective, while others were of a more limited character. Some of the smart practices aimed, for example, at evaluating (1) the policies and practices to eliminate gender bias and promote an inclusive culture that values female staff (the Athena SWAN programme); (2) the visibility of female accomplishments in science (Laura Bassi Centres of Expertise); (3) the effect of motivating women with young children to re-enter the labour market earlier; (4) the participation and advancement of women in academic science and engineering careers (Advance IT programme); (5) the gender integration in leadership (AKKA); (6) the mentoring programmes for women in atmospheric sciences (ESWN); (7) the advancement of female faculty in science, technology, engineering and mathematics (STEM) (LEAP); or (8) the gender equality measures implemented within higher education (in the Netherlands).

Evaluation literature has the following understanding of a smart practice: it allows us to learn from others, produce considerable synergies and facilitate successful, innovative and effective evaluation practices, and provides orientation for the development of new innovative evaluation tools. Furthermore, a smart practice is an evaluation that takes contextual and systemic factors into consideration when assessing an intervention or a measure. Finally, a smart practice demonstrates a reliable and consistent evaluation of positive or negative effects of gender equality measures on RTDI.

The selection of smart practices was based on the criteria of (1) the quality of the implemented measures, and (2) the impact of the measures. The *quality of the measures* was assessed based on the parameters of relevance, effectiveness, efficiency, and sustainability of the interventions, while *the impact of the measures*

was assessed in relation to its subjective/objective dimension (Kalpazidou Schmidt & Cacace 2017). A brief explanation of the different criteria used to identify the smart practices is presented below:

- **Relevance** refers to the adequacy of the initiatives included in the intervention to the situation of the team/organisation/system in which they are conducted and/or the wider social, cultural and economic contexts of reference for RTDI in the countries involved.
- **Effectiveness** addresses the capacity to implement the measure according to the stated objectives and attain the objectives outlined in the design of the activities (i.e. planned measures and activities, completed activities, compliance with planned schedules).
- **Efficiency** refers to the capacity to make the best use of available resources, complying with the timeframes and procedures contemplated for expenses in the context of good managerial capacity (compliance with schedules in granting funds for different initiatives, compliance with expenses criteria, management issues, etc.).
- **Sustainability** refers to the capacity of the measure to continue producing effects even after the end of the programme/intervention (such as new measures in direct continuity of those promoted by the intervention).

As to the **impact** of smart practices, we considered both the subjective and objective impact of the implemented measures. The criteria used are briefly explained below, with some examples of impact in both qualitative and quantitative terms. **Subjective impact** addresses the satisfaction of the targeted beneficiaries of the intervention (as well as the capacity to promote consensus among other stakeholders involved in the programme/measure). Subjective impact indicators could include, for example, job satisfaction or improved work climate. **Objective impact** refers to the effects obtained in terms of real change due to the measure, which may be expressed in numerical/quantitative terms (such as an increase in the proportion of women in senior and decision-making positions), but may also be of a cultural, structural or policy character, expressed in qualitative terms (such as a change in policies or work procedures of institutions implementing the measure or a change in the organisation's ability to generate innovations that reflect societal needs). Based on the smart practice review, objective impact indicators were thus identified, such as increased recruitment of talented women or increased presence of women in key roles in innovation processes.

Having the above-mentioned criteria as a point of departure and mapping the existing practices as regards context, objectives, methodology, instrumentation and impact, smart practice evaluations were identified and indicators for the three levels (micro, meso, macro) were derived that fulfilled the following conditions.

As to the measure itself:

- The smart practice met the **needs and priorities of the programme initiator**.
- The smart practice achieved its initial goal (**effectiveness**) with the allocated resources.
- The smart practice had a **demonstrable impact**.
- The smart practice was **sustainable**: the results were maintained even after the initiative/intervention.
- The smart practice had **learning potential** for other researchers, organisations and policy-makers.

As to the evaluation:

- The smart practice built on a variety of **evaluation concepts of GE measures** and instruments.
- The smart practice framed a variety of different **concepts for the measurement of research and innovation outputs**.
- The smart practice represented a variety of **impact assessment approaches.**
- The smart practice has been exercised within **diverse R&I frameworks**.
- The smart practice was characterised by various **theoretical and empirical tendencies** in the field of evaluation of GE interventions in R&I.

All in all, grounded on these prerequisites, scientific literature dealing with the link between GE and RTDI has been reviewed with the aim of identifying the most promising practices in Europe and beyond. A list of the smart practices is provided in Annex V.

2.3.2. Overview of indicator categorisation

Since one of the aims of the EFFORTI project is to develop an evaluation model emphasising the interconnections between GE and RTDI, the model – and the toolbox – aim at including categories and dimensions specifically relevant in terms of evaluating initiatives where a link between GE and RTDI can be established. The EFFORTI Toolbox 1.0 will be based on five main categories derived from an overview of relevant evaluation cases and smart practices as described above.

As the indicator scheme with the full list of identified indicators is rather detailed, the table below has been developed in order to provide an overview of the five main categories included in the EFFORTI model as well as the respective dimensions and subdimensions. A full, more elaborated list of all indicators within each subdimension can be found in Annex I. It should, however, be noted that the lists of categories, dimensions and indicators derived in EFFORTI serve as a schematic overview of possible indicators for use in future evaluations of policy measures and GE interventions in RTDI. This implies that the scheme cannot be exhaustive or static; therefore, future GE in RTDI measures and evaluations of interventions (such as the ones carried out in connection with the case studies in WP4) may uncover the need to revise the scheme and reveal additional categories, dimensions, subdimensions or indicators not included in the EFFORTI Toolbox at the present stage.

The five main categories identified are:

1. **Personnel**
2. **Working conditions**
3. **Professional capabilities**
4. **Structural features**
5. **Research and innovation/RRI**

Tab. 2: Categories, dimensions and subdimensions identified and developed for the EFFORTI Toolbox 1.0

Category	Dimension	Subdimension
1. Personnel	**1.1 Positions**	1.1.1 Increased number of women in academic and other RTDI positions
		1.1.2 Increased number of women in decision-making positions
	1.2 Recruitment capacity	1.2.1 Improved recruitment of talented women

2. Working conditions	**2.1 Work-life balance**	2.1.1 Improved compatibility of family and career
	2.2 Job satisfaction	2.2.1 Appropriate respect/recognition for (academic/scientific/leadership) work
		2.2.2 Positive individual job rating
		2.2.3 Overall work climate
		2.2.4 Allocation of workload
	2.3 Competitiveness/promotion and career	2.3.1 Transparent, non-biased and flexible promotion/tenure criteria
		2.3.2 Strengthened confidence for promotion and responsible positions
		2.3.3 Improved support to advance research career
	2.4 Workplace	2.4.1 Equal workspace/facilities allocation
3. Professional capabilities	**3.1 Leadership**	3.1.1 Increased confidence in and ability of leadership roles
	3.2 Professional achievements	3.2.1 Increased professional development of work skills (for career success)
		3.2.2 Improvement of network building and use
	3.3 Awareness of/commitment to GE	3.3.1 Increased gender awareness
	3.4 Funding to promote GE in terms of female careers	3.4.1 Increased funding to promote GE
4. Structural features	**4.1 GE challenges/barriers**	4.1.1 Decrease of GE barriers
	4.2 Organisational/cultural change with regard to GE	4.2.1 Organisational/cultural change with regard to GE
	4.3 Preferential treatment	4.3.1 Equal treatment
	4.4 Funding for structural transformation	4.4.1 Increased funding to achieve structural transformation
5. R&I/RRI	**5.1 Research outputs and impacts**	5.1.1 Scientific outputs
		5.1.2 Networks
		5.1.3 Training/human capital
		5.1.4 Strengthened R&I capacities/excellence
		5.1.5 Research priorities and outcomes in terms of GE
	5.2 Innovation outputs and impacts (incl. technological impacts)	5.2.1 Conventional innovation indicators
		5.2.2 Diffusion of innovation in products, services, processes
		5.2.3 Knowledge about sex and gender incorporated into engineering innovation processes
	5.3 Economic outputs and impacts (incl. entrepreneurships)	5.3.1 Economic impacts
		5.3.2 Entrepreneurship
		5.3.3 Strengthened framework conditions for R&I

		5.3.4 Jobs, growth & competitiveness of participants (incl. SMEs[4])
	5.4 Gender-sensitive research	5.4.1 Achieved gender equality in research process
		5.4.2 Research quality: integration of the gender dimension/perspective in research and content, in research projects, patents, and agreements
		5.4.3 Contributions to strengthening gender-sensitive research
	5.5 Responsible research and innovation (RRI)	5.5.1 Gender equality
		5.5.2 Ethics
		5.5.3 Public engagement
		5.5.4 Science education
		5.5.5 Open access
		5.5.6 RRI/governance
	5.6 Societal challenges	5.6.1 Research priorities & outcomes in terms of GE
		5.6.2 R&I indicators
	5.7 Societal and environmental impacts	5.7.1 Societal impacts
		5.7.2 Environmental impacts

A more detailed description of the different categories, dimensions and subdimensions is presented in Annex II.

2.3.3. Visualisation of the conceptual evaluation framework

As outlined above, the EFFORTI approach has its point of departure in theory-based evaluation models. In a theory-based evaluation, the assessed variables are chosen according to a theory that formulates assumptions about interventions and factors expected to be relevant to achieving desired outcomes (Fitz-Gibbon & Morris 1996; Kalpazidou Schmidt & Cacace 2017). Special attention is paid to the singularity of each intervention's context of implementation (Stufflebeam 2001) – consisting of specific team, organisational, regional and system constellations.

Theory-driven evaluations, especially in the form of change models, focus on the following questions: (i) in which way and (ii) under which conditions a programme intervention causes the intended and unintended effects (Döring & Bortz 2016, 1011). This division of theory-driven evaluation into 'how' and 'when' also results in a division of the EFFORTI Toolbox (see Figure 3). The first part of the toolbox will consist of guidelines, smart practice examples and indicator descriptions. The user of EFFORTI is supported in considering and understanding the 'when' (input and context dimensions) of the concrete gender equality measure. The user will be able to systematically include team, organisational and national/system context in a design or evaluation process. Guidance will be provided in terms of universal criteria about, for instance,

[4] Small- and medium-sized enterprises.

how to assess quality, impact or transferability of a gender equality measure (Kalpazidou Schmidt & Cacace 2017). This rather 'static' part of the toolbox will mainly consist of downloadable documents.

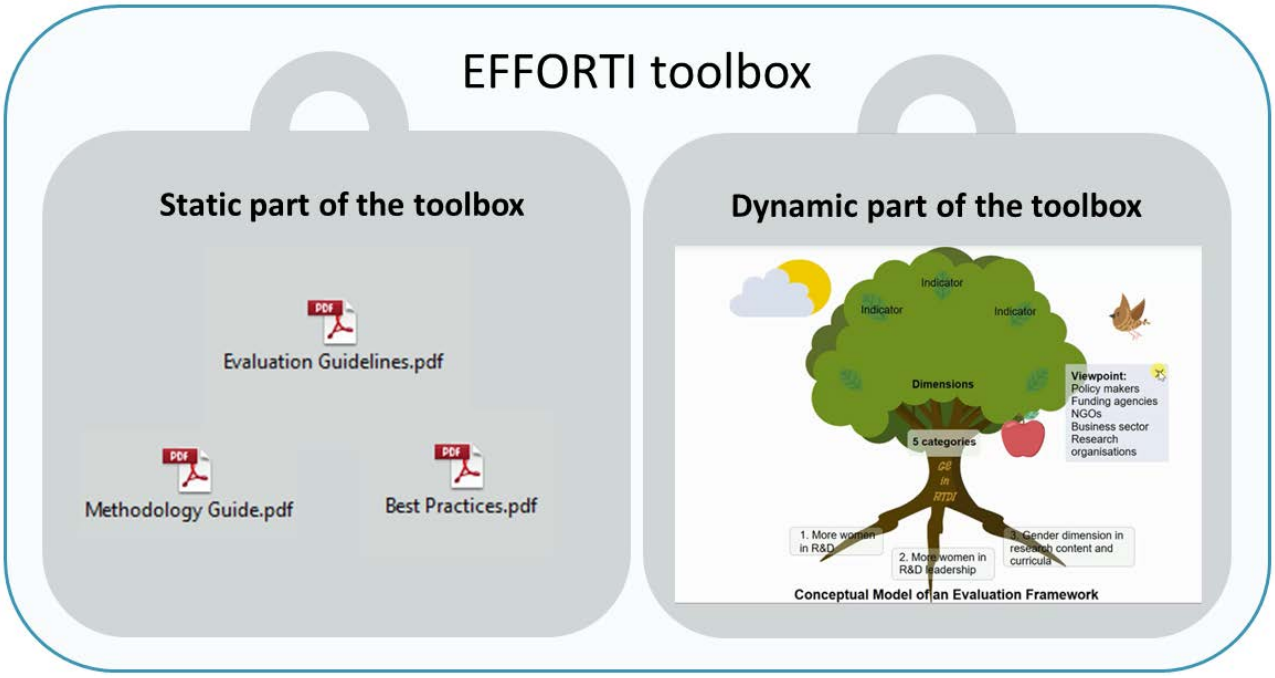

Figure 3: Illustration of the EFFORTI Toolbox as a static and a dynamic process

The second part of the EFFORTI Toolbox assists the user in understanding 'how' gender equality measures support the formulation of intervention theories. It will consist of approximately twenty so-called impact stories to guide the I-O-O-I chain (input, output, outcome and impact) of commonly used gender equality measures. The impact stories and their use are described in detail below (see chapter 6).

The first draft of the conceptual evaluation framework can be considered as a landscape of potential guidelines, best practices and indicators that may find different configurations in actualised specific national, organisational and team contexts, which future evaluators, policy-makers, etc., may use as a source of inspiration. Hence, the EFFORTI conceptual evaluation framework provides a basis for further refinement of the pool of indicators that meet the needs of EFFORTI.

The EFFORTI tree presented below (see Figure 4) is a visualisation of the dynamic part of the conceptual framework. A three-dimensional, interactive version of the tree is planned for online communication of the EFFORTI project. The communicative strength of the tree lies in the possibility to navigate between different elements of the evaluation instruments and the conceptual framework. The three ERA gender equality strategies stand as the foundation of the tree and are intended to form the platform for all GE initiatives. The branching of the tree corresponds to the categorisation of the indicators into categories and dimensions, with the indicators as the level closest to actual operationalisation being embodied by the leaves of the tree.

The contextual aspects of the conceptual framework are emphasised by means of weather icons and refer to the varying structural/cultural features pertaining to any specific implemented programme or intervention. Contextual elements may pertain to country, type of research system, sector type (i.e. public or private), type and position of organisation, type of GE initiative, and previous experiences with policy interventions of similar or dissimilar types. The fruits of the tree represent the positive outcome of the intended gender-equal RTDI system and involve outcome, effects and impact of interventions such as innovation, patents, publications, funding, knowledge dissemination, science communication, research-based teaching, and all sorts of societal impacts. A bird is pictured to symbolise the different viewpoints or perspectives available in the conceptual framework for a variety of target groups. As mentioned, the EFFORTI Toolbox aims at providing interesting insights and instruments to policy-makers and representatives of funding agencies, NGOs, the business sector, research organisations and more.

Multiple examples of I-O-O-I chains constitute a three-dimensional perspective in order to convey the understanding that various GE interventions may take place in different ways and evaluations may focus on each of the stages in the chain. Hence, the leaves of the tree can be situated closer to the trunk or further away, just as the focus of an evaluation can be at the stage of input, output, outcome or impact in relation to a GE initiative. Furthermore, the leaves may take three different colours indicating their focus on micro, meso or macro levels. Indicators that are suited to evaluate GE initiatives at more than one level can be found in more than one example.

The interactive version of the tree[5] is designed in such a way that clicking on one item of the tree should lead the user further into the tree structure so that the potential indicator list narrows down according to the routes in the branching.

[5] The interactive version of the tree is available at http://www.efforti.eu/conceptual-model-evaluation-framework.

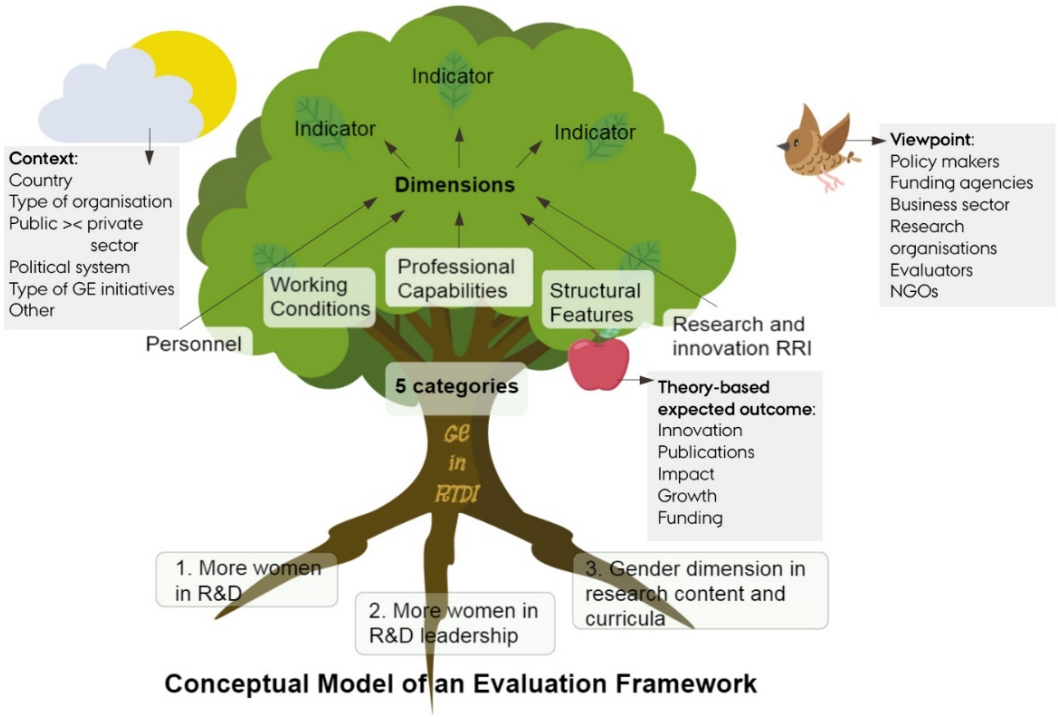

Figure 4: An illustration of the EFFORTI conceptual evaluation framework (designed by the Aarhus University team)

2.4. Limitations and constraints of the adopted approach

There is no smart fix to replace actual immersion in the toolbox elements and critical assessment of the adequacy of each of its indicators for future evaluation of GE initiatives in RTDI. The inclusivity of the EFFORTI Toolbox development and the insistence to encompass traditional socio-economic indicators as well as a range of new, more innovative suggestions for ways to assess impact, specifically in relation to societal impact and RRI, is central. This inclusivity happens at the expense of clear, uni-dimensional guidelines for further use. The toolbox includes indicators that have a narrow operationalisable form and can be meaningfully compared across organisational, cultural and national contexts. However, we have also included indicators that need specific local translation to be meaningfully applicable in a specific future use. Some indicators may cover intervention effects at more than one level in the micro, meso, macro perspective, and the indicators have not been sorted unambiguiously according to their positioning in the evaluation logic model (e.g. indicators of input or output), since this would have been too simplistic and would leave out the often-found possibility for a specific indicator to contain elements at several levels. Furthermore, timing must also be considered, as some indicators are better suited during an intervention or immediately after, whereas indicators of some types of effects require some time to pass. A specific operationalisation of an indicator will often have to re-formulate indicator focus and feasibility in order to maximise indicator validity and value for purpose. An assessment of relevant data sources that can contribute to the use of a specific indicator must also be made. In sum, the sheer number of indicators might seem overwhelming. Therefore, we have made several different entry points that are meant as tools aiding the diverse EFFORTI Toolbox users in the direction that will provide them with the most meaningful selection of indicators. Such entry points include the thematic sorting of the indicators into dimensions and categories.

The adopted approach in EFFORTI is based on the existing evidence and new theoretical and empirical trends in the evaluation field. At the same time, it is targeted towards the field of GE. Hence, it is developed from the observed practices and academic literature and reflects the corresponding limitations and constraints in the evaluation model. The present section comments on these limitations in relation to the adopted approach.

In an ideal experiment, the effect of a measure is identifiable due to the experiment's ability to construct a comparable base population not influenced by the measure but identical on all other dimensions. The effect is then observed in a form of differences between the population exposed to the measure and the base population. However, similar to intervention measures in social sciences in general, none of the identified measures in the smart practice cases fulfils the requirement to construct an identical base case. Another observed characteristic from the smart practice cases is that the involved units are often small in numbers, meaning that quantitative statistics and law of large numbers do not apply well. Consequently, many of the smart practice cases prove effects through exhaustive and thorough circumstantial evidence collection, i.e. indirect and inferred evidence.

Based on an assessment of 125 GE programmes, Kalpazidou Schmidt and Cacace (2017) argue that holistic approaches and multidimensional frames of reference are needed for impact assessment in order to capture the intended outcomes of a GE intervention. Besides serving as an inspiration for evaluations of GE interventions, the study presents six potential challenges in assessing impact of interventions in complex systems, namely establishing attribution, lack of information and indicators, timing and persistence, expected scale and intensity, context dependence, and assessment of societal interventions in general. These are all aspects that need to be considered in the translation of an intervention logic model into an empirical evaluation approach.

In the adopted approach in EFFORTI, the focus is on the intervention logic model in relation to the single measure and its implementation, i.e. throughput and expected effects. The proposed indicators are meant to inspire policy-makers, evaluators and other stakeholders and be used as contributions to support the expected intervention logic by categories and levels of interventions. It thus becomes possible to measure an effect of or a change due to an intervention, linking input and observed effects.

One constraint of the approach is the risk to misinterpret the found evidence caused by the complex connections between inputs, outcomes and impacts of the interventions. Here, the intervention logic model guides the evaluator in identifying sound and credible effects of the interventions, having in mind that it may not be the sole or direct cause for an observed change (i.e. expected, linear or immediate causality). Furthermore and equally important, interventions and measures are embedded in different contexts and interact differently with their contextual environment. Consequently, the design of measures needs to take into consideration the prerequisites for change, i.e. how national/system, organisational and team contexts and incentive structures affect the anticipated effectiveness and efficiency of the interventions.

As discussed above, the establishment of causal relations between interventions and observed effects can be based on theoretically founded hypotheses and a consequential intervention logic model. Hence, theory guides the empirical and methodological issues of attribution, measurement and timing that can be addressed through the intervention logic model and the consequent evaluation framework or model.

However, the non-linearity in evaluation logic still needs to be taken into consideration. As further developed in chapter 3, a theory of change can serve as the foundation for developing or defining the contribution of an intervention to achieving effects. The intervention logic model of the anticipated effects can then be used to confirm or question effects at a certain point and context for the exposed population.[6] Hence, effects of interventions or measures may be found in one context but be absent in another.

Overall, a common constraint among evaluations of GE interventions concerns the complex interacting links between processes, outputs, outcomes and impacts that are usually non-linear in time and direction and therefore often need clarification, i.e. an intervention logic model. The I-O-O-I approach is useful to structure thinking in the evaluation logic, but it is important to emphasise and keep in mind the non-linearity of inputs from an intervention over processes to actual and measurable types of RTDI effects. Again, the intervention logic model supports and guides choices of relevant indicators, e.g. identified through the EFFORTI Toolbox, to be included in the actual GE evaluation.

[6] This indirect evidence gathering is in opposition to trying to prove and attribute causal long-run effects of an intervention in a complex and dynamic system where everything else is held constant. The latter is very seldom possible in a convincing manner in complex processes.

3. Theory of change: Identifying assumptions, risks and contextual factors

This chapter sets the scene for the following chapters by focusing on the theoretical aspects of change and the conditions that must be present for the different links to be realised in order to achieve GE effects on RTDI. A theory of change may explain what conditions must be present for the different links to be realised, i.e. how the intervention is expected to bring about the desired results.

Why do we need to develop theories of change in relation to gender equality and RTDI?

Gender equality programmes and initiatives in RTDI are about change. They are an attempt to overcome the well-known underrepresentation of women as researchers and the lack of gender balance in decision-making (positions of leadership and bodies), latterly taking an institutional transformation approach to tackling the barriers that women in research organisations face. Interventions have also been developed to integrate the gender dimension into research content with an increasing acknowledgement of the negative effects of a predominantly androcentric research agenda and subsequent applications. The European Commission and member states have been, to varying degrees, active in formulating recommendations, policy initiatives and programmes to effect change for greater gender equality and gender-inclusive research and applications at the team level, at the institutional level and at the research system level. Vogel (2012, 8) highlights three main drivers that have contributed to the mainstreaming of the theory of change approach: the importance of context; an increased emphasis on impact; and a recognition of complexity. All three elements have become increasingly important in the field of gender equality and science interventions.

Research that explicitly examines the effects and impact of GE programmes is relatively scarce and uneven throughout Europe. It is, in fact, very difficult to attribute changes in gender equality (be it measured by the number of women researchers/in leadership positions and on decision-making committees, or perceptions of impact/lack of impact on career development, work climate, etc.) to the GE programmes themselves, rather than attributing these developments to wider contextual trends and factors. Some research has even shown a negative correlation between the existence of certain equality measures and the proportion of women scientists (Ruest-Archambault et al. 2008). This can be explained by a compound of contributory factors – but the real explanatory power lies in the field of context, e.g. the size of a country's business enterprise sector negatively affects women's representation in research (see also section 3.1) (Ruest-Archambault et al. 2008, 8). Taking the theory of change approach enables and indeed requires one to factor the context into any explanation of change.

In recent years, the field of policy-making has also seen an increasing trend towards measuring impact (Vogel 2012). Impact assessments that attempt to measure and therefore demonstrate the societal and economic impact of policies have gained currency in times when resources for social policies are increasingly limited and programmes need to be justified in terms of cost effectiveness. Kalpazidou Schmidt and Cacace note how most approaches to societal impact assessments focus on simple, linear models and these often embed a reductive causal chain logic (2017, 2). For example, the World Bank's *Impact Evaluation in Practice* states that "the focus on causality and attribution is the hallmark of impact evaluations and determines the methodologies that can be used" (Gertler et al. 2011, 8). In line with the increasing recognition of the importance of context, notions of "attribution" have therefore generally been replaced by ideas of "contribution." An approach that "attempts to provide rigorous accounts of how and why an intervention *contributed* to producing the observed effects" seems to offer a more promising approach that can factor in

complexity as well as context (Mayne & Johnson 2015). Kalpazidou Schmidt and Cacace (2017, 2) cite Cullen, Junge and Ramsden (2008, 127) highlighting that there is a "substantial body of evidence that the complex combination of structural, cultural, institutional and economic factors that create barriers for women in science, engineering and technology (SET) require a correspondingly integrated and sophisticated strategic and operational response."

Theories of change

"'Theory of change' is an outcomes-based approach which applies critical thinking to the design, implementation and evaluation of initiatives and programmes intended to support change in their contexts" (Vogel 2012, 3). In her review of the use of "theory of change" (ToC) in international development, Vogel highlights that there is consensus on those basic elements that make up the theory of change approach (see Figure 5). She identifies that at a minimum a theory of change encompasses the following points (Vogel 2012, 4):

- **Context** for the initiative, including social, political and environmental conditions, the current state of the problem the project is seeking to influence, and other actors able to influence change
- **Long-term change** that the initiative seeks to support and for whose ultimate benefit
- **Process/sequence of change** anticipated to lead to the desired long-term outcome
- **Assumptions** about how these changes might happen, as a check on whether the activities and outputs are appropriate for influencing change in the desired direction in this context
- **Diagram and narrative summary** that captures the outcomes of the discussion

Amongst her review findings, the following points are highlighted:

- Theory of change is both a process and a product.
- The quality of a theory of change process rests on "making assumptions explicit" and making strategic thinking realistic and transparent.
- Critical thinking is cross-checked with evidence from research (qualitative and quantitative) and wider learning that brings other analytical perspectives, referenced to stakeholders', partners' and beneficiaries' contextual knowledge.
- A number of theories of change are identified as relevant "pathways" to impact for any given initiative, rather than a single pathway, with acknowledgement of the non-linearity and emergent nature of these.

A theory of change has two main elements. First, it can be seen as a tool or methodology that explicitly maps out the logical sequence of an initiative from the activities of the initiative to the change that it has contributed to (Vogel 2012, 9). Second, it encompasses a deeper reflective process where assumptions of change linked to the programme are made explicit. As Mayne and Johnson state, "ToCs set out the framework for telling a credible performance story of an intervention. As such, a verified or partially verified ToC can be used as the basis for reporting on what contribution the intervention has made" (2015, 419–420).

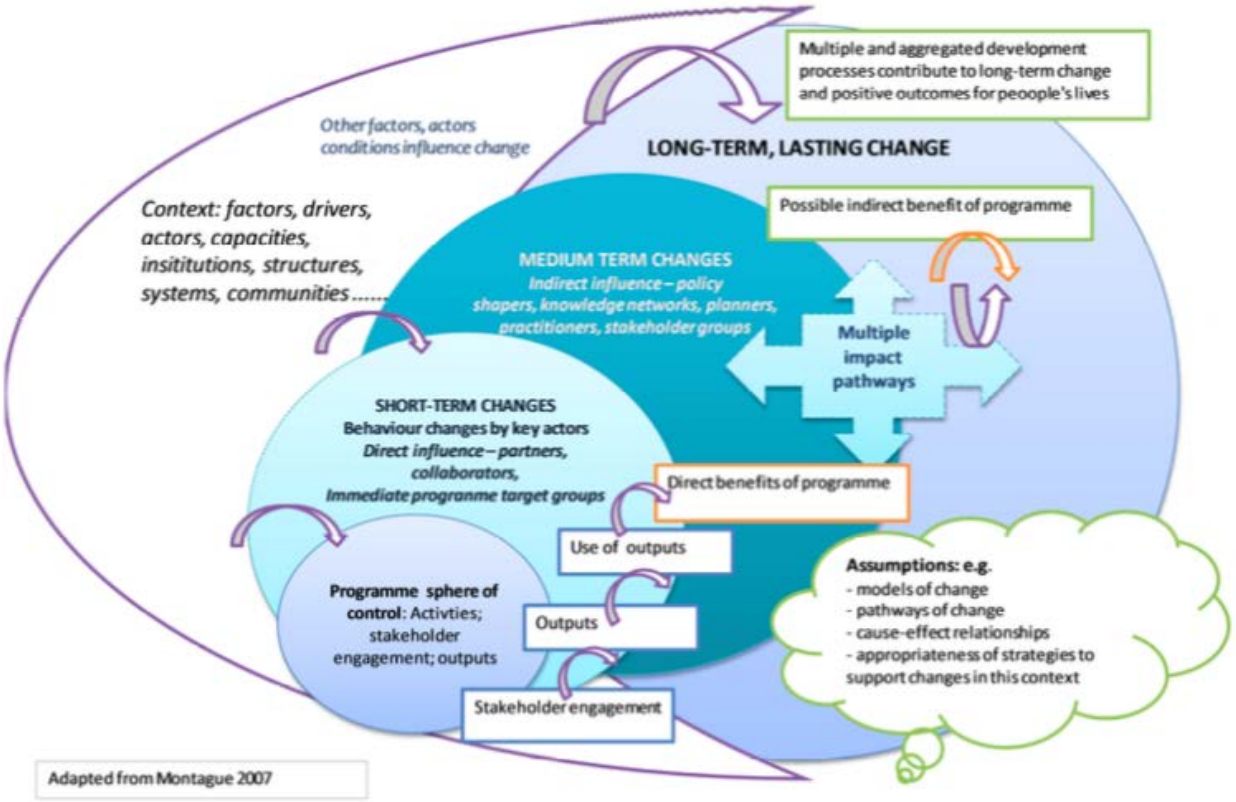

Figure 5: Theory of change thinking (Vogel 2012, 22)

Articulating assumptions is the main part of developing a theory of change. These assumptions have been described as *support factors*, i.e. events and conditions needed to bring about a contribution to effecting change (Cartwright & Hardie 2012). Using evidence to identify, check and challenge these key assumptions and map the implicit and explicit linkages of the intervention (input/resource, throughput, output, outcome/result, impact and context) forms part of developing a theory of change (Vogel 2012, 40). This approach can represent the specific components and context of each programme/initiative and its interaction with contextual variables whilst at the same time remaining scalable.

Mayne and Johnson (2015) identify that theories of change can be used at various stages of an intervention:

Designing/planning interventions:

1) Designing interventions
2) Understanding and agreeing on interventions with stakeholders
3) Identifying and addressing equity, gender and empowerment issues
4) Ex-ante evaluation of proposed intervention

Managing interventions:

5) Designing monitoring systems
6) Understanding implementation, managing adaptively, and learning

Assessing interventions:

7) Designing evaluation questions, methods, and tools
8) Making causal claims about impact
9) Reporting performance

Scaling:

10) Generalising to theory, to other locations and for scaling up and out

Theories of change can be used as a model of how change is expected to happen (ex-ante case) or how change has happened (ex-post case) (Mayne & Johnson 2015, 416). In this project, theories of change could specifically be used as a tool to examine how change has happened, particularly focusing on assessing impact. This is in line with a growing line of research that values the contributions that ToCs can make to evaluating interventions. Developing a ToC is an iterative process that requires time to revisit, validate and refine initial configurations. The process of ToC development should also include stakeholder involvement – for example, programme managers need to be asked to validate or at least confirm that configurations developed accurately explain impact.

In the following, we discuss the contextual factors of importance for GE in RTDI influencing process, outcome and impact at national, organisational and team levels.

3.1. Contextual and cultural issues influencing evaluation at national/system level

Gender equality policies do not take place in a vacuum but are situated in specific national contexts, comprising legal regulations and policies that are formed by cultural factors (Schiffbänker 2009, 66). This context influences the impact of gender equality measures, also in RTDI (Arnold 2004; Edler et al. 2010; Streicher 2017). Therefore, in this chapter we focus on how the national/system level affects the progress towards attaining the GE-related ERA objectives. Consequently, the present chapter describes those framework conditions, which are considered to hinder or promote the achievement of the ERA objectives and should therefore be taken into account in evaluations of GE-specific measures/policies in RTDI.

3.1.1. Proportion of women in RTDI

As discussed earlier, the first ERA target regarding gender equality in RTDI is fostering gender balance in research teams in order to close the gaps in the participation of women (European Commission 2015d). The share of women in RTDI depends, first of all, on the general labour market participation of women. In countries where the participation is comparatively low, fewer women are present in the RTDI sector (Ruest-Archambault et al. 2008, 26). One of the main barriers for women to participate in the labour market and, subsequently, to be employed in science is the unequal gender division of labour related to housework and family care in combination with the lack of childcare facilities (Ruest-Archambault et al. 2008, 39; Godfroy-Genin 2009, 87).

The division of labour regarding paid and unpaid work and, subsequently, the compatibility of family and work is culturally influenced and enshrined in laws, e.g. in the tax law. Joint taxation, in comparison to individual taxation, favours the traditional division of labour between a male primary earner and a female

homeworker or secondary earner (Plantenga 2014, 13f). European welfare systems, however, also differ in how they share the responsibility for childcare among the state, market and individual (Esping-Andersen 1996; Pfau-Effinger 2004). If countries do not provide sufficient childcare facilities, this is at the expense of the labour market participation of women. It contributes to longer parental leave periods and higher shares of part-time work for women.

The cultural influence on compatibility of work and family is also reflected in the design of the parental leave system. According to Ray, Gornick and Schmitt (2008, 19), five policy practices promote a fair division of parental leave between men and women: (1) generous paid leave; (2) non-transferable quotas of leave for each parent; (3) universal coverage combined with modest eligibility restrictions; (4) financing structures that pool risk among many employers; and (5) scheduling flexibility. On the other hand, poorly designed parental leave policies can reinforce tendencies towards gender inequality, also in RTDI: for instance, providing mothers – but not fathers – with leave that is both long and generous may seem to benefit mothers relative to fathers. In practice, however, such a policy would more than likely increase the childcare responsibilities for mothers, while at the same time reducing their long-term earnings relative to fathers (Ray et al. 2008, 10) and hampering their re-entry into the labour market (Schiffbänker & Holzinger 2014, 37; Richter 2011, 248).

If national welfare policies ascribe the main responsibility for childcare to women, it is particularly difficult for them to succeed in the RTDI sector (see also the ERA objective 2). The typical career path in RTDI is currently based on the male life course: in other words, a linear course of full-time employment without breaks (Krais 2000; Metz-Göckel et al. 2009). Long periods of parental leave are not advisable in occupations where knowledge is quickly outdated, as is the case in RTDI (Nyberg 2004, 20). Female scientists therefore try to interrupt employment only as briefly as possible (Althaber, Hess & Pfahl 2011, 113) because maternity leave is the most important factor negatively influencing their career (Schiffbänker 2009, 66, 73). Subsequently, the expectation of availability, coupled with the lack of childcare facilities and mobility demands in academia, makes the compatibility of work and family more difficult for scientists (Lind 2012; Lind & Samjeske 2009).

At universities, the compatibility of work and family is also influenced by employment conditions which are regulated by law. The scientific systems of European states differ in regard to the duration of an academic career after which a permanent position is possible (IDEA Consult et al. 2013, 68). A long period of precarious employment implies low planning security, low financial security and lack of professional establishment and has a negative impact on family planning (Bundesministerium für Bildung und Forschung 2010). Under such conditions, women are more likely not to have children or leave the research sector (Lind & Samjeske 2009; Lind 2010).

In addition to the factors described above, horizontal segregation in the society also influences the proportion of women in research. Despite the rise in women's level of education and in their proportion among PhD graduates, there remains a significant degree of segregation in terms of fields of study (Meulders et al. 2010, 40). All over Europe, there are two fields where women are least well-represented: engineering, manufacturing and construction, and science, mathematics and computing (Meulders et al. 2010, 77). But industrial research relies mostly on professionals in the STEM fields: mathematics, natural sciences, life sciences, computing and engineering (European Commission 2012a, 135). Reasons for gender-different study choices can be found in gender-specific education in the school system. According to Alaluf et al. (2003), stereotypes still play an important role in schools. A plethora of studies have proven that girls are not less

gifted than boys. Success in school is more a function of the social origin or the form of the educational system. Van Langen, Bosker and Dekkers (2006) found integrated educational systems more favourable to the achievement of girls than differentiated educational systems. Therefore, a starting point to increase the proportion of women in science may be examining the degree of integration/differentiation which characterises a country's educational system (van Langen et al. 2006, 174). In addition to the question of whether girls and boys are equally promoted in the school system, gender-specific socialisation also plays a role. Even if girls are performing better at school, their choice of career orientation does not follow the same tendency as that of boys, and they tend to select into socially less "valued" options or orientations (Alaluf et al. 2003).

Gender-specific choices of studies are therefore a reason for the lower proportion of women in the business enterprise sector (BES), since STEM qualifications are in demand there. The proportion of women is also lower in BES than in other sectors because national equality promotion in science in Europe focuses mainly on the public sector because it can be better influenced by policy measures than the private sector (Ruest-Archambault et al. 2008, 23–24). The different relevance of sectors in a country is also crucial for the share of women in RTDI: in BES-dominated economies, it is more difficult to increase the share of women in RTDI.

3.1.2. Proportion of women in RTDI in decision-making positions

Ensuring gender balance in decision-making is the second ERA objective to foster gender equality in RTDI. The European Commission (2015d) specifies that the target is 40 % participation of the underrepresented sex in panels and 50 % in advisory groups. In addition, all panels and committees should have at least one expert (of any gender) with explicit expertise in gender.

The achievement of the second ERA objective is strongly linked to the attainment of the first ERA objective; the higher the proportion of women in RTDI, the higher the likelihood that they occupy leadership positions. A statistical analysis among the Enwise[7] countries revealed that the proportion of women professors Grade A is influenced by the proportion of women among ISCED 6 graduates (Ruest-Archambault et al. 2008, 29–31). Framework conditions regarding childcare facilities, parental leave regulations and employment conditions as described above do not only influence the decision of women to enter the RTDI sector and remain there, but they also have a strong impact on whether women can make a career in RTDI. In regard to employment conditions, the rigidity or, on the contrary, flexibility of scientific career schemes at the universities play an important role in female career advancement. For instance, if dissertations and habilitations must be completed within a certain period of time, it may create barriers for women in academic careers when private obligations must be combined with professional ones (Leitner & Wroblewski 2009; Forster 2001; Kramer 2000; Georgsdóttir 2001; Ulmi & Maurer 2005; Acar 1994; Hegemann White 1994). However, the apparent incompatibility of work and family may not be the main reason why women are marginalised in this field. Even the mere expectation that women in general will not be able to combine family and academic work life can lead to structural discrimination after and even before they have children. This discrimination consists of fewer opportunities for women to take over challenging tasks which subsequently makes career advancement difficult (Schiffbänker 2009, 65, 75–76; Schiffbänker 2011, 199).

[7] Eastern and Central European countries and the Baltic states.

This example makes evident that the gendered organisational culture of higher education institutions and other RPOs is a major factor explaining vertical segregation (Meulders et al. 2010, 103), as it influences everyday working practices, limits the opportunities of women for career advancement and undermines family-friendly policies (Howe-Walsh & Turnbull 2014). The question is therefore whether the change in organisational cultures in RTDI is listed as an objective in national strategy documents. If universities are obliged by law to work towards gender balance – e.g. in recruiting (Lind & Löther 2007, 257) or even in having to implement a GE plan that also considers women in decision-making – they need to deal with implicit bias and GE in their recruitment and selection procedures. Another national policy may be to implement quotas for women in management positions and committees (Reidl et al. 2017b), addressing not only the higher education sector (HES) but also the BES. As a large number of studies (e.g. Zvinkliene 2003; Palomba 2004; Lažnjak & Gaurina Međimurec 1997; Husu 2005; Novelskaite 2008; Bruun, Eskola & Suolinna 1982) conclude, the small number of women in the highest RTDI positions is due to discriminatory practices rather than to the low level of professional ambition of women in academia. Consequently, there is a need for GE policies that counteract this trend.

However, RTDI policy cannot address only RPOs in order to raise the proportion of women in leadership positions – research funding policies are also essential. Possible policies already in place in some EU countries are gender-balanced RFO committees, monitoring and reporting requirements of RFOs regarding GE activities, and also evaluations of RFO committees regarding gender bias (Reidl et al. 2017b, 46). Moreover, special funding for women in science has a positive impact on the proportion of women professors Grade A (Ruest-Archambault et al. 2008, 29-31).

3.1.3. Integration of the gender dimension in research and teaching

The integration of the gender dimension in research and teaching should not only promote gender equality in RTDI but also serve as a strategy to improve scientific quality and excellence as well as social relevance of RTDI. Therefore, strategies and policies are developed which require researchers to integrate gender analysis into their research endeavours (Schiebinger & Schraudner 2011). However, mainstreaming gender analysis in research is confronted with several challenges:

- *Methods of sex and gender analysis are only now being developed in an international context.*
- *Scientists, engineers, and policy makers are not yet trained in methods of sex and gender analysis.*
- *Methods of sex and gender analysis are not yet mainstreamed into curricula from primary through tertiary* [science and technology] *S&T education.* (European Commission 2012a, 156)

A further challenge can be identified from the results of the ERA survey from 2014 (European Commission 2015c), reporting that provisions for integrating gender analysis in research contents or programmes are not widely spread among member states. Only a few countries are supporting the inclusion of the gender dimension in research programmes and content (European Commission 2015c; see also Gender-NET 2015). Policies to promote the inclusion of the gender dimension in research still need to be developed and implemented to provide incentives for researchers to take it into account.

Therefore, it is important to build capacities for gender in research: for instance, gender studies facilities, knowledge hubs, and gender-sensitive curricula or trainings for researchers, reviewers and stakeholders to enable sound and efficient integration of gender analysis in research activities. Furthermore, the available knowledge, theories and methods need to be distributed and made publicly available.

Based on this short assessment, a following hypothesis can be formulated: in countries with higher capacities and policies to promote the inclusion of gender in research programmes and content, the research will be more gender-sensitive. Therefore, to evaluate effects of policies regarding gender in research and teaching in a specific national context, it seems relevant to take the following national framework conditions into account:

- Do national RTDI programmes require researchers to include the gender dimension in their research proposals and projects? Therefore, evaluations must consider how research funders promote the inclusion of the gender dimension in research and how this affects the assessment of research proposals and the execution of research projects.

- Do research institutions provide training/support for researchers in regard to the inclusion of the gender dimension in the content of research? It is important to know if researchers are supported by their organisations in setting up and executing research projects that include gender analysis. Support is important as most researchers are not yet trained in applying gender analysis in RTDI projects.

- Furthermore, it seems important whether there are other capacities like centres for gender studies or networks of gender study experts or practitioners available which can support researchers in applying gender analysis in RTDI projects.

- Additionally, it seems relevant to consider the integration of the gender dimension in courses and curricula in higher education institutions that train researchers of all disciplines in basic knowledge on gender studies and in applying methods of gender analysis in RTDI projects.

3.1.4. The role of the evaluation culture

The effects of gender equality measures in RTDI depend on the quality of the design of the measure and its implementation. This quality can be improved by the evaluation of the measure as this allows for policy learning (Biegelbauer 2013, 50). The advancement of measures is therefore dependent on the extent to which the evaluation culture of a country has developed: are there explicit rules and legislation on evaluation in RTDI in place? Are evaluations regarded as part of a broader system to ensure accountability? Has institutionalisation of evaluation taken place? Is evaluation more the exception or the rule? And how are evaluation outcomes utilised in RTDI?

3.2. Contextual and cultural issues influencing evaluation at organisational level

It is widely accepted that gender inequality dynamics are strongly interconnected with organisational settings and that analysing and addressing them separately is ineffective (Bleijenbergh, Benschop & Vennix 2008; Kanter 1977; Timmers, Willemsen & Tijdens 2010). In regard to the transferability of measures, it is important to understand how these contextual factors influence the potential impact of specific measures. Castaño et al. (2010) also emphasise that institutional contexts play a decisive role in shaping gender balance. Same strategies and solutions may generate different impacts depending on the local context, key variables, and their interactions. Nevertheless, GE policies have hardly been evaluated in this respect and available results are limited on this topic.

In the present chapter, we focus on how the impact of GE measures of an RTDI organisation can be affected by various intervening organisational variables. We discuss three groups of organisational context factors that are of significance for the EFFORTI evaluation logic model as described above, i.e. cultural and structural factors, funding, and gender mainstreaming.

3.2.1. Cultural and structural change

Cultural and structural change implies the institutional anchoring of irreversible and sustainable arrangements. Change needs to be permanent through the overall impact of the implemented measures on the strategic orientation of an organisation (Cacace et al. 2015). Therefore, GE policies must combat or capture powerful context factors that implicitly determine organisational strategy.

Stepan-Norris and Kerrissey (2016) discuss the relevance of structural context in an impact evaluation of a GE programme that targets gender inequalities in STEM disciplines. They compare the gender ratio at University of California, Irvine, that implemented the programme with the progress at seven other Californian campuses. Concerning the observed universities, they found a positive relationship between *organisational growth* and the proportion of women faculty, but not between growth and proportion of women among new hires. They conclude that more recruitment leads to gradual increases as there was also growth in the number of female applicants, but significant change may only happen if organisational growth is coupled with effective GE measures. Problematic is also that RTDI organisations often tend to recruit women for non-tenured and off the tenure-track positions (Cacace 2009, 28).

Furthermore, Stepan-Norris and Kerrissey (2016) found a positive link between *organisational age* and the proportion of women faculty. They assume that because organisational structures and personnel are a mirror of the founding era of an organisation, universities founded after the implementation of the US Civil Rights Act of 1964 in general show less faculty inequalities. They also suggest that younger universities have access to a more diversified applicant pool.

Further exemplary context factors for the efficacy of a gender measure can also be derived from classical organisational sociology, e.g. centralisation, goal orientation, path dependencies, networks or size (Oliver 1991). Regarding *centralisation*, Timmers et al. (2010) investigate the implementation of GE measures across all universities in the Netherlands. They conclude that there are significant friction losses between a university and its departments (Timmers et al. 2010, 733). While most GE measures are decided at university level, it is the departments that are responsible for their implementation – therefore, cooperation with the central body is needed. This, in turn, implies that GE policies are easier to implement at RPOs with a more centralised structure than in the typical autonomy-emphasising university structure.

The factor of *goal orientation* is concerned with the consistency of institutional norms or requirements. If GE also has topical relevance for the work of an organisation, awareness of GE issues will generally be higher (Lipinsky & Schäfer 2015, 84). Thus, one may expect a sociology department to be more open towards GE measures than a mathematics department.

Path dependencies also play an important role: for instance, when an organisation has a very high *proportion of male employees*, the general awareness of GE issues can be lower and GE policies regarding recruitment mean a higher loss of discretion concerning recruitment decisions. The cascade model is a reply to those path dependencies – each hierarchy level is only expected to align to the proportion of women at the preceding

level. However, the cascade model enables only incremental progress, with some institutions needing decades for the realisation of a balanced representation of both sexes.

The degree of integration into relevant *organisational networks* also plays a crucial role for the diffusion of GE measures. Through networks, new knowledge is transferred into an organisation and engaged employees become empowered (Cacace et al. 2015). Relevant networks can be, for example, occupational associations that tie the topic of GE standards with other professional discourses or advocacy networks that provide their members with the state of the art expertise on GE measures.

Finally, *organisational size* presumably has a strong impact on the efficacy of GE measures. Research shows the positive influence of this factor on employers' involvement in work-family issues (Ingram & Simons 1995, 1468; Goodstein 1994, 356f). Organisational size in those studies is understood as an indicator of legitimacy pressure, which is assumed to be bigger in larger organisations that are more visible and have more stakeholders. However, one may also see a link to rationalisation as larger organisations have a higher need for strategic planning and thus should be more likely to have a GE plan. Rationalised organisations also have a more elaborate reporting system which can function as a low-threshold entry point for specialised gender reporting (Cacace et al. 2015).

The mentioned variables influence the ERA goals on GE in various ways. Generally, structural aspects like organisation size and growth, centralisation or ex-ante proportion of male employees will more likely have an impact on GE measures aiming for gender balance in decision-making and research teams. The goal orientation of an organisation and its founding era also have a direct cultural impact and thus will show a significant effect on GE measures that promote the integration of the gender dimension in the content of research and innovation. However, one may argue that other structural factors like a very high proportion of male employees also have direct cultural effects that might be reflected in the content of research and innovation.

In general, the cultural assumptions that are shared by the members of an RTDI organisation strongly influence the potential impact of a GE measure. Van den Brink and Stobbe (2014) argue for the so-called support paradox, inherent in all GE measures that aim to support women (and not both sexes). According to the researchers, even female members of an organisation can perceive such a GE measure as problematic, as something questioning their personal ability to move up the career ladder through merit. While men benefit from the structural status quo, women may be afraid to get stigmatised by making use of a support programme. Thus, it is crucial how the *organisational discourse* around a GE measure evolves which is, again, a product of the dominant assumptions in an RTDI organisation about "the ideal scientist," working practice, or other paradigms on how to produce good science (van den Brink & Stobbe 2014, 171; Cacace 2009, 29). To develop indicators for the discursive context of a GE measure, Lipinsky and Schäfer (2015) suggest a typology of gender discourses. An organisation may be characterised by a gender-blind discourse, a difference-oriented, an equality-oriented or a deconstructivist discourse.

The impact of a GE measure can also be influenced by other cultural factors as intervening variables. Cacace (2009) summarises a broad variety of ways in which organisational culture may harm GE. Most of the problems discussed go beyond the organisational level and can be ascribed to the general cultural tensions in science. However, these problems manifest at the organisational level and can thus be tackled there. The underrepresentation of women in certain disciplines and hierarchy levels reproduces cultural barriers that women face (Cacace 2009). RTDI organisations with a literal *female minority* lack role models and evoke

feelings of isolation for "the pioneers." Women's presence in an organisation is necessary in order for women to be perceived as legitimate and relevant stakeholders. But the presence of women is – varying from one organisation to another – in part culturally constrained by *informal networks* as the main areas for decision-making and "*hidden quotas*," which means that there is an implicitly negotiated proportion of women that is perceived as appropriate. Furthermore, issues of *work-life balance*, with their far-reaching relevance for career development of female researchers, are shaped not only at the national level, but of course also in organisational settings (Cacace 2009).

Van den Brink, Benschop and Jansen (2010) discuss the relevance of *transparent* recruitment procedures for the career chances of female researchers. Their study is an example of the complex intended and unintended effects that a GE policy can have. They conclude that the formal anchoring of transparency and accountability mechanisms for the promotion of GE in recruitment processes can legitimise the paternalistic status quo more than it does to combat it.

Again, we expect culture to have an impact on all three ERA goals on GE. The organisational culture concerning GE that is sustained by the discourse on GE directly influences the relevance given to the gender dimension in recruitment and promotion processes as well as in the overall content of research and innovation.

3.2.2. Mainstreaming gender analysis

The United Nations (UN) (2002) lists various important factors of institutional capacity for the success of gender mainstreaming:

- Understanding and commitment: clarity about GE and commitment to pursuing this goal, especially at the senior decision-making level.
- Analytical and planning skills: the skills needed to identify and respond to issues of GE.
- Structures and mechanisms: they enable intersectoral linkages and ensure that GE is taken into account in planning and decision-making processes and that staff and managers are held accountable.
- Catalytic presence: the existence of a unit dedicated to implementing gender mainstreaming; preferably, the unit should have the role of a catalyst rather than hold the overall responsibility for the implementation of gender mainstreaming at the organisation.

A brief overview of the results of applying the UN's categorisation is provided below.

Understanding and commitment

Linked to organisational discourse, practice guidelines also emphasise the importance of *senior management support* to provide legitimacy to GE measures (European Institute for Gender Equality (EIGE) 2016c, 28; Cacace et al. 2015). The support of governing bodies is assumed to decrease the likelihood of internal opposition, increase the resources that can be mobilised, and reduce people's fears of harming their (scientific) reputation if they engage in equality work (EIGE 2016c, 28). On the other hand, if management staff has a gender-insensitive *leadership style*, using strong "gender schemes," the promotion of female

researchers is more difficult as they suffer from biased evaluations and double standards for competence (Cacace 2009, 28).

Analytical and planning skills

Sex-disaggregated data is a key element to equip GE bodies with the necessary knowledge and information. The application of gender analysis, availability of sex-disaggregated data and gender statistics presenting the status of equality within an organisation are considered to be preconditions for efficient, well-designed evidence-based measures and initiatives (EIGE 2016c; Cacace 2009).

Structures and mechanisms

The EIGE report (2016c) underlines that it is crucial for the institutionalisation and sustainability of GE measures that they are embedded in the existing management procedures and structures. For example, gender training initiatives are more efficient if they are carried out as part of the regular training schemes of organisations. Monitoring procedures of gender mainstreaming are often implemented in isolation which makes it less sustainable. Ryan and Garrett (2004), Cacace et al. (2015) and Kalpazidou Schmidt and Cacace (2017) also emphasise the importance of institutionalising impact assessment procedures.

Turning to the private sector, Kalev, Kelly and Dobbin (2006) note that at organisational level *affirmative action plans, equality committees and taskforces, equality managers and departments* are the most effective means of increasing the proportion of women in management positions in the private sector.

Catalytic presence

It is assumed that the effective implementation of GE plans can be ensured by establishing GE bodies at the organisational level. To be efficient, *gender equality bodies* must be located at the appropriate level so as to effectively support gender mainstreaming implementation. Involvement in decision-making and building linkages between human resources and scientific management enhance effective implementation (EIGE 2016c). For example, having an Equity Advisor (EA) with knowledge, efforts and resources can have a significant positive impact on recruitment processes. Stepan-Norris and Kerrissey (2016) showed the efficiency of having a *dedicated Equity Advisor* in academia in the framework of the ADVANCE programme. The researchers found that the implementation of the ADVANCE programme is associated with higher percentages of women faculty and a higher share of new women hires, but on the other hand, it did not have a significant positive impact on women faculty leaving the organisation.

Interrelated GE measures

Organisations usually apply more than one gender mainstreaming measure; consequently, the particular combination of measures can also influence the results. Timmers et al. conclude the following in their investigation of Dutch universities: “the larger the number of gender equality policy measures, the larger the reduction of the glass ceiling in the university over the period 2000–2007” (2010, 733).

A recent EIGE report (2016c) discusses the impact of initiatives that were proven to effectively support gender mainstreaming in the EU member states. The Athena SWAN Charter was identified as the most impactful among these initiatives. In the United Kingdom (UK), 136 out of 168 research institutions have adopted their strategies as part of the Athena SWAN Charter scheme. As a consequence, stimulants such as *prizes and awards* which provide competition between institutions are now considered as one of the basic

requirements for results-oriented actions towards gender equality. The paper also suggests that organisational provisions stemming from legal requirements created by Equality Act and Athena SWAN scheme *mutually reinforced* each other. GE incentives not connected to this scheme are considered less sustainable.

Timmers et al. (2010) revealed a positive relationship between organisational GE policy measures and the reduction of the glass ceiling. The most frequently applied measures targeting organisational change were accounting for the recruitment of women, adapting job advertisements, and bonuses for hiring women. Measures such as exit interviews, output measures adapted for part-time employees, gender impact assessment and professorial chairs were hardly applied by the universities involved in this study.

3.2.3. Funding resources

Current research discusses the barriers women face in acquiring research resources from public or private funders, mainly due to gender stereotypes and their underrepresentation at higher academic positions (Ranga, Gupta & Etzkowitz 2012; Brooks et al. 2014; Bornmann, Rüdiger & Hans-Dieter 2007; Wennerås & Wold 2001). In turn, the role of funding as a contextual factor that can foster the implementation of GE measures appears not to be considered in research in some countries (see also section 3.1). However, resource dependence theory (Pfeffer & Salancik 2003) implies that a resource-rich actor A (such as a funding agency) that offers critical financial resources to another actor B (such as a university) has the power to influence the actions of actor B. While it is largely absent in theory, the *coupling of funding with GE targets* is taken up especially in public funding practice.

In a recently published guide *Improving gender equality in research organisations*, Science Europe (2017) provides recommendations on how to monitor GE and how to avoid bias in peer review processes, and lists various best practices. The guide shows a broad range of instruments that are used by European RFOs to promote GE, reaching from integrated strategy plans like in Ireland to more situational measures in other member states' organisations (Science Europe 2017, 30). It can be concluded that the higher an organisation's dependence on public funders and the more binding and comprehensive the GE policy of those funders, the higher RTDI organisations' commitment to GE will be.

Lipinsky and Schäfer (2015) also point to another way in which the funding structure of an organisation may affect the impact of GE measures: the overall financial situation of an RTDI organisation often sets the frame for the engagement in GE. One may argue that gender mainstreaming and consciousness should be integrated in an organisation's everyday business to be effective and thus will cause no further costs. However, the necessary training of staff and implementation of new procedures require a certain degree of *financial leeway:* organisations need uncommitted funds for covering those implementation costs.

The formulation of concrete funding conditions concerning GE can be assumed to be one of the most powerful leverages for achieving all three ERA goals in RTDI organisations. However, most RFOs do not use compulsory conditions. In turn, financial discretion is a contextual factor that mainly affects investments into staff trainings and offers for better work-life balance, which fosters the intra-organisational promotion of women.

Finally, it seems worthwhile to reflect on the consequences that organisational context has on RTDI organisations in different sectors. In Germany, for example, in 2013 only 13.6 % of all researchers in the

business enterprise sector were women. In comparison, the share of women in the higher education sector was 35.4 % (Eurostat 2016). This significant underrepresentation of female researchers in the business sector may partly be explained by organisational context. The following considerations should be taken into account among the main factors: (1) the more technical goal orientation of business RTDI with an important role of applied sciences like engineering and computer sciences (European Commission 2012a, 135), (2) the efficiency culture of business with shorter deadlines which may complicate work-life balance, and (3) the higher independence from public funding and, thus, public GE policy (Ruest-Archambault et al. 2008, 25). On the other hand, business RTDI shows a higher potential for top-down organisational change as there is higher fluctuation of top-level staff[8] and a higher degree of centralisation, and RTDI business units are younger in age than their academic counterparts. However, in view of the underrepresentation of female researchers in business RTDI, this potential seems to remain untapped.

3.3. Contextual and cultural issues influencing evaluation at team level

Gender equality interventions in RTDI that explicitly target the team level are rare. Despite this fact, the team unit is beginning to be recognised as an important arena for gender diversity. This emphasis coincides with the increasing acknowledgement of the importance of the team level, especially in regard to performance. What precisely is the link between gender equality or gender diversity at the team level and performance? And what are the factors at the team level that influence RTDI evaluations?

Callerstig and Müller (2016) provide a word of warning on three main counts. The very notions of both "gender diversity" and explanations for optimal "performance" need unpacking. Gender diversity is still often conflated with "sex" diversity, i.e. the proportion of women and men in a team and those associated fixed biological attributes of women and men. A focus on gender differences as opposed to sex differences highlights those societal factors that shape these differences, i.e. socialisation processes and stereotypes that can be transmitted in the family, educational and organisational spheres (Callerstig & Müller 2016, 74). Increasingly, research has highlighted how sex and gender similarities and differences interact (Wood & Eagly 2012), whilst it has been recognised that these very distinctions between gender and sex are in fact gendered and reproduced by the literature on how gender affects teamwork (Callerstig & Müller 2016, 74). The very notion of gender diversity needs to be scrutinised. The team science literature highlights the very complex nature and configuration of a wide range of different variables that may account for team performance. Whilst gender is an important element, unpacking this from the wide range of other variables that interact with and subsequently impact on team performance is complex. Lastly, a simplistic and reductionist approach that links gender diversity, often conceived as the proportion of women and men in teams (input), to their performance (output/outcome) is no longer valid.

The wealth of team science literature highlights how an increasing focus has been placed on the team level for performance. There has been a great deal of work carried out examining the different factors that can explain why a team functions well (or not): combination of different personality traits; motivational factors; the role of conflict; the importance of emotions, trust and psychological safety for the internal workings of

[8] In Germany, full professors have the life-long status of civil servants who have far-reaching protection against dismissal.

teams (Müller et al. 2016, 4). In parallel, research has also examined the impact of collaboration networks, team boundary spanning and the role of leadership (Müller et al. 2016). Collaboration is increasingly seen as important, as the locus in knowledge production in science has shifted from the individual to collaboration in networks demonstrated by joint authorship. There is also evidence that high research performance – demonstrated by high levels of publication- is positively associated with high levels of collaboration (Katz & Martin 1997). Whilst individual scientists can collaborate and publish with colleagues in other institutional settings – i.e. joint publications can be the result of collaborations between scientists who do not form part of the same organisational team – the team as a unit operating on a level between the individual and the organisation offers a unique window on collaboration and joint production (Müller et al. 2016, 8). Hollenbeck, Beersma and Schouten (2012) identify three basic elements of a team based on their revision of 42 different classifications: 1) skill differentiation, 2) authority differentiation, and 3) temporal stability. If the focus, however, is on teams embedded within organisations, the definition needs to be further refined:

> *"(a) two or more individuals who (b) socially interact (face-to-face or increasingly virtually) (c) possess one or more common goals; (d) are brought together to perform organizationally relevant tasks; (e) exhibit interdependence with respect to workflow goals, and outcomes; (f) have different roles and responsibilities; and (g) are together embedded in an encompassing organizational system, with boundaries and linkages to the broader system context and task environment.*" (Kozlowski & Ilgen 2006)

This section of the conceptual framework therefore examines key variables and phenomena that might affect performance at the team level. This conceptual framework aims at identifying some of the empirical research that looks specifically at gender diversity at the team level in RTDI. The main themes that have been highlighted in the literature that have been operationalised for the EFFORTI framework for this unit of analysis are the following:

- Gendered competency expectations
- Level of team deference
- Scale of empathy
- Gender balance in research team/research team composition
- Power relations at the team level

This conceptual framework will examine each of the above elements. Two additional EFFORTI indicators are concerned with taking a reflexive approach to the above as well as examining cultural change at the team level.

- Acknowledgement of gender issues in the team
- Perceived extent and pace of cultural change at the team level

3.3.1. Gendered competency expectations

Müller et al. (2016, 4) identify how a review of the literature in this field demonstrates that one of the main effects of gender diversity on team performance is related to gender bias – how it can negatively impact on performance through underutilisation of available expertise in teams. There is a range of factors linked to gender bias that can undermine the optimal sharing of information: status differentials, formal power relations, homophily or sexual harassment amongst team members (Müller et al. 2016). Ridgeway (2014) looks at how gender affects and is affected by hierarchical relations in groups. She builds on Berger, Cohen

and Zeldich's (1972) expectation status theory which attempts to explain it as follows: "When a task-oriented group is differentiated with respect to some external status characteristic, this status difference determines the observable power and prestige within the group whether or not the external status characteristic is related to the group task." Ridgeway (2014, 5–6) explains that biased expectations for competence and authority are important because their effects are self-fulfilling and that these are intrinsically linked to status beliefs. Status beliefs about social difference are activated in contexts where people differ in terms of social distinction and where this is deemed relevant for context goals (Ridgeway, 2014). The effects of these status beliefs – specifically in relation to gender – have been shown to be amplified in male/female-dominated contexts. Gender competency expectations vary across scientific disciplines, depending on the relative minority status of women. This means that competency expectations for women in male-dominated teams, for example in engineering, are particularly strong (Callerstig & Müller 2016, 88). This can have important effects – limiting optimal information sharing: "silencing often non-redundant and most valuable information from low status-low power members" (Callerstig & Müller 2016, 87).

3.3.2. Level of team deference, social affinity & homophily

Joshi and Knight highlight the importance of 'deference' – i.e. "yielding to one another's opinions, beliefs, and decisions in the course of teamwork" (2015, 59). They argue that this concept is crucial when examining teams performing complex mutually independent tasks for both task coordination and knowledge combination. They define 'deference' as a "fundamental process by which team members gain access to and capitalize on one another's expertise […] — yielding to one another's opinions, beliefs, and decisions in the course of teamwork" (Joshi & Knight 2015, 59). A major question regarding deference is: who defers to whom and why? The research points to the complexity of the relationship between status, deference and social affinity in teams, with subsequent effects on team performance. Social affinity ties in this context are understood as friendship and strong interpersonal relationships. Gender and ethnicity influence who defers to whom through social affinity ties. Team members tend to develop social affinity ties to others with whom they share the same demographic attributes which in turn biases deference, "above and beyond perceived task contributions" (Joshi & Knight 2015, 78). The authors find that "while demographic attributes such as educational level, tenure, gender, and ethnicity certainly serve as status signals, they also predict reciprocal social affinity and deference at the dyad level of analysis. Although deference can be a product of various demographic attributes, deference due to beliefs about task contributions enhances, while deference due to social affinity detracts from, team performance" (Joshi & Knight 2015, 81). This is an important finding about how diversity in teams can influence and impact on performance.

3.3.3. Gender and sex differences in social sensitivity/empathy

A key research strand in the debate regarding the impact of gender diversity on research teams is based on assumptions regarding sex differences and social sensitivity and empathy (Callerstig & Müller 2016, 89). Research has shown that women are better at recognising and interpreting an individual's non-verbal emotional expressions and mental state (see, for example, Baron-Cohen et al. 2001). The *Reading the mind in the eyes* test developed by Baron-Cohen et al. to demonstrate "social intelligence" – i.e. the ability to read emotions of others at the team level – is linked to performance on team-based problem-solving tasks, and women tend to score better on the test (Baron-Cohen et al. 2001). This may begin to explain some of the research that looks at collective intelligence in groups.

Woolley et al. (2010) state that collective intelligence can be predicted by the proportion of women in groups. They have conducted further research which identifies that it is not so much the sum of individual intelligence but the average social perceptiveness of group members that can predict the collective intelligence of a group (Woolley, Aggarwal & Malone 2015). Callerstig and Müller highlight how different socialisation processes for women towards more communal behaviour combined with certain sex differences, i.e. empathy and emotion processing, can begin to explain some of the observed differences linked to social sensitivity in Wooley et al.'s research (2016, 89–90). Other research has identified the crucial role of women in developing collective emotional intelligence (Curşeu et al. 2014). This is defined as the ability of the group to develop a set of norms that promote awareness and regulation of member and group emotions. It has been noted how women promote the emergence of collective competencies – partly due to their higher social sensitivity and relational focus – and facilitate the coordination of individual competencies through social interactions (Callerstig & Müller 2016, 90).

3.3.4. Sex-gender balance in research team/research team composition

At the policy level, there is increased recognition of the importance of "gender balance" in research teams as well as in key decision-making positions and committees. Fostering gender balance in Horizon 2020 research teams is one of the three objectives that underpins the European Commission's activities on gender equality in Horizon 2020. This approach, it is anticipated, will begin to address the gaps in the participation of women in the Framework Programme's projects. The *Effective Gender Equality in Research and the Academia* (EGERA) guidelines highlight how these could be used as an established benchmark for gender diversity in teams (Universitat Autònoma de Barcelona (UAB) & EGERA 2016, 9).

The notion of "gender balance" in science, however, has been problematised by gender scholars (see the GenPORT (2017) online discussion on gender balance). World experts came together to discuss the issue online – and whilst generally welcoming the desire to foster "more collective knowledge and expertise putting women's and feminist concerns more fully on scientific agendas, developing more democratic processes" to tackle largely male-dominated science – notions of gender balance were criticised for a variety of different reasons. Gender scholars have problematised the notion of "gender balance" as it can reinforce assumptions about "heterosexual complementarity between men and women." It may also put forward a very simple solution to a very complex phenomenon. Jeff Hearn stated: "But, is 'gender balance' really so simple, and is it the complete answer? As far as I can see, at the same time as agreeing with and promoting gender balance, the term 'gender balance' in decision-making is perhaps not really quite right; it can suggest a natural, heterosexual complementarity between women and men. Gender balance may also suggest that all we need is counting the numbers of women and men. It may even play down other differences both among women, men and further genders (queer, intersex, transgender, non-binary), and also differences other than gender, such as age, class, racialisation and ethnicity. It would be a mistake to see greater gender balance in the numbers of women automatically producing better decisions in every situation. The evidence on this is more diverse" (GenPORT 2017).

Whilst these kinds of reflections highlight the problematic presumption that a greater gender 'balance' at the team level automatically leads to better decision-making, evidence does exist that gender balance at the team level can affect perceptions of leadership. Gloor and Reid (2016) explored whether intervening at the team level restores gender equality in followers' evaluations of male and female leaders. They found that team members rated male leaders as more exemplary than female leaders in majority male teams but not

in gender-balanced teams. They highlight how the tipping point for equality in leader evaluations occurred when the team includes approximately 40 % women. They go on to highlight how their findings support team composition as a strategy to enable gender equality in leadership evaluations by design.

3.3.5. Power relations at the team level

Müller et al. (2016, 25) highlights how power relations have been documented to affect group dynamics in three main ways:

- Anchorage of shared goals
- Risk taking and experimentation
- Conditioning the knowledge transfer between members

In the first place, shared goals and a common agenda are more difficult for lower status members to buy into. In groups that are hierarchically structured, lower status members have much more limited options to take part and influence group decisions and actions – and, as a consequence, may feel less accountable and personally involved. This affects the extent to which low status members consider the range of informational cues within the group and the extent to which they consider others.

In the second place, psychological safety forms an important component of team functioning and is affected by status and power differentials. Risk taking and experimentation are key to high-performing teams – but team members with lower status are less likely to feel 'safe' being more dependent on those with a higher status for access to resources, transactions (authorisations) and, essentially, opportunities that may depend on respect and approval. This can negatively affect overall team performance as lower status team members may fail to take the initiative or not share novel ideas for fear of failure.

In the third place, the actual content of the information that is shared is affected by both power and status. Lower status members often repeat information that has already been shared – but when it comes to sharing 'new' unshared information, it becomes less memorable and repeated less often in comparison to high status members (Wittenbaum & Bowman 2005). These power and status disparities within teams therefore can be seen to constrain effective information sharing between all members, thereby negatively influencing the quality of the decisions taken (Müller et al. 2016, 26).

The above takes place within an organisational context where women are severely underrepresented at the top of the career ladder (vertical segregation) which significantly undermines their ability to be a 'high-status' team member. Vertical segregation can therefore be seen as hindering effective information sharing that is so desirable for maximising team performance. As women tend to have less influence in group interactions than men (Mannix & Sauer 2006), these gendered hierarchies may, in fact, curtail women's contributions in important ways (Müller et al. 2016).

3.3.6. Beyond the team level

As the above example demonstrates, the team level is also heavily influenced by other units of analysis – i.e. the wider context. The team is embedded within an "organisation" and a "discipline" which have their own shaping structures, processes and cultures. For example, in male-dominated disciplines – where women are the minority – the majority of men do not recognise women's expertise: "If the discipline in which the team is embedded is male-dominated, team members may not have had exposure to visible symbols of female

success. Team members may assume that female team members are generally less qualified than men, and gender may therefore significantly predict expertise recognition and utilization" (Joshi 2014, 5). Joshi's research demonstrates how undervaluing the expertise of the minority can negatively affect team performance:

> *Teams with greater proportion of highly educated women were significantly more productive in gender-balanced disciplines than in male dominated disciplines. These findings support the argument that the level of gender integration in any given discipline can shape the salience of gender as bias for the status differences or role expectations among women and men in science and engineering*. (2014, 27)

The proportion of women in a discipline affects the extent to which their expertise is recognised – which is also partly dependent on the degree to which men identify with their gender: "Male actors who strongly identify with their gender are more likely to favour men irrespective of their educational status […]" penalising women with high educational status (Joshi 2014, 19).

4. GE measures and RTDI impact and indicators

This chapter summarises recent knowledge on the interlinkage between gender equality and research and innovation indicators. Based on the standard literature on RTDI indicators (Innovation Indicator 2012 (Frietsch et al. 2012); the European Innovation Scoreboard 2016 (European Commission 2016a); the RIO Observatory (European Commission 2016b); the OECD STI Scoreboard 2015 (OECD 2015); the OECD STI Outlook 2014 (OECD 2014)), we can summarise that most of the indicators mentioned refer to framework conditions and input factors at the macro level, whereas the output and impact area is not fully elaborated. Thus we suggest, according to the relevant literature (see Annex II), to consider the following indicators:

- **Scientific impacts**: number of publications, number of citations, interdisciplinarity of the publications, international co-publications, publications in emerging fields;
- **Technology and innovation impacts**: patent applications, patent citations, new instruments, products, processes, services, standardisation, new datasets, spin-offs;
- **Economic impacts**: increased business performance, increased competitiveness, access to markets;
- **Social impacts**: social responsibility, consumer interests, social cohesion, liveable communities, and also contribution to solving grand challenges;[9]
- Impacts in the field of **responsible research and innovation:** following the conceptualisation of the European Commission, one of the most important drivers of the concept of RRI, we ground our considerations on the five keys, which recently reflect RRI, i.e. ethics, science literacy and science education, open access, public engagement, and gender equality.

In the following, we summarise the existing knowledge as to some of the indicators mentioned above. In the course of EFFORTI, these considerations will be continuously complemented by academic or practice-oriented insights and can thus be understood as an intermediate state.

4.1. Scientific impacts

There are numerous academic articles that investigate the effects of female authorship on publication outputs (Abramo, D'Angelo & Caprasecca 2009; Allison & Long 1990; Campbell et al. 2013; Cole & Zuckerman 1984; Dundar & Lewis 1998; Pan & Kalinaki 2015; Frietsch et al. 2009; Hunter & Leahey 2010; Long 1992; Prpic 2002; Symonds et al. 2006; van Arensbergen, van der Weijden & van den Besselaar 2012; Xie & Shauman 1998). Overall, the most important results can be summarised as follows:[10]

[9] The grand challenges are: Health, demographic change and wellbeing; Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy; Secure, clean and efficient energy; Smart, green and integrated transport; Climate action, environment, resource efficiency and raw materials; Europe in a changing world – inclusive, innovative and reflective societies; Secure societies – protecting freedom and security of Europe and its citizens.

[10] Depending on the concrete bibliometric method, the results differ: for example, there are also studies that do not show any productivity gaps between male and female authors. However, the results listed below present a common understanding shared by the majority of the studies.

- The share of *female authors* increased during the past decade, accounting for 33 % in 2014, reflecting the general share of women among researchers (Frietsch, Bührer & Helmich 2016).
- Female authors publish *less in terms of quantity* (van Arensbergen et al. 2012; Xie & Shauman 1998; Penas & Willett 2006; Xie & Shauman 2003), but this gap has been decreasing during the past years (Pan & Kalinaki 2015; Cole & Zuckerman 1984; Long 1992; Xie & Shauman 1998; Prpic 2002; Symonds et al. 2006; Abramo et al. 2009; Nakhaie 2002; Penas & Willett 2006; Taylor, Fender & Burke 2006; Ledin et al. 2007).
- There are also studies which show that women produce fewer publications than men during the first decade of their career, but later in their career they more or less catch up with male researchers (Long 1992; Symonds et al. 2006).
- Publications of mixed teams, i.e. with a high share of female authors, receive higher citation rates than homogenous teams; respectively, women have higher citation rates than men (Campbell et al. 2013; Long 1992; Penas & Willett 2006; Tower, Plummer & Ridgewell 2007; Powell et al. 2009; Ledin et al. 2007).
- Men and women differ significantly regarding the *scientific fields* where they publish. *Higher presence* of female authors can be observed in: food/nutrition; social sciences, other; humanities; pharmacy; medicine; biology/biotechnology. *Low presence***:** computers, mathematics, physics, engineering (Frietsch et al. 2016).
- In subject areas with skewed gender ratios in favour of males, female researchers are more likely to focus on similar topics as their male counterparts. In contrast, in subject areas with more balanced gender distribution, women *tend to focus on different topics* (Pan & Kalinaki 2015).
- Mixed-gender publications are more interdisciplinary but less internationally collaborative than mono-gender publications, but female-only publications are the most internationally collaborative (Pan & Kalinaki 2015).
- The team size of female authors is larger than that of men (Frietsch et al. 2016).

The reasons for this overall picture described above are manifold and can be clustered as follows:

- *Individual characteristics:* Marriage and motherhood can keep women away from publishing (Long 1992). The relevant mechanism in this regard is that women more often interrupt their career to have children and start a family (Prozesky 2008). Having children also causes a decline in research productivity growth, more for women than for men (Hunter & Leahey 2010; Fuchs, van Stebut & Allmendinger 2001). Finally, women were found to initiate their careers at a later age than men (Karamessini 2004; Prozesky 2008).
- *Structural and institutional support factors*: Women seem to be more active in institutional settings where publishing is not expected or encouraged. Women seem to be less encouraged than men to publish (Bunker Whittington 2006; Bunker Whittington & Smith-Doerr 2005). Women also work, on average, at lower ranks and in less prestigious institutions. Thus, men outnumber women in positions of formal power, authority and high income (Xie & Shauman 1998; Timmers et al. 2010).
- *Access to resources*: According to Zuckerman, Cole and Bruer (1991), women do not have equal access to research instrumentation like funding, laboratory space and time allocation, i.e. women

often remain in "the outer circle" of the scientific community. Especially the variable "time" seems to play a crucial role.

- *Access to networks and social capital*: Male researchers generally have better networks than female researchers (Kyvik & Teigen 1996; Fuchs et al. 2001) and collaboration influences performance (Lee & Bozeman 2005). Moreover, women receive less academic support and mentoring than men (Landino & Owen 1988; Fuchs et al. 2001).
- *Research topics*: Women specialise less clearly in their topic than men (Leahey 2006) and they often choose less exploitable research areas (Bunker Whittington 2006; Bunker Whittington & Smith-Doerr 2005).
- Women concentrate more often on teaching and service and therefore spend less time on research (Taylor et al. 2006; Snell et al. 2009).

4.2. Technological and innovation impacts

Even if the exact share of women among inventors differs according to different authors and their respective patent analysis methods,[11] it can be concluded that women are considerably underrepresented among inventors in Europe. The percentage of female inventors (related to the total number of inventors of an EU member state) is even lower than the percentage of female researchers in all EU member states, even if there is generally a positive correlation between the proportion of women researchers and the proportion of women inventors (Busolt & Kugele 2009). Frietsch et al. (2016) show that the share of female inventors remains below 10 % (EU28) despite a steady increase during the past years.

The horizontal segregation of women is also confirmed by the patent data, i.e. men and women differ significantly regarding the scientific fields where they invent: *higher presence* of women can be observed within biotechnology; pharmaceuticals; food chemistry; organic fine chemistry; analysis of biological materials; and macromolecular chemistry, polymers; *low presence* can particularly be found in engineering (Frietsch et al. 2016).

An important result, which corresponds to the results of the bibliometric literature, is that despite the low quantity of female inventors, the opposite is true for their quality: the percentage of cited patents is higher for women than for men and there are more citations per patent for women than for men (Frietsch et al. 2016).

One main reason for the strong underrepresentation of women among European inventors is the fact that most of the patent applications are done by the business enterprise sector where women are still largely underrepresented (European Commission 2016c, 49f). Further reasons mentioned by Busolt and Kugele (2009) are that female researchers often experience a lack of professional high-quality time compared to

[11] Whereas Ding, Murray and Stuart (2006) report that female academic scientists patent at about 40 % of the rate of men (database: random sample of 4 227 life scientists over a 30-year period), Bunker Whittington and Smith-Doerr (2005) state that women enter the patenting system at similar rates to men. Fraunhofer investigations (Frietsch et al. 2009; Frietsch et al. 2012; Frietsch et al. 2016), however, confirm a strong gender gap in patent applications.

men. This is due to maternity leave, part-time work, home office work and possible differences in work duties, motivation and obligations, as well as salary differences, etc. Female researchers are also confronted with a lack of resources like project money, laboratory space, equipment (hardware and software, computing time), number and quality of co-workers, secretaries, etc., which hinders exhaustive research activities.

4.3. Economic impacts

Since the early 1990s, the presence of women in science has gained increased interest in political as well as scientific debates. The debate was first supported by *social justice arguments* and embedded in the development of general anti-discrimination policy at national as well as European levels aiming at equal rights for women in employment. Research focused on career paths of men and women as well as on the complex interplay between institutional arrangements and personal preferences that might explain the underrepresentation of women, especially at the top levels (European Commission 2004; Caprile et al. 2012). Since the turn of the century, *economic arguments* have been used increasingly to support gender equality policies:

- In the view of the European Commission (2003), to realise Europe's ambitions in achieving a *competitive knowledge-based society*, the number of researchers must be increased. In 2012, the EC (2012b) claimed again that boosting innovation in the EU means increasing the number of researchers in Europe by at least one million. In order to achieve goals such as higher "competitiveness," "innovation" and "knowledge-based society," it is obvious that the talents and potential of women must be mobilised and used.
- In the view of science and technology, *gendered innovations* enhance excellence in science, medicine and engineering both in terms of knowledge and personnel. They lead to gender-responsible science and technology, and seek to enhance the lives of women and men globally. The term "gendered innovations" is defined as the process that integrates sex and gender analysis into all phases of basic and applied research to assure excellence and quality in outcomes (Schiebinger & Schraudner 2011; European Commission 2013c).
- In the view of the business sector, the reasons why *gender diversity*[12] should be taken into consideration seriously lie in women's talents, their economic power, the changing market structure, and women's positive impact on organisational excellence and financial performance. Many studies thus indicate the *"business case,"* i.e. the positive benefit that can be generated if more women are represented in companies, at top level but also within the different working units (Hoogendoorn, Osterbeek & van Praag 2013; Stvilia et al. 2011; Bear & Woolley 2011). These benefits refer to *better products* through gendered product development but also to a higher turnover through more women in boards (European Commission 2006b; Catalyst 2004; McKinsey & Company 2007).

[12] Catalyst (2004) defines gender diversity as "recruiting, retaining and advancing women."

- The European Institute for Gender Equality (2017b) recently published an investigation about economic benefits of gender equality in the EU which showed a strong impact of GE on higher employment, more jobs and increased gross domestic product (GDP).

Gender in research content

The discussion of gender aspects in research and innovation content emerged several years ago and is part of a shift towards a "*benefit-orientation*" in the debate about gender equality. The benefit-oriented argument emphasises the *improvement of performance* through more diversity within RTDI teams. Regarding excellence in science, for example, several studies show a positive impact of the heterogeneity of (research) teams on creativity and output.

In a large explorative study, the Fraunhofer Society developed a conceptual framework and subsequent guidelines that aim to support researchers in the identification of gender aspects in their research processes (Bührer & Schraudner 2006). Additionally, a checklist has been developed which helps guarantee proper consideration of gender aspects when applying methods of empirical social research like surveys, interviews, focus groups, etc. (Bührer 2006; Kane & Macaulay 1993). The conceptual framework of the Fraunhofer project elaborated four different aspects of the gender construct (Bessing 2006): (1) biological aspects (i.e. sex), (2) psychological aspects (individual attitudes and needs), (3) social aspects (role patterns, differences in the way of life, availability of financial, social, cultural resources, etc.), and (4) ideological aspects (values, norms, stereotypes) that are intended to help identify gender aspects in research. Meanwhile, many other checklists and collections of examples exist (see Oertelt-Prigione & Regitz-Zagrosek 2012; Schenck-Gustafsson et al. 2012; Regitz-Zagrosek 2012; and the database[13] of references in major clinical disciplines).

The *Gendered Innovations Website*[14] offers a series of tools and case studies aiming to help researchers and innovators identify gender aspects in research. The conceptual framework covers the whole research and development process, starting with the identification and determination of topics up to the utilisation of the results. It is pointed out, for example, that the *definition of research priorities* is largely shaped by the availability of (public) funding, but also by the dominant reward systems for the respective careers and existing norms and stereotypes (Schiebinger & Klinge 2010).

There are numerous examples how the negligence of gender aspects (Wajcman 2010) leads to sub-optimal or even *harmful results* (for examples from the health sector, see Institute of Medicine 2010). There are also examples of *dysfunctional product development*: for example, household robots for elderly people neglecting the fact that the main target group – elderly women – are not tall and strong enough to manoeuvre the robots; voice recognition systems that were not able to identify female voices, etc. (for further examples, see Schraudner & Lukoschat 2006). The potential of improved user orientation through participatory research and design involving both female and male target groups, is described in several studies (see Schraudner & Lukoschat 2006; Leung, Yen & Minkler 2004; Oudshoorn & Pinch 2003; Greenwood, Whyte & Harkavy 1993).

[13] The database can be found at http://bioinformatics.charite.de/gender/ (restricted access).

[14] The *Gendered Innovations Website*'s address is http://genderedinnovations.stanford.edu/.

4.4. Societal and environmental impacts

Gender and corporate social responsibility

At the intersection between social and economic impacts we can rely on several studies that show that the number of women in (top positions of) companies influences corporate social responsibility (CSR) strategies (Bernardi & Threadgill 2010; Soares, Marquis & Lee 2011; Vilké, Raišienė & Simanavičienė 2014).

As several studies show, the number of women in (top positions of) a company influences the CSR strategies and activities. Bernardi and Threadgill (2010) demonstrate, for example, that companies with a higher share of women on their boards are more socially responsible, with responsibility measured as a multi-dimensional construct consisting of charitable giving, community involvement and outside recognition of employees' benefits. The authors also found that companies with a higher share of women on their boards implemented more policies towards female employees; these companies were more likely to sponsor or create charity organisations and have a formal employee volunteer programme and stronger self-commitment towards charitable giving (Bernardi & Threadgill 2010, 20). Furthermore, their literature review identified the following impacts of better representation of women on boards and thus of higher diversity: (1) broader range of knowledge and professional contacts; (2) higher probability to be listed on *Fortune*'s *Best Companies to Work for* and *Ephisphere*'s *Most Ethical Companies*; (3) reduction of unethical decisions and thus of the danger that the company's image is harmed; (4) less corporate corruption; (5) consideration of the needs of a wider range of stakeholders; (6) wider use of non-financial performance measures; (7) higher probability to have company codes of conduct and, respectively, conflict of interest guidelines; (8) attraction of more women in the workforce at other levels too; (9) better access to markets ("women are a huge market force, and understanding the female perspective is essential in generating goods and services that meet consumer wants and needs" (Bernardi & Threadgill 2010, 16)); (10) diverse effects on key financial figures (better return on investment, profitability, shareholder value, etc.).

Soares et al. (2011) showed a strong link between gender-inclusive leadership and CSR as well, especially a significantly higher amount of philanthropic contributions in companies with more female directors and corporate officers. They cite further studies that documented an interrelationship between gendered leadership and environmental CSR, improved quality of CSR initiatives and different definition of fairness.

Other studies, cited in an article written by Vilké et al. (2014), state that "companies with a significant number of women at the top are better practitioners of CSR and sustainability than other firms and are delivering big wins for business and society" (Babcock 2012, cited in Vilké et al. 2014, 199). One crucial challenge identified by the authors is the lack of continuous and systematic monitoring and reporting of relevant gender equality information. In this context, they point to the publication of Scholz (2012) who gives an overview of the effects of women in corporate governance on results like increased shareholder accountability, better legal compliance, and stronger financial performance.

Gender and environment

Numerous studies establish the relationship between a high share of women leaders and promotion of sustainability and environmental issues. For instance, Kassinis et al. (2016) and Glass, Cook and Ingersoll (2016) showed that gender diversity is an important driver for a firm's environmental sustainability initiatives and the promotion of sustainability in general (see also above, *Gender and corporate social responsibility*).

Other studies demonstrated that gender diversity on boards is correlated to higher environmental ratings (Post, Noushi & Rubow 2011, Webb 2004).

A recent study in Germany (Horbach & Jacob 2017) shows that a high share of highly qualified women and a mixed gender composition of the management board are positively correlated with *eco-innovation activities*. The basis for this study is data from an employer-employee database of the Institute for Employment Research for 2010 and 2012. Potential explanatory factors for these results are that female leaders seem to be less concerned with short-term economic goals (Brush 1992), that female personell can bring in their particular competencies to cope with the necessary changes induced by eco-innovations (shift in firms' organisantional goals, practices and routines due to their complexity and systemic character) (de Marchi 2012; Horbach, Oltra & Belin 2013), through emphasising team-work and cohesion. Studies also show that female entrepreneurs are more interested in the realisation of non-economic goals compared to men (Terjesen, Bosma & Stam 2016; Estrin, Mickiewicz & Stephan 2013).

Outside the firm context, it can be stated that gender and education are the most important predictors for sustainable behaviour, at least more imporant than income (de Silva & Pownall 2014). The fact that environmental consciousness is higher among women than men has also been demonstrated by Davidson and Freudenberg (1996) or Zeleznay, Chua and Aldrich (2000).

Moreover, the influence of gender on climate change was studied by EIGE (2012). According to this report, gender has a strong influence on sustainable consumption (OECD 2008). The report provides several examples of how social roles shape behaviour: "women are more likely to have a higher recognition of health issues and more highly developed risk perceptions, often acting on their internalised health and environment orientation; men tend to be more strongly oriented towards convenience and a 'consumption-is-annoying' attitude (Schultz & Stiess 2009); women's decisions on consumption are to a larger extent based on aspects of ethics and fairness; women feel a stronger need to adhere to social norms (e.g. slenderness) and control their eating habits more strictly, while men are able to follow their personal tastes and preferences and not follow strict gender body ideals. Ideal images of masculinity or femininity are strongly associated with patterns of consumption and types of products consumed (e.g. meat and fast cars are associated with masculinity and virility; mild, light, sweet products are associated with weakness and femininity)" (EIGE 2012, 21). Further studies cited in the EIGE report show that women typically have a higher inclination to change their consumer behaviour in favour of the environment, for example by buying products from companies which offer organic products or that support climate change initatives (EIGE 2012, p. 22).

4.5. Responsible research and innovation

A starting point for the development of indicators for the policy concept of RRI (responsible research and innovation) is the work carried out in the context of the EU-funded MoRRI – *Monitoring the Evolution and Benefits of Responsible Research and Innovation* – project (Ravn, Nielsen & Mejlgaard 2015b; Ravn, Nielsen & Mejlgaard 2015a) and the results of an expert group on policy indicators for RRI (European Commission 2015b). While the indicators collected in the cource of MoRRI mainly refer to the macro level and input indicators, the indicators suggested by the expert group focus on process, outcome and perception indicators.

A further source for the indicator development are two large-scale surveys conducted among European researchers in the course of the MoRRI project (Bührer & Berghäuser 2017). In the first step, the study team surveyed researchers listed on the EC CORDA database, delivered by the European Commission Services. In the second step, Fraunhofer ISI generated a control group based on selected main characteristics of the EU researchers' group (country of work, gender and scientific discipline). But, unlike the first group, this group of researchers had not received any EU research funding within the last five years. Main topics of the surveys were awareness of the RRI concept, conrecte RRI activities along the five main keys (public engagement, gender equality, science education, open access, ethics), main drivers to conduct RRI, perceived and expected benefits, and supporting and hindering factors for the implementation of RRI.

By these surveys, the research team could show significant differences between female and male researchers: i.e. women support female colleagues, encourage gender-balanced teams and consider gender aspects in their research design more frequently than men. Additionally, female researchers more frequently engage in science cafes, science festivals and researchers' nights as well as in partnerhips with schools and/or teachers. They also communicate and disseminate their research results more frequently than male researchers but, in contrast, are less engaged with industry in their research work. A further adverse relationship can be observed regarding open access publications which are less frequently done by female researchers (Bührer & Berghäuser 2017).

Another important result of this study was that the institutional environment positively influenced the degree of RRI activities and the general attitudes towards more responsible research and innovation: researchers working in an institutional environment that systematically supports the practice of RRI were more active in RRI practices than researchers who did not rely on such structures. For the gender equality dimension, this means that institutions that have a gender equality plan (GEP) in place are more inclined to support female researchers than institutions without such institutional incentives. Further factors which influence the practice of RRI (including its five keys) and its perceived benefits were the scientific age and scientific discipline of the respondents (Bührer & Berghäuser 2017).

5. Core set of indicators and descriptions

This chapter summarises and discusses the selection of the most promising indicators based on a systematic assessment of each indicator and the coverage of the different categories identified during the progress of the project. At large, this chapter is an attempt to synthesise a great amount of data and reduce complexity by providing a systematic, yet simplified assessment of data coverage and related implications for a set of promising indicators and within each category, dimension or subdimension.

Thus, in order to provide further exemplification of indicator meaning and ways to work with indicators, partners were asked to immerse themselves into one of the main EFFORTI Toolbox categories and select 10 indicators that are most promising or relevant (for the stakeholders) within each category. This was processed on the basis of key parameters such as relevance, effectiveness, efficiency, sustainability and impact of the considered items. The concrete analytical steps taken in the task of quality classifications have been specified in chapter 2.

In the selection of the core set of indicators, both qualitative and quantitative indicators were taken into consideration, as well as indicators that address all the ERA strategies/objectives, and also allow for variation in terms of the selected level, so that micro, meso and macro level indicators are included in the core set. With much attention paid to the balancing of the level of abstraction allowing for both adequate general appeal and practical relevance, the partners then developed a brief description of each indicator to elaborate what we understand by it and how this indicator can be addressed. A template was thus developed to guide the process of describing the core set of indicators. The indicator descriptions were next circulated among all partners and adjustments were made for overall cohesion and variation. The synthesis and quality reviews are not offered as a final version of the core set of indicators but are rather meant to provide an overview of the gathered data, and, considering various levels of interventions and quality parameters, make a qualified appraisal of indicators. This appraisal calls for further verification in the following project work. The core indicators will hence be further developed and revised based on the selected case studies and insights from the national and international workshops as well as the input of the EFFORTI Advisory Board. The selected core indicator short descriptions in each category are presented in five schemes, one for each category, in the following tables. The extended descriptions of the indicators per category are provided in Annex III.

Tab. 3: Core set of indicators for Category 1

Indicator Description	Category 1. PERSONNEL
Name of indicator	**Relative size of business enterprise in R&D sector / researchers by sector of performance 2013, in percent of total R&D personnel**
Brief description	This quantitative indicator displays the size of the business enterprise sector in R&D in relation to the governmental, higher education and private non-profit subsectors by comparing the number of researchers employed in the subsectors concerned. It is available for the EU 28 member states, which makes an EU-wide comparison possible.
Indicator	**Number of tenured / tenure-track / non-tenured faculty**
Brief description	This quantitative indicator shows the distribution of women and men in the institutionalised career path “tenure track” and in the group of employees without involvement in the programme. An equal distribution is intended as underrepresentation

	of women in the tenure-track group may indicate a lack of career support for women and, therefore, gender bias in the personnel development in the organisation concerned.
Indicator	**Comparison between the proportion of female faculty during the most recent academic year to the proportion hired in the period of the past 3 years**
Brief description	It is a quantitative indicator for measuring development in hiring processes and illustrating gender bias in recruitment by comparing the proportion of men and women in the most recent academic year to the proportion hired in the past 3 years.
Indicator	**Horizontal gender segregation in occupations and in economic sectors**
Brief description	The index of gender segregation in occupation describes the percentage of employees who would have to change work if an equal proportion of men and women across occupations was to be achieved. It ranges from 0 (no horizontal segregation) to 50 (complete horizontal segregation), meaning the lower the number, the more equal the society. Since it is conducted by Eurostat, an EU-wide comparison is possible.
Indicator	**Success rates of men and women applicants to positions**
Brief description	Quantitative differences in the success rates of men and women applicants to positions may indicate a gender bias in the recruiting process of the organisation concerned. The indicator is calculated by dividing the number of recruited male and female applicants by the total number of male and female applicants; it may be useful to break the data down by field, department, academic positions, part-/full-time positions, temporary/permanent positions.
Indicator	**Percentage of research evaluation panels in RFOs that included the target of at least 40% of underrepresented sex in boards**
Brief description	One of the targets of the EC's Horizon 2020 programme is to ensure gender balance in decision-making. Therefore, another important issue concerns the participation of the underrepresented sex in evaluation and recruitment panels. A target of a minimum of 40 % for all panels has been agreed upon; it can be achieved through various policies, e.g. targets, quotas. According to the results of the 2014 ERA survey, 36 % of research evaluation panels in the EU28 include at least 40 % of the underrepresented sex in their composition. The indicator shows the percentage of gender-balanced research evaluation panels in 2013 in 27 EU countries, as there is no data available for Croatia.
Indicator	**Proportion of women grade A staff by main field of science**
Brief description	This quantitative indicator shows the proportion of women grade A staff across fields of science, displaying the horizontal segregation in the academic field at professorial level.
Indicator	**Encouragement to engage in decision-making**
Brief description	The subjective perception of encouragement to engage in decision-making can be a valuable outcome and indicator of success of human resource development programmes.
Indicator	**Gendered composition of boards or committees**
Brief description	This indicator displays the representation of both genders in boards or committees. Equal gender representation in these decision-making groups is considered crucial to enabling a change in practice; as gatekeepers, they have the influence to enforce or hinder the development of equal gender opportunities. The composition can also be an indicator for the permeation of GE policies (Munir et al. 2013, 104; Frehill et al. 2005, 13).

Indicator	**Percentage of professional staff at employment levels differentiated by gender**
Brief description	This quantitative indicator can show either the current state or the development of gender equality at different employment levels, reflecting vertical segregation or leaky pipeline in the organisation concerned. It may be used to evaluate the results of a human resource development programme in a longitudinal study (Harris & Leberman 2012).
Indicator	**Distribution of gender in recruitment or promotion boards**
Brief description	A quantitative indicator that shows the share of women and men, hence the representation of both genders in recruitment or promotion boards of the organisation concerned, analysing decision-making groups which play a crucial role in regard to the career development. It may be useful to break the data down to scientific fields or departments.

Tab. 4: Core set of indicators for Category 2

Indicator Description	**Category 2. WORKING CONDITIONS**
Indicator	**Extent of experienced work-family conflict**
Brief description	Qualitative outcome indicator on the self-reported extent of the conflict perceived by employees between the demands of their work and family roles in teams, organisations and member states to illustrate satisfaction with work-life balance.
Indicator	**Possibility of paternity leave**
Brief description	Qualitative/quantitative context indicator to reveal whether employment-protected leave of absence for employed fathers exists in member states as a part of their parental leave systems to illustrate the more equal sharing of family responsibilities.
Indicator	**Employment rate in RTDI by age of children and sex**
Brief description	Quantitative context indicator on the proportion of employed persons aged 25-49 by age of youngest child, sex, country and year to show the differences in men's and women's participation in the labour force and to describe the impact of having children on the employment of women (and men).
Indicator	**Gender pay gap in RTDI**
Brief description	Quantitative context/outcome indicator on the difference between the average gross hourly earnings of men and women in the RTDI sector expressed as a percentage of the average gross hourly earnings of men. It illustrates the extent of gender equality in the labour market.
Name of indicator	**Perceptions of work climate**
Brief description	Qualitative outcome indicator on the self-reported perceptions of workplace environment to illustrate the satisfaction with one's work environment and equal opportunities.
Indicator	**Main differences of working hours between men and women in full-time employment**

Brief description	Quantitative context indicator on the actual amount of weekly working hours of full-time workers by gender and country to illustrate the extent of well-being, satisfaction with work and gender equality in the labour market.
Indicator	**Time spent on unpaid work**
Brief description	Quantitative context indicator that reveals how much time women and men aged 15-64 invest in unpaid, paid and total work in minutes per day to illustrate gender inequalities stemming from stereotypical family roles.
Indicator	**Transparent promotion system**
Brief description	Qualitative outcome/impact indicator on the openness, accountability, auditability of all promotions made by decision-making bodies to illustrate potential gender discrimination and inequality in decision-making and promotion procedures.
Indicator	**Confidence in own ability**
Brief description	Qualitative outcome indicator on the self-assessment of employees regarding their professional value and capabilities. It is assumed that self-confidence can be dependent on performance reviews and feedback; therefore, the indicator reflects the negative effects of potential discrimination, gender bias, stereotypical or sexist acts and remarks, etc.
Indicator	**Study of actual space allocation of faculty at organisational level**
Brief description	Quantitative/qualitative output indicator that measures the specifics of space allocation of faculties in organisations (e.g. access to labs, square footage, proximity to electrical power, years since last renovation, services, etc.) to illustrate the satisfaction with one's work environment and equal opportunities.

Tab. 5: Core set of indicators for Category 3

Indicator Description	**Category 3. PROFESSIONAL CAPABILITIES**
Indicator	**Women with leadership positions**
Brief description	Women represent a minority of Grade A professors (21 % in 2013), heads of higher education institutions (HEI) (20 % in 2014) and board members (including leaders) in research decision-making (28 % in 2014) (European Commission 2016c). Machado-Taylor and White (2014) recognise the various factors that explain why women are underrepresented in HEI leadership. They identify the availability of only a small recruitment pool as an important factor. University leaders consider that the usual career path into senior management is through academic promotion and that being a full professor is a pre-condition for securing a leadership position (Bagihole & White 2011). The underrepresentation of women in higher positions within academia (grade A) therefore leads to greatly reduced chances of women becoming the head of a university or a similar higher education institution.
Indicator	**Availability of positions in the RTDI system and in the research organisation**
Brief description	Quantitative contextual composite indicator. In many countries, there are not many research positions or permanent positions (such as professor positions) available due to economic constraints and cuts in funding. We see a development towards more external

	funding to finance positions, increase in non-tenure positions, etc. At the same time, the autonomy of universities has increased, which means that universities in many countries receive less basic funding and have difficulties in recruiting personnel, in particular at A & B level. The share of external funding is increasing in general, but that also means there are more temporary positions until funds are used.
Indicator	**Scale of organisational commitment to gender diversity** (measurement through regulations, contract reformulation, founding of new initiatives)
Brief description	This indicator measures the overall organisational awareness and commitment to gender diversity goals through identifying the presence of gender-inclusive regulations, contracts, initiatives, processes and procedures.
Indicator	**Percentage of staff/researchers who have received training on integration of gender analysis into research (IGAR)**
Brief description	Quantitative indicator to measure the level of staff's/researchers' know-how of integrating sex and gender considerations into policies, programmes and projects, and to measure the awareness about the importance of sex and gender in research and innovation.
Indicator	**Proportion of budget allocated to GE monitoring of total budget**
Brief description	Quantitative indicator that measures the proportion of the total budget allocated to GE monitoring. This indicates how seriously the institution takes implementing gender equality measures by monitoring their progress.
Indicator	**Share of men and women among successful applicants**
Brief description	Quantitative indicator to measure research funding success rate differences between women and men – indicative of a gendered process of resource allocation. The European Research Council has recognised that imbalances persist in the success of women in their calls for funding, whilst these imbalances vary across countries. There are great differences in women's propensity to apply for funding, so this indicator looks at the differences in success rates of women and men when applying for research funding (European Commission 2016c, 95).
Indicator	**Average size of grant for women and men**
Brief description	Quantitative indicator of resource distribution between men and women, indicative of a gendered resource allocation process. This indicator should be broken down by scientific field, funding scheme, academic age, number of years since obtaining a PhD. If relevant, this indicator can also be broken down by academic position and/or sector (Science Europe 2017).
Indicator	**Promotion of gender equality as a funding requirement**
Brief description	Promotion of gender equality as demonstrated by the existence of a gender equality plan, improved action (demonstrated by monitoring) or impact (demonstrated by evaluation of a plan) as an explicit criterion in order to receive funding. This is a powerful RFO steering mechanism to influence the uptake and implementation of gender equality measures in RPOs.
Indicator	**Reasons for potential applicants not to apply/apply for funding**
Brief description	Research has demonstrated women's lower propensity to apply for funding than men. Some of the main factors influencing the application behaviour include: seniority,

	employment status, tenure, type of institution, professional profile, institutional support, career breaks and family circumstances. The securing of research funding is decisive for career advancement and has been identified as a major factor, which means that women tend to get stuck on the 'sticky floor' of a research career.
Indicator	**Overall strategic gender equality policies in place**
Brief description	The overall strategic orientation of gender equality policies in RTDI including the legal basis/acts relevant to the field of gender equality in RTDI is an important context-related indicator to assess the awareness/commitment to gender equality at the national level. This undoubtedly frames professional capabilities.

Tab. 6: Core set of indicators for Category 4

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Indicator	**GE-dedicated administrative staff**
Brief description	Qualitative process indicator that measures if and to what extent staff is dedicated to the conception, implementation and/or monitoring of GE measures at a research institution. It is assumed that clear responsibilities are needed for the effective and sustainable anchoring of GE measures.
Indicator	**Value of GE-promoting measures**
Brief description	Quantitative outcome indicator on various personal gains a participant of a GE measure may have experienced as a result of the measure to illustrate the effectiveness of the measure (e.g. access to role models and/or mentors, ability to identify networking opportunities, confidence in voicing one's opinion).
Indicator	**Perception of preferential treatment such as advice, access to lab or equipment, resources, recruitment, promotion, attention to meetings**
Brief description	Quantitative outcome indicator on the self-assessment of equal opportunities limited or promoted by leader behaviour or the informal and formal rules at the workplace to illustrate the perceived satisfaction with one's work environment and equal opportunities.
Indicator	**Rating of communication paths and processes**
Brief description	Quantitative outcome indicator on the self-assessment of the usefulness of several ways (e-mail, regular meetings, staff appraisals) and arenas (research groups, social events, seminars) of communication to illustrate equal opportunities by men and women in communication procedures.
Indicator	**Rating of transparency regarding decision-making bodies and criteria**
Brief description	Quantitative outcome indicator on the self-assessment of the perceived auditability of made decisions by an organisation's decision-making bodies to illustrate potential gender bias in decision-making procedures.
Indicator	**Sustainability of gender equality initiatives**

Brief description	Qualitative process indicator to illustrate whether a GE measure led to ongoing engagement of a research institution regarding GE. Sustainability is indicated, for instance, by the incorporation of GE measures at strategic (GE in key strategic documents) and operational levels (e.g. promotion guidelines) through permanent dedication of staff to GE affairs, permanent data collection and monitoring of key indicators.
Indicator	**Percentage of RPOs that document specific actions aiming to change aspects of their organisational culture that reinforce gender bias**
Brief description	Quantitative indicator on the share of organisations that establish actions to change their organisational culture in order to reduce gender bias compared to the total number of organisations in a field.
Indicator	**Share of RPOs with gender in research content**
Brief description	Quantitative indicator on the share of research performing organisations which included the gender dimension in research programmes compared to the total number of RPOs.
Indicator	**GE unit/committee in place**
Brief description	Quantitative process indicator that measures whether an organisation has set up structures dedicated to gender equality and/or the implementation of a gender equality plan, including the creation of a dedicated budget for staffing gender equality offices and committees and ensuring the institutional anchoring of equal opportunities at department/faculty level.
Indicator	**Composition of applicants and those who received funding**
Brief description	Quantitative indicators on the gender distribution of applicants for funding and the gender distribution of successful applicants. A comparison of both indicators allows a conclusion on a potential gender bias in funding processes.
Indicator	**Adoption of GE plans**
Brief description	Quantitative process indicator that measures if a research performing organisation has a gender equality plan and applies it in its work. GE plans are assumed to be a prerequisite of an effective and sustainable GE strategy.

Tab. 7: Core set of indicators for Category 5

Indicator Description	**Category 5. (RESPONSIBLE) RESEARCH AND INNOVATION**
Indicator	**Publication's interdisciplinarity**
Brief description	This indicator shows the degree of interdisciplinarity of scientific publications and relates this to the share of women within the research teams. It requires expertise in analysing bibliometric databases like Web of Science or Scopus.
Indicator	**Number of citations**

Brief description	This indicator is a proxy variable for the quality of a scientific publication by analysing how frequently the article was cited. It requires expertise in analysing bibliometric databases like Web of Science or Scopus.
Indicator	**Percentage of international scientific co-publications**
Brief description	This indicator shows to what extent a scientific publication is based on an author team with a variety of national backgrounds. It requires expertise in analysing bibliometric databases like Web of Science or Scopus.
Indicator	**Networks of developers, providers and users of solutions involved in co-creation (value chain)**
Brief description	This indicator requires information on the number and kind of participants of research and innovation projects. Presumably, this information is accessible for funded projects, for example, H2020 projects.
Indicator	**Patents' citations**
Brief description	This indicator shows how frequently patents are cited and can thus be understood as a measure of quality of patents. It requires expertise in analysing patent databases like Patstat.
Indicator	**Share of women founding a company**
Brief description	This indicator is intended as a proxy that estimates knowledge flow from academia to private start-up companies with economic growth potentials, for example, via research based spinouts. The indicator provides a gender-segregated statistical probability of entrepreneurial activity, i.e. knowledge transfers by starting up a company of people at different levels of academic career trajectory.
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. Possible question: When allocating research and development funding in 2014, 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)
Indicator	**Active consideration of how research and innovation results will be perceived and used**
Brief description	This indicator illustrates an operationalisation of a public engagement item used in the course of a large-scale survey among European researchers where these researchers were asked whether they take actively into account how the research and innovation results will be perceived and used.
Indicator	**Science competence in secondary school pupils**
Brief description	Indicator describing science competence of secondary school pupils in science subjects (biology, chemistry, physics and earth science).
Indicator	**Societal challenges – number of joint public-private publications**

Brief description	This indicator describes the number and percentage of joint public-private publications out of all relevant publications.
Indicator	**Better societal acceptance of innovative solutions**
Brief description	This indicator describes expected impact from research and innovation projects, up to 20 years after the project has received funding. It requires data from large-scale surveys among citizens, such as Eurobarometer.

6. Theory-based impact stories – Concept, relevance and structure

As discussed earlier (see chapter 2), the EFFORTI Toolbox will consist of two parts, a 'static' part, which will mainly consist of downloadable documents, and a dynamic one. The latter will provide the user with the necessary tools to understand 'how' gender equality measures are supposed to work and will support the formulation of programme theories. This part will contain approximately twenty "impact stories". The impact stories are (1) ideal type impact chains, describing the outputs (immediate technical results), outcome (direct social effects) and impacts (intended middle- or long-term effects) of commonly used gender equality measures. Furthermore, the impact stories explain (2) how the elements of the I-O-O-I chain (input, output, outcome and impact dimensions) causally interact with each other, (3) through which indicators the expected positive effects can be verified, and (4) which positive as well as negative unintended effects have to be taken into account and how they can be fostered or, respectively, avoided.

The impact stories will be compiled into a database and made accessible through a user interface. The interface allows filtering of the impact stories for specific goals, measures or indicators (see Figure 6). The separate items of the tree structure (goals, measures, outcomes/impacts, indicators; see also the 'EFFORTI tree' in chapter 2) will be dynamically selectable. By selecting one item, its vertical connections on the goal, outcome, impact or indicator level will be displayed. By selecting two or more items, also the horizontal interrelations between the particular GE measures, goals, effects or indicators will be available for the user.

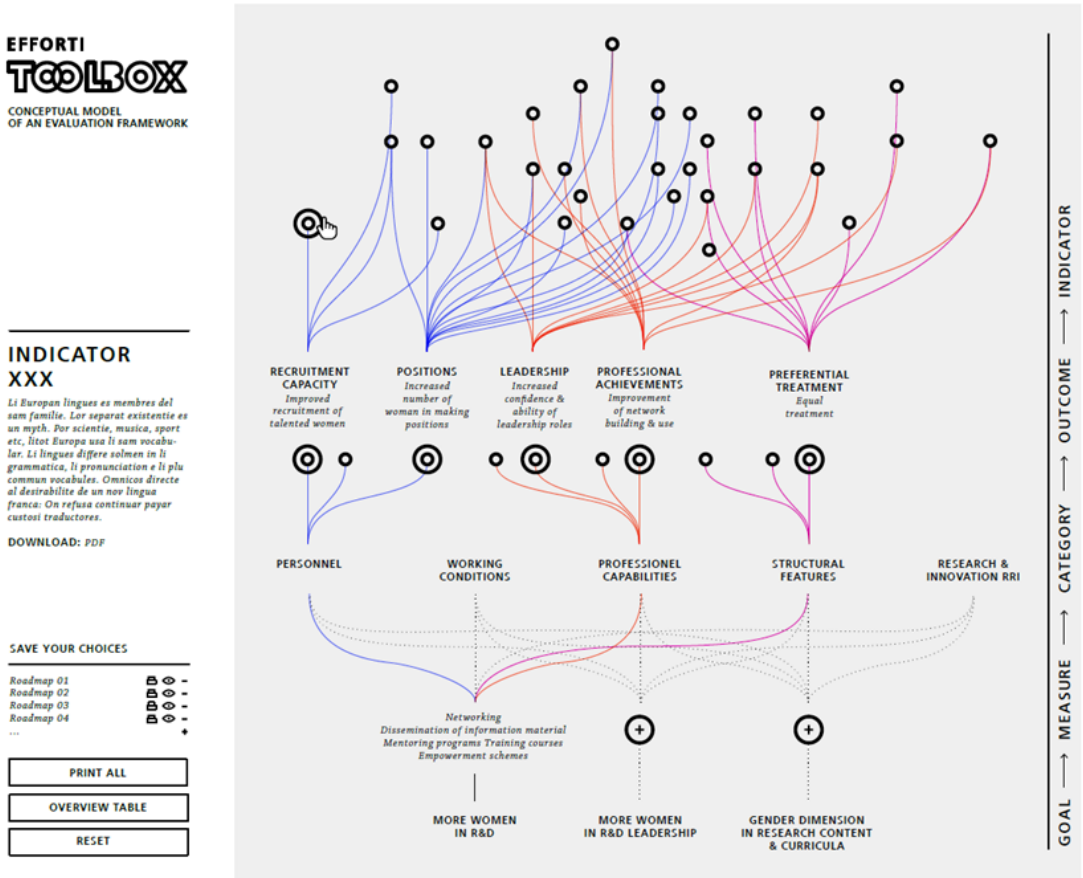

Figure 6: Early user interface draft of the dynamic part of the EFFORTI Toolbox (designed by Fraunhofer CeRRI)

Giving systematic access to the impact story database, the dynamic part of the EFFORTI Toolbox makes it possible to compile a customised gender equality intervention programme or evaluation design and to simulate ideal-type processes, outcomes and impacts. One of the basic premises of EFFORTI is that the specific context of a gender equality measure substantially affects the measure's outcome and impact. Taking into consideration the specificity of each context implies that the EFFORTI impact story database cannot assert the claim to enable the construction of universal and "one size fits all" impact chains. The database has to be understood as an expert system. An expert system is a subtype of artificial intelligence, i.e. it is a knowledge-based system with inference or problem-solving capability and (sometimes) highly developed interaction capability for application in a very limited special field (Styczynski, Rudion & Naumann 2017, 9).

The knowledge base of the EFFORTI expert system consists of the impact stories, prepared by the EFFORTI team members and substantiated by their collective experience from different and complementary fields of science, empirical findings in the literature and the case studies that will be conducted in WP4. Metaphorically, the EFFORTI Toolbox will allow the user to have a discourse with the EFFORTI experts on plausible impact chains and programme theories. Behind the user interface of the EFFORTI expert system lays a limited inference component that uses rudimentary IF-THEN rules, e.g. "IF measure X and measure Y are selected, THEN this may cause overlaps at the impact level," or "IF goal X is selected, THEN measure X, measure Y and measure Z should be part of the programme design."

Output, outcome und impact are classified according to the system of categories that was developed in the context of D3.2 and further elaborated during the course of the project (see Annex I). Hereby, it will be possible to visualise the intersections between the particular gender equality measures. The typology of gender equality measures that are included in the EFFORTI impact story database is derived from multiple sources. The basic typology is adapted from Kalpazidou Schmidt and Cacace (2017), who assessed 125 gender equality programmes in research organisations worldwide. The initial typology was extended by the EFFORTI team and its advisory board during a workshop meeting for further measures that promote the inclusion of gender in research content. During the last step, the resulting typology was compared to the extensive list of fields and sub-fields of action of the GENERA project (Oetke, Holzinger & Baraban 2017).

Figure 7 shows the logic of the impact story approach by the means of an exemplary gender equality measure 'revision of internal policies regarding promotions'. The measure aims at the immediate output of a more transparent and formalised promotion process. An increase in transparency can lead to an increase of performance-related justice in promotions as an outcome, and to stronger performance-orientation of the whole research organisation/system as an impact. Figure 7 also visualises the theoretical assumptions that are present to validate the superior intervention logic (in the green boxes of Figure 7). First, the measure is split into its particular activities, and then the output, outcome and impact are further specified. For example, increased transparency in promotion processes enables better career planning, increases work climate and job satisfaction (as promotions are perceived as more justified) and may also lead to higher performance incentives for all team members (as performance requirements are clarified). In the long run, because of a weakening of institutional gender bias, the number of women at all hierarchy levels is expected to increase and research performance is expected to improve. Suitable quantitative and qualitative indicators are attributed to all levels of the impact chain (output, outcome, impact). Consequently, the impact stories are also used to decide which of the versatile set of indicators that was compiled during the previous research steps will be part of the EFFORTI Toolbox.

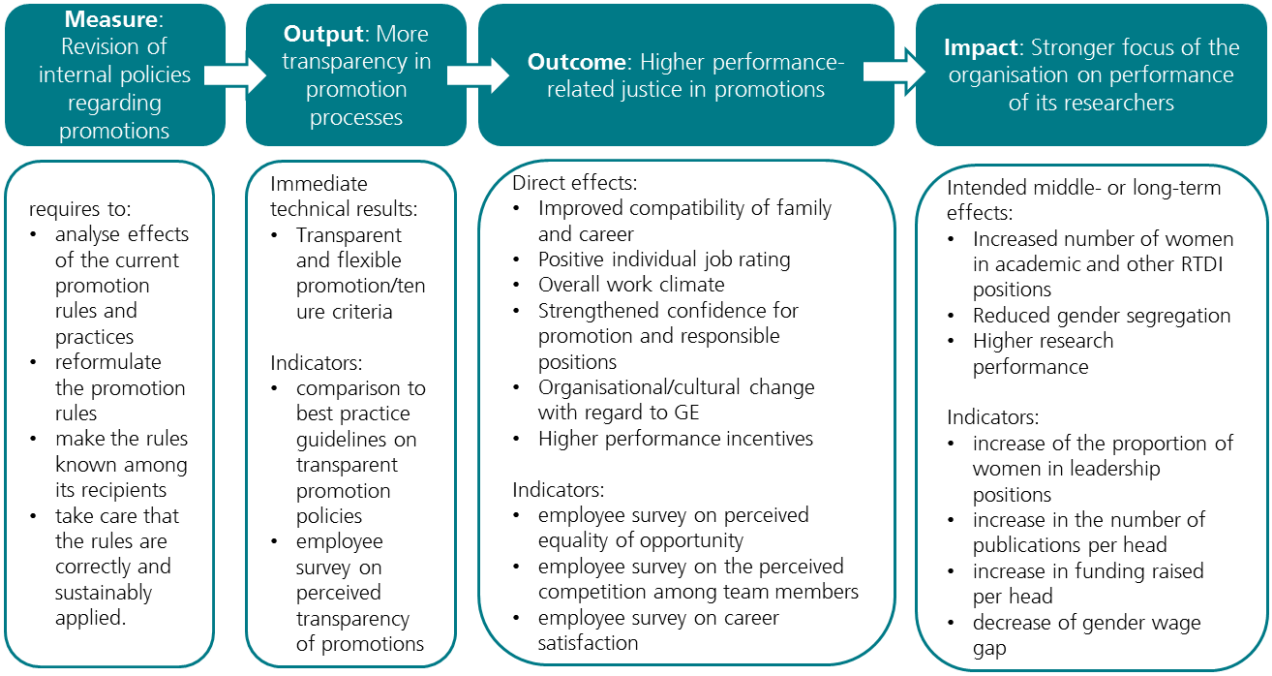

Figure 7: Logic of an exemplary impact story

Methodologically, the impact stories not only form the core of the EFFORTI expert system, they also set a cornerstone for the case studies. In preparation of the case studies, change models of the examined programmes are built on the basis of the impact stories. During the case studies, the change models are assessed for their reliability and functionality. In turn, the case studies allow for validation, refining or readjustment of the impact stories. All impact stories are constructed based on the same structure:

1. Definition of the gender equality measure
2. Output: description of the measure's immediate technical results and output indicators
3. Outcome: description of the measure's direct social effects and outcome indicators
4. Impact: description of the measure's intended middle- or long-term effects and impact indicators
5. Description of possible positive and/or negative unintended effects and strategies to foster or avoid those effects

Below, two examples of impact stories are presented, one on gendered user involvement (see Tab. 8) and one on mentoring (see Tab. 9) to illustrate the impact chain of concrete interventions. Additional impact stories, one for each intervention type in accordance with the intervention typology developed in EFFORTI (see Tab. 1), are provided in Annex IV.

Tab. 8: An exemplary impact story on gendered user involvement

Impact story Gendered user involvement in development of products
Measure definition The GE intervention "gendered user involvement" describes an approach in the development of new products that focuses on usability for women and men (and other diversity dimensions). This will be

achieved by involving (future) female and male users of a product in the development process (see Schraudner et al. 2013) and identifying their needs and requirements for the product. If technologies are developed based on "I Methodology", this can lead to non-target-group-adequate products. "I Methodology" describes a development process in which (mostly male) researchers and designers see themselves as a typical user and develop products based on their needs (see Akrich 1995; Oudshoorn, Rommes & Stienstra 2004). This can be problematic because (male) researchers have a special "insider relationship" with technology: because they are technology experts, their worldview is different from that of other male and female users of their product.

Goal

Gender dimension in research content & curricula

Responsible research and innovation

Research performance

Output

The measure's short-term output consists in the integration of gendered user involvement activities into technology development processes like gender-divided test groups, gendered needs assessments, usability tests, participatory co-designing, etc., ideally from the very beginning (see Nedopil, Schauber & Glende 2013; Rommes 2014). The result of this changed technology development process is information on gender-specific (and diversity-specific) user requirements for the product to be developed.

Output dimension

5.1 Research outputs and impacts

5.2 Innovation outputs and impacts

5.4 Gender-sensitive research

5.5 RRI

Output subdimension

5.6.1 Research priorities and outcomes of GE

5.1.1 Scientific output

5.2.3 Incorporation of knowledge about sex and gender into engineering innovation processes

5.3.2 Research quality: integration of the gender dimension/perspective in research and content, in research projects, patents, and agreements

5.5.3 Public engagement

Output indicators short

Composition of gendered product development

New, altered or improved research tools & techniques, models and simulations

New advanced capabilities, methods, systems, infrastructures and technologies

Development of user-driven innovation/design innovation

Sample composition by sex

Needs and expectations of research subjects and gender assumptions have been considered and included

Involvement of citizens in the phases of research

Outcome

The measure's middle-term outcome consists in products that meet the different needs of various user groups. Considering diversity dimensions can lead to an extension of the target group of a product and thus to an increase in market opportunities (Schraudner & Lukoschat 2006) and an increase in sales figures (for example, due to customer satisfaction and recommendations). In addition, an early involvement of

users in development processes may limit the risk of development mistakes by taking into account user needs right from the beginning of the development process and thus reducing possible development costs (e.g. cost reduction by solving usability problems right at the beginning of the development process, reducing costs for future revisions, reducing the cost of usage instructions) (Bevan 2005, 3). "Early societal intervention in the (…) process can help avoid technologies failing to embed in society and/or help that their positive and negative impacts are better governed and exploited at a much earlier stage" (von Schomberg 2013, 64f). Positive and negative impacts of technologies can be manifold. Examples of positive impacts are reduced workloard, improved safety, increased support for elderly people to live independently, etc. Examples of negative impacts can be loss of added value, environmental pollution, child labour, social exclusion etc.
Outcome dimension 5.2 Innovation outputs and impacts 5.3 Economic outputs and impacts 5.4 Gender-sensitive research
Outcome subdimension 5.2.1 Conventional innovation indicators 5.2.2 Diffusion of innovation in products, services, processes 5.3.1 Economic impacts 5.3.2 Research quality: integration of the gender dimension/perspective in research and content, in research projects, patents, and agreements
Outcome indicators short Demonstrators of innovative solutions New context-adapted solutions New products, processes and methods launched into the market Turnover from innovation Sales of new to market and new to firm innovations Improved market uptake and replication of tested technologies Improved cost-effectiveness and sustainability of solutions Improved time-to-market Turnover of company Competitive advantage through increased usability of products
Impact Taking into account different diversity dimensions of potential users when developing technological products creates an added value, since research and development is aligned with the demands of society and thus excellence and quality of the results is promoted (see GenSET 2010; von Schomberg 2013; Kristensson, Gustafsson & Archer 2004; Lüthje 2003; Rauterberg 2003). When gendered user involvement is practiced by many companies of an economy, this might also have positive economic effects at the national level (hypothesis).
Impact dimension 5.1.1 Scientific outputs 5.2 Innovation outputs and impacts 5.3 Economic outputs and impacts
Impact subdimension

5.1.4 Strengthened R&I capabilities/excellence 5.2.1 Conventional innovation indicators 5.3.1 Economic impacts 5.3.4 Jobs, growth & competitiveness of participants
Impact indicators short Reputation and excellence of Europe in technological research Better innovation capability of EU firms EU technological leadership & strengthened competitive position of European industry Enhanced innovation capability and competitiveness of European enterprises in the global market Improved performance of existing businesses
Conditions of effectiveness In order to avoid development mistakes, it is essential to introduce participatory designs for the entire development process and not only when testing prototypes or end products (Rommes 2014, 51f; Sarodnick & Brau 2011). It is also important to ensure that the test persons are representative of potential users. Therefore, other diversity dimensions of the consumers in addition to gender must be taken into account in the sample selection (e.g. not testing products with students only because they are easily accessible). Ensuring a sufficiently diverse and representative sample of potential users is also important in order to counteract the risk of (gender) stereotyping (see Rommes 2014; Erharter & Xharo 2014). Due to a lack of comprehensive methodological knowledge, standardised usability tests are frequently used in the form of questionnaires to cover the user orientation. Adaptation to the specific research context often does not take place; in addition, only very few qualitative methods are used to better interpret the quantitative results (Ohl & Schade 2015). The use of qualitative and creative methods is, however, central in order to make the "tacit knowledge" of the test persons regarding use of the technology to be developed available to incorporate it in the further development process.

Tab. 9: An exemplary impact story on mentoring

Impact story Mentoring programme
Measure definition The share of women within RTDI fields, as well as in research in general, decreases with every career step (the so-called 'leaky pipeline'). Women are not only underrepresented among researchers, but also in leadership positions within academia (Göransson 2011; European Commission 2016c). Mentoring is expected to contribute to improving the female talent pool for career progression by strengthening women mentees' professional and/or leadership skills and career prospects through planning, networking, and insights into organisational norms, processes, and politics. Other mentoring relationships are close and caring with a focus on personal development and emotional support (Hansman 1998, 64). Mentoring schemes may take different forms and have different objectives. However, most definitions agree that a mentoring relationship typically involves an experienced (older) mentor who guides, advises, and supports a less experienced mentee (Chandler 1996, 79). Finally, some scholars stress that mentoring relationships are reciprocal and benefit not only the mentee but the mentor as well (Kalpazidou Schmidt & Faber 2016, 5). In practice, mentoring usually entails a recruitment process of mentors and mentees, followed by matching of well-suited mentor-mentee pairs. Depending on the degree of formalisation, a mentoring

scheme may be commenced by a launch meeting or workshop, or mentor-mentee pairs may start the mentoring meetings directly from the outset. Formal requirements may also determine how often mentor-mentee pairs should meet and what they should discuss, whereas in informal mentoring relationships, meetings and content may be agreed upon on an ad hoc basis. As the mentor-mentee pair gets to know each other, the level of mutual trust and self-disclosure increases which, ideally, adds to psycho-social support and benefits both parties (Hansman 1998).

Goal

More women in research
More women in leadership positions
Improved research performance/output

Output

The measure's short-term output is the fostering of confidence, well-being and job satisfaction of individual mentees. Mentees further stress improved knowledge and understanding of advancement prerequisites and career strategies as a valuable output. Mentoring may also concern leadership career ambitions and specific competencies. Additional outputs include the formulation of mentoring scheme policies and guidelines for the mentoring relationship, ensuring adequate mentoring infrastructure such as introduction meetings, workshops, etc., as well as recruitment and matching of mentors and mentees. Lastly, increased intrinsic motivation and satisfaction of mentors to 'do something good' for a young researcher may be considered as a positive side effect of mentoring (Kalpazidou Schmidt & Faber 2016)

Output subdimension

2.3.2 Strengthened confidence for promotion and responsible positions
4.1.1 Decrease of GE barriers

Output short

Increased mentee confidence, well-being, and job satisfaction
Increased intrinsic motivation of mentors
Formulation of mentoring policies, guidelines, and establishment of infrastructure
Recruiting and matching of mentors/mentees

Output indicators short

Individual mentees: Confidence and preparedness in long-and short-term goals/path
Value of having a mentor (male/ female)
Satisfaction with career
Perceptions of work climate
Benefits of coaching/mentoring
Short and long-term career plans are developed
Improved understanding of different departments/sections culture and procedures
Ability to apply and exercise learned leadership skills
Growth of knowledge about local leadership and organisation culture
Individual mentors: Supervising/mentoring others
Organisational level: Implementation of mentoring/coaching programmes/sessions
Ability to identify and access mentors

Outcome

The measure's direct outcomes include retention of competent researchers, as mentors teach mentees about career 'paths, shortcuts and minefields' within research environments (Kalpazidou Schmidt & Faber

2016, 13). Effects may also reside in the mentees' improved efficiency when mentors give advice on time management and prioritising work assignments but also in support of developing leadership skills. Mentees may feel more confident and goal focused when mentors help clarify competencies and strengths and identify learning potential. Finally, mentees benefit from the mentoring relationship by gaining access to the professional network of the mentor (Kalpazidou Schmidt & Faber 2016).

Outcome dimension

1.1 Positions

1.2 Recruitment capacity

3.1 Leadership

3.2 Professional achievements

Outcome subdimension

1.1.1 Increased number of women in academic and other RTDI positions

1.2.1 Improved recruitment of talented women

3.2.1 Increased professional development of work skills (for career success)

3.2.2 Improvement of network building and use

Outcome indicators short

Individual level: Network was built/has extended and is used to advance career

Clarity about own value as a scientist

Attaining of competence awareness

Knowledge about own career paths and potential obstacles

Share of hours spent on research/teaching/other activities per sex

Ability to create/enhance/sustain new networks/contacts/collaborations

Use of mentoring (promoting of career, obtaining of resources, useful advice to early career researchers regarding visibility and publications, etc.)

Knowledge about leadership and university governance

Improved understanding of different departments'/sections' culture and procedures

Impact

Mentoring potentially improves research impact by increasing collegial support, knowledge sharing and collaboration across seniority ranks, clarifying pathways to qualifying for permanent positions, as well as better understanding of the norms and culture of the research environment and increased awareness of gender structures in the organisation (Kalpazidou Schmidt & Faber 2016; Gardiner et al. 2007). Furthermore, when senior mentors learn about the (gendered) struggles of young researchers, this may contribute to increased awareness at the organisational level about gender issues, change organisational structures and culture in the long run and foster better integration of women in the research environment (Kalpazidou Schmidt & Faber 2016). Improved networking with more experienced researchers and better integration into the research environment may lead to increased number of publications in peer-reviewed high-impact journals.

Impact dimension

4.1 Gender equality challenges/barriers

4.2 Organisational/cultural change with regard to GE

Impact subdimension

4.1.1 Decrease of GE barriers

4.2.1 Organisational/cultural change with regard to GE

Impact indicators short *Organisational level*: Number of publications in peer-reviewed high-impact journals Number of citations/field-specific citation rates Number of awarded patents Acknowledgement of gender issues Acceptance of cultural change Cultural/professional features of work environment
Conditions of effectiveness The success of mentoring schemes may be impeded by factors such as lack of women mentors, lack of clearly established goals, lack of guidelines for interaction, and challenges of men mentoring women (Hansman 1998). Mentoring scheme owners further need to consider whether the mentor role should be assumed on a voluntary basis (intrinsic motivation, doing it for the 'greater good') or whether reimbursement is offered (extrinsic motivation) (Kalpazidou Schmidt & Faber 2016). Critics point to how mentoring schemes target individual women as opposed to organisational structures and culture, in efforts to 'fix the women' as opposed to 'fixing the organisation'. As such, mentoring cannot stand alone in improving gender equality in organisations (van den Brink & Benschop 2012). Finally, to be effective, mentoring schemes need to be intersectional in order to successfully include and positively support women of colour, disabled women, etc. (Chandler 1996).

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7. Glossary

BES	business enterprise sector
BRC	Biomedical Research Centre
BRU	Biomedical Research Unit
CEWS	Centre of Excellence Women and Science
CSR	corporate social responsibility
CU	Copenhagen University
DFF	Det Frie Forskningsråd
EA	Equity Advisor
EC	European Commission
EFFORTI	Evaluation Framework for Promoting Gender Equality in Research and Innovation
EGERA	Effective Gender Equality in Research and the Academia
EIGE	European Institute for Gender Equality
ERA	European Research Area
ERC	European Research Council
ESS	European Social Survey
ESWN	Earth Science Women's Network
EU	European Union
GBAORD	government budget appropriations or outlays for research and development
GDP	gross domestic product
GE	gender equality
GEP	gender equality plan
GPG	gender pay gap
HEI	higher education institution
HES	higher education sector
IGAR	integration of gender analysis into research
ILO	International Labour Organisation
I-O-O-I	inputs, outputs, outcomes and impact
ISCED	International Standard Classification of Education
IT	institutional transformation
KPI	key performance indicator
LBC	Laura Bassi Centres of Expertise
LDW	Leadership Development for Women
LFS	Labour Force Survey
MINT	mathematics, information technology, natural sciences and technology
MORRI	Monitoring the Evolution and Benefits of Responsible Research and Innovation
NGO	non-governmental organisation
NZWIL	New Zealand Women in Leadership
OA	open access
OAL	open access literature
ODB	Open Data Barometer
OECD	Organisation for Economic Cooperation and Development
PhD	Doctor of Philosophy
PI	principal investigator
PISA	Programme for International Student Assessment
R&D	research and development
R&I	research and innovation

RFO	research funding organisation
RIA	Research and Innovation Action
RIO	Research and Innovation Observatory
RPO	research performing organisation
RRI	responsible research and innovation
RTDI	research, technological development and innovation
S&T	science and technology
SBS	social and behavioural sciences
SES	Structure of Earnings Survey
SET	science, engineering and technology
SMEs	small and medium-sized enterprises
STEM	science, technology, engineering and mathematics
STEMM	science, technology, engineering, mathematics and medicine
STI	sciency, technology and industry
STRIDE	Science and Technology Recruiting to Improve Diversity and Excellence
SWAFS	Science with and for Society
TBIE	theory-based impact evaluation
ToC	theory of change
TRO	translational research organisation
UAB	Universitat Autònoma de Barcelona
UK	United Kingdom
UM	University of Michigan
UN	United Nations
UNECE	United Nations Economic Commission for Europe
WP	work package

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9. Annex

Annex I. Indicators distributed per category[15]

CATEGORY **1** **PERSONNEL** in regard to research organisations, universities, ministries, companies

RESULTS/ POLICY MEASURE STRATEGIES	INDICATORS AT TEAM LEVEL	INDICATORS AT ORGANISATIONAL LEVEL	INDICATORS AT POLICY/ COUNTRY LEVEL
1.1 GENDER EQUALITY DIMENSION: **POSITION**			
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions*	• Composition of academic positions per team (AKKA, LDW, LEAP, NL, Rice, Stanford) • Number of tenured/tenure-track/non-tenured faculty (Toolkit)	• Horizontal/vertical segregation in positions (AU) • Relative probability between the ability of men and women to reach a top position (NL)	• Relative size of business enterprise in R&D sector (FI) • Models of public involvement in S&T decision-making (MoRRI)

[15] Descriptions of the programmes can be found in the following: Advance IT (Laursen et al. 2015), AKKA (Lövkrona & Widén 2012), Athena SWAN (Munir et al. 2014), AU (Cacace et al. 2015), FI (DFF – Det Frie Forskningsråd 2013a), ECNGD (Reidl et al. 2017b), ESWN (Archie & Laursen 2013; University of Colorado n.d.), Gender-NET (Gender-NET n.d.-b), GenPORT (GenPORT 2016), GPGSR (UAB & EGERA 2016), JR (FFG & BMWA 2008), LDW (Davidson 2013), INTEGER (INTEGER n.d.), LEAP (Hassi & Laursen 2008), Michigan (Stewart, La Vaque-Manty & Malley 2004), MoRRI (MoRRI n.d.; Ravn et al. 2015a; 2015b), NL (Timmers et al. 2010), NZWIL (Harris & Leberman 2012), Rice (O'Brien et al. 2015), Stanford (Stanford University n.d.; Valantine et al. 2014), Toolkit (Frehill et al. 2015), Uppsala (Neu Morén 2012) YDUN (Damvad Analytics 2015).

1.1.1 Increased number of women in academic and other RTDI positions	• Perception of hampering performance due to increased costs of coordination and negotiating between diverse members (ESWN, A4) • Gendered competency expectations (GenPORT) • Women's participation in paid work (MoRRI)	• Period of time spent in academic positions (LEAP) • Cohort/event history analyses of tenure and promotion (Toolkit) • Proportion of doctorates becoming professors within a 12-year period (VINNMER) • Comparison between the proportion of female faculty during the most recent academic year to the proportion hired in the period of the past 3 years (Michigan) • Rate of change in composition of faculty (Stanford) • Number of newly appointed full professors (hired or promoted) (Stanford) • Encouragement to engage in decision-making (LDW) • Share of female heads of RPOs (MoRRI) • Citizen preferences for active participation in S&T decision-making (MoRRI)	• Horizontal/vertical gender segregation in occupations and in economic sectors (ECNGD, 53) • Distribution of grade A staff across age groups by sex (ECNGD, 64) • Distribution of staff across gender • Distribution of RFOs across gender • Success rates of men and women applicants to positions • Percentage of research evaluation panels in RFOs that included the target of at least 40 % of underrepresented sex in boards (ECNGD, 64) • Proportion of women in grade A positions (ECNGD, 63) • Proportion of women grade A staff by main field of science (ECNGD, 63) • Dissimilarity Index (MoRRI) • Glass Ceiling Index (MoRRI) • Gender wage gap (MoRRI) • Percentage of member state's funding programmes explicitly including gender requirements (MoRRI)
STRATEGY 2. More women in leadership positions **1.1.2 Increased number of women in decision-making positions**	• Increase in leadership positions by women who participated in the programme (Uppsala, NZWIL) • Experiences to be sought for leadership roles (NZWIL)	• Taken up leadership positions such as rector, associate professor, dean/as-sociate dean, centre director, head of department, leader of research (AKKA) • Composition of boards or committees (AKKA, Athena SWAN, Toolkit)	• Measures addressing gender balance in decision-making (ECNGD, 41) • Proportion of women heads of institutions in the higher education sector (ECNGD, 64) • Proportion of women in leadership positions (AU)

		• Percentage of professional staff at employment levels (NZWIL) • Kinds of leadership roles engaged since the programme (NZWIL) • Proportion of women on (company) boards, members and leaders (ECNGD, 64) • Share of male and female members of boards in largest quoted companies, supervisory board or board of directors (ECNGD, 58) • Percentage of women in advisory committees (MoRRI) • Percentage of women in expert groups (MoRRI) • Percentage of women in proposal evaluation panels (MoRRI)	• Distribution of gender among rectors • Distribution of gender among reviewers • Distribution of gender among heads of review panels • Distribution of gender in recruitment or promotion boards
1.2 GENDER EQUALITY DIMENSION: **RECRUITMENT CAPACITY**			
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions* **1.2.1 Improved recruitment of talented women**	• Number of new hired faculty (Toolkit) • Negotiation of job offers (concerning salary, workload, office space) (LEAP) • Reaction to female supporting treatment (Athena SWAN, ESWN)	• Fairness of evaluation (Advance IT) • Guidelines for recommendation letters (e.g. content; length; solid recommendation; professional portrayal) (Advance IT) • Composition of search committees and applicant pool (Advance IT) • Facts about contracts of newly hired faculty (e.g. base salary, funding source, benefits, technical support) (Toolkit) • Relation between gender composition and success rate of the candidate pool (Stanford)	• Openness of labour market for researchers (ECNGD, 6) • Degree of institutional autonomy (ECNGD, 6) • Sex differences in international mobility of researchers during PhD/in post-PhD careers (ECNGD, 63)

		• Share of gender-balanced recruitment committees at RPOs (MoRRI)	

CATEGORY

2 WORKING CONDITIONS

RESULTS/ POLICY MEASURE STRATEGIES	INDICATORS AT TEAM LEVEL	INDICATORS AT ORGANISATIONAL LEVEL	INDICATORS AT POLICY/ COUNTRY LEVEL
2.1 GENDER EQUALITY DIMENSION: **WORK-LIFE BALANCE**			
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions* **2.1.1 Improved compatibility of family and career**	• Extent of experienced work-family conflict (Rice) • Perceived challenges in balancing private life and work (AKKA, Athena SWAN) • Satisfaction with current work-life balance (ESWN) • Perception of influence of career break on career progress (Athena SWAN) • Ability to balance work-life (LDW) • Who is entitled to take parental leave (ECNGD, 32)	• On-site child care is seen to reduce job stress (Rice) • Range of institutional support (childcare; partner/spousal hiring; health accommodations; career planning; etc.) (LEAP) • Work-life culture points enables work-life balance (family-friendly working conditions; flextime, work-family policies, etc.) (Athena SWAN) • Working time culture – average working time compared to contracts, all-inclusive contracts, working on weekends, during the night, etc. (JR)	• Possible duration of maternity leave (ECNGD, 31) • Possibility of paternity leave (ECNGD, 31) • Possible duration of parental leave (ECNGD, 32) • Legal right to reduce working time on request (ECNGD, 35) • Compensation rate for wages for maternity/parental leave (ECNGD, 34) • Protection against dismissal (ECNGD, 35)

	• Flexibility of parental leave arrangements (ECNGD, 33) • Average duration of parental leave periods by sex (ECNGD, 36) • Amount of professional high-quality time (FI) • Perceived interpersonal conflicts related to family obligations; "mothers leave earlier from work" (HM Government 2016)	• Opportunity to bring family along during stay abroad (VINNMER) • Modified duties in response to personal needs (Advance IT) • Support for returners (Athena SWAN) • Possibility of paternity leave (ECNGD, 31) • Share of entitled men and women using parental leave (ECNGD, 35) • Regulations and initiatives supporting parents returning to work (ECNGD, 33) • Number of sick days (Eurofound 2010) • Fluctuation at the department/sex (Griffeth, Hom & Gaertner 2000) • Who is entitled to take parental leave (ECNGD, 32) • Flexibility of parental leave arrangements (ECNGD, 33) • Average duration of parental leave periods by sex (ECNGD, 36) • Culture and attitude towards parental leave (AU) • Employment by full-time and part-time status, sex (ECNGD, 49) • Administrative/organisational practices on space allocation (Toolkit)	• Additional paid leave for working parents (ECNGD, 34) • Who is entitled to take parental leave (ECNGD, 32) • Flexibility of parental leave arrangements (ECNGD, 33) • Average duration of parental leave periods by sex (ECNGD, 36) • Employment rate by age of children and sex (ECNGD, 46)
2.2 GENDER EQUALITY DIMENSION: **JOB SATISFACTION**			
STRATEGY 1. More women in R&D	• Range of respect by boss/colleagues/ students (ESWN)	• Award or honour by institution (Toolkit)	• General gender pay gap (ECNGD, 62) • Gender pay gap in RTDI (ECNGD, 62)

2.2.1 Appropriate respect/recognition for (academic/ scientific/leadership) work	• Perception by others as a legitimate scholar (LEAP) • Changes in salary and position from entry to exit/current position (JR) • Transparent promotion system (van den Brink et al. 2010) • Salary compared to colleagues (ESWN) • Equality of attention (ESWN) • Experienced sex discrimination/ sexist remarks (ESWN)	• Events to create visibility and credibility and specific types of recognition for women (Advance IT, AKKA) • Transparent promotion system (van den Brink et al. 2010)	
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions* **2.2.2 Positive individual job rating**	• Satisfaction with career (ESWN) • Amount of social interaction in unit/ team (ESWN) • Contribution to scientific field (ESWN) • Day-to-day intellectual stimulation (ESWN) • Level of funding (ESWN) • Involvement in unit/team decision-making (ESWN)	• Sense of valuing scholars and colleagues (ESWN) • Perception of people working in the area of R&I in regard to gender equality, e.g. percentage of women in R&I who believe they have equal opportunities to pursue their careers in comparison to men (MoRRI)	
STRATEGY 1. More women in R&D **2.2.3 Overall work climate**	• Perceptions of work climate (Athena SWAN) • Feelings of social isolation (ESWN) • Sense of belonging to group (Athena SWAN, LDW) • Sense of community (ESWN)	• Measures on work environment/work practices (LEAP) • Cultural/professional features of work environment (LEAP)	
STRATEGY 1. More women in R&D **2.2.4 Allocation of workload**	• Composition of faculty workload (in terms of number of taught courses and supervised graduate students) (Toolkit) • Workload by gender (AU)	• Share of hours spent on research/teaching/other activities per sex (AU) • Measures led to renegotiation of workload (LDW)	• Measures due to labour law (AU) • Time spent on unpaid work (ECNGD, 39) • Actual weekly working hours of full-time employed persons in

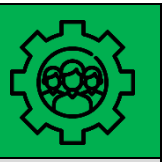
	• Main differences of working hours between men and women in full-time employment (ECNGD, 59)	• Guidelines on how to argue a release from one kind of activity (for example teaching) to focus on research (LEAP)	academic/ scientific professions by gender and country (ECNGD, 60) • Actual weekly working hours of full-time employed persons in leadership positions by gender and country (ECNGD, 60)
2.3 GENDER EQUALITY DIMENSION: **COMPETITIVENESS/PROMOTION AND CAREER**			
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions* **2.3.1 Transparent, non-biased and flexible promotion/ tenure criteria**	• Diversity in team structure concerning tenure (Toolkit) • Career opportunities (ECNGD, 61)	• Contracts take major life events into account (e.g. child birth) (Advance IT, VINNMER) • Flexibility in promotion policy (Athena SWAN) • Assessment of number of submitted tenure applications and number of awarded tenures (Toolkit) • Assessment of number of promotion applications and number of admissions (Toolkit) • Assessment of fixed-term contracts vs. permanent positions/contracts (ECNGD, 61) • Transparent promotion system (van den Brink et al. 2010)	
STRATEGY 2. More women in leadership positions **2.3.2 Strengthened confidence for promotion and responsible positions**	• Knowledge of criteria for promotion (Athena SWAN) • Rating of obstacles to get promotion/responsible position (ESWN) • Rating of own contribution (ESWN) • Awareness of research opportunities (Athena SWAN) • Confidence in own ability (Athena SWAN)	• Existence of rewards and incentives (Athena SWAN) • Received personal and professional support from institution (VINNMER) • Extent of support and encouragement from institution to adopt and enact the content of promotion programmes (Uppsala)	• Awareness of gender-specific know-ledge (AU) • Participation of women and men in RTDI (ECNGD, 50) • Gender-specific research funding pro-gramme in place (Gender-NET) • Proportion of scientists and engineers (ECNGD, 15) • Share of ISCED 6 STEM graduates in the whole population (ECNGD, 14)

2.3.3 Improved support to advance research career	• Revisions of career plan (VINNMER, LDW) • Considerations about leaving current positions (Athena SWAN) • Number of participants promoted after the programme (NZWIL) • Change in motivation to invest more effort in scientific career (Uppsala) • Perception of own improvement of profession (Uppsala) • Description of academic future (Uppsala) • Perceived challenges to get a scientific position (Athena SWAN) • Possibility to approach senior staff for assistance and tips (measuring the confidence) (LDW) • Acts of support through upper manager (NZWIL) • Received personal and professional support from unit/team (VINNMER) • Experienced extent of support and encouragement from unit/team to adopt and enact the content of promotion programmes (Uppsala)	• Implementation of new tasks/respon-sibilities (VINNMER, LDW) • Development of the number and proportion of women ISCED 5 graduates within a certain period of time (ECNGD, 44) • Development of the proportion of wo-men ISCED 6 graduates (ECNGD, 44) • Development of the number and proportion of women ISCED 6 graduates differentiated by field of study (ECNGD, 44) • Development of the proportion of women ISCED 6 graduates differen-tiated by narrow fields of study (ECNGD, 45) • Employment rate by sex (ECNGD 46) • Distribution of researchers across economic activities (NACE Rev. 2) in the business enterprise sector, by sex (ECNGD, 57)	• Share of tertiary educated population among the group of 25 to 34 years old by sex (ECNGD, 18)
2.4 GENDER EQUALITY DIMENSION: **WORKPLACE**			
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions*	• Perceived space allocation of faculty (Toolkit) • Access to necessary facilities and work space (VINNMER) • Ranking of workplaces' quality (Toolkit) • Gender resource gap	• Parking for pregnant women (AU) • Study of actual space allocation of faculty at organisational level (access to the lab, square footage, proximity to electrical power, years since last renovation, services) (Toolkit)	

2.4.1 Equal work-space/facilities allocation		• Study of perceived space allocation of faculty (Toolkit)	

CATEGORY

3 PROFESSIONAL CAPABILITIES

RESULTS/ **POLICY MEASURE STRATEGIES**	**INDICATORS AT TEAM LEVEL** 	**INDICATORS AT ORGANISATIONAL LEVEL** 	**INDICATORS AT POLICY/ COUNTRY LEVEL** 
3.1 GENDER EQUALITY DIMENSION: **LEADERSHIP**			
STRATEGY 2. More women in leadership positions **3.1.1 Increased confidence and ability of leader-ship roles**	• Ability to apply and exercise learned leadership skills (LDW, Uppsala) • Attractiveness and personal motives to take up leadership positions (AKKA) • Growth of knowledge about local leadership and organisation culture (LDW) • Perception of own role being a leader concerned with supporting women's opportunities (LDW) • Contribution to the participant's self-perception as a primary investigator/project leader (YDUN)	• Implementation of leadership deve-lopment programme (VINNMER) • Assessing deans/chairs/committee leaders by assessment criteria, pro-fessional requirements, stereotypes (Advance IT) • Organisational views of the advance-ment of women by structural features (Athena SWAN) • Mentoring system from the very be-ginning when one enters the organisation (NaTE) • Visibility of women at the university/ organisation (AKKA)	• Women with leadership positions (AU) • Visibility of women at national level (AU)

	• Tangible examples of leadership development skills in daily work (Uppsala) • Visibility in the unit/team (AKKA) • Strength of identification as a female leader (Uppsala) • Increased self-awareness (Uppsala) • Contributed to and/or leading meetings (LDW) • Initiation/involvement in projects (LDW)	• Share of projects directed by women (LDW)	
3.2 GENDER EQUALITY DIMENSION: **PROFESSIONAL ACHIEVEMENTS**			
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions* **3.2.1 Increased professional development of work skills (for career success)**	• Time management improvement (ESWN) • Building/extension of network and its usage to advance career (ESWN) • Development of long-term career plan (ESWN) • Improved ability to manage budgets (ESWN) • Deepening of knowledge of own discipline (ESWN) • Clarity about own value as a scientist (ESWN) • Encouragement to undertake further training and pursue personal develop-ment opportunities (Athena SWAN) • Knowledge about own career path and potential obstacles (ESWN) • Knowledge about leadership and university governance (AKKA)	• Availability of positions in the organi-sation (AU) • Support and opportunities to publish (AU) • Availability of training and workshops (Advance IT) • Support to management of grant writing (Advance IT)	• Availability of positions in the RTDI system (AU) • Availability of research grants (AU) • Availability of grants for staying abroad (AU) • Availability of publishing grants (AU)

	• Improved understanding of different departments'/sections' culture and procedures (AKKA) • Improved negotiation skills (ESWN) • Improved voicing of opinion/confidence to argue one's position (ESWN) • Confidence and preparedness in long-and short-term goals/path (ESWN) • Ability to identify and access mentors (ESWN) • Improved self-promotion skills (ESWN) • Supervising/mentoring others (ESWN) • Gaining a research or mission state-ment (ESWN) • Participation/strategic behaviour in committees (LDW) • Opportunities for publishing (VINNMER) • Number and level of career activities: participation in training, coaching, conferences, etc. (JR) • Quality of the activities for the support of a scientific career (JR) • Gender differences in research focus (FI)		
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions*	• Ability to create/enhance/sustain new networks/contacts/ collaborations (AKKA, Athena SWAN, Uppsala)	• Support to create/sustain networks (AU) • Implementation of mentoring/ coaching programmes/sessions (Advance IT, Athena SWAN)	

3.2.2 Improvement of network building and use	• Use of mentoring (promoting of career, obtaining of resources, useful advices, etc.) (LEAP) • Identification of useful local "allies" in encouraging GE (Michigan) • Experienced value of the opportunity to network and discuss with peers (NZWIL) • Value of having a mentor (male/ female) (Rice) • Benefits of coaching/mentoring (Uppsala)	• Invitations of visiting scholars (Advance IT, Athena SWAN) • Invitation of female speakers (AU) • Invitation of female panelists (AU) • Facilitation of informal get-together events (Advance IT, Athena SWAN) • Existence of women-only groups/ networks (AKKA, Athena SWAN) • Share of women local researchers who are considered as mentors (LEAP)	
3.3 GENDER EQUALITY DIMENSION: **AWARENESS OF/COMMITMENT TO GENDER EQUALITY**			
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions* *STRATEGY 3. Gender dimension in research content and curricula* **3.3.1 Increased gender awareness**	• Scale of personal commitment to gender diversity (LEAP) • Scale of empathy (GenPORT) • Concernment in terms of gender awareness/knowledge (Michigan) • Motivation and confidence in actively promoting gender equality (Michigan) • Level of team deference (GenPORT, A23)	• Scale of organisational commitment to gender diversity (measurement through regulations, contracts' re-formulation, founding of new initiatives) (AU) • Perceived commitment of the university/institution to promote equality and diversity (Athena SWAN) • Raised credibility to former and current GE work (Athena SWAN) • Establishment of institutional data-gathering (Advance IT, AU) • Effect of data collection on the application process (Athena SWAN) • Perceived general gender egalitarian-ism (Rice) • Inclusion of the gender dimension in teaching/curricula (ECNGD, 66)	• Content and manner of appropriate GE campaigns (AU) • National R&I strategy/goals per country (ECNGD, 9) • Equal opportunity/anti-discrimination legislation (ECNGD, 25) • Overall strategic gender equality policies in RTDI in place (ECNGD, 39) • Measures addressing GE in scientific careers (ECNGD, 41) • Measures addressing GE in leadership positions in RTDI (AU) • Bodies responsible for GE monitoring (AU)

		• Institution's commitment to promote equality and diversity (Athena SWAN) • Share of staff/researchers who have received training on IGAR (Gender-NET) • Budget allocated to GE monitoring (NaTE) • Dedicated person/department/team in charge of GE monitoring (NaTE)	
3.4 GENDER EQUALITY DIMENSION: **FUNDING TO PROMOTE GE IN TERMS OF FEMALE CAREERS**			
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions* *STRATEGY 3. Gender dimension in research content and curricula* **3.4.1 Increased funding to promote GE**	• Proportion of women receiving a grant (AKKA) • Average size of grant distributed by gender (AU) • Reasons for potential applicants not to apply/to apply for funding • Offers of grants (AU)	• Grants for early career development (Advance IT) • Support for career and life transitions (e.g. returners), fieldwork, conferences, professional development (Advance IT) • Proportion of women receiving a grant (AKKA) • Offer of grants (AU) • Distribution of project funds among men and women (AU) • Research Funding Organisations Index (MoRRI)	• Major funding agencies (national & regional) (ECNGD, 22) • Promotion of gender equality as a funding requirement (AU) • Existence of formal governance structures for RRI within research funding and performing organisations (MoRRI) • Share of research funding and performing organisations promoting RRI (MoRRI) • Funder mandates (MoRRI) • Share of men and women among applicants (AU) • Share of men and women among successful applicants (AU)

CATEGORY

4 STRUCTURAL FEATURES

RESULTS/ POLICY MEASURE STRATEGIES	INDICATORS AT TEAM LEVEL	INDICATORS AT ORGANISATIONAL LEVEL	INDICATORS AT POLICY/ COUNTRY LEVEL
4.1 GENDER EQUALITY DIMENSION: **GENDER EQUALITY CHALLENGES/BARRIERS**			
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions* **4.1.1 Decrease of GE barriers**	• Perception of a gender-oriented receipt of attention (Athena SWAN) • Perception of working up effort with respect to gender (Athena SWAN) • Acknowledgement of gender issues in team (AKKA) • Acceptance of cultural change (Athena SWAN) • Value of gender-promoting measures (ESWN) • Experienced sex discrimination/sexist remarks (ESWN) • Gender bias in task allocation (Gender-NET) • Level of visibility (Rice)	• Acknowledgement of gender issues (AKKA) • Acceptance of cultural change (Athena SWAN) • Engagement of decision-makers (INTEGER) • Gender monitoring/reporting in regular monitoring instruments (INTEGER) • Sustainability of gender equality initiatives (Athena SWAN, LDW) • GE-dedicated administrative staff (Athena SWAN) • Enacting of policy change (Advance IT) • Science communication culture (MoRRI)	• Main challenges concerning GE in RTDI (ECNGD, 41) • Percentage of schools (primary and secondary) that have programmes promoting GE issues in regard to career choices (MoRRI) • Perception of gender roles in science amongst young people and their parents (MoRRI) • Percentage of parents who believe their children (daughters) will have equal opportunities to pursue a career in STEM (MoRRI) • Percentage of research institutions that document specific actions that minimise/reduce barriers in work/environment that

		• Citizen science activities in RPOs (MoRRI) • RPO support structures for researchers as regards incentives and barriers for data sharing (MoRRI) • Integration of GE in key performance indicators (KPIs) (FI) • Percentage of women taking part in research mobility programmes (MoRRI)	disadvantage one sex (e.g. flexibility of working hours) (MoRRI) • Share of RPOs with gender in research content (MoRRI)
4.2 GENDER EQUALITY DIMENSION: **ORGANISATIONAL/CULTURAL CHANGE**			
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions* **4.2.1. Organisational/cultural change with regard to GE**	• Perceived extent and pace of cultural change at team level (Athena SWAN) • Experience of a cultural shift during career (LDW) • Advices to a successful cultural/ organisational change (Rice) • Rating of communication paths and processes (INTEGER) • Rating of transparency regarding decision-making bodies and criteria (Athena SWAN)	• Establishment of gender equality structures and procedures (GenderNET) • Perceived extent and pace of cultural change at organisational level (Athena SWAN) • Adaptations in guidelines, employee rights, spousal appointments (Rice) • Capacity building as to GE (e.g. career development centre) (AU) • General organisational consciousness and messages with symbolic value (Advance IT) • Assessment of the effectiveness of existing equal opportunity/anti-discrimination legislation/measures (ECNGD, 28) • Adoption of GE plans (ECNGD, 44) • Ethics at the level of universities/ RPOs (MoRRI)	• Perceived extent and pace of cultural change at policy level (Athena SWAN) • Ministries responsible for R&I and GE (ECNGD, 21) • Structures for GE (ECNGD, 26) • Relevant policy initiatives to foster equality (ECNGD, 26) • Policy-oriented engagement with science and GE (MoRRI) • Percentage of RPOs that document specific actions aiming to change aspects of their organisational culture that reinforce gender bias (MoRRI)
4.3 GENDER EQUALITY DIMENSION: **PREFERENTIAL TREATMENT**			

STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions* *STRATEGY 3. Gender dimension in research content and curricula* **4.3.1 Equal treatment**	• Perception of preferential treatment such as advice, access to lab or equip-ment, resources, recruitment, pro-motion, attention to meetings (Athena SWAN, ESWN) • Perception of likelihood of male/fe-male success in academia (Athena SWAN) • Amount of free time, i.e. high-quality time for the researcher to stimulate ideas, discussion, etc. (FI)	• GE unit/committee in place (Gender-NET) • Gender in Research Content unit/ committee in place (Gender-NET) • Facilitating mobility of female researchers (Gender-NET)	• Legislation in place
4.4 GENDER EQUALITY DIMENSION: **FUNDING FOR STRUCTURAL TRANSFORMATION**			
STRATEGY 1. More women in R&D *STRATEGY 2. More women in leadership positions* *STRATEGY 3. Gender dimension in research content and curricula* **4.4.1 Increased funding to achieve structural transformation**	• Proportion of women receiving a grant (AKKA) • Average size of grant distributed by gender (AU) • Reasons for potential applicants not to apply/to apply for funding • Offers of grants (AU)	• Budget spent on GE measures (INTEGER) • Grants for early career development (Advance IT) • Support for career and life transitions (e.g. returners), fieldwork, conferences, professional development (Advance IT) • Proportion of women receiving a grant (AKKA) • Composition of applicants and those who received funding (YDUN) • Offer of grants (AU) • Distribution of project funds among men and women (AU) • Research Funding Organisations Index (MoRRI)	• Major funding agencies (national & regional) (ECNGD, 22) • Requirements for funding to promote GE (AU) • Existence of formal governance struc-tures for RRI within research funding and performing organisations (MoRRI) • Share of research funding and per-forming organisations promoting RRI (MoRRI) • Funder mandates (MoRRI) • Share of men and women among applicants (AU) • Share of men and women among successful applicants (AU)

CATEGORY

5 RESEARCH & INNOVATION/RRI

RESULTS/ POLICY MEASURE STRATEGIES	INDICATORS AT TEAM LEVEL	INDICATORS AT ORGANISATIONAL LEVEL	INDICATORS AT POLICY/ COUNTRY LEVEL
5.1: RESEARCH AND INNOVATION DIMENSION: **RESEARCH OUTPUTS AND IMPACTS**			
5.1.1 Scientific outputs	• H-index (Campbell et al. 2013, 2–3) • Number of presentations at conferences • New, altered or improved research tools and techniques, models and simulations (EC 2016) • New advanced capabilities, methods, systems, infrastructures and technologies (EC 2016) • Science prizes/rewards (WR) • Stipends/scholarships/grants (WR) • Consulting activities (WR) • Membership in editorial boards/editors (WR) • License income (patent, software, know-how, patents, trademarks) (WR)	• Percentage of publications from projects which are among the top 1 % highly cited (EC 2015b) • Number of publications in peer-reviewed high impact journals (EC 2015b) • Percentage of publications published in the top 10 % impact ranked journals (EC 2015b) • Publications' interdisciplinarity (FI) • Number of citations/field-specific citation rates (FI) • Percentage of women that are first authors of research papers (EC 2015a) • Conferences/workshops papers and proceedings (EC 2016)	• Publications' interdisciplinarity (FI) • Number of citations (FI) • Country's share of publications (ECNGD, 6) • Number and share of female authors (MoRRI) • Scientific breakthroughs spurring innovation across sectors (EC 2016) • Emergence of new technologies or fields of science in the EU (EC 2016) • EU world-class excellence in science (EC 2016) • Number of scientific papers in relation to the population size (ECNGD, 17)

5.1.2 Networks	• Scientific collaboration across disciplines on new, high-risk ideas (EC 2016) • Cross-country (also beyond EU) and cross-disciplinary research and innovation networks (incl. SMEs) (EC 2016)	• Publication's international collaboration (FI) • Number and percentage of joint public-private-publications out of all publications (EC 2015b)	• Publication's international collaboration (FI) • Percentage of international scientific co-publications (ECNGD, 6) • Public-private co-publications (ECNGD, 6) • Stronger pan-European collaboration across disciplines, sectors, value chains and technology levels (EC 2016)
5.1.3 Training/ human capital		• Researchers trained (inc. PhD, post-docs, gender-balanced) (EC 2016)	• Improved attractiveness of researchers' careers across the EU (EC 2016) • Strengthened human potential in R&D in business and academia (incl. gender balance) across EU countries
5.1.4 Strengthened R&I capacities/excellence			• Reputation and excellence of Europe in scientific and technological research (modernisation of research institutions, vitality of research environment, quality of research outputs in basic and applied research) (EC 2016)
5.1.5 Research priorities and outcomes in terms of GE	• Personal experience and interests (Stanford) • Beliefs and unconscious assumptions (Stanford) • Women's perception of their ability to be an entrepreneur and to hold themselves to a stricter standard of competence (FI, A29) • Women's perception to hold themselves to a stricter standard of competence (FI, A29)	• Professional career tracks and standards for promotion (Stanford) • Turnover at RPOs (FI, A7) • Composition of gendered product development (FI, A7)	• Initiatives of public and private funders and other stakeholders (Stanford) • Industrial funding and lobbying (Stanford) • Military funding priorities and lobbying (Stanford) • Health funding priorities and lobbying (Stanford) • Regulatory environment (Stanford)

	• Degree of fear of failure (FI, A28)		• Market research on competitors or particular market segments (Stanford) • Configuration of academic disciplines (Stanford) • Political and cultural initiatives and movements (Stanford) • RTDI tax incentives (ECNGD, 9) • Expenditures on RTDI sector in comparison to remaining sectors by public sector/domestic business (ECNGD, 7) • Share of research projects with specific GE actions (MoRRI)
5.2 RESEARCH AND INNOVATION DIMENSION: **INNOVATION OUTPUTS AND IMPACTS (INCL. TECHNOLOGICAL IMPACTS)**			
5.2.1 Conventional innovation indicators	• Joint databases, platforms, testbeds (EC 2016) • New common methodologies (EC 2016) • Technology roadmaps (EC 2016) • New or improved standards (EC 2016) • Proof of scientific and technological feasibility (EC 2016) • Awareness of market and end-user needs (EC 2016) • Demonstrators of innovative solutions • Business plans (EC 2016) • New context-adapted solutions (technological and non-	• Number of patent applications (EC 2015b) • Number of awarded patents (EC 2015b) • Number of patent applications by theme (EC 2015b) • Number of awarded patents by theme (EC 2015b) • New products, processes, and methods launched into the market (EC 2015b), according to societal challenges • Improved products, services, processes launched onto the market (EC 2015b)	• Women's representation among inventors in Europe (FI) • RTDI expenditures in the business sector (ECNGD, 6) • Community designs (ECNGD, 6) • Community trademarks (ECNGD, 6) • Number of patents per inhabitant/ citizen (ECNGD, 18) • Number and share of female inventors (MoRRI) • Better innovation capability of EU firms (EC 2016) • Number of young patenting firms per GDP

	technological, e.g financial, regulatory or business models) (EC 2016) • Innovative processes, products and service delivery systems (EC 2016) • Projects having sought additional or follow-up funding – private or public – incl. from regional/national schemes (EC 2016)	• Standardisation/norm-setting (Horvat 2011) • New instruments/demonstrators • Industrial spill-overs • Spin-offs (WR) • Set-up of knowledge and innovation communities gathering research, innovation and higher education (EC 2016) • Networks of developers, providers and users of solutions involved in co-creation (value chain) (EC 2016) • Private companies introducing innovations (self-reporting (yes/no) of participating firms, based on a common definition of "innovations new to the company or the market") (EC 2015b) • Number and percentage of participating SMEs that have introduced innovations to the company or the market (EC 2015b) • New, altered or improved ideas, products, designs, processes, services and business models (EC 2016) • Turnover from innovation; sales of new to market and new to firm innovations (Fan) • License and patent revenues from abroad (Fan)	
5.2.2 Diffusion of innovation in			• Portfolio of demonstrated replicable, up-scalable and "contextualisable" innovative solutions (EC 2016)

products, services, processes			• All forms of innovation that enable the transition to more sustainable economies fostered, incl. through digital systems (EC 2016) • Improved market uptake and replication of tested technologies (EC 2016) • Solutions brought closer to market (increase in technology readiness level) (EC 2016) • Improved cost-effectiveness and sustainability of solutions (EC 2016) • Improved manufacturing processes and equipment of EU industry (EC 2016) • Improved time-to-market for European manufacturers and service providers (EC 2016) • Improved sustainability across the entire product-service lifecycle (EC 2016) • Increased digitisation of industry and economy (EC 2016) • New and better product-service offerings addressing customer needs (EC 2016) • Creation of smart global value chains that enable value capture to Europe (EC 2016)
5.2.3 Incorporation of knowledge about sex and gender into engineering			• Innovations and technologies serving certain groups of women or men more than others (Stanford) • Development of user-driven innova-tion/design innovation (JR, A33)

innovation processes			• Degree of competition by image shaping by gendered productivity (JR, A33)
5.3 RESEARCH AND INNOVATION DIMENSION: **ECONOMIC OUTPUTS AND IMPACTS (INCL. ENTRPRENEURSHIPS)**			
5.3.1 Economic impacts		• Growth and job creation in participating SMEs (EC 2015b) • Turnover of company, number of employees (EC 2015b)	• EU technological leadership & strengthened competitive position of European industry (incl. SMEs, start-ups) (EC 2016) • Diffusion of innovation in the economy (incl. in SMEs) generating jobs, growth and investments (EC 2016) • Share of enterprises cooperating with academia (e.g. patents filed by unis and public labs per GDP) (Fan)
5.3.2 Entrepreneurship		• Risk finance – total investments mobilised via debt financing and venture capital investments (EU 2015b) • Number of business ideas incubated (EU 2015b)	• Share of women founding a company (FI) • Average number of full-time equivalents in women-owned businesses (FI) • Employment in fast-growing firms of innovative sectors (Fan) • Ease of entrepreneurship index (Fan) • Venture capital investments per GDP (Fan) • Innovative enterprises as percentage of total enterprises by size and type of innovation (Fan)
5.3.3 Strengthened framework			• Leveraged private and public investment in R&I (EC 2016)

conditions for R&I			• Leveraged demand for solutions for tackling societal challenges (EC 2016) • More innovation-conducive regulatory frameworks (EC 2016) • Innovative financing, business and governance models for innovative solutions adopting transdisciplinary and participatory approaches and promoting citizens' engagement (co-creation processes) (EC 2016) • Increased availability of debt & equity finance for R&D and innovation-driven companies (EC 2016)
5.3.4 Jobs, growth & competitiveness of participants (incl. SMEs)			• Enhanced innovation capability and competiveness of European enterprises in global market for innovative solutions (esp. SMEs) (EC 2016) • Jobs maintained and created in business and academia (EC 2016) • New business entities created or improved performance of existing businesses (EC 2016) • Opening up of new markets for participants (EC 2016) • Growth & internationalisation of participating SMEs (EC 2016)
5.4 GENDER EQUALITY DIMENSION: **GENDER-SENSITIVE RESEARCH**			
STRATEGY 1. More women in R&D *STRATEGY 3. Gender dimension in research content and curricula*	• Gender balance in research team/research team composition (GPGSR, 9) • Number of projects lead by women (GPGSR, 9)	• Research includes or fosters participation of all agents in the process of investigation (GPGSR, 11)	• Awareness of and support to gender-sensitive research at system level (research councils, other RFOs) (AU)

5.3.1 Achieved gender equality in research process		• Equitably published results to ensure a balance of authorship in research (GPGSR, 12) • Measures for research team-building and their regularity (JR)	
STRATEGY 3. Gender dimension in research content and curricula **5.3.2 Research quality: integration of the gender dimension/perspective in research and content, in research projects, patents, and agreements**	• Research question has been delimited (Stanford)	• Percentage of research projects inclu-ding gender analysis/gender dimen-sions in the content of research (MoRRI) • Scientific production infused with power relations and based on hierar-chical relationships between different fields of knowledge (GPGSR, 6) • Gender, sexuality and the body are part of the processes of control in work organisations, especially of women (GPGSR, 6) • Issues related to procreation and emotions are abandoned and ex-cluded (GPGSR, 6) • Reconsiderations of the significance of scientific validity in order to visibilise hidden hierarchy of organisations (GPGSR, 6) • Importance in scientific analyses to attach to everything related to gender inequalities and power relationships (GPGSR, 6) • Gender appears in studies of any subject (GPGSR, 6) • The project's title in terms of gender and gender equality to describe project (GPGSR, 9)	• Share of research projects with gender dimension in content (MoRRI) • Share of RFOs promoting gender con-tent in research (MoRRI) • Share of gender-balanced research evaluation panels in RFOs (MoRRI) • Percentage of research institutions that provide training/support for re-searchers in regard to the inclusion of gender dimension in the content of research (EC 2015a) • Competitive advantage through in-creased usability of products (FI, A32) • Measures addressing the integration of gender dimension in research (ECNGD, 42)

		• Existence/absence of knowledge on sex and gender in research field (GPGSR, 10) • Definition of research priorities considering who will benefit/be ignored by research projects (GPGSR, 10) • Sample composition by sex (GPGSR, 11) • Needs and expectations of research subjects as well as power relationships and gender assumptions (of research-ers and research subjects) have been considered and included (GPGSR, 10) • Sex differences have been analysed (GPGSR, 11) • Other "biological and socio-cultural" differences have been taken into account (GPGSR, 11) • Analysis of gender has been set out and clearly explained in the dissemination of research results (GPGSR, 12) • Gender-neutral, non-sexist language is used (GPGSR, 12) • Active information search about controversial technology (Meijer et al. 2016)	
STRATEGY 3. Gender dimension in research content and curricula **5.3.3 Making of contributions to strengthening**	• People/employees feel empowered making research more participatory, creative and inclusive (GPGSR, 7) • Perception of improvement of people's and social groups' lives (GPGSR, 7)	• Perception of rebalancing power, especially in relation to women at organisational level (GPGSR, 7) • Level of scientific reflection of research projects (GPGSR, 7)	• Perception of rebalancing power, especially in relation to women at country level (GPGSR, 7) • Increase of scientific knowledge about gender (GPGSR, 8)

gender-sensitive research	• Perception of rebalancing power especially in relation to women at team level (GPGSR, 7)	• Level of taking the role of the researchers and their relationship with their participants into account (GPGSR, 7) • Research tools are adapted to the subject's language and worldview (GPGSR, 7) • Legal concepts related to gender and analysis techniques about mainstreaming gender perspectives in public policies are included (GPGSR, 7) • Senior managers are involved in the implementation of the policy that integrates gender analysis into research funding (Gender-NET) • Number of calls that include dissemination materials and guidelines to support applicants in the integration of the gender analysis into research proposals (Gender-NET) • Explicit integration of sex/gender analysis as one of the issues to be monitored in mid-term/final project reporting (Gender-NET)	• Policy requiring the integration of the gender analysis into research funding programmes in place (Gender-NET) • Support to the inclusion of gender contents in research agendas by funders (ECNGD, 65) • Inclusion of the gender dimension in research contents (ECNGD, 65) • Relevance of national and regional levels in R&I policy and financing (ECNGD, 23) • Number of programmes which include measures aimed at integrating the gender analysis (Gender-NET) • Number of topics which are gender flagged/tagged (explicit cross-cutting gender analysis) (Gender-NET) • Number of calls that include a mandatory requirement for applicants to indicate whether sex and/or gender is relevant to their research proposal (Gender-NET) • Number of calls that include a mandatory requirement for applicants who do not include sex and gender analysis to explain why not (Gender-NET) • Number and percentage of proposals submitted that have responded 'Yes' to the sex/gender relevance question (Gender-NET)

			• Number and percentage of 'Yes' respondents to the sex/gender relevance question that: Do not include explicit consideration to sex/gender in the content of the research approach/cycle; Provide inappropriate (inconsistent, apparent) explicit inclusion of sex/gender considerations in the research approach/cycle; Appropriately include sex/gender analysis across the research approach/cycle (Gender-NET) • Amount and percentage of the total call budget spent on projects which include sex/gender analysis (Gender-NET) • Amount and percentage of overall budget dedicated to enforcing the gender integration in research contents (e.g. gender training, gender experts, gender eligible costs in calls, etc.) (Gender-NET)
5.5 GENDER EQUALITY DIMENSION: **RESPONSIBLE RESEARCH AND INNOVATION (RRI)**			
5.5.1 Gender equality	• Encouragement of gender-balanced teams in the work environment (MoRRI) • Active support of female colleagues within the teams (MoRRI) • Considering gender aspects in the research design (MoRRI) • Using a gender-sensitive language in publications (MoRRI)	• Percentage of member state‘s funding programmes explicitly including gender requirements (EC 2015a) • Percentage of research institutions (including universities) that (a) have gender equality plans and (b) provide documentation of their implementation (EC 2015a)	• Share of female heads of RPOs (MoRRI) • Share of female researchers by sector (MoRRI) • Share of RFOs promoting gender content in research (MoRRI) • Dissimilarity Index (MoRRI) • Share of RPOs with gender in research content (MoRRI)

	• Explicitly dealing with gender issues in research projects (MoRRI) • Percentage of women participants in [Horizon 2020] projects (EC 2015b) • Percentage of women project coordinators [in Horizon 2020] (EC 2015b) • Percentage of projects taking into account the gender dimension in research and innovation content (EC 2015b)	• Percentage of research institutions that document specific actions that minimise/reduce barriers in work environment that disadvantage one sex (e.g. flexibility of working hours) (EC 2015a) • Percentage of research institutions that document specific actions aiming to change aspects of their organisational culture that reinforce gender bias (EC 2015a) • Percentage of research institutions that provide training/support for researchers in regard to the inclusion of gender dimension in the content of research (EC 2015a) • Percentage of schools (primary and secondary) that have programmes promoting gender equality issues in regard to career choices (EC 2015a) • Percentage of women on advisory committees (EC 2015a) • Percentage of women in expert groups (EC 2015a) • Percentage of women on proposal evaluation panels (EC 2015a) • Percentage of women in projects throughout the whole life cycle (in full-time equivalent) (EC 2015a) • Percentage of women that are principal investigators on a project (EC 2015a) • Percentage of research projects including gender analysis/gender	• Glass Ceiling Index (MoRRI) • Gender wage gap (MoRRI) • Share of female heads of RPOs (MoRRI) • Share of gender-balanced recruitment committees at RPOs (MoRRI) • Number and share of female inventors and authors (MoRRI) • Percentage of women in [EC] advisory groups, expert groups, evaluation panels, individual experts, etc. (EC 2015b) • Share of gender-balanced recruitment committees of RPOs (MoRRI) • Share of RPOs with GE plans (MoRRI) • Share of organisations with organisational structures for GE (MoRRI) • Share of RPOs with female recruitment and promotion policies (MoRRI) • Gender of individual participants with contact person roles in signed grant agreements (MoRRI) • Years to achieve gender equality in research participation (MoRRI) • Female graduates and academic staff by grade (MoRRI) • Development of number of researchers in the whole RTDI sector and its subsectors (ECNGD, 10)

		dimensions in the content of research (EC 2015a) • Percentage of women taking part in research mobility programmes (EC 2015a)	
5.5.2 Ethics	• Submission of projects to ethical reviews) (MoRRI) • Conduction of ethical reviews of projects (MoRRI) • Considering ethical issues when designing research (MoRRI) • Contributing to the development of ethical standards (MoRRI) • Contributing to training on ethical issues (MoRRI)	• Documented change in R&I priorities attributable to appraisal of ethical acceptability (EC 2015a) • Percentage of research proposals for which ethics review/institutional review board clearance process requires substantive changes in grant application or second ethics assessment (EC 2015a)	• New or improved ethical standards or guidelines (EC 2016) • Ethics at the level of yniversities (MoRRI) • National Ethics Committees Index (NEC index) (MoRRI) • Research Funding Organisations Index (MoRRI)
5.5.3 Public engagement	1) Information for non-academics about research results through • Written outputs (popular science books, chapters, articles in newspapers/magazines/blogs) (MoRRI) • public lectures (MoRRI) • appearances on TV/radio (MoRRI) • science cafés, science festivals, researchers' nights (MoRRI) 2) Involvement of citizens in the following phase(s) of the research by • determining what research should be performed (MoRRI) • conducting the research (data collection, data analysis) (MoRRI) • discussing the consequences of research/its application (including technology assessment) (MoRRI)	• Public engagement funding percentage from R&I (EC 2015a) • Public influence on research agendas (EC 2015a) • Share of PE in R&I projects based on consultation, deliberation or collaboration (EC 2015a) • Media coverage (EC 2015a) • Social media/Web 2.0 attention (EC 2015a) • Museum visits and impacts (on visitors, stakeholders, local communities) (EC 2015a) • Civil society organisation activities and impacts (EC 2015a) • Training of communicators (EC 2015a)	• Models of public involvement in S&T decision-making (MoRRI) • Policy-oriented engagement with science (MoRRI) • Citizen preferences for active participation in S&T decision-making (MoRRI) • Active information search about controversial technology (MoRRI) • Public engagement performance mechanisms at the level of research institutions (MoRRI) • Dedicated resources for PE (MoRRI) • Embedment of PE activities in the funding structure of key public research funding agencies (MoRRI) • PE elements as evaluative criteria in research proposal evaluations (MoRRI)

	• communicating and disseminating the results of the project (MoRRI) • commercialising/exploiting results (MoRRI) 3) Active consideration of how research and innovation results will be perceived and used (MoRRI) 4) Collaborating with people who specialise in dialogue with citizens and civil society (e.g. professional mediator, communication company, science museums) (MoRRI)	• Training of scientists/engineers (EC 2015a) • PR staffing (EC 2015a) • Social scientists' collaboration (EC 2015a) • In-house/outsourced consultancies (EC 2015a) • The stat of science journalism (EC 2015a)	• R&I democratisation index (MoRRI) • National infrastructure for involvement of citizens and societal actors in research and innovation (MoRRI)
5.5.4 Science education	• Work with school pupils (e.g. open days, joint projects) (MoRRI) • Development of science education material (e.g. kits, websites, explanatory booklets, DVDs) (MoRRI) • Work in partnership with schools and/or teachers (MoRRI)	• Education institutions/research disciplines: presence of RRI education/training (EC 2015a) • R&I project level: encouraging or requiring RRI education/training (e.g. in an integrated ethical, legal and social aspects model) (EC 2015a) • Percentage of research projects with at least one educational resource deliverable (EC 2015a) • Percentage of research projects involving STEM teachers or students (EC 2015a) • Number of projects registered (EC 2015a)	• Textbook knowledge about science and technology (MoRRI) • Share of STEM graduates (MoRRI) • Science competence in secondary school pupils (PISA) (MoRRI) • School hours in STEM subjects in primary and secondary school (MoRRI) • Science communication culture (MoRRI) • Science communication budget (MoRRI) • Number of science museum visitors per million inhabitants of a country (MoRRI) • Strategic approach to citizen science (MoRRI) • Citizen science projects (MoRRI) • Importance of societal aspects of science in science curricula (MoRRI) • EU and national levels: presence of RRI descriptors in the qualification

			frameworks for lower and higher education (EC 2015a) • Science and innovation awareness-raising activities (incl. science shops, science cafés, exhibitions) (EC 2016)
5.5.5 Open access	• Use of open access publications (MoRRI) • Publish open access (green or gold) (MoRRI) • Use of publicly available data (MoRRI) • Providing publicly available data (MoRRI) • Implementing research data management plans (MoRRI)	• Percentage of research projects with a virtual environment that is updated and actively used with a threshold frequency (to be defined) (EC 2015a) • Percentage of data repositories that include explanation and commentary to facilitate use (EC 2015a) • Percentage of research projects with daily laboratory notebooks online (EC 2015a) • Percentage of research projects that report real added value by an open science mechanism (for themselves and/or other actors) (EC 2015a)	• OAL (Open Access Literature) (MoRRI) • Data publications and citations per country (MoRRI) • Social media outreach/take up of OAL and open research data (MoRRI) • Public perception of open access (MoRRI) • Funder mandates for open access publishing (MoRRI) • RPO support structures for researchers as regards incentives and barriers for data sharing (MoRRI) • Number of OA journals/publications per country (MoRRI) • Number of OA repositories (MoRRI) • Open Data Barometer (ODB) (MoRRI)
5.5.6 RRI/ governance	• Percentage of projects where citizens, civil society organisations and other societal actors contribute to the co-creation of scientific agendas and scientific contents (EC 2015b)	• Activities of funders to promote RRI (EC 2015a) • Number of funding mechanisms to support RRI activities (EC 2015a) • Amount of money invested in RRI projects (EC 2015a) • Number of references in applications to RRI (EC 2015a)	• Identification of formal and informal networks of R&I that promote RRI, at both the national and the EU level (EC 2015a) • Involvement of the wider public in RRI debates, measured e.g. through social media (EC 2015a) • Involvement of the wider public in RRI policy, the development of policy, protocols (EC 2015a)

		• Number of collaborative RRI projects (EC 2015a) • RRI-related training at RPOs (MoRRI) • Responsible R&I principles embedded in EU higher education (EC 2016)	• RRI awareness and support to implementation at system level (AU) • Composite indicator of RRI governance (MoRRI) • Existence of formal governance structures for RRI within RFO and RPO (MoRRI) • Share of RFO and RPO promoting RRI (MoRRI)
5.6 RESEARCH AND INNOVATION DIMENSION: **SOCIETAL CHALLENGES**			
5.6.1 Research priorities & outcomes in terms of GE	• A desire to address societal problems (Stanford)	• A desire to address societal problems (Stanford)	• Composition of innovation policy put-ting more emphasis on social and service innovations (JR, A26)
5.6.2 R&I indicators		• Publications in peer-reviewed high impact journals in the area of the different societal challenges (EC 2015b) • Percentage of publications published in the top 10 % impact-ranked journals by subject category (EC 2015b) • Number of patent applications and patents awarded in the area of the different societal challenges, by theme (EC 2015b) • Number of prototypes, testing (feasibility/demo) activities, clinical trials (EC 2015b) • Societal challenges – number of joint public-private publications (EC 2015b)	• Better contribution of R&I to tackling societal challenges (EC 2016) • Stronger global role of the EU, steering the international agenda to tackle global societal challenges (EC 2016)

		• Number of projects with new innovative products, processes and methods • New products, processes, and methods launched into the market (EC 2015b), according to SC	
5.7 RESEARCH AND INNOVATION DIMENSION: **SOCIETAL AND ENVIRONMENTAL IMPACTS**			
5.7.1 Societal impacts		• Responsible R&I principles embedded in EU higher education (EC 2016)	• Improvement of societal awareness, understanding and engagement to tackle societal challenges through R&I (EC 2016) • Better societal acceptance of innovative solutions (EC 2016) • Increased awareness of innovations among industry, research, user and policy communities (EC 2016) • Reinforced research integrity and ethics standards (EC 2016) • More effective promotion of gender equality and the gender dimension in research and innovation content (EC 2016) • Improved quality of life • Reduced direct and indirect costs linked to societal issues (EC 2016) • Improved research and innovation culture in EU (EC 2016)
5.7.2 Environmental impacts			• Improved environmental performance (climate change, biodiversity, sustainability) (EC 2016)

Annex II. Description of EFFORTI categories, dimensions and subdimensions

Category 1, *personnel*, refers to personnel in research organisations, universities and ministries, as well as personnel in companies. In dimension **1.1**, *(development in the) composition of academic and RTDI positions*, it is relevant to evaluate GE in regard to personnel in terms of both *gender equality in decision-making* and *increased number of women in academic and other RTDI positions* (subdimension **1.1.1**). Relevant indicators can be related to gender segregation and history of tenure/promotion in personnel groups, contextual circumstances or barriers for change, etc. *Equality in decision-making* includes parameters such as funding programmes that include gender requirements, encouragement to engage in decision-making, probability of women reaching a top position (e.g. full professorship), gender wage gap, etc. *Academic and other RTDI positions* (i.e. positions in RFOs, economic sector, etc.) include, for instance, women in decision-making positions (top academic positions, heads of RFOs, etc.), doctorates, professors, principal investigators (PIs), administrative staff, etc. Subdimension **1.1.2**, *increased number of women in decision-making positions* – more specifically than subdimension **1.1.1** – provides indicators for measurements specifically targeting the number or share of women in top leadership positions (e.g. company leader, company board leader/ member, recruitment/promotion board member, reviewer/head of review or evaluation panel, rector, professor, dean, centre director, head of institution/department), different leadership roles, etc.

Dimension **1.2,** *recruitment capacity*, is relevant in, for instance, evaluations focusing on changes in terms of recruitment, including (recent) recruitment history – procedures and structures (e.g. whether and/or how there have been improvements/changes in the overall recruitment of talented women, and whether this was an intentional strategy). The respective subdimension, *improved recruitment of talented women* (**1.2.1**), includes indicators such as initiatives targeting female personnel, composition of search/recruitment committees, applicant pool, mobility of researchers, contracts, job negotiations, recruitment evaluations, etc.

Category 2, *working conditions*, relates to institutional[ised] factors as well as factors related to e.g. family policy, employees' perceptions of the working conditions, and internal career/tenure possibilities (such as promotion issues).

Dimension **2.1,** *work-life balance*, is especially relevant for evaluations that take into account employees' possibilities of balancing career objectives and private/family life. This is also illustrated in subdimension **2.1.1,** *improved compatibility of family and career*, which includes indicators such as career planning, influence of work breaks on career progress, parental leave policy and flexibility, (actual) working time, possibilities for reduced working time/part-time, etc.

Dimension **2.2**, *job satisfaction*, includes four subdimensions ranging from *appropriate respect/recognition for work* (**2.2.1**) and *positive individual job rating* (**2.2.2**), to *overall work climate* (**2.2.3**) and *allocation of workload* (**2.2.4**). Indicators in the first subdimensions are mainly concerned with aspects of sex discrimination and gender pay gap (**2.2.1**), as well as inter-collegial relations, scientific contribution, received funding, and perceptions of career opportunities (**2.2.2**). Subdimensions **2.2.3** and **2.2.4** include indicators such as employees' social well-being and (results from) employee well-being studies (**2.2.3**), as well as

workload compositions, working time/time spent on paid and unpaid tasks, and (guidelines for) negotiating workload or work tasks (**2.2.4**).[16]

Dimension **2.3**, *competitiveness/promotion and career*, is specifically oriented towards parameters concerning promotions/possibilities for future promotion, the history of/possibilities for career progression, employees' perceptions/experiences of career competitiveness, and other career parameters. Subdimension **2.3.1,** *transparent and flexible promotion/tenure criteria*, is relevant for evaluators particularly interested in measuring tenure and includes indicators such as fixed-term vs. permanent positions, (contractual) handling of major life events, promotion policies, flexibility in promotion arrangements, etc. Subdimension **2.3.2**, *strengthened confidence for promotion and responsible positions/improved support to advance research career*, consists of indicators for evaluators interested in how employees navigate in regard to possibilities for promotion and career progression, e.g. developments in the participation of men and women in RTDI (e.g. proportion of scientists and engineers), but also employees' awareness of research [project] opportunities, personal as well as professional institutional/managerial support, career obstacles/challenges, etc.

Dimension **2.4**, *workplace*, relates to the quality of the workplace: for instance, subdimension **2.4.1**, *equal workspace/facilities allocation*, includes indicators such as employees' access to appropriate workspace as well as other facilities and services.

Category 3, *professional capabilities*, is concerned with aspects regarding (female) leadership (**3.1**), different kinds of measurable achievements (e.g. skills, networks, collaborations, mentoring) and women's visibility (**3.2**), overall organisational awareness of or commitment to gender equality goals (**3.3**), as well as funding promoting women's careers (**3.4**).

As the title of dimension **3.1**, *leadership*, reveals, the subdimension *confidence and ability of leadership roles* (**3.1.1**), consists of indicators such as leadership positions, leadership skills, leadership development programmes, organisational culture, support to women's opportunities (e.g. mentoring systems), etc.

Dimension **3.2**, *professional achievements*, provides a variety of indicators measuring achievements related to *professional developments of work skills* (**3.2.1**) and *network building and use* (**3.2.2**). Subdimension **3.2.1** contains indicators such as organisational understanding, improvements in time and budget management, participation in and development of career activities (e.g. networks, coaching, career plans), support for writing applications and for publishing, available workshops, etc. Subdimension **3.2.2** consists of indicators related to contacts/networks, collaborations, coaching and mentoring programmes (including indicators for measuring women's visibility and arrangements/networks for women).

Dimension **3.3**, *awareness of/commitment to gender equality*, is primarily concerned with indicators aiming to measure commitment to gender equality. Subdimension **3.3.1**, *gender awareness*, includes indicators such

[16] While, for instance, subdimensions 2.1.1 and 2.2.4 include similar indicators regarding working time, workload and flexibility of working arrangements, indicators in dimension 2.1 *work-life balance* mainly have employees with family responsibilities as their focus, while indicators in dimension 2.2 *job satisfaction* do not (necessarily) take family responsibilities as their point of departure – here the interest is in the more general (perceived) fairness of different aspects of the working conditions (some of which might also be found in studies with a particular focus on employees with children, as in dimension 2.1 and its subdimensions).

as national strategies, legislation and goals, overall promotion of gender equality and diversity (as a value), (history) of gender equality and diversity initiatives and campaigns, studies initiated on GE issues and initiatives, inclusion of the gender dimension in teaching/curricula, etc.

Dimension **3.4**, *funding to promote gender equality in terms of female careers*, and subdimension **3.4.1** are particularly concerned with indicators for evaluating which funding and grants are available and how they are distributed in terms of gender equality, e.g. funding requirements promoting GE, proportion of women receiving grants, average size of grants distributed by gender, etc.

Category 4, ***structural features***, contains broader aspects related not to the women in question, but to relevant structures in organisations (e.g. RPOs, universities, companies), such as the organisational logic and culture in which barriers for gender equality can be found.

Dimension **4.1**, *gender equality challenges/barriers*, is especially relevant when analysing institutionalised inequalities/barriers for gender equality in organisations. Consequently, subdimension **4.1.1**, *decrease of gender equality barriers*, provides the evaluator with a diverse range of indicators at team, organisational and policy/country levels, centred around structural matters such as general acknowledgement of and attentiveness to GE issues and challenges, perceptions of gender roles in STEM, initiation of cultural change, citizen science activities in RPOs, RPOs with gender in research content, employees' experiences of sexism, etc.

Dimension **4.2**, *organisational/cultural change (with regard to gender equality*, **4.2.1**), also provides the evaluator with indicators at all three levels of evaluative analysis, including indicators such as GE policy initiatives and policy-oriented engagement with science and gender equality, clear communication paths and transparency in decision-making bodies, ethics in universities/RPOs, and adoption of GE plans/actions targeting gender bias in organisational culture in RPOs. Subdimension **4.2.1** also includes indicators such as (experiences of) successful implementation of cultural changes/shifts, career development capacity, etc.

Dimension **4.3**, *preferential treatment,* places particular focus on the gender perspective regarding (perceptions of) differences in the work culture and climate for women and men. Consequently, subdimension **4.3.1**, *equal treatment*, contains indicators for the evaluation of perceptions of preferential treatment, differences in women's and men's academic careers, time available for academic activities such as idea stimulation, discussions, etc., as well as indicators such as GE legislation and policies and existence of a GE unit/committee.

Dimension **4.4**, *funding for structural transformation,* pays attention to increased funding to achieve structural and cultural change in organisations, and budget spent on gender equality measures; it also considers offers and opportunities of grants to women researchers and focuses on the proportion of women receiving grants.

Category 5, *research and innovation/RRI*, provides evaluators with an overview of the most important research and innovations indicators including RRI mentioned in the respective academic literature, but also reflecting recent discourses at the EU level regarding the evaluation of H2020 and collection of RRI indicators. Category 5 is divided into seven dimensions and 25 subdimensions. Dimension **5.1** is dedicated to *research outputs*. Different types of scientific outputs play a prominent role and build the subdimension **5.1.1.**, reflecting a variety of primarily bibliometric indicators like number of articles and number of citations, but also international co-publications and interdisciplinarity. A further subdimension is constituted by scientific

networks which are assumed to differ between male and female researchers (**5.1.2**), training and human capital effects like number of researchers trained, but also (gendered) attractiveness of research careers, (**5.1.3**), strengthened R&I capacities (**5.1.4**) as well as research priorities and outcomes in terms of GE (**5.1.5**).

Dimension **5.2**, *innovation outputs and impacts including technological ones*, is divided into three subdimensions. The first one, *conventional innovation indicators*, collects the most frequently mentioned indicators from comparative overview reports compiled by the OECD or the EC. It involves patent indicators as well as effects on norms and standards, spill-overs and spin-offs but also product and process innovations (**5.2.1**). Subdimension **5.2.2** collects indicators which measure the diffusion of innovations (**5.2.3**), laying special emphasis on innovations that foster sustainable economies. The last subdimension refers to the incorporation of knowledge about sex and gender into engineering and innovation processes (**5.2.3**) and asks, for example, whether innovation and technologies serve certain groups of women or men more than others, or examines the degree of competition by image shaping by gendered productivity.

Dimension **5.3**, *economic outputs and impacts including entrepreneurship*, involves four subdimensions. In this area, one can find numerous indicators used in classical impact evaluation studies at the European level: for example, within subdimension **5.3.1** (*economic impacts*) – indicators on growth and job creation, turnover, co-patents between science and industry. Subdimension **5.3.2**, *entrepreneurship*, involves indicators regarding risk financing as well as the share of women founding a company. Subdimensions **5.3.3** (*strengthened framework conditions*) and **5.3.4** (*jobs, growth, competitiveness*) mention only indicators at the macro level which will presumably be only measurable in the long run, i.e. opening up of new markets, jobs maintained and created, and growth of SMEs, to mention some of them.

Dimension **5.4**, *gender-sensitive research*, provides suggestions for measuring research from a gender perspective. Where subdimension **5.4.1**, *achieved gender equality in research process,* contains indicators addressing the share of female project leaders, gender balance in research teams and in authorships, team building, awareness of/support for gender-sensitive research in RFOs, etc., subdimension **5.4.2** is centred around questions of *research quality,* i.e. whether a *gender dimension/perspective in research and content, in research projects, patents, agreements* is integrated into the research in question. This includes measures such as exclusion of issues related to procreation as well as “emotional issues” and gender mainstreaming in research/research content. The latter includes indicators such as RPOs providing support for the inclusion of a gender dimension, RFOs promoting gender content, gender balance in research evaluation panels in RFOs, sample composition by sex/analysis of sex differences (e.g. regarding product usability or social media and open access outreach), share of research projects including gender analysis/gender dimension, inclusion of analysis of power relations and gender inequalities, (awareness of) hierarchical dimensions in perceptions of scientific validity, etc.

The subdimension **5.4.3**, *contribution to strengthening gender-sensitive research agenda*, consists of indicators related to different aspects of reflexivity, ethics and responsibility as well as diversity and gender awareness. The indicators included in this subdimension are, for instance, (support for engagement in) participatory, creative and inclusive research, (perceptions towards and) awareness of (gendered) power relations, awareness of the relationship between researcher and informant/participator, inclusion of concepts of and techniques for gender mainstreaming in public policies and policies on the inclusion of gender analysis in research funding programmes, (senior managers involved in the) implementation/integration of gender analysis in research funding/calls and proposals (including senior managers involved, measures related to public engagement, share of calls that include dissemination

material/guidelines for applicants, research calls that include a “comply or explain” principle, share of budget spent on this matter, etc.), increase of scientific knowledge on gender, (programmes targeting the) inclusion of the gender dimension in research contents, etc.

Dimension **5.5** is dedicated to the collection of *RRI* indicators at the micro, meso and macro levels. The basis for this collection are EU-funded projects and expert groups and it thus follows the EC approach to defining RRI as consisting of 5 crucial RRI keys, i.e. *gender equality* (subdimension **5.5.1**), *ethics* (**5.5.2**), *public engagement* (**5.5.3**), *science education* (**5.5.4**), *open access* (**5.5.5**) and, lastly, *RRI/governance* (**5.5.6**). The GE indicators collected here refer to all three ERA objectives, e.g. more women in R&I, more women in leadership positions and better consideration of gender aspects in research. *Ethics* shows indicators which describe new standards or guidelines or the National Ethics Committee Index but also, for instance, the percentage of research proposals for which ethics reviews required any changes. *Public engagement* addresses questions about the role the general public plays during all stages of research and innovation processes but also includes indicators which refer to organisational strategies to foster public engagement. *Science education* involves indicators to describe the development of science education material, engagement in partnership with schools, science communication culture and budget in the EU member states. *Open access* involves the most recent indicators at the macro level like open access literature and public perception of open access, but also indicators which describe the relevance of OA for the daily practice of European researchers. Finally, *RRI/governance* reflects the emergence of formal and informal RRI networks as well as the number of projects showing co-creation of scientific agendas or the existence of RRI-related trainings at RPOs.

Dimension **5.6**, *societal challenges*, involves research priorities and outcomes in terms of GE (subdimension **5.6.1**), as well as more traditional research and innovation indicators like publications and patents, but with a special focus on the societal challenges (subdimension **5.6.2**). Lastly, we added the dimension **5.7** to describe further societal (**5.7.1**) and environmental impacts (**5.7.2**) which both refer primarily to the macro level and are partly linked to the RRI indicators above.

Annex III. Extended descriptions of key indicators per category

Category 1. Personnel

Indicator Description	Category 1. PERSONNEL
Name of indicator	Relative size of business enterprise in R&D sector
Short description	This quantitative indicator displays the size of the business enterprise in the R&D sector in relation to the governmental, higher education and private non-profit subsectors by comparing the number of researchers employed in the subsectors concerned. It is available for the EU 28 member states, which makes an EU-wide comparison possible.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.1 Increased number of women in academic and other RTDI positions
Level of observation	Policy/country level (macro level) (global, national, regional)
Logic model	Context-related indicator
Source of data	The data is provided by Eurostat and is published on its website under the table [rd_p_persocc].[17] Although the data quality is considered good, the BES displays a higher non-response rate and therefore, the data raises coverage concerns.
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Secondary data collection: data retrieved from databases (Eurostat, Patstat, Scopus, Web of Science)
Feasibility issues	Low costs, data is publicly available
Comments / limitations	The different relevance of RTDI sectors in a country is crucial for the share of women in RTDI: in BES-dominated RTDI systems, it is more difficult to increase the share of women in RTDI. The proportion of women is lower in BES than in other sectors because the national equality promotion in science in Europe focuses mainly on the public sector because it can be better influenced by policy measures than the private sector (European Commission 2008, 23–24).
Link to best practice / literature	Ministry of Science, Denmark (see DFF - Det Frie Forskningsråd 2013)

[17] The table can be found at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_persocc&lang=en.

Indicator Description	Category 1. PERSONNEL
Name of indicator	Number of tenured/tenure-track/non-tenured faculty
Short description	The indicator shows the distribution of women and men in the institutionalised career path "tenure track" and in the group of employees without involvement in the programme. An equal distribution is intended, as underrepresentation of women in the tenure-track group may indicate a lack of career support for women and, therefore, gender bias in the personnel development in the organisation/country concerned. Department level analysis allows identification of departments with no women, token women, or no/low numbers of women full professors, as well as changes in positive or negative directions.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.1 Increased number of women in academic and other RTDI positions
Level of observation	Individual/team level (micro level); organisational/institutional level (meso level)
Logic model	Context-related indicator; output indicator
Source of data	Data has to be gathered through own personnel statistics differentiated by department, rank and gender; later in the analysis, some departments' data may be aggregated as seen fit.
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Primary data collection: online surveys/questionnaire or monitoring data of personal statistics The monitoring must cover the contract of employment, gender, hierarchy level and field of science at the individual level. In order to measure impact, it is recommended to first identify a baseline (of one year or up to three years) and then conduct subsequent observations periodically (e.g. annually). Furthermore, STEM and SBS (social and behavioural sciences) fields should be reported separately, and clinical, research, non-tenure-track instructional, emeritus, volunteer, and visiting, etc., faculty should be excluded (Frehill et al. 2005, 3–4).
Feasibility issues	The collection and analysis of data may be moderately time-consuming.
Comments / limitations	The indicator can only be applied in organisations which provide an institutionalised career path as the tenure track. The introduced indicator serves more as a guideline than as a rule; if necessary, it should be modified to fit the organisation concerned (Frehill et al. 2005, 1). Furthermore, this descriptive indicator does not allow drawing conclusions regarding the reasons for the stated distribution of women and men in tenured or non-tenured faculty;

	but an analysis of gender composition of different tracks may help identify where women scientists with PhDs are in the university.
Link to best practice / literature	Programme *Toolkit for Advance IT: Increasing the participation and advancement of women in academic science and engineering careers* (ADVANCE) founded by NSF. The programme has three tracks with distinct purposes, but the evaluation at hand focuses on the Institutional Transformation (IT) track (Frehill et al. 2005).

Indicator Description	**Category 1. PERSONNEL**
Name of indicator	Comparison between the proportion of female faculty during the most recent academic year to the proportion hired in the period of the past 3 years
Short description	It is a quantitative indicator for measuring development in hiring processes and illustrating a gender bias in recruitment by comparing the proportion of women employees hired in the most recent year to the proportion of women hired in the preceding years. This can be illustrated by an example: if the proportion of women hired by a university was 20 % in 2010 and increased to 30 % in 2011 and to 40 % in 2012, it could be interpreted as a positive development towards gender equality in recruitment of the university concerned.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.1 Increased number of women in academic and other RTDI positions
Level of observation	Organisational/institutional level (meso level)
Logic model	Context-related indicator; output indicator; impact indicator
Source of data	Data has to be gathered through own personnel statistics.
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Primary data collection: - Monitoring data of personnel statistics: the monitoring must cover the number and gender of hired employees in the organisation concerned, disaggregated by years - Data retrieved from university statistics
Feasibility issues	The collection and analysis of data may be moderately time-consuming.
Comments / limitations	Due to the descriptive nature of the indicator, no causal conclusions can be drawn about the concrete reasons for the development in hiring figures. However, to measure impact, the indicator can be modified by comparing the hiring composition before and after a certain measure regarding hiring practices.

Link to best practice / literature	Programme of the University of Michigan (UM): The evaluation focuses on one of UM ADVANCE Project's interventions: the creation of a faculty committee called *Science and Technology Recruiting to Improve Diversity and Excellence* (STRIDE), which was designed to improve the recruitment and hiring of women through a process of peer education conducted by senior science and engineering faculty members (Stewart et al. 2004).

Indicator Description	**Category 1. PERSONNEL**
Name of indicator	Horizontal gender segregation in occupations and in economic sectors
Short description	The index of gender segregation in occupation describes how many percent of employed would have to change work if an equal proportion of men and women across occupations was to be achieved. It ranges from 0 (no horizontal segregation) to 50 (complete horizontal segregation), meaning the lower the number the more equal the society. Since the index is monitored by Eurostat, a Europe-wide comparison is possible.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.1 Increased number of women in academic and other RTDI positions
Level of observation	Policy/country level (macro level) (global, national, regional)
Logic model	Context-related indicator Output indicator
Source of data	The data for the index comes from the Labour Force Survey of Eurostat. The survey is conducted quarterly in private households in 28 member states. The publications along with information regarding methodology and reliability are publicly accessible on the Eurostat's website. The data is available for scientific purposes (Eurostat 2017a). The results are also published annually in the *Report on equality between women and men* (European Commission 2017b, 57).
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Secondary data collection: data retrieved from databases (Eurostat, Patstat, Scopus, Web of Science)
Feasibility issues	Low costs, the data is either publicly available or available for scientific purposes
Comments / limitations	Gender segregation of a country can be compared with the EU level or other EU countries, or its change over time can be analysed to describe the context in which a certain gender equality measure takes place. When interpreting a comparison across countries, one has to be aware that due to a back data revision of population figures (caused by Census 2001 and 2011), there is a break in series for some member states (Eurostat 2017a).

Link to best practice / literature	

Indicator Description	**Category 1. PERSONNEL**
Name of indicator	Success rates of men and women applicants to positions
Short description	Quantitative differences in the success rates of men and women applicants to positions may indicate a gender bias in the recruiting process of the organisations concerned. The indicator is calculated by dividing the number of recruited male and female applicants by the total number of male and female applicants; it may be useful to break the data down by field, department, academic positions, part-/full-time positions, temporary/ permanent positions.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.1 Increased number of women in academic and other RTDI positions
Level of observation	Policy/country level (macro level) (global, national, regional) Organisational/institutional level (meso level)
Logic model	Context-related indicator Output indicator
Source of data	Data has to be gathered through own personnel statistics.
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Primary data collection: monitoring data of personnel statistics The monitoring must cover the number and gender of applicants to positions, as well as the number and gender of the successful candidates. It may be useful to include information regarding the field, department, academic positions, part-/full-time positions, temporary/permanent positions in the data collection process to allow a more detailed analysis.
Feasibility issues	The collection and analysis of data may be moderately time-consuming.
Comments / limitations	The indicator may detect a potential gender bias in recruiting and therefore offer a starting point for initial measures for equal career opportunities, but it does not allow conclusions about the reasons for differences in the success rates of men and women.
Link to best practice / literature	Science Europe (2017)

Indicator Description	Category 1. PERSONNEL
Name of indicator	Percentage of research evaluation panels in RFOs that included the target of at least 40 % of underrepresented sex in boards
Short description	One of the targets of the European Commission's Horizon 2020 programme is to ensure gender balance in decision-making. Therefore, another important issue concerns the participation of the underrepresented sex in evaluation and recruitment panels. A target of a minimum of 40 % for all panels has been agreed upon; it can be achieved through various policies, e.g. targets, quotas. According to the results of the 2014 ERA survey, 36 % of research evaluation panels in the EU28 include at least 40 % of the under-represented sex in their composition. The indicator shows the percentage of gender-balanced research evaluation panels in 2013 in 27 EU countries, as there is no data available for Croatia.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.1 Increased number of women in academic and other RTDI positions
Level of observation	Policy/country level (macro level) (global, national, regional)
Logic model	Context-related indicator Output indicator
Source of data	The data for the indicator comes from the 2014 ERA survey; the results were published in 2015 in the *ERA Facts and Figures 2014* report (European Commission 2015a). The survey is a follow-up to the 2012 ERA survey (European Commission 2013d). It surveys public research funding and RPOs in the EU and its objective is to monitor the progress to date and to identify further fields of action regarding the ERA objectives. The data is aggregated at the national level (European Commission 2014c; 2017a).
Qualitative/ quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Secondary data collection: data retrieved from databases (Eurostat, Patstat, Scopus, Web of Science)
Feasibility issues	Low costs, data is publicly available
Comments/limitations	It should be noted that the indicator only reflects the RFOs that answered the ERA survey in 2014, representing 34 % of the total EU GBAORD (government budget appropriations or outlays for research and development). Also, one has to be aware that a low share of gender-balanced research evaluation panels does not inevitably mean that gender is not a relevant criterion in the evaluations regarding research funding. Then again, a gender-balanced research evaluation panel does not necessarily have to have a non-gender-biased perspective on applications. Evidence even suggests that success chances for female applicants are lower in panels with more female panelists, revealing a gender-biased judgement among women referred to as the queen bee syndrome (Jayasinghe, Marsh & Bond 2003; Ellemers et al. 2004; Mutz, Bornmann & Daniel 2012).

	Furthermore, the indicator only displays the gender-balanced evaluation panels, but does not provide information on the non-gender-balanced panels in these countries; consequently, no conclusions can be drawn from this indicator with respect to the underrepresented sex. Nevertheless, the participation of women in evaluation panels ensures gender balance in decision-making, one of the targets of the European Commission's Horizon 2020 programme. The percentage of research evaluation panels in RFOs that included the target of at least 40 % of underrepresented sex in boards can be compared with the EU level or other EU countries.
Link to best practice/ literature	

Indicator Description	**Category 1. PERSONNEL**
Name of indicator	Proportion of women grade A staff by main field of science
Short description	The indicator shows the proportion of women grade A staff across fields of science, displaying horizontal and vertical segregation in the academic field at professorial level.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.1 Increased number of women in academic and other RTDI positions
Level of observation	Policy/country level (macro level) (global, national, regional)
Logic model	Context-related indicator Output indicator
Source of data	The numbers for proportion of women grade A staff differentiated by fields of science can be found in the *She Figures* (European Commission 2006a; 2009d, 2013e, 2016c) published by the European Commission. The data for these figures is collected annually through the UOE (UNESCO-UIS/OECD/Eurostat) education questionnaire and comes from Eurostat's database New Cronos (Eurostat 2015). Detailed information on the methodology can be retrieved from the *She Figures Handbook* (European Commission 2016d).
Qualitative/ quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Secondary data collection: data retrieved from databases (Eurostat, Patstat, Scopus, Web of Science)
Feasibility issues	Low costs, data is publicly available
Comments/limitations	The indictor is descriptive, so with only these numbers at hand, one can only assume the reasons why women's proportion at professorial level is lower or higher in different fields

	of study. Furthermore, it only describes the field of education; therefore, it does allow some explanations regarding the horizontal gender segregation the RTDI labour market, but limited conclusions can be drawn from this indicator for the general labour market. Moreover, the indicator can only be used in the university sector. In the GOV and BES sectors, hierarchical levels in organisations are too inconsistent. The proportion of women grade A staff by main field of science can be compared with the EU level, other EU countries or other universities, or its change over time can be analysed to describe the context in which a certain gender equality measure takes place or to measure the impact of a certain gender equality measure.
Link to best practice / literature	

Indicator Description	**Category 1. PERSONNEL**
Name of indicator	Encouragement to engage in decision-making
Short description	The subjective perception of encouragement to engage in decision-making can be a valuable outcome and indicator of success of human resource development programmes. It can be measured by asking the participants of HR programmes about the development of their confidence, professional profile, skills and strategies, goals and plans, participation and networking activities concerning (potential) decision-making roles as a consequence of the programme.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.1 Increased number of women in academic and other RTDI positions
Level of observation	Organisational/institutional level (meso level)
Logic model	Context-related indicator Output indicator Impact indicator
Source of data	Data has to be gathered through own interviews or questionnaire surveys.
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results) and/or Qualitative (e.g. interview transcripts, national reports or similar)
Data collection methods	Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews - Focus groups, ethnographic field studies, etc.

Feasibility issues	The collection and analysis of data in quantitative surveys may be moderately time-consuming and involves basic statistical knowledge, as well as competency in regard to questionnaires. Conducting qualitative surveys requires more resources and expertise in gathering and interpreting interview material.
Comments / limitations	The encouragement to engage in decision-making due to an initiative is considered crucial as it provides the basis for further action, but it does not necessarily have to be followed by actual engagement in decision-making.
Link to best practice / literature	Programme *Leadership Development for Women* (LDW) (Davidson 2013) The programme creates different learning spaces which include interactive workshops, individual readings, mentoring, and peer support groups. The Charles Sturt University's LDW programme has three broad learning components: 1) The core workshop programme consists of an initial four-day workshop, a two-day leadership skill development workshop mid-year, and a one-day workshop at the end of the year. Participants are directed to a set of readings which are referred to in the workshops. 2) Self-learning peer groups which select their own learning goal and strategy. 3) Mentor relationship where participants are able to identify their preferred mentor, and every effort is made to match to the participant's preference.

Indicator Description	**Category 1. PERSONNEL**
Name of indicator	Gendered composition of boards or committees
Short description	Equal gender representation in decision-making groups like boards or committees is considered crucial to enable a change in practice; as gatekeepers, they possess the influence to enforce or hinder the development of equal gender opportunities. The composition can also be an indicator for the permeation of gender equality policies (Munir et al. 2013, 104; Frehill et al. 2005, 13).
ERA objectives	Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.2 Increased number of women in decision-making positions
Level of observation	Organisational/institutional level (meso level)
Logic model	Context-related indicator Output indicator
Source of data	Data has to be gathered through own personnel statistics and documents or interviews.
Qualitative / quantitative	Quantitative (e.g. official statistics, documentation) and/or Qualitative (e.g. interview transcripts, national reports or similar)

Data collection methods	Primary data collection: - Official statistics/documentation - Structured/semi-structured/explorative interviews The collected data should allow identifying powerful committees in the organisation/ department concerned and their status quo of (equal) representation. In the university field, data must include promotion and tenure-track committees.
Feasibility issues	The collection and analysis of data of official statistics and documentation may be moderately time-consuming. Conducting qualitative surveys requires more resources and expertise in gathering and interpreting interview material.
Comments/limitations	An equal gendered composition of boards does not necessarily lead to a more gender equality-oriented decision-making. Nevertheless, more women in boards and committees mean a higher share of women in decision-making positions.
Link to best practice/ literature	Programme *Athena SWAN* (Munir et al. 2013). The Athena SWAN Charter award scheme operates by allocating Gold (significant sustained progress and achievement), Silver (significant record of achievement and progress) and Bronze (solid foundation of policies and practices to eliminate gender bias and an inclusive culture that values female staff) awards at both institutional and departmental level twice per year. Furthermore, it provides workshops, guidance and opportunities to share effective practice via its website. Any (mainly UK-based) HEI that is committed to the advancement of the careers of women in STEM can become a member of the Charter. Programme *AKKA – Akademiska Kollegors Ansvar (Academic Colleagues' Responsibility)* (Lövkrona & Widén 2012). AKKA is a gender-integrated leadership programme at Lund University. The programme started in 2004 and is still running every second year (AKKA I, II, III, IV and V). Programme *Toolkit for Advance IT: Increasing the participation and advancement of women in academic science and engineering careers* (ADVANCE) founded by NSF (Frehill et al. 2005). The programme has three tracks with distinct purposes, but the evaluation at hand focus on the Institutional Transformation (IT) track.

Indicator Description	**Category 1. PERSONNEL**
Name of indicator	Percentage of professional staff at employment levels differentiated by gender
Short description	This quantitative indicator can show either the current state or the development of gender equality at different employment levels, reflecting the vertical segregation or leaky pipeline in the organisation concerned. It may be used to evaluate the results of a human resource development programme aiming for gender equality in a longitudinal study (Harris & Leberman 2011).
ERA objectives	Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.2 Increased number of women in decision-making positions
Level of observation	Organisational/institutional level (meso level)

Logic model	Input indicator Output indicator
Source of data	Data has to be gathered through own personnel statistics.
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Primary data collection: - Online surveys - Monitoring data of personnel statistics The data must cover information about the hierarchy level and gender of the employees at the individual level. In case of a longitudinal study, it must also include career developments.
Feasibility issues	The collection and analysis of data may be moderately time-consuming.
Comments / limitations	Due to the descriptive nature of the indicator, no causal conclusions can be drawn about the reasons for the relevant distribution of men and women across employment levels.
Link to best practice / literature	Programme *New Zealand Women in Leadership* (NZWIL) (Harris & Leberman 2011) The programme was designed by women for women, consisting of 20 participants per cohort from the eight universities of New Zealand. The target population is women at upper-middle levels in universities in academic and general staff positions and catered for women who are in, or aspire to be in, leadership positions. It provides opportunities for participants to examine leadership attributes and reflect on strategies; increase knowledge of a range of management competencies relevant to higher education, the tertiary education sector, and of the research funding environment to develop strategies for securing grants; and build personal and national networks.

Indicator Description	**Category 1. PERSONNEL**
Name of indicator	Distribution of gender in recruitment or promotion boards
Short description	This is a quantitative indicator that shows the share of women and men, hence the representation of both genders in recruitment or promotion boards of the organisation concerned, analysing decision-making groups which play a crucial role in regard to career development. It may be useful to break the data down to scientific fields or departments.
ERA objectives	Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.2 Increased number of women in decision-making positions
Level of observation	Policy/country level (macro level) (global, national, regional) Organisational/institutional level (meso level)

Logic model	Context-related indicator Output indicator
Source of data	Data has to be gathered through own personnel statistics.
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Primary data collection: - Document analysis - Structured/semi-structured/explorative interviews
Feasibility issues	The collection and analysis of data may be moderately time-consuming.
Comments / limitations	An equal gendered composition of boards does not necessarily lead to a more gender equality-oriented decision-making. Furthermore, equal representation in decision-making bodies is often defined as between 40 % and 60 % of men and women, but establishing that share may be challenging in a field or organisation with a low share of women or boards with a high share of external members (Science Europe 2017, 35).
Link to best practice / literature	Science Europe (2017)

Indicator Description	**Category 1. PERSONNEL**
Name of indicator	Relative probability between the ability of men and women to reach a top position (Glass Ceiling Index)
Short description	This quantitative indicator tells if there is a glass ceiling for women in the organisation concerned. The higher the value of the index, the higher the difficulty for women to reach a top position compared to men. It is calculated by dividing the percentage of women in top positions by the percentage of women in low-/middle-level positions; it can range from 0 to infinity, a value of more than 1 indicates an existing glass ceiling (Timmers et al. 2010).
ERA objectives	Strategy 2. More women in leadership positions
Category	1. Personnel
Dimension	1.1 Positions
Subdimension	1.1.1 Increased number of women in academic and other RTDI positions
Level of observation	Organisational/institutional level (meso level)
Logic model	Context-related indicator Output indicator Impact indicator
Source of data	Data has to be gathered through own personnel statistics.

Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Primary data collection: - Online surveys - Monitoring data of personnel statistics The data must cover the hierarchy level and gender of the employees at the individual level.
Feasibility issues	The collection and analysis of data may be moderately time-consuming.
Comments / limitations	Due to the descriptive nature of the indicator, no causal conclusions can be drawn about the reasons for the relevant difficulty of women to reach a top position in the organisation concerned. However, to measure impact, the indicator can be modified by comparing the index before and after a certain measure regarding women's access to top positions.
Link to best practice / literature	

Category 2. Working conditions

Indicator Description	Category 2. WORKING CONDITIONS
Name of indicator	Extent of experienced work-family conflict
Short description	Work-family conflict occurs when there are incompatible demands between the work and family roles of an individual that makes participation in both roles more difficult (Greenhaus & Beutell 1985). Since Western culture encourages a strong work ethic, work-family conflict tends to be of particular concern in Europe. Experiences and commitments at work may interfere with family life in many ways. Job type, work time commitment, job involvement, role overload and job flexibility are the most typical job-related predictors of work-family conflict (Ahmad 2008). Specific examples that may contribute to an insufficient work-life balance include extensive, irregular or inflexible work hours, work overload and other forms of job stress, interpersonal conflict at work, extensive travel, career transitions, unsupportive supervisor or organisation, etc. Conflict between work and family is important for organisations and individuals because it is linked to negative consequences, e.g. increased occupational burnout and decreased organisational commitment and job performance. Establishing family-friendly and flexible policies in the workplace can diminish work-family conflict. Feelings of work-life balance vary significantly across Europe. Available data shows the extent of the conflict perceived by employees between the demands of their work and family roles in several European countries. Furthermore, this indicator may be a very effective tool for measuring the experienced work-family conflict in teams and organisations; therefore, it could be used at the meso and micro levels, as well.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	2. Working conditions
Dimension	2.1 Work-life balance
Subdimension	2.1.1 Improved compatibility of family and career
Level of observation	Individual/team level (micro level) Organisational/institutional level (meso level) Policy/country level (macro level)
Logic model	Outcome indicator
Source of data	Data on the macro level is presented by the European Social Survey (ESS): a social scientific endeavour to map the attitudes, beliefs and behaviour patterns of the various populations in Europe; the lattest report gathered the data for 2010–2011 (European Social Survey 2015, 13). The source of data at the meso and micro levels can be the individual teams and organisations whose employees are interviewed on the extent of work-family conflict they experience.

Qualitative / quantitative	Quantitative, qualitative
Data collection methods	Secondary data collection at the macro level: - Data retrieved from databases (European Social Survey) The ESS is a biennial cross-national, cross-sectional survey of attitudes and behaviour, which uses probability samples of persons resident within private households in each country. The base for analysis is all employees aged 20–64 years, living with partner. Data on well-being is available for more than 30 countries across Europe that took part in at least one of the first six rounds of the ESS. Primary data collection at the meso and micro levels: - Surveys - Structured/semi-structured/explorative interviews - Focus groups Questionnaires and several less structured methods may be used to obtain empirical results of the extent of experienced work-family conflict among the members of a work team or an organisation.
Feasibility issues	Understanding and diminishing work-family conflict requires a sound evidence base. Subjective well-being data at the macro level needs to be collected with large and representative samples and in a consistent way across different population groups and – if possible – over time. This makes it a costly process, which requires a high level of methodological expertise. Data protection issues, e.g. anonymity, have major importance at the meso and micro levels.
Comments / limitations	Conceptually, conflict between work and family is bi-directional. Most researchers make the distinction between what is termed work-to-family conflict, and what is termed family-to-work conflict. The latter occurs when experiences and commitments in the family interfere with work (e.g. presence of young children, primary responsibility for children, elder care responsibilities, interpersonal conflict within the family unit, unsupportive family members, etc.). Since work demands are easier to quantify – that is, the boundaries and responsibilities of the family role are more elastic than the boundaries and responsibilities of the work role – the interpretations of the collected data tend to focus exclusively on work-to-family conflict and do not take into account the bi-directional nature of the conflict measured by the indicator. Another limitation is that the indicator shows only individual perceptions of work-family conflict. The subjective experience of conflict can be influenced by a number of factors, e.g. the employee's personality, values, coping strategies, etc. The indicator does not provide information regarding any of the more objective determinants of job stress, work overload, etc.
Link to best practice / literature	Ahmad (2008); Burchell et al. (2007); Crompton & Lyonette (2006); Greenhaus & Beutell (1985); Grönlund (2007); King (2008); Kinman & Jones (2008); Kossek & Ozeki (1998); van der Lippe, Jager & Kops (2006)

Indicator Description	**Category 2. WORKING CONDITIONS**
Name of indicator	Possibility of paternity leave

Short description	Parental leave systems are designed to minimise conflict between work and family responsibilities and to encourage the participation of people with children in the labour market without discouraging reproduction. The most general types of family-related leave entitlements in European countries are the following (van Belle 2016). Parental leave: employment-protected and paid leave of absence for employed parents, which is often supplementary to specific maternity and paternity leave periods, and frequently, but not in all countries, follows the period of maternity leave. The directive of the European Union grants men and women workers an individual right to parental leave on the grounds of the birth or adoption of a child to enable them to take care of that child, for at least three months, until a given age up to 8 years to be defined by member states (Council of the European Union 1996). Maternity leave (or pregnancy leave): employment-protected and paid leave of absence for employed women at around the time of childbirth, or adoption in some countries. The International Labour Organisation (ILO) convention on maternity leave stipulates the period of leave to be at least 14 weeks. Paternity leave: employment-protected leave of absence for employed fathers at or in the first few months after childbirth. Paternity leave is not stipulated by international conventions. In general, periods of paternity leave are much shorter than those of maternity leave and they might or might not be paid. The concept of paternity leave indicates a shift from the traditional male breadwinner models, in which men have the primary responsibility to earn and women to care, to a more balanced distribution of paid and unpaid work between men and women (Lewis 2001). There is no legal instrument of the European Union that requires member states to introduce a minimum standard regarding father's leave at the occasion of the birth of a child. However, the European Parliament proposes a paternity leave of two weeks as a minimum standard in all member states. Fathers taking leave is of key importance for female labour force participation, enabling families to reconcile work and family responsibilities and child development, especially if accompanied by other policy elements, such as compensations. This indicator reveals whether employment-protected leave of absence for employed fathers exists in member states as part of their parental leave systems, presenting a quite varied picture across Europe.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	2. Working conditions
Dimension	2.1 Work-life balance
Subdimension	2.1.1 Improved compatibility of family and career
Level of observation	Policy/country level (macro level)
Logic model	Context-related indicator
Source of data	Detailed information about the possibility of paternity leave in member states can be retrieved from the national governments and ministries. For the 28 member states of the European Union, a comparison is provided by the European Parliament (Schulze & Gergoric 2015, 59–65, 94–98). The report also provides an overview of the basic paternity leave and/or special incentives to take the parental leave in member states as of 2014 (Schulze & Gergoric 2015, 99–100).
Qualitative / quantitative	Qualitative, quantitative

Data collection methods	Secondary data collection: - Data retrieved from databases - Desk and literature research - Document analysis The information provided in the cited studies is based on publications of the ILO, the International Network on Leave Policies and Research, the European Commission, Eurofound, and the General Directorate for Parliamentary Research of the European Parliament. Cross-checks of the above information had to be carried out to ensure a high level of reliability regarding the present situation in member states.
Feasibility issues	Some of the information used in the cited publications dates back to 2010 as more recent data is not available. To make the provisions in the member states comparable, some simplification measures were applied.
Comments/limitations	Some definition problems may arise due to the fact that national leave systems are diverse and do not always fit neatly into classifications suitable for international comparison. The figures in the study should be used for impressions of the current situation regarding certain aspects of leave schemes for the reconciliation of work and family life. Comparisons of statutory leave entitlements do not capture cross-national variations in take up of the various policies. In some countries, societal norms and culture may act as an effective barrier to take-up for some parents. As a result, while the information above reflects what is technically on offer to parents, statutory entitlements may say little about what is actually used. Furthermore, a lack of flexible leave arrangements and low or non-existent compensation levels during the leave are a key factor as to why fathers choose not to, or are unable to, take their leave entitlement. For this reason, the indicator should not be used by itself, but should be complemented by other indicators that describe the design of the parental leave system. Finally, it should be noted that questions of maternity, paternity or parental leave of parents in same-sex partnerships or in cases of surrogacy, whether or not regulated by law in the member states, are not subject of the studies cited above.
Link to best practice/ literature	Good practice: “A hug from Daddy” initiative in Denmark (COFACE 2015) The company TDC, which is the largest telephone, broadband, and television company in Denmark, has since 2002 had a generous leave policy for parents – but few fathers took up the leave. The company campaign “A hug from Daddy” aimed to raise awareness amongst fathers and has led to a large increase in fathers taking leave, from 13 % to almost 100 % in 10 years. Fathers get up to ten weeks of paid parental leave, in addition to the two-week leave after a child is born, brought home from hospital, or adopted. One of the aims of the campaign was to show that taking leave would not interrupt career progression. Information was provided on a website and leaflets, new fathers received a package containing a bib, rucksack, etc., and a letter with information about the parental leave policy. Literature: Council of the European Communities (1992); Council of the European Union (1996); Beveridge et al. (2014); Schulze & Gergoric (2015); European Parliament & Council of the European Union (2006); Kotsadam & Finseraas (2011); Lewis (2001); Ray et al. (2008); van Belle (2016)

Indicator Description	**Category 2. WORKING CONDITIONS**
Name of indicator	Employment rate by age of children and sex

Short description	Despite recent employment gains of women in many occupations, female employees continue to be underrepresented in science and engineering jobs throughout Europe. Since the economic competitiveness of the European Union is linked to the availability of high-quality science and engineering professionals, it is of major importance to retain talented women in scientific fields and to encourage them to pursue careers in science. It is obvious that the share of women in the RTDI sector strongly depends on the general participation of women in the labour force. A more equal general proportion of employed men and women can foster gender balance in research teams, organisations and decision-making. On the other hand, a low level of female employment is a strong indication of gender inequality (Plantenga 2014). Over the past decades, women's roles have changed dramatically – a reality captured by substantial increases in employment and reductions in fertility. Yet the social organisation of work and family life has not changed much. The typical gendered division of labour in which men have the primary responsibility to earn and women to care is still valid in most EU member states, which leads to pervasive work-family conflict. This indicator shows the proportion of employed persons aged 25–49 by age of youngest child, sex, country and year. It is more informative than overall employment rates, because in addition to offering an insight into the differences in male and female participation in the labour force, it also quantifies the "child penalty", that is, the impact of having children on the employment of women (Sainsbury 1999). It appears that almost all countries indicate the same pattern: the impact of parenthood is positive for men, but negative for women. However, when it comes to employment behaviour, the impact of parenthood on men is rather similar in all member states, whereas it differs considerably for women (Plantenga 2014). The data also shows changes over time since 1980.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	2. Working conditions
Dimension	2.1 Work-life balance
Subdimension	2.1.1 Improved compatibility of family and career
Level of Observation	Policy/country level (macro level)
Logic model	Context-related indicator
Source of data	Data on the employment rate of persons aged 25–49 by age of youngest child and sex were compiled from national official sources and can be found in the UNECE (United Nations Economic Commission for Europe) Statistical Database (UNECE 2016).
Qualitative/ quantitative	Quantitative
Data collection methods	Secondary data collection: - Data retrieved from databases (UNECE)
Feasibility issues	Systematic and standardised collection and statistical analysis of large quantitative data samples across countries require abundant resources and a high level of methodological expertise.

Comments/limitations	The data does not allow a distinction between different types of employment, though working hours, working conditions and working contracts can also be subject to gender differences. Furthermore, data does not provide information about persons living and working in institutional households or the military. These groups make up less than 2 % of the European working age population. Children living outside the household are not considered.
Link to best practice/ literature	Bianchi (2000); Fagan & Warren (2001); Plantenga (2014); Preston (1994); Sainsbury (1999)

Indicator Description	**Category 2. WORKING CONDITIONS**
Name of indicator	Gender pay gap in RTDI
Short description	Salary levels are an important aspect of job quality. Imbalances in wages between men and women reflect the gender inequalities of the labour market. The gender pay gap (GPG) is the consequence of various structural differences in the labour market, such as different working patterns, differences in institutional mechanisms and systems of wage setting. Consequently, the pay gap is linked to a number of legal, social and economic factors which go far beyond the single issue of equal pay for equal work. The gender pay gap exists in all countries, particularly within scientific research and development. However, gender inequalities in terms of pay vary widely among member states. Mirroring the situation at the European level, most countries (20 out of 30 countries for which data is available) showed a higher gender pay gap in research and development than in the whole economy (European Commission 2016c). There are various reasons for the existence and size of a gender pay gap and they may differ strongly between member states, e.g. kind of jobs held by women, consequences of breaks in career or part-time work due to childbearing, decisions in favour of family life, etc. Moreover, the proportion of women working and their characteristics differ significantly across countries, particularly because of institutions and attitudes governing the balance between private and work life which impact on the careers and thus the pay of women. This indicator shows the difference between average gross hourly earnings of male paid employees and of female paid employees as a percentage of average gross hourly earnings of male paid employees, thus giving an overall picture of the gender differences in pay due to gender discrimination, inequalities in the labour market and other factors (European Commission 2016c). Available data considers the extent of the gender pay gap in 2010 at the macro level, for those working in scientific research and development. However, it may make sense to collect and interpret data at the organisational/ institutional and even at the project/programme level, as well.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	2. Working conditions
Dimension	2.2 Job satisfaction
Subdimension	2.2.1 Appropriate respect/recognition for (academic/scientific/leadership) work

Level of observation	Organisational/institutional level (meso level) Policy/country level (macro level) Project/programme level
Logic model	Context-related indicator Outcome indicator
Source of data	Macro-level gender pay gap data (%) in the economic activity 'Scientific research & development' and in the total economy for 2010 is presented in the *She Figures 2015* report (European Commission 2016c, 109–110). All presented GPG data originates from the Structure of Earnings Survey (SES), conducted every four years in the EU and available from Eurostat (2017b). Economic activities are defined using the Statistical Classification of Economic Activities in the European Community, Rev. 2 (NACE Rev. 2). Classification No. 72 is used for scientific research and development; it falls under 'M. Professional, Scientific and Technical Activities'. Data is based on mean hourly earnings. Data at the meso and micro levels may be retrieved from individual studies carried out in order to measure wage differences between men and women in research teams, organisations and institutions.
Qualitative / quantitative	Quantitative
Data collection methods	Secondary data collection: data retrieved from databases (Eurostat, individual surveys) The indicator has been defined as unadjusted, because it should give an overall picture of gender inequalities in terms of pay.
Feasibility issues	Systematic and standardised collection and statistical analysis of large quantitative data samples across countries or specific samples in small teams and organisations require abundant resources and a high level of methodological expertise, even more so if we wish to observe changes over time.
Comments / limitations	Data is available only for 2010. The indicator has been defined as unadjusted (e.g. not adjusted according to individual characteristics that may explain part of the earnings difference); therefore, it gives an overall picture of gender inequalities in terms of pay. Moreover, while the size of the unadjusted gender pay gap certainly gives an indication of the situation women face in the labour market, it generally makes sense to take into account other labour market indicators as well to get a fuller picture of the possible reasons underlying the pay gap in a particular member state.
Link to best practice / literature	Blackaby, Booth & Frank (2005); European Commission (2016c); Lips (2003); Plantenga & Remery (2006); Rees (2001)

Indicator Description	**Category 2. WORKING CONDITIONS**
Name of indicator	Perceptions of work climate

Short description	Work environment involves the geographical location as well as the immediate surroundings of the workplace. It typically involves other factors relating to the place of employment, such as noise level, and additional benefits of employment, such as adequate parking. However, an even more important factor of employee well-being is work climate, which is a term to describe what it feels like to work at a given workplace. The term *climate* can designate descriptions at the individual, team or organisational level of analysis. Team climate is based on employees' perceptions of the workteam environment. Its key dimensions include human relations, participation in decision-making, team leader support, team member trust, safety and support, conflict, etc. Climate perceptions are likely to be shaped by the behaviours that are rewarded and supported (Ashkanasy, Wilderom & Peterson 2011). The study of team climate perceptions can provide information about the attitudes and behaviours of team members, and about the antecedents of their commitment, performance and satisfaction outcomes. From the gender perspective, it has to be pointed out that sex differences exist in the workplace, where men and women exhibit different behaviours in a number of situations and have different perceptions of work climate (Tannen 1994). Research suggests that team climate perceptions are associated with a variety of important outcomes, such as productivity, innovation, etc. Consequently, work climate dimensions are strongly related to scientific effectiveness, user-oriented effectiveness and overall research performance. The following aspects of work climate are of major importance for research institutions to thrive in a world made up of increasingly diverse workforces and highly competitive markets: morale, openness, job satisfaction, work contacts, career opportunities, satisfaction with supervisor, information on research plans, research autonomy (Singh & Krishnaiah 1987). By contrast, features in the functioning of the work unit such as poor information flow, authoritative way of settling differences of opinion, lack of mutual conversations about the tasks and goals of the work unit, and insufficient possibilities for employees to influence matters concerning themselves can all promote an aversive, constraining atmosphere (Vartia 2008). This is an indicator on the perceptions of work climate to illustrate the satisfaction with one's work environment and equal opportunities.
ERA objectives	Strategy 1. More women in R&D
Category	2. Working conditions
Dimension	2.2 Job satisfaction
Subdimension	2.2.3 Overall work climate
Level of observation	Individual/team level (micro level) Organisational/institutional level (meso level)
Logic model	Outcome indicator
Source of data	Due to the qualitative nature of this indicator, data can be retrieved and, if necessary, aggregated from the results of individual surveys, interviews, etc., carried out among the members of research teams, organisations and institutions.
Qualitative / quantitative	Qualitative
Data collection methods	Primary data collection: - Surveys

	- Structured/semi-structured/explorative interviews Individual perceptions of the work environment are usually termed psychological climate, and when shared to a level sufficient for aggregation to the team or organisational level, are labelled group or organisational climate. One possible tool for measuring perceptions of work climate is the Work Environment Scale, which was created to measure the social environments of work milieus. It is comprised of 90 true and false statements that represent ten subscales or dimensions, which are divided into three sets: the relationship dimension, the personal growth or goal orientation dimensions, and the system maintenance and system change dimensions. The Work Environment Scale can help an organisation evaluate productivity, assess employee satisfaction and clarify the expectations and goals of employees, which, in turn, ensures a healthy work environment (Moos 2008).
Feasibility issues	Organisational culture is very diverse, and therefore problematic to measure. The patterns of relationships between work climate dimensions and research performance are incredibly difficult to describe. Conducting qualitative surveys requires adequate resources and highly qualified personnel with relevant experience in interview making and other primary data collection methods. Perceptions of work climate constitute a very delicate matter. When gathering information on this matter, data protection principles, such as anonymity, transparency and legitimate purpose of data collection must be respected and followed, especially at the meso and micro levels. For some protected characteristics, particularly where there are likely to be small numbers of people who hold a specific characteristic, it may not be possible or practical to consult with or involve them in this process.
Comments/limitations	Although it is clear that organisational climate is likely to influence team climate, much empirical research has shown significant variations in team climate between teams within one organisation (Ashkanasy et al. 2011). Furthermore, individuals interpret processes, practices and behaviours in their environments in relation to their own sense of well-being, and this contributes to their experience of climate, be it team or organisational.
Link to best practice/ literature	Good practice: The NFS ADVANCE programme at the University of Michigan initially focused on the promotion of institutional transformation in science and engineering fields by increasing the participation, success and leadership of women faculty in academic science and engineering (University of Michigan n.d.). The programme was since expanded to address necessary institutional changes to support the needs of a diverse faculty in all fields. It is gradually beginning to address some issues facing diverse postdoctoral fellows, and graduate and undergraduate students. Coordinators of the project work directly with many departments, schools and colleges to support their efforts to bring positive changes to the work environment. They also offer many documents, research reports, lists of resources and programmes that are designed to facilitate departmental, school and college efforts. Finally, they assist in designing departmental climate reviews, providing evidence of potential issues to address, so that improvements can be targeted to real needs. Literature: Ashkanasy et al. (2011); Insel & Moos (1974); Moos (2008); Singh & Krishnaiah (1987); Tannen (1994); Vartia (2008)

Indicator Description	**Category 2. WORKING CONDITIONS**
Name of indicator	Main differences of working hours between men and women in full-time employment

Short description	The number of hours worked per week influences work-life balance, which in turn has an effect on subjective well-being. However, this effect is not linear. Research has shown that subjective well-being increases with the number of hours an individual works per week but only up to a certain point, beyond which it starts to deteriorate, possibly because excessive working hours reduce job satisfaction, which in turn reduces overall fulfilment (Eurostat 2005). Research found that working hours remain a very important dimension of work-family reconciliation practices, with large differences in both patterns and preferences (Lewis, Campbell & Huerta 2008). In past decades, the gendered division of paid and unpaid work was sufficiently in line with the male breadwinner model, which was based on a set of assumptions about male and female contributions at the household level: men having the primary responsibility to earn and women to care for the young and the old. Female dependence was inscribed in the model. Since then some kind of dual-breadwinner model has become the norm in most Western countries and the balance between the hours that men and women spend in paid work is becoming less unequal. However, given women's lower earnings, a one-and-a-half earner model is the one that actually prevails outside the Nordic countries (Lewis 2001). This indicator of the actual number of weekly working hours of full-time workers by gender shows a very important quantitative aspect of employment, thus illustrating the extent of well-being, satisfaction with work and gender equality in the labour market. Detailed macro-level data shows wide variation across and within member states and over time. Data on the differences of working hours between men and women can be collected and interpreted at the meso and micro levels, as well.
ERA objectives	Strategy 1. More women in R&D
Category	2. Working conditions
Dimension	2.2 Job satisfaction
Subdimension	2.2.4 Allocation of workload
Level of observation	Individual/team level (micro level) Organisational/institutional level (meso level) Policy/country level (macro level)
Logic model	Context-related indicator
Source of data	Most of the data on the quantitative aspects of employment, such as the average number of usual weekly hours of work in main job, by sex, professional status, full-time/part-time and economic activity (from 2008 onwards) comes from the European Union Labour Force Survey (EU LFS), a continuous household survey carried out in all EU member states (Eurostat n.d.-a)
Qualitative / quantitative	Quantitative
Data collection methods	Secondary data collection at the macro level: data retrieved from databases (Eurostat) A labour force survey is an inquiry directed to households, designed to obtain information on the labour market and related issues through a series of personal interviews. The EU LFS covers all citizens living in private households and the definitions used are common to all EU member states and are based on international recommendations by the ILO.

	Primary data collection at the meso and micro levels: surveys conducted in research teams and organisations
Feasibility issues	Systematic and standardised collection and statistical analysis of large quantitative data samples across countries or specific samples in small teams and organisations require abundant resources and a high level of methodological expertise, even more so if we wish to observe changes over time.
Comments / limitations	When gathering LFS data, the European Union excludes those in collective households, such as boarding houses, residence halls and hospitals.
Link to best practice / literature	Atkinson (2000); Becker & Moen (1999); Eurostat (2005); Fagnani (1998); Fagnani & Letablier (2004); Haas et al. (2006); Lewis (2001); Lewis et al. (2008)

Indicator Description	**Category 2. WORKING CONDITIONS**
Name of indicator	Time spent on unpaid work
Short description	Unpaid work includes a wide range of activities such as washing, cleaning, repair work, shopping, voluntary activities, caring for children or dependant family members, etc. The dual-earner family model is now the most common family structure in Europe, due to the increased labour participation of women and increased living costs (van Belle 2016). However, the typical gendered division of labour in which men have the primary responsibility to earn and women to care is still valid in most EU member states. Consequently, the gender distribution of care within the family is still unequal and women represent the majority of carers, with great impact on their paid employment. Even in the countries with a high uptake of parental leave by fathers, women still do most of the unpaid domestic work (Beveridge et al. 2014). This inequality in unpaid work results in more women reducing work hours, or leaving the labour market than men. The indicator shows how much time women and men aged 15–64 invest in unpaid, paid and total work in minutes per day, thus illustrating gender inequalities stemming from stereotypical family roles. Data enable international comparisons among OECD countries.
ERA objectives	Strategy 1. More women in R&D
Category	2. Working conditions
Dimension	2.2 Job satisfaction
Subdimension	2.2.4 Allocation of workload
Level of observation	Policy/country level (macro level)
Logic model	Context-related indicator
Source of data	Data is based on national time use surveys and can be retrieved from the OECD database (OECD n.d.).
Qualitative / quantitative	Quantitative

Data collection methods	Secondary data collection: data retrieved from databases (national time use surveys, OECD database) Member states conduct national surveys in which participants keep a diary and note all their activities in several representative days. Information on the time spent on each activity is given in minutes per day. OECD data is for 15–64-year olds, except for Hungary (15–74) and Sweden (25–64). Data refers to the latest available year, which ranges from 1999 (Portugal) to 2010 (Sweden).
Feasibility issues	International comparisons require data gathered through individually conducted surveys by each country. Tackling the methodological problems that arise from the different data collection methods of these countries and harmonising collected data can be a costly and time-consuming procedure, which requires personnel of high expertise. Observations of changes in time spent on unpaid work would need repeated surveys and additional resources. Time use is a very personal aspect of one's life. When gathering information on this aspect, data protection principles, such as transparency, proportionality and legitimate purpose of data collection must be respected and followed.
Comments / limitations	Since data originates from national time use surveys, some differences necessarily exist regarding sampling and the way data is obtained. Data does not enable observations of changes over time. Unpaid work is not a clear-cut category; therefore, it may be subject to arbitrary assessment. It is also much less quantifiable than paid work. As a consequence, it may be reported less consistently. Moreover, there might be differences between genders in the needs or priorities regarding housework. The indicator might be biased by these differences.
Link to best practice / literature	Good practice: support to families within their homes in Belgium (COFACE 2015) Family care and additional home care (Gezinszorg en aanvullende thuiszorg) introduced in Flanders correspond to a service provided by a professional in the home of the person cared for. The client pays a set price per hour based on the income of the family. Family care includes personal care (washing, dressing and personal hygiene), help with cooking, laundry and ironing, psychosocial and educational support, guidance and minor cleaning of the house. Additional home care is also available per hour and although there is no set price, providers of services need to take into account the income and the family composition. Literature: Beveridge et al. (2014); Cory & Stirling (2015); Szelewa (2013); van Belle (2016)

Indicator Description	**Category 2. WORKING CONDITIONS**
Name of indicator	Transparent promotion system
Short description	Transparency in the workplace is one of the most important criteria of career satisfaction. Fair competition among team members and promotion decisions that are based on real performance improve the organisational climate and contribute to the employees' sense of achievement and recognition in every field, including RTDI. In addition to the well-being of individuals, transparency is also beneficial for the teams, organisations and institutions, as it encourages competitiveness, productivity, innovation and excellence.

	A transparent promotion system is characterised by formalised and correctly applied promotion rules, explicit guidelines and consequent practices. Agents, criteria and decision-making processes that are involved into a promotion decision should be made explicit (van den Brink et al. 2010). Organisational structure is generally not gender-neutral and science is largely organised on the basis of a male role model (Etzkowitz et al. 1992). Personal interests and values of the participating male actors persist and are likely to reproduce gender bias. Furthermore, women may be perceived as less committed and hence seem less suitable for a scientific career to those who have to select and encourage young academics (Ellemers et al. 2004). Consequently, one of the holes in the 'leaky pipeline', that is, one of the possible causes of women leaving the scientific field, is that advancement seems unattainable for them (Preston 2004). Therefore, gender-biased promotions not only marginalise women and contribute to the maintenance of gender segregation in organisations, but also decrease the proportion of females in RTDI. By contrast, equal opportunities between male and female employees lead to an increased probability of women representation and promotion in the scientific field (van den Brink et al. 2010). The aim of this indicator is to show the extent of openness, accountability, and auditability regarding promotions made by decision-making bodies and to illustrate potential gender discrimination and inequality in decision-making and promotion procedures.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	2. Working conditions
Dimension	2.2 Job satisfaction 2.3 Competitiveness/promotion and career
Subdimension	2.2.1 Appropriate respect/recognition for (academic/scientific/leadership) work 2.3.1 Transparent, non-biased and flexible promotion/tenure criteria 2.3.2 Strengthened confidence for promotion and responsible positions 2.3.3 Improved support to advance research career
Level of observation	Individual/team level (micro level) Organisational/institutional level (meso level) Project/programme level
Logic model	Outcome indicator Impact indicator
Source of data	Due to the qualitative nature of this indicator data can be retrieved and, if necessary, aggregated from the results of individual surveys, interviews, etc., carried out among the members of research teams, organisations and institutions.
Qualitative / quantitative	Qualitative
Data collection methods	Secondary data collection: - Desk and literature research

	Primary data collection: - Surveys - Structured/semi-structured/explorative interviews - Ethnographic field studies, etc. A qualitative approach can help gain insights into perceptions, attitudes, behaviours, experiences, awareness of different issues, knowledge and skills, etc. This kind of research provides fuller, richer information, generally in non-numerical form, that can help us understand less quantifiable aspects of social phenomena, and is an important tool for steering work on gender inequality issues as well as demonstrating the results and impact of work to advance equality.
Feasibility issues	Conducting qualitative surveys requires adequate resources and highly qualified personnel with relevant experience in interview making and other primary data collection methods. Promotion systems constitute an element of organisational cultures, which are very diverse, and therefore problematic to measure. The patterns of relationships between transparency and research performance are incredibly difficult to describe. Data protection principles, such as anonymity, transparency and legitimate purpose of data collection must be respected and followed, especially at the meso and micro levels. For some protected characteristics, particularly where there are likely to be small numbers of people who hold a specific characteristic, it may not be possible or practical to consult with or involve them in this process.
Comments/limitations	Research argues that it is impossible to formalise each and every aspect of the recruitment and selection process. Furthermore, the lack of transparency is not the only cause of insufficient female representation in decision-making and leadership positions. A large number of other factors may also contribute to the small proportion of women leaders in RTDI, e.g. lack of ambition, family obligations, etc. It is essential to ensure that interpretation of the evidence is correct and that appropriate meanings and themes have been captured. As respondents will have their own particular perspectives and views, it is important that they are considered alongside other opinions and are not used in isolation.
Link to best practice/ literature	Acker (1987); Cooper (1997); Ellemers et al. (2004); Etzkowitz et al. (1992); Lyness & Thompson (2000); Merton (1988); Preston (2004); Valian (1997); Van den Brink et al. (2010)

Indicator Description	**Category 2. WORKING CONDITIONS**
Name of indicator	Study of actual space allocation of faculty at organisational level (access to the lab, square footage, proximity to electrical power, years since last renovation, services)
Short description	Resources are essential to new professors as they start their careers, and also to senior faculty to maintain productive research and teaching agendas. Ensuring that faculty are provided the resources that will help them succeed is extremely important, and space constitutes one of the different types of resources for faculty. Space is a precious commodity at universities and research institutions, because it is relatively fixed and is essential for research and teaching. Not only may a scientist's research productivity be directly related to the quantity and quality of her space, but women who receive less space then their male counterparts receive the message that their research is marginal and less important than that of their male counterparts.

	Allocation is a process whereby space is assigned to an academic unit, either a department or a programme. In making allocation decisions, administrators generally depend on institutional priorities and goals. They use priority reviews and standards to determine how much space is needed to accommodate the personnel and equipment for the desired activities. This indicator measures the specifics of space allocation of STEM faculties in organisations, universities and research institutions, which is fundamental in understanding women's status as faculty within these organisations and institutions. Although originally it is a meso level indicator, it makes sense to use it at the micro level, as well, in order to illustrate female employees' satisfaction with their work environment and equal opportunities.
ERA objectives	Strategy 1: More women in R&D Strategy 2: More women in leadership positions
Category	2. Working conditions
Dimension	2.4 Workplace
Subdimension	2.4.1 Equal workspace/facilities allocation
Level of observation	Individual/team level (micro level) Organisational/institutional level (meso level)
Logic model	Output indicator
Source of data	The sources of data are the research teams, organisations, institutions and university departments in which space allocation measurements are carried out.
Qualitative/ quantitative	Quantitative, qualitative
Data collection methods	Primary data collection: - Surveys - Structured/semi-structured/explorative interviews - Field studies, observations, measurements, etc. In-depth analysis of space allocation is necessary to understand how gender affects the distribution of resources. For this end, a number of quantitative and qualitative methods can be used. Quantitative measures of space allocation should include square footage, proximity to electrical power, years since last renovation, etc. Appropriate qualitative information regarding space includes services (e.g. internet, windows, etc.), satisfaction with quality of space (e.g. location, amenities and condition), satisfaction with the amount of space, understanding of the processes of space allocation, satisfaction with the processes of space allocation, participation in the processes of space allocation, impact of administrative changes on space allocation, etc. The analysis might also benefit from collecting data about the space controlled by departments, such as library, seminar rooms, classrooms, departmental offices, conference rooms, research labs, kitchen, break area, lounge, etc. In the case of bigger organisations, data should be collected by department. Analyses of gender differences must necessarily include important control variables. The institution should identify a baseline period and data should be gathered for that baseline first. Subsequent reports should make comparisons with that baseline.

Feasibility issues	The data gathering and analysis associated with these studies are very labour-intensive; therefore, they require adequate research personnel. The repository of this quantitative data varies among institutions. Data collectors will need to identify where to locate the data. Very often, after the collection of initial official records, a process of verification must take place. Interviewing all female employees about space can help to verify the accuracy of the records and to examine issues of space quality and perceived fairness of the allocation process more closely. Data protection issues, e.g. anonymity, have major importance in research at the meso and micro levels.
Comments / limitations	Space allocation is a dimension of gender equality that is extremely difficult to quantify and standardise, which may lead to methodological problems and controversies. Data focuses only on tenured and tenure-track faculty, and does not include clinical, research, non-tenure-track, instructional, emeritus, volunteer, visiting, etc. faculty.
Link to best practice / literature	Good practice: The NFS ADVANCE programme at the University of Michigan initially focused on the promotion of institutional transformation in science and engineering fields by increasing the participation, success and leadership of women faculty in academic science and engineering (University of Michigan n.d.). The programme was since expanded to address necessary institutional changes to support the needs of a diverse faculty in all fields. It is gradually beginning to address some issues facing diverse postdoctoral fellows, and graduate and undergraduate students. Coordinators of the project work directly with many departments, schools and colleges to support their efforts to bring positive changes to the work environment. They also offer many documents, research reports, lists of resources and programmes that are designed to facilitate departmental, school and college efforts. Finally, they assist in designing departmental climate reviews, providing evidence of potential issues to address, so that improvements can be targeted to real needs. Literature: Babcock & Laschever (2003); Frehill et al. (2005); New Zealand Government (2014)

Indicator Description	**Category 2. WORKING CONDITIONS**
Name of indicator	Sense of belonging to group
Short description	Research states that each and every individual has an evolved and robust need for closeness and social belonging (Baumeister & Leary 1995). Belongingness encourages members of social groups to comply, cooperate and help. Members of cohesive groups show more consideration, report positive relationships within the group and elicit more supportive behaviours. Researchers propose a fairly direct relationship between positive social identity and self-confidence (Tajfel & Turner 1986). By contrast, feeling disliked, excluded or devalued can stir up negative emotions in any individual. Adverse feedback leads to a decline in self-esteem. The need to belong is especially evident in the workplace. Employees want to fit in at work and they seek approval and acceptance of leaders and other employees, which gives them an identity with which to belong. Despite women's increasing participation, RTDI is still a male-dominated sector, both historically and numerically. Organisational structure is generally not gender-neutral and science is largely organised on the basis of a male role model (Etzkowitz et al. 1992). Therefore, women and members of other minority groups might easily feel isolated and undervalued in comparison to their male colleagues. It is assumed that persistent stereotypes associating science with males more than with females also lead to a decreased sense of belonging and lowered self-

	esteem and, as a consequence, insufficient participation of women in RTDI (Nosek et al. 2009). A workplace functions better as a collective whole. Congenial human relations, participation in decision-making, team leader support, team member trust, safety and support are all characteristics of a cohesive work team (Ashkanasy et al. 2011). Belongingness has a positive impact on the development of group motivation and, in a broader sense, also on the group performance. Therefore, the marginalisation of women and the maintenance of gender segregation in research organisations not only decrease the proportion of females in RTDI and in leaderhip positions, but also worsen the overall research performance and competitivity. This is an indicator on the self-assessment of employees regarding their sense of belonging to their group in the workplace. It shows one aspect of the achievement and promotion barriers still faced by women in STEM, thus reflecting the negative effects of social exclusion, potential discrimination, gender bias, stereotypical or sexist acts and remarks from colleagues, leaders and decision-makers, etc. (Steele 1997).
ERA objectives	Strategy 1. More women in R&D
Category	2. Working conditions
Dimension	2.2 Job satisfaction
Subdimension	2.2.3 Overall work climate
Level of observation	Individual/team level (micro level) Organisational/institutional level (meso level)
Logic model	Outcome indicator
Source of data	Due to the qualitative nature of this indicator, data can be retrieved from the results of individual surveys, interviews, etc., carried out among the members of research teams, organisations and institutions.
Qualitative / quantitative	Qualitative
Data collection methods	Primary data collection: - Surveys (with open text responses) - Structured/semi-structured/explorative face-to-face interviews A qualitative approach can help gain insights into perceptions, attitudes, behaviours, experiences, awareness of different issues, knowledge and skills, etc. This kind of research provides fuller, richer information, generally in non-numerical form, that can help us understand less quantifiable aspects of social phenomena, and is an important tool for steering work on gender inequality issues as well as demonstrating the results and impact of work to advance equality.
Feasibility issues	The patterns of relationships between group belongingness and research performance are incredibly difficult to describe. Conducting qualitative surveys requires adequate resources and highly qualified personnel with relevant experience in interview making and other primary data collection methods. When gathering information on self-reported perceptions, data protection principles, such as anonymity, transparency, proportionality and legitimate purpose of data collection must be respected and followed. For some protected characteristics, particularly where there are likely to be small numbers of people who hold a specific

	characteristic within the examined group, it may not be possible or practical to consult with or involve them in this process.
Comments / limitations	Due to the qualitative nature of the indicator, samples will not be representative of the population. Another limitation is that the indicator shows only individual perceptions of group belongingness. The subjective experience of belonging to a group can be influenced by a number of different factors apart from social exclusion, stereotypes, discrimination, etc. These factors include the employee's personality, previous group experiences, coping strategies, etc. The indicator does not provide information regarding any of the more objective determinants of job stress, team climate, level of social acceptance, etc. For these reasons, it is essential to ensure that interpretation of the evidence is correct and that appropriate meanings and themes have been captured. As respondents will have their own particular perspectives and views, it is important that they are considered alongside other opinions and are not used in isolation.
Link to best practice / literature	Ashkanasy et al. (2011); Baumeister & Leary (1995); Ellemers et al. (2004); Etzkowitz et al. (1992); Nosek et al. (2009); Steele (1997); Tajfel & Turner (1986); Turner & Reynolds (2010); Watts (2006)

Category 3. Professional capabilities

Indicator Description	Category 3. PROFESSIONAL CAPABILITIES
Name of indicator	Women in leadership positions
Short description	Women represent a small minority of Grade A professors (21 % in 2013), heads of higher education institutions (20 % in 2014) and board members (including leaders) in research decision-making (28 % in 2014) (European Commission 2016c). Machado-Taylor and White (2014) recognise that various factors explain why women are underrepresented in HEI leadership. They identify the availability of a small recruitment pool as an important factor. University leaders consider that the usual career path into senior management is through academic promotion and that being a full professor is a pre-condition for securing a leadership position (Bagihole & White 2011). The underrepresentation of women in higher positions within academia (grade A) therefore leads to greatly reduced chances of women becoming the head of a university or a similar higher education institution. The gender gap at this level could also have repercussions on decisions that affect the entry and retention of women within such higher-level positions. The underrepresentation of women in positions of power could also deter young women from starting a scientific career as well as acting as an obstacle to their progression to PhD level and the first stages of an academic career (European Commission 2016c, 140).
ERA objectives	Strategy 2. More women in leadership positions
Category	3. Professional capabilities
Dimension	3.1 Leadership
Subdimension	3.1.1 Increased confidence and ability of leadership roles
Level of observation	Policy/country level (macro level) (global, national, regional)
Logic model	Input indicator Output indicator Outcome indicator Impact indicator
Source of data	*She Figures 2015* shows the number of academic staff in Grade A by grade and sex in the EU28 and uses data from the Women in Science Database, DG Research and Innovation (European Commission 2016c, 145). *She Figures 2015* looks at the proportion of women as heads of institutions in the EU28 and uses data from the Women in Science Database (European Commission 2016c, 140). It also charts the share of women on boards as members and leaders in the EU28 and uses data from the Women in Science Database (European Commission 2016c, 144).
Qualitative / quantitative	Quantitative data taken from the Women in Science Database and accessible in *She Figures 2015*.
Data collection methods	Secondary data collection: data retrieved from *She Figures 2015*

Feasibility issues	Systematic and standardised collection and statistical analysis of large quantitative data samples across countries require abundant resources and a high level of methodological expertise, even more so if we wish to observe changes over time. *She Figures*, however, publishes its analysis of this data for the majority of the EU28 countries biannually.
Comments / limitations	*She Figures 2015* uses the data necessary to compute the majority of indicators from the Women in Science database collected by the Helsinki Group's statistical correspondents. The Helsinki Group has been renamed into the Working Group on Gender and Innovation.
Link to best practice / literature	European Commission (2016c); Bagihole & White (2011); Machado-Taylor & White (2014)

Indicator Description	**Category 3. PROFESSIONAL CAPABILITIES**
Name of indicator	Availability of positions in the RTDI system and in the research organisation
Short description	This is a quantitative contextual composite indicator. In many countries, there are not many research positions or permanent positions such as professor positions available due to economic constraints and cuts in funding. We see a development towards more external funding to finance positions, existence of more non-tenure positions, etc. At the same time, the autonomy of universities has been increased, which means that universities in many countries receive less basic funding and have difficulties in recruiting personnel, in particular at A and B levels. The share of external funding is increasing in general but that also means temporary positions until funds are used. At the organisational level, HR management should have data regarding the types of available positions, level, duration of contract, type of funding (internal/external), etc. It is more difficult to measure the availability of positions in the RTDI system on a country level. One strategy may be to tap into the EURAXESS database of research positions. These can be searched by research field, researcher profile, sector, country and European Research Programme. It supports researcher mobility and career development, while enhancing scientific collaboration between Europe and the world.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	3. Professional capabilities
Dimension	3.2 Professional achievement
Subdimension	3.2.1 Increased professional development of work skills (for career success)
Level of observation	Policy/country level (macro level) (global, national, regional) Organisational level
Logic model	Context-related indicator Input indicator
Source of data	Macro-level data for the country level within Europe can be found in the following databases.

	Available positions in RTDI can be searched at the country level through the EURAXESS database.[18] Employment in knowledge intensive activities may be found in the European Innovation Scoreboard 2017 database (European Commission 2016a). Proportion of scientists and engineer in total labour force by sex may be found in the Eurostat database HRST by category sex and age (Eurostat 2016). Gross domestic expenditure on R&D as a percentage of GDP. The total R&D expenditure database is available on Eurostat (n.d.-b). Human resource departments in RTDI organisations should collect data on the number of positions available by year/post.
Qualitative / quantitative	Quantitative (e.g. official statistics at the country level and data provided by human resources at the organisational level).
Data collection methods	Secondary data collection: - Data retrieved from databases (EURAXXES, European Innovation Scoreboard and Eurostat) - Data retrieved from human resource departments of the RTDI organisation
Feasibility issues	Data on the availability of positions in RTDI at the national level is patchy and varies greatly from country to country. For example, the extent to which the EURAXESS database reflects the availability of positions in each country varies greatly. In Ireland, all publically funded (and research-active private) organisations are encouraged to advertise research positions on the EURAXESS Ireland portal.[19] But in Spain in 2013, the number of researcher posts advertised through the EURAXESS Jobs portal per thousand researchers in the public sector was 10.6, compared with 39.9 among the Innovation Union reference group and the EU average of 43.7 (Deloitte 2014b, 6).
Comments / limitations	This data is easier to collect at the organisational level as human resource management will have information systems that produce this data. It may, however, be difficult for researchers to access.
Link to best practice / literature	Reidl et al. (2017b); European Commission (2016c); Deloitte (2014a; 2014b)

Indicator Description	**Category 3. PROFESSIONAL CAPABILITIES**
Name of indicator	Scale of organisational commitment to gender diversity (measurement through regulations, contracts' reformulation, founding of new initiatives)
Short description	Measures the overall organisational awareness and commitment to gender diversity goals through identifying the presence of gender-inclusive regulations, contracts, initiatives, processes and procedures. The European Commission's Expert Group on Structural Change identified various institutional barriers that may limit the advancement of gender equality – these include lack of transparency in decision-making, institutional practices that indirectly discriminate against women, gender biases in the assessment of excellence, and gender bias in the organisation of the workplace (European Commission

[18] The database can be found at https://euraxess.ec.europa.eu/jobs/search.
[19] The portal's website is www.euraxess.ie.

	2012b). Research organisations can implement a range of actions to promote gender equality and diversity internally. The ERA encourages research organisations to pursue gender equality through institutional change in human resource management, funding, decision-making and research programmes (European Commission 2012).
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions Strategy 3. Integrating the gender dimension in research and innovation content
Category	3. Professional capabilities
Dimension	3.3 Awareness/commitment to gender equality
Subdimension	3.3.1 Increased gender awareness
Level of observation	Organisational/institutional level (meso level) Policy/country level (macro level) (global, national, regional)
Logic model	Input indicator
Source of data	*Organisational level*: Organisational documents including mission statement, strategies and plans. The extent to which gender equality is mainstreamed throughout organisational policy strategies and plans. The existence of a gender equality plan as well as gender equality policies and subsequent monitoring and evaluations reports. Charter commitments (e.g. the EURAXXES human resources charter, or the Athena SWAN, UK). Interviews with key stakeholders and focus groups could provide rich data to explore the organisational commitment to gender equality. *National level*: The European Commission has carried out two surveys to measure the level of progress made by research organisations in the EU member states and associated countries in implementing the policy priorities of the ERA. The ERA surveys include questions that explore the actions taken by research organisations to encourage gender equality. As part of the 2014 survey, research organisations were asked if they had set up gender equality plans, defined as a consistent set of measures and actions aimed at achieving gender equality.
Qualitative/ quantitative	Qualitative assessment, e.g. a review of organisational mission statement, strategies and plans including the monitoring and evaluation of these strategies and plans, as well as charter commitments. Quantitative survey aimed at research organisations and aggregated at the national level.
Data collection methods	Secondary data collection: - Desk and literature research - Document analysis, etc. Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews - Focus groups, ethnographic field studies, etc.
Feasibility issues	It may be time-consuming to carry out a thorough documentary analysis to establish the scale of organisational commitment to gender diversity/equality.

	National level aggregation of RPOs' commitment to gender diversity/equality is a costly and time-consuming exercise. Ensuring a high enough response rate of RPOs to guarantee the validity of the findings may prove difficult.
Comments/limitations	Whilst mission statements, action plans and policies may highlight the scale of organisational commitment, effective implementation of this vision is another issue. The limitations of the ERA survey include that it was a self-assessment, so the implementation figures are based on those organisations that reported that they were implementing certain measures. It also only concerns those RPOs which answered the ERA survey (they employ 515 000 researchers – around 20 % of total EU researchers). The sample for the ERA survey was not randomly selected and the results have not been weighted due to the lack of substantiated information about the sample frame and the whole population of RPOs. It is therefore not possible to infer the statistics to the wider population. The percentage of organisations that report implementing policy measure X is not indicative of the overall national situation – in some cases, a high percentage of organisations indicated that the measure was not applicable to their organisation.
Link to best practice/ literature	Although the GEAR tool (EIGE 2016b) does not explicitly mention how to measure organisational commitment, it is insistent on the commitment of top mangers and leaders as a necessary precondition for the successful implementation of gender equality plans. European Commission (2012b; 2015a; 2016c, 111;2016d)

Indicator Description	**Category 3. PROFESSIONAL CAPABILITIES**
Name of indicator	Percentage of staff/researchers who have received training on integration of gender analysis into research (IGAR)
Short description	Quantitative indicator to measure the level of staff's/researchers' know-how of integrating sex and gender considerations into policies, programmes and projects, and to measure the awareness about the importance of sex and gender in research and innovation. IGAR refers to the use of sex and/or gender analysis in all the phases of the research cycle. It means taking into account the biological characteristics of both females and males (sex) and the evolving social and cultural features of women and men (gender) (EIGE 2016b). In some projects, only sex analysis will be relevant to the research, for instance, in preclinical studies on cells and tissues or in medical studies to develop new drugs. In others, only gender analysis is necessary (mainly in studies where biological differences do not play a role), for example, reducing existing gender inequalities by developing new tools aimed at detecting and preventing gender-based violence. In other cases, both gender and sex interact in a particular study, for example, in studies of nutrition or exercise where hormonal or cultural factors can influence the likelihood of disease. *The Gendered Innovations* project has developed practical methods of sex and gender analysis for scientists and engineers. It also provides case studies as concrete illustrations of how sex and gender analysis leads to innovation. The fields covered include basic science, engineering and technological development, environment, food and nutrition, health and medicine, transport, communicating science.

	The percentage of staff/researchers who have received training on integrating gender analysis into research is a key measure of gender competence.
ERA objectives	Strategy 3. Integrating the gender dimension in research and innovation content
Category	3. Professional capabilities
Dimension	3.3 Awareness/commitment to gender equality
Subdimension	3.3.1 Increased gender awareness
Level of observation	Organisational/institutional level (meso level)
Logic model	Input indicator Output indicator
Source of data	Organisational level: A question included into a survey to research staff on whether they have received training on how to integrate gender analysis into research may provide useful data at the institutional level. An initial assessment of the professional development training offered by the institution may be useful to determine the extent to which this type of training is offered and its eventual uptake.
Qualitative / quantitative	Quantitative (e.g. survey results) Qualitative interviews with professional development and training managers within the institution might also yield useful information.
Data collection methods	Primary data collection: - Online survey to research staff - Semi-structured interviews with professional development and training managers
Feasibility issues	An online survey to all research staff may be particularly time-consuming, and adequate response levels are difficult to achieve. A semi-structured interview with professional development/training manager for the research organisation may be more feasible (than a survey to all research staff) and can indicate the extent to which this kind of training is offered in-house and the levels of take-up of this training.
Comments / limitations	Including a question about whether or not a researcher has received training on integrating gender analysis into research into an organisation-wide survey may provide rich data to map those departments and schools that are strong on gender analysis training and those that are weaker. It may therefore provide some kind of basis for targeting those departments and schools where training to integrate gender analysis is currently weak or non-existent.
Link to best practice / literature	Gender-NET (n.d.-b; 2016); Schiebinger (2008)

Indicator Description	**Category 3. PROFESSIONAL CAPABILITIES**
Name of indicator	Proportion of budget allocated to GE monitoring of total budget

Short description	This is a quantitative indicator that measures the proportion of the total budget allocated to GE monitoring. It indicates how seriously the institution takes implementing gender equality measures by monitoring their progress. Gender mainstreaming as well as gender budgeting measures need to be continuously monitored to ensure that gender equality measures are sustainable (Rothe et al. 2008). As Rothe et al. (2008, 72) state, it is necessary to design the controlling instruments of the organisation in a gender-sensitive way. Gender equality must become part of the management's responsibility and become an integrated part of the management process. Measuring the proportion of the budget allocated to GE monitoring of the total budget indicates how seriously the institution takes gender equality. Gender monitoring has the potential to gather information on: a) the numbers of women in RTDI (different levels, types of contracts, etc.), b) women in leadership, and c) research programmes/projects that integrate the gender dimension into research and innovation content.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions Strategy 3. Integrating the gender dimension in research and innovation content
Category	3. Professional capabilities
Dimension	3.3 Awareness/commitment to gender equality
Subdimension	3.3.1 Increased gender awareness
Level of observation	Organisational/institutional level (meso level)
Logic model	Input indicator
Source of data	Organisational monitoring systems should be able to provide this data.
Qualitative / quantitative	Quantitative data at the institutional level
Data collection methods	Secondary data collection: - Data retrieved from key institutional actors, for example decision-makers, and key monitoring and information systems - Document analysis, etc.
Feasibility issues	This information may be difficult to access as it may be considered sensitive. Current monitoring systems may not (and probably do not) disaggregate the budgetary information in this way. An institutionally grounded approach would need to be developed taking into consideration the organisational specifics, particularly regarding the budget.
Comments / limitations	There may not be a specific allocation for 'gender monitoring'.
Link to best practice / literature	Rothe et al. (2008); Steinthorsdottir et al. (2016)

Indicator Description — Category 3. PROFESSIONAL CAPABILITIES

Name of indicator	Share of men and women among successful applicants
Short description	This is a quantitative indicator to measure research funding success-rate differences between women and men, indicative of a gendered process of resource allocation. The report *Gender Challenge in Research Funding* (European Commission 2009a) highlights that in many cases the success rates in funding are regularly monitored and published; however, the gender of applicants and awardees is not followed up and neither success rates are calculated nor is this information published (Caprile et al. 2012). Where this information is available, there are, however, great differences in women's and men's propensity to apply for funding – the proportion of women applicants is lower than the proportion of potential applicants in practically all funding systems and most disciplines (Caprile et al. 2012, 54). The 2009 report highlights that there is little research on application behaviour in general and especially on its gendered patterns. The meta-analysis of gender and science literature regarding funding highlights the following: • Women apply at a lower rate than men; success rates are not systematically lower for women than for men. • The gender gap in applications for funding and in access to funding varies across disciplines. • Generally, it is harder for women to obtain high-prestige awards. Access to a long-term position is more difficult for women than for men. Female applicants have higher success rates when they apply for smaller amounts then when they apply for much bigger research grants. Surprisingly, the higher the position in the hierarchy, the more difficult it is to access funding (Caprile et al. 2012, 54). The European Research Council (ERC) recognises that imbalances persist in the success of women in their calls for funding, but these imbalances vary across countries. They pledge to challenge any potential source of gender bias in the evaluation process through a range of actions including the following: • continuing to ensure eligibility and evaluation criteria are designed to encompass the situation of both women and men in research; • continuing to monitor success rates and granted amounts for women and men and publish gender statistics from ERC evaluations in long-term time series and by ERC domain. In particular, submission rates and requested amounts should be compared to granting rates and granted amounts for women and men respectively (ERC 2014). *She Figures 2015* looks at the evolution of the funding success rate differences between women and men between 2010–2013 across the EU28.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	3. Professional capabilities
Dimension	3.4 Funding to promote GE in terms of career
Subdimension	3.4.1 Increased funding to promote GE
Level of observation	Policy/country level (macro level) (global, national, regional)
Logic model	Input indicator Outcome indicator

Source of data	*She Figures 2015* (European Commission 2016c, 170), based on DG Research and Innovation's Women in Science Database, for number of women applicants for research funding for a given year; number of women beneficiaries for research funding for a given year; number of men applicants for research funding for a given year, and then subsequent calculations
Qualitative / quantitative	Quantitative (e.g. official statistics)
Data collection methods	Secondary data collection: data retrieved from databases (until 2015 – Women in Science Database and reported in *She Figures*)
Feasibility issues	Systematic and standardised collection and statistical analysis of large quantitative data samples across countries require abundant resources and a high level of methodological expertise, even more so if we wish to observe changes over time. The publication *She Figures*, however, publishes its analysis of this data for the majority of the EU28 countries biannually.
Comments / limitations	*She Figures 2015* uses the data necessary to compute the majority of indicators from the Women in Science Database collected by the Helsinki Group's statistical correspondents. The Helsinki Group was remaned into the Working Group on Gender and Innovation.
Link to best practice / literature	Caprile et al. (2012); European Commission (2009a; 2016c); ERC (2014); Lövkrona & Widén (2012)

Indicator Description	**Category 3. PROFESSIONAL CAPABILITIES**
Name of indicator	Average size of grant for women and men
Short description	This is a quantitative indicator of resource distribution between men and women, indicative of a gendered resource allocation process. This indicator should be broken down by scientific field, funding scheme, academic age, number of years since obtaining a PhD. If relevant, this indicator can also be broken down by academic position and/or sector. In the case of large grants aimed at groups of researchers, the above indicators should be complemented by indicators that take into account the gender distribution of the applying groups. The gender of the principal investigator, however, is still of interest, since the PI usually has decisive influence over the distribution of the grant (Science Europe 2017). Research has examined the differences in research funding for women scientists in the UK in the field of global infectious disease research from 1997–2010. It looked at 6 052 studies, in which 72 % of grants were awarded to men and women received 28 % of grants. In terms of the average size of grant, the median value of the award was greater for men than women. Awards were also greater for male PIs across all infectious disease systems, except neurological infections and sexually transmitted infections. The proportion of total funding awarded to women ranged from 14.3 % in 1998 to 26.8 % in 2009 and was lowest for pre-clinical research at 18.2 % and and highest for operational research at 30.9 % (Head et al. 2013).
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions

Category	3. Professional capabilities
Dimension	3.4 Funding to promote GE in terms of career
Subdimension	3.4.1 Increased funding to promote GE
Level of observation	Organisational level (research funding organisations)
Logic model	Input indicator Output indicator
Source of data	At the organisational level, data should be kept on funding distribution. This data should be collected and indicators calculated annually, and the results should be made public on a regular basis. Yearly data collection makes it possible to observe changes, such as improvements in special areas, thus helping an organisation to adapt its gender equality actions. If possible, success stories on actions taken to improve gender equality can be included in the progress reports (Science Europe 2017, 29).
Qualitative / quantitative	Quantitative institutional data
Data collection methods	Primary data collection: institutional resource allocation distribution records disaggregated by sex
Feasibility issues	Collection of gender statistics is increasingly recognised as an important element of monitoring the allocation of research funding. Whilst some indicators (funding success rate difference between women and men (see *She Figures 2015*); differences between application and grantee success rates by gender (ERC Gender Statistics)) have been integrated into monitoring systems, the average size of the research grant is yet to be integrated.
Comments / limitations	The organisation may consider this data as sensitive and may not wish to provide access.
Link to best practice / literature	Science Europe (2017); Head et al. (2013)

Indicator Description	**Category 3. PROFESSIONAL CAPABILITIES**
Name of indicator	Promotion of gender equality as a funding requirement
Short description	This indicator refers to promotion of gender equality as demonstrated by the existence of a gender equality plan, improved action (demonstrated by monitoring) or impact (demonstrated by evaluation of a plan) as an explicit criterion to receive funding. This is a powerful RFO steering mechanism to influence the uptake and implementation of gender equality measures in RPOs. For example, a best practice example of this steering mechanism is the Athena SWAN Charter which was established in 2005 to encourage and recognise commitment to advancing the careers of women in science, technology, engineering, maths and medicine (STEMM) employment in higher education and research. It has subsequently been expanded to recognise work undertaken in arts, humanities, social sciences, business and law, and in professional and support roles, and for trans staff and students.

	It received a major boost in 2011, when the UK Chief Medical Officer announced that the National Institute for Health Research would only expect to shortlist medical schools for Biomedical Research Centre (BRC) and Unit (BRU) funding if the associate academic school holds a Silver Athena SWAN award. This was later expanded to include Patient Safety Research Centre funding in 2012. Athena SWAN has since started to work with the Medical and Dental School Councils. In 2016, in the first round of funding to be awarded since the Chief Medical Officer's announcement, the Department of Health awarded GBP 816 million to 20 BRCs, all of which are associated with a Silver Athena SWAN award-holding academic unit (Department of Health and Social Care 2016).
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	3. Professional capabilities
Dimension	3.4 Funding to promote GE in terms of career
Subdimension	3.4.1 Increased funding to promote GE
Level of observation	Policy/country level (macro level) (global, national, regional)
Logic model	Input indicator (steering mechanism)
Source of data	Data on the promotion of gender equality as a funding requirement at the country level is scarce. A survey targeted at research funding organisations or national level ministries would be able to provide this data. Another approach may be to carry out a qualitative assessment of RFOs' criteria to see whether promotion of gender equality is specified as a funding criterion.
Qualitative / quantitative	Survey of RFOs at the national level Qualitative assessment of funding criteria
Data collection methods	Survey of RFOs Documentary analysis of funding criteria
Feasibility issues	Whilst documentary analysis of funding criteria involves a relatively low-cost data collection strategy, an initial mapping of all national RFOs may be more time-consuming.
Comments / limitations	This kind of bottom-up approach – i.e. a qualitative assessment of whether gender equality is specified as a requirement for funding – would be valid at the national level, but a cross-national comparison would be difficult.
Link to best practice / literature	Equality Challenge Unit (n.d.)

Indicator Description	**Category 3. PROFESSIONAL CAPABILITIES**
Name of indicator	Reasons for potential applicants not to apply/to apply for funding
Short description	Research points to the existence of gender-specific differences in grant application behaviour of women and men: "female researchers were as successful in gaining funding

	as their male colleagues, but significant differences were identified in females vs. males' application behaviour" (Ranga et al. 2012, 16). Fewer women than men applied for grants, they applied for smaller numbers of grants and requested smaller amounts (regardless of the grant type). The main factors influencing the application behaviour included: seniority, employment status, tenure, type of institution, professional profile, institutional support, career breaks, and family circumstances. Whilst men and women were affected by many of these factors, some disproportionately stopped women from making applications. Some eligibility criteria designed by research funders produced a gender bias at the application stage, as more women than men were employed on fixed-term contracts and were at lower academic grades (Ranga et al. 2012). Ranga et al. (2012) also highlight research examining several large Swedish scientific funding programmes (Nervik 2006) which demonstrated women's lower propensity to apply compared to men. They identified the internal selection process within the universities as a likely cause for the lower number of applications by women.
ERA objectives	Strategy 2. More women in leadership positions
Category	3. Professional capabilities
Dimension	3.4 Funding to promote GE in terms of career
Subdimension	3.4.1 Increased funding to promote GE
Level of observation	Individual/team level (micro level)
Logic model	Input indicator Output indicator Outcome indicator
Source of data	Quantitative data analysis of factors influencing the application behaviour, i.e. seniority, employment status, tenure, type of institution, professional profile, institutional support, career breaks, and family circumstances. A more qualitative approach can also be taken, exploring the reasons stated for applying or not applying for specific research funding. For example, Ackers (2001), in her study of the European Commission's mobility fellowships, shows the importance of taking into consideration the impact of occupational cultures and 'commitment' on confidence levels and grant application behaviour.
Qualitative / quantitative	Quantitative data analysis of survey results and monitoring data linked to research funding programmes Qualitative interview transcripts, exploring the stated reasons and concerns for applying for certain funds
Data collection methods	Secondary data collection: - Desk and literature research - Document analysis, etc. Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews - Focus groups, ethnographic field studies, etc.

Feasibility issues	Carrying out a comprehensive survey of research funding applicants is resource-intensive. Access to research applicants can only be gained with prior consent of research funders. Research funders may be wary of sharing this data, given data protection issues.
Comments/limitations	Qualitative interviews may shed light on some of the subtler processes at play regarding the reasons why applicants apply. It is, however, very difficult to reach those 'potential' applicants who do not apply for funding. It may be necessary to sample a 'potential pool' of applicants, e.g. from a certain research grade. This sampling strategy may therefore include those researchers who have no intention of applying for funding and explore the reasons why.
Link to best practice/ literature	Ranga et al. (2012)

Indicator Description	**Category 3. PROFESSIONAL CAPABILITIES**
Name of indicator	Overall strategic gender equality policies in place
Short description	The overall strategic orientation of gender equality policies in RTDI including the legal basis/acts relevant to the field of gender equality in RTDI is an important context-related indicator to assess the awareness/commitment to gender equality at the national level. This undoubtedly frames professional capabilities.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions Strategy 3. Integrating the gender dimension in research and innovation content
Category	3. Professional capabilities
Dimension	3.3 Awareness of/commitment to gender equality
Subdimension	3.3.1 Increased gender awareness
Level of observation	Policy/country level (macro level) (global, national, regional)
Logic model	Context-related indicator
Source of data	National strategy and policy documents: level to which GE is anchored in RTDI strategy documents. Specific strategy documents on promoting GE in RTDI. The extent to which GE policies in a country focus on specific R&D sectors (HES, BES, GOV or PNP). RIO country reports; ERA Survey; Lipinsky (2014) – for comparative country data
Qualitative/ quantitative	Qualitative assessments based on documentary analysis
Data collection methods	Secondary data collection: - Desk and literature research - Document analysis, etc. Primary data collection: - Structured/semi-structured/expert interviews to validate main policies

	- Focus groups, ethnographic field studies, etc.
Feasibility issues	It may be time-consuming to carry out a thorough documentary analysis to map the overall strategic gender equality policies in RTDI in place. Expertise of gender equality in RTDI is needed to ensure that all policy areas are covered, i.e. employment legislation, legislation in RTDI and gender equality legislation.
Comments / limitations	Initial decisions regarding the scope of the research will impact heavily on the results, i.e. whether or not to include relevant secondary education policies.
Link to best practice / literature	Reidl et al. (2017b); Lipinsky (2014)

Category 4. Structural features

Indicator Description	Category 4. STRUCTURAL FEATURES
Name of indicator	GE-dedicated administrative staff
Short description	This is a qualitative process indicator that measures if and to what extent staff is dedicated to the conception, implementation and/or monitoring of GE measures at a research institution. It is assumed that clear responsibilities are needed for the effective and sustainable anchoring of GE measures.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features
Dimension	4.1 Gender equality challenges/barriers
Subdimension	4.1.1 Decrease of GE barriers
Level of observation	Organisational/institutional level (meso level)
Logic model	Context-related indicator Throughput/process indicator
Source of data	No database
Qualitative / quantitative	Qualitative (e.g. interview transcripts, national reports or similar)
Data collection methods	Secondary data collection: - Desk and literature research - Document analysis, etc. Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews
Feasibility issues	Data is easily collectable, no demands for data protection
Comments / limitations	The indicator needs a context-sensitive benchmark (e.g. situation in the past or situation at similar research organisations) and should always be considered for analysis of organisational level.
Link to best practice / literature	Munir et al. (2013)

Indicator Description	Category 4. STRUCTURAL FEATURES

Name of indicator	Value of gender-promoting measures
Short description	This is a quantitative outcome indicator on various personal gains a participant of a GE measure may have experienced as a result of the measure to illustrate the effectiveness of the measure (e.g. access to role models and/or mentors, ability to identify networking opportunities, confidence in voicing one's opinion).
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features
Dimension	4.1 Gender equality challenges/barriers
Subdimension	4.1.1 Decrease of GE barriers
Level of observation	Individual/team level (micro level)
Logic model	Outcome indicator
Source of data	No database
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Primary data collection: Online surveys Structured/semi-structured/explorative interviews
Feasibility issues	Quantitative data collection requires competencies in survey design; the collected data set underlies confidentiality; representativeness has to be taken into account.
Comments / limitations	Indicator can also be collected qualitatively; a qualitative pilot study can support the development of the questionnaire items.
Link to best practice / literature	University of Colorado (n.d.)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Perception of preferential treatment such as advice, access to lab or equipment, resources, recruitment, promotion, attention to in meetings
Short description	This is a quantitative outcome indicator on the self-assessment of equal opportunities limited or promoted by leader behaviour or the informal and formal rules at the workplace to illustrate the perceived satisfaction with one's work environment and equal opportunities. The indicator can also be used qualitatively to gain descriptions of experienced discrimination at the workplace.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions Strategy 3. Integrating the gender dimension in research and innovation content

Category	4. Structural features
Dimension	4.3 Preferential treatment
Subdimension	4.3.1 Equal treatment
Level of observation	Individual/team level (micro level) Project/programme level
Logic model	Outcome indicator
Source of data	No database
Qualitative/ quantitative	Quantitative (e.g. official statistics, survey results) Qualitative (e.g. interview transcripts)
Data collection methods	Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews
Feasibility issues	Quantitative data collection requires competencies in survey design; the collected data set underlies confidentiality; representativeness has to be taken into account.
Comments/limitations	Indicator can also be collected qualitatively; a qualitative pilot study can support the development of the questionnaire items.
Link to best practice/literature	Munir et al. (2013); University of Colorado (n.d.)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Rating of communication paths and processes
Short description	This is a quantitative process indicator on the self-assessment of the usefulness of several ways (e-mail, regular meetings, staff appraisals) and arenas (research group, social events, seminars) of communication to illustrate equal opportunities by men and women in communication procedures. The indicator can also be used qualitatively to derive descriptions of internal communication processes relating to the implementation of gender equality measures.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features
Dimension	4.2 Organisational/cultural change with regard to GE
Subdimension	4.2.1 Organisational/cultural change with regard to GE

Level of observation	Individual/team level (micro level) Project/programme level
Logic model	Context-related indicator Throughput/process indicator
Source of data	No database
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results) Qualitative (e.g. interview transcripts)
Data collection methods	Secondary data collection: - Document analysis (e.g. e-mail communication networks, meeting protocols regarding attendees and requests to speak) Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews
Feasibility issues	Quantitative data collection requires competencies in survey design; the collected data set underlies confidentiality; representativeness has to be taken into account.
Comments / limitations	Indicator can also be collected via mixed methods; a qualitative pilot study can support the development of a quantitative questionnaire.
Link to best practice / literature	Munir et al. (2013); INTEGER (n.d.)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Rating of transparency regarding decision-making bodies and criteria
Short description	This ia a quantitative outcome indicator on the self-assessment of the perceived auditability of made decisions by an organisation's decision-making bodies to illustrate potential gender bias in decision-making procedures.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features
Dimension	4.2 Organisational/cultural change with regard to GE
Subdimension	4.2.1 Organisational/cultural change with regard to GE
Level of observation	Individual/team level (micro level) Project/programme level
Logic model	Outcome indicator

Source of data	No database
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results) Qualitative (e.g. interview transcripts)
Data collection methods	Secondary data collection: - Document analysis (e.g. e-mail communication networks, meeting protocols regarding attendees and requests to speak) Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews
Feasibility issues	Quantitative data collection requires competencies in survey design; the collected data set underlies confidentiality; representativeness has to be taken into account.
Comments / limitations	Indicator can also be collected qualitatively; a qualitative pilot study can support the development of the questionnaire items.
Link to best practice / literature	Munir et al. (2013)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Sustainability of gender equality initiatives
Short description	This is a qualitative process and outcome indicator to illustrate if a GE measure led to ongoing engagement of a research institution regarding GE. Sustainability is indicated, for instance, by the incorporation of GE measures on a strategic (GE in key strategic documents) and operational level (e.g., promotion guidelines), permanent dedication of staff to GE affairs, permanent data collection and monitoring of key indicators.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features
Dimension	4.1 Gender equality challenges/barriers
Subdimension	4.1.1 Decrease of GE barriers
Level of observation	Organisational/institutional level (meso level)
Logic model	Context-related indicator Throughput/process indicator Outcome indicator
Source of data	No database

Qualitative / quantitative	Qualitative (e.g. interview transcripts, national reports or similar)
Data collection methods	Secondary data collection: - Desk and literature research - Document analysis, etc. Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews - Focus groups, ethnographic field studies, etc.
Feasibility issues	Data is easily collectable, no demands for data protection
Comments / limitations	The indicator should always be considered for analysis of organisational level.
Link to best practice / literature	Munir et al. (2013); Davidson (2013)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Percentage of RPOs that document specific actions aiming to change aspects of their organisational culture that reinforce gender bias
Short description	This is a quantitative process and outcome indicator on the share of organisations which establish actions to change their organisational culture in order to reduce gender bias compared to the total number of organisations in a field. 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?
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features
Dimension	4.2 Organisational/cultural change with regard to GE
Subdimension	4.2.1 Organisational/cultural change with regard to GE
Level of observation	Policy/country level (macro level) (global, national, regional) Programme level
Logic model	Context-related indicator Input indicator Throughput/process indicator Output indicator

	Outcome indicator
Source of data	European Commission (2015a, 29); gender equality plans of RPOs
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Secondary data collection: - Data retrieved from databases (ERA Survey) - Desk and literature research Primary data collection: - Online surveys
Feasibility issues	Data is freely available.
Comments / limitations	The indicator only measures the existence of measures to reduce gender bias, but not the effectiveness of the measures.
Link to best practice / literature	MoRRI (n.d.)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Share of RPOs with gender in research content
Short description	This indicator summarises 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).
ERA objectives	Strategy 3. Integrating the gender dimension in research and innovation content
Category	4. Structural features
Dimension	4.1 Gender equality challenges/barriers
Subdimension	4.1.1 Decrease of GE barriers
Level of observation	Policy/country level (macro level) (global, national, regional) Programme level
Logic model	Context-related indicator Input indicator Throughput/process indicator Output indicator Outcome indicator

Source of data	European Commission (2015a, 33); gender equality plans of RPOs
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Secondary data collection: - Data retrieved from databases (ERA Survey) - Desk and literature research Primary data collection: - Online surveys
Feasibility issues	Data is freely available.
Comments / limitations	The indicator only measures the anchoring of gender in research content, but not the effectiveness of its implementation.
Link to best practice / literature	MoRRI (n.d.)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	GE unit/committee in place
Short description	This is a quantitative process indicator that measures whether an organisation has set up structures dedicated to GE and/or the implementation of a GEP, including the creation of a dedicated budget for staffing gender equality offices and committees and ensuring the institutional anchoring of equal opportunities at department/faculty level. The indicator can also be used qualitatively to describe the tasks and influence of the existing gender equality offices and committees.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions Strategy 3. Integrating the gender dimension in research and innovation content
Category	4. Structural features
Dimension	4.3 Preferential treatment
Subdimension	4.3.1 Equal treatment
Level of observation	Organisational/institutional level (meso level)
Logic model	Context-related indicator Throughput/process indicator Output indicator
Source of data	Horvat (2015)

Qualitative / quantitative	Quantitative (e.g. official statistics, survey results) Qualitative (e.g. interview transcripts, national reports or similar)
Data collection methods	Secondary data collection: - Data retrieved from databases (Eurostat, Patstat, Scopus, Web of Science) Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews
Feasibility issues	Quantitative data collection requires competencies in survey design; the collected data set underlies confidentiality; representativeness has to be taken into account. For the qualitative data collection, competencies in qualitative research are required.
Comments / limitations	Data can also be collected by analysing organisational charts.
Link to best practice / literature	Gender-NET (n.d.-a)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Composition of applicants and those who received funding
Short description	These are quantitative indicators on the gender distribution of applicants for funding and the gender distribution of successful applicants. A comparison of both indicators allows a conclusion on a potential gender bias in funding processes.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions Strategy 3. Integrating the gender dimension in research and innovation content
Category	4. Structural features
Dimension	4.4 Funding for structural transformation
Subdimension	4.4.1 Increased funding to achieve structural transformation
Level of observation	Organisational/institutional level (meso level)
Logic model	Context-related indicator Throughput/process indicator Outcome indicator Impact indicator
Source of data	European Research Council
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)

Data collection methods	Secondary data collection: data retrieved from databases (Eurostat, Patstat, Scopus, Web of Science)
Feasibility issues	Data is freely available.
Comments/limitations	Data is freely available, but has to be collected through different channels (e.g. funding reports from different organisations).
Link to best practice/ literature	Damvad Analytics (2015)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Adoption of GE plans
Short description	This is a quantitative process indicator that measures whether an RPO has a gender equality plan and applies it in its work. GEPs are assumed to be a prerequisite of an effective and sustainable GE strategy. This indicator can also be used qualitatively to describe how an RPO applies their gender equality plan in its work.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features
Dimension	4.2 Organisational/cultural change with regard to GE
Subdimension	4.2.1 Organisational/cultural change with regard to GE
Level of observation	Organisational/institutional level (meso level)
Logic model	Throughput/process indicator Outcome indicator
Source of data	European Commission (2016c, 116) (data only for 2013; based on *ERA Survey 2014*)
Qualitative/ quantitative	Quantitative (e.g. official statistics, survey results) Qualitative (e.g. interview transcripts)
Data collection methods	Secondary data collection: - Data retrieved from databases (Eurostat, Patstat, Scopus, Web of Science) - Desk and literature research - Document analysis, etc. Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews
Feasibility issues	Quantitative data collection requires competencies in survey design; the collected data set underlies confidentiality; representativeness has to be taken into account.

Comments/limitations	Data unavailable for Lithuania, Macedonia and Moldova.
Link to best practice/ literature	Reidl et al. (2017b, 44)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Facilitating mobility of female researchers
Short description	This is a quantitative indicator that measures existing structures for supporting incoming and outgoing mobility. Mobility has become an important factor for the individual researchers' career opportunities. This indicator can also be used qualitatively to describe the different instruments and their perceived effectiveness to support the mobility of female researchers.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions Strategy 3. Integrating the gender dimension in research and innovation content
Category	4. Structural features
Dimension	4.3 Preferential treatment
Subdimension	4.3.1 Equal treatment
Level of observation	Organisational/institutional level (meso level)
Logic model	Context-related indicator Throughput/process indicator Impact indicator
Source of data	European Commission (2016c); MORE2 survey (online database, flag GMD3)
Qualitative/ quantitative	Quantitative (e.g. official statistics, survey results) Qualitative (e.g. interview transcripts)
Data collection methods	Secondary data collection: - Data retrieved from databases (Eurostat, Patstat, Scopus, Web of Science) - Desk and literature research - Document analysis, etc. Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews
Feasibility issues	Quantitative data collection requires competencies in survey design; the collected data set underlies confidentiality; representativeness has to be taken into account.

	Qualitative data collection can be used as a tool for identifying and better understanding structures for supporting mobility of female researchers.
Comments/limitations	The mobility of female researchers not only depends on structures and support system – it also requires a network between the different institutions. This has to be considered.
Link to best practice/ literature	Gender-NET (n.d.)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Budget spent on GE measures
Short description	This is a quantitative indicator that provides information on monetary input and can be compared with other GE measures and process reports from other institutions.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions Strategy 3. Integrating the gender dimension in research and innovation content
Category	4. Structural features
Dimension	4.4 Funding for structural transformation
Subdimension	4.4.1 Increased funding to achieve structural transformation
Level of observation	Organisational/institutional level (meso level)
Logic model	Input indicator Throughput indicator Context-related
Source of data	No database
Qualitative/ quantitative	Quantitative (e.g. process reports from GEP)
Data collection methods	Secondary data collection: - Desk and literature research - Document analysis, etc. - Databases
Feasibility issues	Organisations will have to share data.
Comments/limitations	The indicator describes only the monetary input but gives no information about the quality of the measure.
Link to best practice/ literature	INTEGER (n.d.)

Indicator Description	Category 4. STRUCTURAL FEATURES
Name of indicator	Gender bias in task allocation
Short description	This is a qualitative indicator that measures the experience of gender bias in task allocation within the institution and/or from supervisor/project manager/line manager.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features
Dimension	4.1 Gender equality challenges/barriers
Subdimension	4.1.1 Decrease of GE barriers
Level of observation	Individual/team level (micro level)
Logic model	Context-related indicator Throughput/process indicator Outcome indicator Impact indicator
Source of data	No database
Qualitative/ quantitative	Qualitative (e.g. interview transcripts, national reports or similar) Quantitative (e.g. survey results)
Data collection methods	Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews - Focus groups
Feasibility issues	Requires competencies in conducting interviews.
Comments/limitations	Data can be collected qualitatively and quantitatively.
Link to best practice/ literature	Gender-NET (n.d.)

Indicator Description	Category 4. STRUCTURAL FEATURES
Name of indicator	Engagement of decision-makers
Short description	This is a qualitative indicator that describes GE engagement of decision-makers by actions taken (e.g. raising awareness and trainings, affirmation of political will by setting

	GE as one of the institution's priorities, management practices, institutional commitment).
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features
Dimension	4.1 Gender equality challenges/barriers
Subdimension	4.1.1 Decrease of GE barriers
Level of observation	Organisational/institutional level (meso level)
Logic model	Input indicator Throughput indicator Context-related indicator Outcome indicator
Source of data	No database
Qualitative / quantitative	Qualitative (e.g. interview transcripts, national reports or similar)
Data collection methods	Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews - Focus groups, ethnographic field studies, etc.
Feasibility issues	No demands for data protection
Comments / limitations	This indicator can also be quantified in the sense that the number of undertaken actions can be counted.
Link to best practice / literature	INTEGER (n.d.)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Structures for GE
Short description	This is a qualitative process indicator that describes the existing structures for gender equality at federal and/or local level.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features

Dimension	4.2 Organisational/cultural change with regard to GE
Subdimension	4.2.1 Organisational/cultural change with regard to GE
Level of observation	Policy/country level (macro level) (global, national, regional)
Logic model	Throughput/process indicator Context-related indicator
Source of data	Legal texts, political initiatives (European Commission 2017c)
Qualitative / quantitative	Qualitative (e.g. interview transcripts, national reports or similar)
Data collection methods	Secondary data collection: - Desk and literature research - Document analysis, etc. Primary data collection: - Structured/semi-structured/explorative interviews
Feasibility issues	Data is easily collectable, no demands for data protection
Comments / limitations	This indicator describes what kind of structures exist, but it does not measure their impact.
Link to best practice / literature	Reidl et al. (2017b, 26)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Establishment of gender equality structures and procedures
Short description	This is a qualitative indicator that describes the established GE structures and procedures and gives advice on the qualitative achievement of the institution's GE strategy.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features
Dimension	4.2 Organisational/cultural change with regard to GE
Subdimension	4.2.1 Organisational/cultural change with regard to GE
Level of observation	Organisational/institutional level (meso level)
Logic model	Context-related indicator Throughput/process indicator

	Outcome indicator
Source of data	No database
Qualitative / quantitative	Qualitative (e.g. interview transcripts, national reports or similar)
Data collection methods	Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews
Feasibility issues	No demands for data protection
Comments / limitations	This indicator can also be quantified in the sense that the number of established structures and procedures can be counted and compared.
Link to best practice / literature	Gender-NET (n.d.)

Indicator Description	**Category 4. STRUCTURAL FEATURES**
Name of indicator	Gender monitoring/reporting in regular monitoring instruments
Short description	This is a qualitative process indicator that describes if and how gender monitoring/reporting is implemented in regular monitoring instruments.
ERA objectives	Strategy 1. More women in R&D Strategy 2. More women in leadership positions
Category	4. Structural features
Dimension	4.1 Gender equality challenges/barriers
Subdimension	4.1.1 Decrease of GE barriers
Level of observation	Organisational/institutional level (meso level)
Logic model	Context-related indicator Throughput/process indicator Output indicator
Source of data	INTEGER (n.d.)
Qualitative / quantitative	Qualitative (e.g. interview transcripts, national reports or similar)
Data collection methods	Secondary data collection: - Document analysis, etc. - Online surveys

	Primary data collection: - Structured/semi-structured/explorative interviews
Feasibility issues	Data is easy collectable within the process report of a GEP.
Comments/limitations	The organisation has to make sure that a process report exists within the GEP.
Link to best practice/ literature	INTEGER (n.d.)

Category 5. Research and innovation/RRI

Indicator Description	Category 5. RESEARCH & INNOVATION/RRI
Name of indicator	Publications' interdisciplinarity
Short description	This indicator shows the degree of interdisciplinarity of scientific publications and relates this to the share of women within the research teams. It requires expertise in analysing bibliometric databases like Web of Science or Scopus.
ERA objectives	The (R)R&I indicators typically do not refer to one of the three ERA GE objectives but are assumed to be a long-term effect of more women in teams, more women in decision-making positions and the consideration of gender aspects in research.
Category	5. Research and innovation/RRI
Dimension	5.1 Research outputs and impacts
Subdimension	5.1.1 Scientific outputs 5.1.2 Networks 5.1.4 Strengthened R&I capacities/excellence 5.1.5 Research priorities and outcomes in terms of GE
Level of observation	Individual/team level (micro level) Organisational/institutional level (meso level) Policy/country level (macro level) (global, national, regional)
Logic model	Output indicator
Source of data	Bibliometric database (Web of Science, Scopus)
Qualitative/ quantitative	Quantitative
Data collection methods	Secondary data collection: data retrieved from databases (Scopus, Web of Science)
Feasibility issues	Publication indicators require access to the respective databases and extensive technical knowledge on how to run a bibliometric analysis. To investigate gender differences, it is important to use a database with the first names of the authors and the referring countries, e.g. relating the Italian name "Andreas" to a male author.
Comments/limitations	This indicator depends on the quality of the bibliometric database used and the competence/experience of the researcher running the analysis.
Link to best practice/ literature	DFF – Det Frie Forskningsråd 2013a; Frietsch et al. (2016)

Indicator Description	Category 5. RESEARCH & INNOVATION/RRI

Name of indicator	Number of citations
Short description	This indicator is a proxy variable for the quality of a scientific publication by analysing how frequently the article was cited. It requires expertise in analysing bibliometric databases like Web of Science or Scopus.
ERA objectives	The (R)R&I indicators typically do not refer to one of the three ERA GE objectives but are assumed to be a long-term effect of more women in teams, more women in decision-making positions and consideration of gender aspects in research**.**
Category	5. Research and innovation/RRI
Dimension	5.1 Research outputs and impacts
Subdimension	5.1.1 Scientific outputs 5.1.4 Strengthened R&I capacities/excellence
Level of observation	Individual/team level (micro level) Organisational/institutional level (meso level) Policy/country level (macro level) (global, national, regional)
Logic model	Output indicator Outcome indicator
Source of data	Bibliometric database (Web of Science, Scopus)
Qualitative/ quantitative	Quantitative
Data collection methods	Secondary data collection: data retrieved from databases (Scopus, Web of Science)
Feasibility issues	Publication indicators require access to the respective databases and extensive technical knowledge on how to run a bibliometric analysis. To investigate gender differences, it is important to use a database with the first names of the authors and the referring countries, e.g. relating the Italian name "Andreas" to a male author.
Comments/limitations	This indicator depends on the quality of the bibliometric database used and the competence/experience of the researcher running the analysis.
Link to best practice/ literature	DFF – Det Frie Forskningsråd 2013a; Frietsch et al. (2016)

Indicator Description	**Category 5. RESEARCH & INNOVATION/RRI**
Name of indicator	Percentage of international scientific co-publications
Short description	This indicator shows to what extent a scientific publication is based on an author team with a high number of different national backgrounds. It requires expertise in analysing bibliometric databases like Web of Science or Scopus.

ERA objectives	The (R)R&I indicators typically do not refer to one of the three ERA GE objectives but are assumed to be a long-term effect of more women in teams, more women in decision-making positions and consideration of gender aspects in research.
Category	5. Research and innovation/RRI
Dimension	5.1 Research outputs and impacts
Subdimension	5.1.1 Scientific outputs 5.1.2 Networks 5.1.4 Strengthened R&I capacities/excellence
Level of observation	Individual/team level (micro level) Organisational/institutional level (meso level) Policy/country level (macro level) (global, national, regional)
Logic model	Output indicator Outcome indicator
Source of data	Bibliometric database (Web of Science, Scopus)
Qualitative/ quantitative	Quantitative
Data collection methods	Secondary data collection: data retrieved from databases (Scopus, Web of Science)
Feasibility issues	Publication indicators require access to the respective databases and extensive technical knowledge on how to run a bibliometric analysis. To investigate gender differences, it is important to use a database with the first names of the authors and the referring countries, e.g. relating the Italian name "Andreas" to a male author.
Comments/limitations	This indicator depends on the quality of the bibliometric database used and the competence/experience of the researcher running the analysis.
Link to best practice/ literature	Reidl et al. (2017b); Frietsch et al. (2016)

Indicator Description	**Category 5. RESEARCH & INNOVATION/RRI**
Name of indicator	Networks of developers, providers and users of solutions involved in co-creation (value chain)
Short description	This indicator requires information on the number and kind of participants of research and innovations projects. Presumably, this information is accessible for funded projects, for example H2020 projects.
ERA objectives	The (R)R&I indicators typically do not refer to one of the three ERA GE objectives but are assumed to be a long-term effect of more women in teams, more women in decision-making positions and consideration of gender aspects in research.

Category	5. Research and innovation/RRI
Dimension	5.2 Innovation outputs and impacts (incl. technological impacts) 5.3 Economic outputs and impacts (incl. entrepreneurships) 5.4 Gender-sensitive research 5.5 Responsible research and innovation (RRI)
Subdimension	5.2.2 Diffusion of innovation in products, services, processes 5.2.3 Incorporation of knowledge about sex and gender into engineering innovation processes 5.3.3 Strengthened framework conditions for R&I 5.3.4 Jobs, growth & competitiveness of participants (incl. SMEs) 5.4.2 Research quality: integration of a gender dimension/perspective in research and content, in research projects, patents, and agreements 5.4.3 Contributions to strengthening gender-sensitive research 5.5.1 Gender equality 5.5.3 Public engagement
Level of observation	Organisational/institutional level (meso level) Project/programme level
Logic model	Input indicator Throughput/process indicator Output indicator
Source of data	H2020 monitoring data, primary data
Qualitative/ quantitative	Quantitative (e.g. official statistics, survey results) and/or Qualitative (e.g. interview transcripts, national reports or similar)
Data collection methods	Secondary data collection: - Data retrieved from databases: monitoring data from H2020 - Document analysis, etc.: project reports Primary data collection: - Online surveys among beneficiaries - Structured/semi-structured/explorative interviews
Feasibility issues	If monitoring data or project reports of a funded project do not display this kind of information, a primary data collection process is necessary. This requires access to the addresses of the beneficiaries. Furthermore, data protection issues have to be taken into account. Finally, receiving reliable data on networks is always a challenging undertaking.
Comments/limitations	If primary data collection is needed, the results will be based on subjective perceptions of the surveyed populations. Furthermore, there are challenges regarding the response rates and social desirability of answers. In this regard, it would be helpful if project funders could deliver the relevant information through their monitoring systems.

Link to best practice / literature	European Commission (2016f)

Indicator Description	**Category 5. RESEARCH & INNOVATION / RRI**
Name of indicator	Patent citations
Short description	This indicator show how frequently patents are cited and can thus be understood as a measure of quality of patents. It requires expertise in analysing patent databases like Patstat.
ERA objectives	The (R)R&I indicators typically do not refer to one of the three ERA GE objectives but are assumed to be a long-term effect of more women in teams, more women in decision-making positions and consideration of gender aspects in research**.**
Category	5. Research and innovation/RRI
Dimension	5.2 Innovation outputs and impacts (incl. technological impacts)
Subdimension	5.2.1 Conventional innovation indicators
Level of observation	Individual/team level (micro level) Organisational/institutional level (meso level) Policy/country level (macro level) (global, national, regional)
Logic model	Output indicator Outcome indicator
Source of data	Patstat
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Secondary: data data collection retrieved from databases (Patstat)
Feasibility issues	Patent indicators require access to the respective databases and extensive technical knowledge on how to run a patent analysis. To investigate gender differences, it is important to use a database with the first names of the authors and the referring countries, e.g. relating the Italian name "Andreas" to a male inventor.
Comments / limitations	This indicator depends on the competence/experience of the researcher running the patent analysis.
Link to best practice / literature	Frietsch et al. (2016)

Indicator Description	Category 5. RESEARCH & INNOVATION/RRI
Name of indicator	Share of women founding a company
Short description	This indicator is intended as a proxy that estimates knowledge flow from academia to private start-up companies with economic growth potential, for example via research-based spinouts. The indicator provides gender-segregated statistical probability of entrepreneurial activity, i.e. knowledge transfers by starting up a company of people with different levels of academic career trajectory.
ERA objectives	The (R)R&I indicators typically do not refer to one of the three ERA GE objectives but are assumed to be a long-term effect of more women in teams, more women in decision-making positions and consideration of gender aspects in research.
Category	5. Research and innovation/RRI
Dimension	5.2 Innovation outputs and impacts (incl. technological impacts) 5.3 Economic outputs and impacts (incl. entrepreneurships) 5.7 Societal and environmental impacts
Subdimension	5.2.1 Conventional innovation indicators 5.2.2 Diffusion of innovation in products, services, processes 5.2.3 Incorporation of knowledge about sex and gender into engineering innovation processes 5.3.2 Entrepreneurship 5.3.3 Strengthened framework conditions for R&I 5.7.1 Societal impacts 5.7.2 Environmental impacts
Level of observation	Individual/team level (micro level) Policy/country level (macro level) (global, national, regional)
Logic model	Context-related indicator Output indicator
Source of data	Labour Force Survey (Eurostat, UNECE, ILOSTAT and national statistics)
Qualitative/ quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Secondary data collection: data retrieved from databases (Eurostat, UNECE, ILOSTAT and national statistics) Primary data collection: online surveys
Feasibility issues	This indicator depends on the quality of national statistics data. For particular questions, e.g. whether the companies founded by women are more inclined to consider societal challenges, primary data collection might be necessary. This requires access to the addresses of the female entrepreneurs. Furthermore, data protection issues have to be

	taken into account. The results will be based on subjective perceptions of the surveyed populations.
Comments/limitations	The quality of the data collected by online surveys depends on the exact definition of the relevant sample, response rate and quality of the questionnaire.
Link to best practice/ literature	DFF – Det Frie Forskningsråd (2013a); European Commission (2014d)

Indicator Description	**Category 5. RESEARCH & INNOVATION/RRI**
Name of indicator	Share of RFOs promoting gender content in research
Short description	This indicator illustrates the integration of gender as part of research design and process. It entails sex and gender analysis being integrated into basic and applied research. Possible question: When allocating research and development funding in 2014, 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)
ERA objectives	The (R)R&I indicators typically do not refer to one of the three ERA GE objectives but are assumed to be a long-term effect of more women in teams, more women in decision-making positions and consideration of gender aspects in research.
Category	5. Research and innovation/RRI
Dimension	5.1 Research outputs and impacts 5.4 Gender-sensitive research 5.5 Responsible research and innovation (RRI)
Subdimension	5.1.4 Strengthened R&I capacities/excellence 5.1.5 Research priorities and outcomes in terms of GE 5.4.1 Achieved gender equality in research process 5.4.2 Research quality: integration of a gender dimension/perspective in research and content, in research projects, patents, and agreements 5.4.3 Contributions to strengthening gender-sensitive research 5.5.1 Gender equality
Level of observation	Policy/country level (macro level) (global, national, regional)
Logic model	Context-related indicator Input indicator
Source of data	*ERA Facts and Figures 2014*
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results) and/or Qualitative (e.g. interview transcripts, national reports or similar)

Data collection methods	Secondary data collection: - Data retrieved from *She Figures* and *ERA Facts and Figures*/MoRRI indicators Primary data collection: - Online surveys - Structured/semi-structured/explorative interviews
Feasibility issues	If monitoring data (ERA, *She Figures*, MoRRI) does not display this kind of information, a primary data collection process is necessary. This requires access to the RFOs and their readiness to answer the respective questions.
Comments/limitations	*ERA Facts and Figures* but also the MoRRI data collections are based on answers from selected RFOs across Europe and thus depend on the respective accuracy of the self-reports. It has to be carefully checked whether the existing reports have a reliable and valid set of answers available.
Link to best practice/ literature	Ravn et al. (2015a)

Indicator Description	**Category 5. RESEARCH & INNOVATION/RRI**
Name of indicator	Active consideration of how research and innovation results will be perceived and used
Short description	This indicator illustrates an operationalisation of a public engagement item used in the course of a large-scale survey among European researchers where they were asked whether they actively take into account how the research and innovation results will be perceived and used.
ERA objectives	The (R)R&I indicators typically do not refer to one of the three ERA GE objectives but are assumed to be a long-term effect of more women in teams, more women in decision-making positions and consideration of gender aspects in research**.**
Category	5. Research and innovation/RRI
Dimension	5.5 Responsible research and innovation (RRI)
Subdimension	5.5.3 Public engagement
Level of observation	Individual/team level (micro level)
Logic model	Throughput/process indicator
Source of data	Own primary data collection
Qualitative/ quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Primary data collection: online surveys
Feasibility issues	Launching an online survey requires access to the relevant actors. Addresses might stem from databases of project funders or from bibliometric databases. Generally, survey

	results are based on subjective perceptions of the surveyed populations. There are always challenges regarding response rates and social desirability of answers.
Comments/limitations	The quality of the data collected by online surveys depends on the exact definition of the relevant sample, response rate and quality of the questionnaire.
Link to best practice/ literature	Bührer & Berghäuser (2017)

Indicator Description	**Category 5. RESEARCH & INNOVATION/RRI**
Name of indicator	Science competence in secondary school pupils
Short description	This indicator describes science competence of secondary school pupils in science subjects (biology, chemistry, physics and earth science).
ERA objectives	The (R)R&I indicators typically do not refer to one of the three ERA GE objectives but are assumed to be a long-term effect of more women in teams, more women in decision-making positions and consideration of gender aspects in research.
Category	5. Research and innovation/RRI
Dimension	5.5 Responsible research and innovation (RRI)
Subdimension	5.5.4 Science education
Level of observation	Policy/country level (macro level) (global, national, regional)
Logic model	Context-related indicator Output indicator
Source of data	PISA – Programme for International Student Assessment
Qualitative/ quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Secondary data collection: data retrieved from PISA
Feasibility issues	The PISA surveys are launched every three years.
Comments/limitations	-
Link to best practice/ literature	Ravn et al. (2015a)

Indicator Description	**Category 5. RESEARCH & INNOVATION/RRI**
Name of indicator	Societal challenges – number of joint public-private publications

Short description	This indicator describes the number and percentage of joint public-private publications out of all relevant publications.
ERA objectives	The (R)R&I indicators typically do not refer to one of the three ERA GE objectives but are assumed to be a long-term effect of more women in teams, more women in decision-making positions and consideration of gender aspects in research.
Category	5. Research and innovation/RRI
Dimension	5.1 Research outputs and impacts 5.6 Societal challenges
Subdimension	5.1.1 Scientific outputs 5.1.4 Strengthened R&I capacities/excellence 5.6.1 Research priorities & outcomes in terms of GE 5.6.2 R&I indicators
Level of observation	Individual/team level (micro level) Organisational/institutional level (meso level) Project/programme level
Logic model	Output indicator
Source of data	Web of Science, Scopus
Qualitative/ quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Secondary data collection: data retrieved from Scopus/Web of Science
Feasibility issues	Publication indicators require access to the respective databases and extensive technical knowledge on how to run a bibliometric analysis. To investigate gender differences, it is important to use a database with the first names of the authors and the referring countries, e.g. relating the Italian name "Andreas" to a male author.
Comments/limitations	This indicator depends on the quality of the bibliometric database used and the competence/experience of the researcher running the analysis.
Link to best practice/ literature	European Commission (2016f)

Indicator Description	**Category 5. RESEARCH & INNOVATION/RRI**
Name of indicator	Better societal acceptance of innovative solutions
Short description	This indicator describes an expected impact from research and innovation projects, up to 20 years after the project has received funding. It requires data from large-scale surveys among citizens like Eurobarometer.

ERA objectives	The (R)R&I indicators typically do not refer to one of the three ERA GE objectives but are assumed to be a long-term effect of more women in teams, more women in decision-making positions and consideration of gender aspects in research.
Category	5. Research and innovation/RRI
Dimension	5.1 Research outputs and impacts 5.5 Responsible research and innovation (RRI) 5.7 Societal and environmental impacts
Subdimension	5.1.4 Strengthened R&I capacities/excellence 5.5.4 Science education 5.5.6 RRI/governance 5.7.1 Societal impacts
Level of observation	Individual/team level (micro level) Policy/country level (macro level) (global, national, regional)
Logic model	Impact indicator
Source of data	Eurobarometer surveys
Qualitative / quantitative	Quantitative (e.g. official statistics, survey results)
Data collection methods	Secondary data collection: data retrieved from Eurobarometer
Feasibility issues	Depends on the availability of Eurobarometer surveys on the specific topic of public perception of science, research and innovation (Special Eurobarometer 419).
Comments / limitations	Depends on the availability of Eurobarometer surveys on the specific topic of public perception of science, research and innovation (Special Eurobarometer 419).
Link to best practice / literature	European Commission (2016f)

Annex IV. Impact stories

Impact story 1

Impact story Introduction of chairs and positions reserved to women
Measure definition Women are underrepresented in science relative to men in general and especially in academic decision-making. Women are underrepresented in science, mathematics and computing as well as engineering, manufacturing and construction (European Commission 2015a). Even though the share of women in science in general has increased over the past years, the leaky pipeline phenomenon is still present (European Commission 2012a). Therefore, this GE intervention is usually linked to higher positions, such as grade A positions (APA-OTS 2008; Bundesministerium für Bildung und Forschung 2016). The GE intervention "introduction of chairs and positions reserved to women" comprises the introduction of positions and chairs which can only be occupied by women. The measure requires an analysis of fields, divisions and levels where women are underrepresented, special funding for these positions, implementation of appropriate recruitment or funding guidelines and monitoring of the adherence to the guidelines.
Goal More women in research and development More women in research and development leadership Responsible research and innovation
Output The measure's short-term output aims to ensure that special chairs or positions are reserved for women. The output is indicated through checking if the corresponding chairs or positions were established.
Output dimension 1.1 Positions
Output subdimension 1.1.1 Increased number of women in academic and other RTDI positions 1.1.2 Increased number of women in decision-making positions
Output indicators short Availability of positions reserved for women Relative probability of men and women to reach a top position
Outcome The direct effect of the GE intervention "introduction of chairs and positions reserved to women" is to fill the position with a woman with adequate expertise, which leads to a different composition of the faculty/department. According to the evaluation of GE measures, this intervention is not widespread.
Outcome dimension 1.1 Positions 2.3 Competitiveness/promotion and career 3.1 Leadership
Outcome subdimension 1.1.1 Increased number of women in academic and other RTDI positions 1.1.2 Increased number of women in decision-making positions

2.2.1 Appropriate respect/recognition for (academic/scientific/leadership) work 2.3.3 Improved support to advance research career 3.1.1 Increased confidence and ability of leadership roles
Outcome indicators short Increase in leadership positions by women who participated in the programme Relative probability to reach a higher position between men and women Changes in salary and position from entry to exit/current position Career opportunities Diversity in team structure concerning tenure Visibility of women at the university/organisation
Impact The measure's long-term impact aims at the equality of women and men in science and engineering. This impact is indicated through the representation of women at all levels of qualification (as students and as professionals) and a higher number of women in top academic positions (Bundesministerium für Bildung und Forschung 2008), which in turn promotes responsible research and innovation by increasing GE. Furthermore, female role models who are accomplished, successful and recognised researchers in science and engineering are provided (Natural Sciences and Engineering Research Council of Canada 2016). Staffing special positions with women increases the visibility of women in STEM and in decision-making positions. This role model function promotes the attraction and retention of young women in scientific positions (European Commission 2008).
Impact dimension 1.1 Positions 2.2 Job satisfaction 2.3 Competitiveness/promotion and career 5.4 Gender-sensitive research
Impact subdimension 1.1.1 Increased number of women in academic and other RTDI positions 1.1.2 Increased number of women in decision-making positions 2.2.1 Appropriate respect/recognition for (academic/scientific/leadership) work 2.3.3 Improved support to advance research career 5.3.1 Achieved gender equality in research process
Impact indicators short Relative probability between the ability of men and women to reach a top position Rate of change in composition of faculty Number of newly appointed full professors (hired or promoted) Share of female heads of research performance organisations Distribution of grade A staff across age groups by sex Distribution of staff across gender Proportion of women in grade A positions Increase in leadership positions by women who participated in the programme Composition of boards or committees Proportion of women on (company) boards, members and leaders; boards in largest quoted companies, supervisory board or board of directors

Percentage of women in advisory committees
Proportion of women heads of institutions in the higher education sector
Proportion of women in leadership positions
Changes in salary and position from entry to exit/current position
Career opportunities
Perceived challenges to get a scientific position
Visibility of women at the university/organisation
Women with leadership positions
Share of female heads of RPOs
Share of female researchers by sector
Share of gender-balanced recruitment committees at RPOs
Percentage of women in [EC] advisory groups, expert groups, evaluation panels, individual experts, etc.

Conditions of effectiveness

Regression analyses show that the presence of special funding for women in science is positively correlated with the proportion of women in grade A academic positions, but negatively correlated with the proportion of women researchers. Special funding initiatives are mostly a reaction to the underrepresentation of women in science, which explains the negative correlation with the proportion of women researchers. Countries with higher proportions of women researchers are also countries with less developed national systems of innovation and, therefore, policies. Thus, the introduction of funding or other special measures has only limited impact on lower level posts, but has more impact in terms of encouraging the movement of women upwards through the occupational hierarchy (European Commission 2008).

GE measures that use reserved quotas for women often face a lot of resistance because it is assumed that women would be judged according to their sex, not according to their scientific capabilities or intellectual value (European Commission 2008). This is also true for chairs and positions reserved to women. Therefore, discrimination against women occupying these positions and perceived discrimination against men might rise. A very important mechanism to avoid these effects is the support of the senior management to provide legitimacy to GE measures (EIGE 2016c; Cacace et al. 2015). Success is also related to programme justification. Generally speaking, affirmative action justifications which reactivate group identities are more vulnerable to backlash than diversity management justifications which aim at creating a competitive advantage for the organisation as a whole (Kidder et al. 2004).

Impact story 2

Impact story Revision of internal policies regarding promotions
Measure definition Research states that gender-biased promotions are more likely to occur if assessments of applicants are based on obscure criteria and are kept confidential (van den Brink et al. 2010, 1461). The GE intervention "revision of internal policies regarding promotions" is defined as the formulation or reformulation of a research organisation's explicit guidelines and rules that underlie internal promotions. The measure requires to analyse the effects of the current promotion rules and practices, reformulate the promotion rules, make the rules known among its recipients and ensure that the rules are correctly and sustainably applied.
Goal More women in research and development leadership Responsible research and innovation Research performance
Output The measure's short-term output aims at promotion of transparency and/or formalisation of internal promotion processes by making explicit the agents, criteria and decision-making processes that are involved in a promotion decision (van den Brink et al. 2010, 1465). The output is indicated through the mirroring of the revised promotion policy with best practice guidelines about transparent promotion.
Output dimension 2.3 Competitiveness/promotion and career
Output subdimension 2.3.1 Transparent, non-biased and flexible promotion/tenure criteria
Output indicators short Transparent promotion system Contracts take major life events into account Flexibility in promotion policy Adaptions in guidelines, employee rights, spousal appointments
Outcome The measure's mid-term outcome aims at promotion of equal opportunities between male and female employees, which means increased probability of promotion for women (van den Brink et al. 2010; Bakker & Jacobs 2016). Transparent promotion criteria also aim at better work-life balance through enabling flexible career planning that takes into account major life events like childbirth, care work for relatives or continuing education (Laursen et al. 2015, 43). This form of equal treatment is the first step to achieving structural change regarding the dimension of equal treatment. Besides, supporting more women in higher positions can support structural change by decreasing barriers to gender equality (hypothesis). A side effect of higher equality of opportunity is higher performance incentives and job satisfaction for all team members, as promotions are perceived to better take into account individual performance and the criteria of good performance are made explicit (hypothesis).
Outcome dimension 2.1 Work-life balance

2.2 Job satisfaction 2.3 Competitiveness/promotion and career 4.2 Organisational/cultural change with regard to GE
Outcome subdimension 2.1.1 Improved compatibility of family and career 2.2.2 Positive individual job rating 2.2.3 Overall work climate 2.3.2 Strengthened confidence for promotion and responsible positions 4.2.1 Organisational/cultural change with regard to GE 4.1.1 Decrease of GE barriers 4.3.1 Equal treatment
Outcome indicators short Extent of experienced work-family conflict Perceived challenges in balancing private life and work Satisfaction with current work-life balance Perception of influence of career break on career progress Satisfaction with career Perceptions of work climate Knowledge of criteria for promotion Rating of obstacles to get promotion/responsible position Revisions of career plan Change in motivation to invest more effort in scientific career Description of academic future Perceived challenges to get a scientific position Rating of communication paths and transparency regarding decision-making bodies General organisational consciousness and messages with symbolic value Acceptance of cultural change Perception of likelihood of male/female success in academia
Impact The measure's long-term impact aims at increasing the number of women in high-level positions (van den Brink et al. 2010; Bakker & Jacobs 2016). A side effect of higher equality of opportunity is higher publication output and higher funding gains of the research organisation due to the increased performance incentives of a more justly perceived promotion system (hypothesis). The impact is indicated through an increase in women leadership positions, higher number of publications of a research organisation, higher funding raised per head, and closing of the gender wage gap.
Impact dimension 1.1 Positions 5.1 Research outputs and impacts 5.4 Gender-sensitive research
Impact subdimension 1.1.1 Increased number of women in academic and other RTDI positions 5.1.1 Scientific outputs 5.4.1 Achieved gender equality in research process

Impact indicators short

Horizontal/vertical segregation in positions
Relative probability between the ability of mean and women to reach a top position
Distribution of staff across gender
Distribution of grade A staff across age groups by sex
Success rates of men and women applicants to positions
Proportion of women in grade A positions
Proportion of women grade A staff by main field of science
Gender wage gap
H-Index
Number of presentations at conferences
Percentage of women that are first authors of research papers
Number of publications in peer-reviewed high impact journals
Number of scientific papers in relation to the population size
Science prizes/rewards
Stipends/scholarships/grants
Average size of grant distributed by gender
Proportion of women receiving a grant
Share of men and women among (successful) applicants

Conditions of effectiveness

While a transparent promotion policy (e.g. through a tenure-track system) has a significant effect on female representation at lower hierarchical levels, the effects at the highest hierarchical levels are hardly noticeable due to the generally low number of staff that is promoted into the highest positions of a research organisation (Bakker & Jacobs 2016).

Besides, researchers argue that all aspects of recruitment and selection process can never be formalised. Personal interests and values of the participating actors persist and are likely to reproduce gender bias. If not accompanied by other gender measures, like trainings on gender bias in appointment processes, the revision of the internal promotion policy could also be counterproductive for gender equality as 'objectivity' formally seems to exist, which veils social practices of inequality. Lastly, research also points to the importance of strict monitoring of compliance to the promotion rules, e.g. through the produced protocols (van den Brink et al. 2010).

Impact story 3

Impact story
Targeting funding practices to improve women's access to research funding
Measure definition
Current research shows that women are less successful in acquiring research resources from public or private funders (European Commission 2015a). After years of intensive discussions, current research sees the main reasons for this less in gender-biased grant review processes and more in the characteristics of the research system itself, like its immanent gender stereotypes, concurrence of the critical years in a research career with those in family-planning, and female underrepresentation at higher academic and non-tenured positions (Ceci & Williams 2011; Ranga et al. 2012; Brooks et al. 2014; Bornmann et al. 2007; Wennerås & Wold 2001). The intervention "targeting funding practices to improve women's access to research funding" aims at the levelling of this disadvantage through two possible approaches. First, funding instruments (like scholarships, travel grants, support for career and life transitions, subsidies for childcare) can be directly addressed towards women researchers (European Commission 2008, 31). Second, gender mainstreaming practices can be integrated into fund allocation of research financing organisations. Regarding funding instruments, the measure requires to define a funding target (e.g. an increase in women grant applications, promotion of women grant-writing capacities), a target group, process of fund allocation, and monitoring of the use of funds. Regarding gender mainstreaming of funding, the measure comprises the revision of current funding procedures to grant women researchers higher access and probability of success. This requires an analysis of current funding procedures, reformulation of the procedures, and monitoring of the new procedure's effects on gender equality.
Goal
More women in research and development More women in research and development leadership Responsible research and innovation
Output
Funding instruments and gender mainstreaming of funding processes can be conducted separately from each other or can both be integrated into an overall strategy. Immediate technical results of targeted funding instruments for women are the implementation of a funding instrument to explicitly promote female researchers (or non-tenured and junior researchers who are mostly women). Possible indicators for this output are the existence of grants for early career development (e.g. for grant writing for non-tenured researchers) or grants reserved to women researchers. The output of gender mainstreaming of funding is the revision of current funding procedures to avoid gender bias. Indicators are adaptions in the guidelines of funding processes. Those adaptations may comprise measures regarding the allocation and usage of the funds, e.g. consideration of lacking scientific experience/publications of junior researchers, project extensions due to parental leave, or integration of measures like gender bias trainings for reviewers, blind peer review or gender-balanced review boards.
Output dimension
3.4 Funding to promote GE in terms of female careers
Output subdimension

3.4.1 Increased funding to promote GE
Output indicators short Grants for early career development Support for career and life transitions (e.g. for returners) Grants fieldwork, conferences, professional development Offer of grants (reserved for women researchers) Revision of funding process guidelines
Outcome The direct social effects of targeted funding instruments are only limited to lower hierarchy levels and are more tangible in encouraging the movement of women upwards on the career ladder (European Commission 2008, 32). Current research gives anecdotal evidence that small grants that encouraged on- or off-campus collaborations lead to an increase in presentations, publications and successful applications for external funding (Laursen et al. 2015, 45). Grants that support career and life transitions (funds for research travel, assistance, equipment, family care, conferences or professional development) were also assumed to have an effect on research productivity and on the recipient's feelings of being valued. Symbolic awards were ascribed a potential to raise awareness of women's contributions and to support bridge-building with influential senior women (Laursen et al. 2015, 46). In contrast, gender mainstreaming of funding aims at increasing female success probability in funding processes by setting up rules against gender bias in the review process or by trying to increase the number of women grant applications. Success in the procurement of third-party funds is an experience in self-efficacy that directly strengthens the self-confidence of women as potential leaders and as members of the research profession (hypothesis). The career opportunities of women also improve directly by their gathering of experience as a principal investigator or project coordinator (hypothesis). Targeted funding instruments as well as gender mainstreaming of funding can be mixed to cushion the phase of uncertainty after PhD, when a significant share of women researchers decides for a child ('leaky pipeline'), e.g. by short-term financial support in grant writing or consideration of a researcher's 'scientific age' in terms of scientific experience (publications, projects), in contrast to his or her real age (hypothesis).
Outcome dimension 2.1 Work-life balance 2.2 Job satisfaction 2.3 Competitiveness/promotion and career 3.1 Leadership 3.2 Professional achievements 3.4 Funding to promote GE in terms of female careers
Outcome subdimension 2.1.1 Improved compatibility of family and career 2.2.1 Appropriate respect/recognition for (academic/scientific/leadership) work 2.3.1 Transparent, non-biased and flexible promotion/tenure criteria 2.3.2 Strengthened confidence for promotion and responsible positions 3.1.1 Increased confidence and ability of leadership roles 3.2.1 Increased professional development of work skills (for career success) 3.4.1 Increased funding to promote GE
Outcome indicators short

Perception of influence of career break on career progress
Ability to balance work and life
Flexibility of third-party-funded projects regarding parental leave and other life events
Equality of attention
Award or honour by institution
Career opportunities
Confidence in own ability
Considerations about leaving current positions
Change in motivation to invest more effort in scientific career
Description of academic future
Perception of own role being a leader concerned with supporting women's opportunities
Contribution to the participant's self-perception as a primary investigator/project leader
Visibility of women at the research organisation
Visibility in the unit/team
Strength of identification as a female leader
Increased self-awareness
Contributed to and/or leading meetings
Clarity about own value as a scientist
Opportunities for publishing
Support to management of grant writing
Proportion of women receiving a grant
Average size of grant distributed by gender
Reasons for potential applicants not to apply/to apply for funding
Distribution of project funds among men and women
Share of men and women among applicants for funding
Share of men and women among successful applicants for funding

Impact

In the long run, the mentioned outcomes of targeted funding and gender mainstreaming in funding – increase in productivity, networking, self-esteem and probability of successful grant applications – may lead into an overall increase of female work capacity. This consequently results in a higher number of women researchers among the faculty, especially in higher positions, and higher job satisfaction of women researchers due to better and fairer perceived career chances (hypothesis).

On a systemic level, the measure may result in a research system with more gender equality in research processes as the number of female project heads is expected to increase (hypothesis).

Finally, with an increase in the interconnectedness of women researchers (Laursen et al. 2015, 45) and in the probability of women researchers to be in project responsibility, the research performance of women should also significantly increase, e.g. regarding authorships or patents (hypothesis).

Impact dimension

1.1 Positions
2.2 Job satisfaction
3.3 Awareness of/commitment to gender equality
3.4 Funding to promote GE in terms of female careers
5.1 Research outputs and impacts

5.4 Gender-sensitive research
Impact subdimension 1.1.1 Increased number of women in academic and other RTDI positions 2.2.2 Positive individual job rating 3.1.1 Increased gender awareness 3.4.1 Increased funding to promote GE 5.1.1 Scientific outputs 5.3.1 Achieved gender equality in research process
Impact indicators short Relative probability between the ability of men and women to reach a top position Success rates of men and women applicants to positions, horizontal/vertical segregation in positions Level of funding Satisfaction with career Visibility of women at the research organisation or at national level Share of projects directed by women Perceived general gender egalitarianism of funding processes Percentage of women that are first authors of research papers Share of women patents
Conditions of effectiveness As targeted funding instruments imply positive discrimination of women researchers, rejection of excluded colleagues or fears of stigmatisation of the target group are possible (van den Brink & Stobbe 2014). This can be countered by the critical reflection of these effects during the phase of policy design, formulation of sex-neutral eligibility criteria that address special problems of women researchers without excluding men (e.g. by addressing non-tenured researchers or parental leavers), and by ensuring explicit support of senior research staff (van den Brink & Stobbe 2014). Furthermore, targeted funding instruments are problematic regarding their scope of impact. To reach a broad target group, they need a relevant amount of resources or alternatively focus on 'lighthouses' as target groups in particularly vulnerable career situations. The impact of gender mainstreaming of funding has to be constantly monitored for its effectiveness; otherwise, the possibility persists that the conducted revisions were only superficial and only serve legitimacy, veiling lasting practices of discrimination (van den Brink et al. 2010). However, current research sees gender bias less in grant peer review processes and more in the research system itself (Ceci & Williams 2011). As a consequence, measures appear to be more effective if applied directly to the research organisations, trying to increase the number of women grant applicants and quality of the applications.

Impact story 4

Impact story
Training courses (different targets)
Measure definition
Training courses communicate contents to the participating audience with the aim to achieve a behavioural change. There is a variety of training courses that aim at promoting gender equality. From a theoretical perspective and with regard to the category of personnel development, we can broadly distinguish two training targets: 1. To develop awareness regarding gender inequalities and diversity in the organisation. They may address a broad audience in STEM or focus on managers in particular (Kalev et al. 2006). 2. To pass knowledge concerning career options and possibilities to women. Not further discussed here is that training courses can also address gender equality topics beyond the personnel level, e.g. the role of gender in research contents. In detail, the measure comprises an analysis of gender equality in research institutions and derivation of concrete needs that should be met through a training; compilation of relevant content and development of training courses; execution of the training with the pre-defined target group; evaluation of the participants‘ conscious and unconscious learnings; and finally, evaluation of the social effects that were expected as the consequences of the training.
Goal
More women in research and development More women in research and development leadership Gender dimension in research content and curricula Responsible research and innovation Research performance
Output
Conducted trainings are the direct output of this measure. This is indicated by the number of trainings and the number of participants.
Output dimension
5.1 Research outputs and impacts
Output subdimension
5.1.3 Training/human capital
Output indicators short
Availability of training and workshops Number of participants at trainings Researchers trained Quality of the activities for the support of a scientific career
Outcome

The direct outcome of the intervention is an increase in knowledge, skills and awareness. Diversity trainings for all members of an organisation, especially leaders, raise gender awareness and consciousness of bias (Carnes et al. 2012). They help decrease false associations with women (Jackson, Hillard & Schneider 2014). Trainings for female junior researchers increase their knowledge of possible career ways, build networks and teach confidence and ability to assume leadership roles. The trainings can provide an opportunity to learn new work skills that are useful for career success (Lipinsky 2009; Archie & Laursen 2013). This outcome is indicated by assessing the understanding of the contents before and after the training.

A second outcome is that participants of the trainings use the new knowledge, skills and awareness in their professional practice (Archie & Laursen 2013). For instance, this is indicated by employees being more open to cooperating with fellows from social backgrounds other than their own (Bezrukova, Jehn & Spell 2012). Women who have been at a training for career development get clarity about their goals and values and become more self-aware. They improve their self-presentation and learn to network more successfully. They can identify promising fellows to work with.

Women who have participated in leadership trainings report similar effects. The programme New Zealand Women in Leadership (NZWIL) aimed specifically at leadership development for women. Participating women have developed self-confidence to be a leader, confidence in their own ability, knowledge of career opportunities and own career goals, as well as networking skills (Harris & Leberman 2012).

Outcome dimension

3.2 Professional achievements

2.3 Competitiveness/promotion and career

3.3 Awareness of/commitment to GE

3.1 Leadership

4.1 Gender equality challenges/barriers

Outcome subdimension

3.2.1 Increased professional development of work skills (for career success)

3.2.2 Improvement of network building and use

2.3.2 Strengthened confidence for promotion and responsible positions

3.3.1 Increased gender awareness

3.1.1 Increased confidence and ability of leadership roles

4.1.1 Decrease of GE barriers

Outcome indicators short

Trainings targeting diversity consciousness:

Increased awareness of gender and unconscious bias

Perception of own role being a leader concerned with supporting women's opportunities

Trainings targeting career development:

Growth of knowledge about local leadership and organisation culture

Increased self-awareness, knowledge about own career path and potential obstacles

Knowledge about leadership and university governance

Improved understanding of different departments'/sections' culture and procedures

Improved negotiation skills

Improved voicing opinion/confidence to argue one's position

Tangible examples of leadership development skills in daily work

Negotiation of job offers (concerning salary, workload, office space)
Ability of managing budget is improved
Confidence in and preparedness for long- and short-term goals/path
Improved self-promotion skills
Encouragement to undertake further training and pursue personal development opportunities
Network was built/extended and is used to advance career
Success rates of participating women to positions
Participation/strategic behaviour in committees
Ability to create/enhance/sustain new networks/contacts/collaborations
Identification of useful local "allies" in encouraging GE
Acknowledgement of gender issues in team

Impact

In regard to diversity trainings: as a result of the reduced bias, more women will be employed and promoted. Employees from various backgrounds can cooperate better and the work is more productive overall (Bezrukova et al. 2012). It is assumed to affect a cultural change in the organisation (Kalev et al. 2006).

It can be hypothesised that diversity trainings, which help increase gender awareness, will also affect how the gender dimension is integrated into research contents. Employees who have been trained to identify gender bias will be more likely to identify gender bias in products and research gaps. Trainings for women's career development have an impact on competitiveness/promotion and career development. Having gained insights into career development options and negotiation skills and with increased self-consciousness, more women will be promoted (Harris & Leberman 2012) and attain high positions.

The measure may have an impact on more subdimensions in the organisation. The reason for this broad variety of dimensions is the dependence on the precise contents and goals of the training. Therefore, diversity, career and leadership trainings can have effects on several RRI indicators: having become more self-conscious and being in high-ranking positions, women researchers can share their perspective more often, which helps decrease gender bias. Besides, diversity of staff is useful for increasing innovation capacities because it enhances knowledge of user needs (Froese & Schraudner 2010, 38). Knowing more about successful career paths, women researchers will be more focused on work that pays out, e.g. publish more, carefully select peer-reviewed journals with a high citation index and insist on being mentioned as first authors of articles (hypothesis). These steps that women take to advance their careers will also bring about more overall citations and thus be beneficial for the organisation they work in and the research and innovation system as a whole.

Impact dimension

1.1 Positions
1.2 Recruitment capacity
4.2 Organisational/cultural change with regard to GE
5.1 Research outputs and impacts
5.2 Innovation outputs and impacts (incl. technological impacts)
5.3 Economic outputs and impacts (incl. entrepreneurships)
5.4 Gender-sensitive research
5.5 Responsible research and innovation (RRI)

Impact subdimension
1.1.1 Increased number of women in academic and other RTDI positions
1.1.2 Increased number of women in decision-making positions
1.2.1 Improved recruitment of talented women
4.2.1 Organisational/cultural change with regard to GE
5.1.1 Scientific outputs
5.1.2 Knowledge/innovation networks
5.1.4 Strengthened R&I capacities/excellence
5.1.5 Research priorities and outcomes in terms of GE
5.2.3 Incorporation of knowledge about sex and gender into engineering innovation processes
5.3.3 Making of contributions to strengthening gender-sensitive research
5.3.4 Jobs, growth and competitiveness of participants (incl. SMEs)
5.4.1 Achieved gender equality in research process
5.4.2 Research quality: integration of the gender dimension/perspective in research and content, in research projects, patents, and agreements
5.4.3 Making of contributions to strengthening gender-sensitive research
5.5.1 Gender equality
5.7.1 Societal impacts
Impact indicators short
Horizontal/vertical segregation in positions
Increase in leadership positions by women who participated in the programme
Distribution of gender among rectors
Improved recruitment of talented women
Number of publications in peer-reviewed high-impact journals
Percentage of publications published in the top 10 % impact ranked journals
Publications' interdisciplinarity
Percentage of women that are first authors of research papers
Conferences/workshops papers and proceedings
Country's share of publications
Number and share of female authors
Number of scientific papers in relation to the population size
Women's perception to hold themselves to a stricter standard of competence
Number of patent applications by theme
Number of awarded patents by theme
Number and share of female inventors
Better innovation capability of EU firms
New and better product-service offerings addressing customer needs
Gender balance in research team/research team composition
Number of projects led by women
Awareness of market and end-user needs
Percentage of research projects including gender analysis/gender dimensions in the content of research
Share of research projects with gender dimension in content
Gender-neutral, non-sexist language is used

Perception of rebalancing of power, especially in relation to women on team level
Active support of female colleagues within the teams
Using gender-sensitive language in publications
Percentage of women participants in [Horizon 2020] projects
Percentage of women project coordinators [in Horizon 2020]
Percentage of research institutions that document specific actions that minimise/reduce barriers in work environment that disadvantage one sex (e.g. flexibility of working hours)
Share of female heads of RPOs
Share of female researchers by sector
Glass Ceiling Index
More effective promotion of GE and the gender dimension in research and innovation content

Conditions of effectiveness

Offering a training is an intuitive measure if an organisation wants to change its culture or decrease discrimination. However, trainings are not always effective in promoting gender equality and, when evaluating a training, certain circumstances should be taken into account. Kalev et al. (2006, 611) argued that even though trainings are widely used (in 39 % of the organisations surveyed), they often have little or even reverse effects.

The specific effects of trainings depend on possibilities to implement the content from the training in work practice. For instance, van den Brink and Benschop (2012) suggest that the success of a training on gender awareness depends on whether it is implemented into recruiting practices. Along with this goes the result of Kalev et al. (2006, 607) that the effect of training is higher in organisations which have clear responsibilities for agents to support diversity, e.g. an affirmative action plan or a diversity committee.

Certain types of trainings have been identified to be particularly vulnerable to producing reverse effects. Trainings to sensitise leaders for diversity may activate unconscious cognitive bias against minority groups (Kidder et al. 2004; Rynes & Rosen 1995). Unconscious stereotypes are difficult to control rationally (Nelson, Acker & Manis 1996). The existing literature suggests that such reverse effects of diversity trainings are more common if they discuss bias against one particular minority group, while trainings which discuss overall diversity have been assessed as more successful (Kalinoski et al. 2013, 1077–1078; Bezrukova et al. 2012, 222–223).

In a study at the University of Colorado, participants of trainings reported several success factors for diversity trainings: openness, good atmosphere, networking opportunities, presentation of workshop contents. Training courses on gender equality can be combined with other gender equality measures or evaluations of short-term and long-term effects (Archie & Laursen 2013). In this case, it is suggested for evaluations to consider which effects can be attributed to training courses and which to the measures they support.

Impact story 5

Impact story Support to career development
Measure definition Major life events such as childbirth, care work for relatives, continuing education or accommodating spouses' careers may result in voluntary or involuntary career interruptions in the case of many women in STEM (Hewlett 2007). Furthermore, male competitors usually get more support from their male colleagues and have better professional networks; therefore, they have competitive advantages in their careers compared to women. Another major barrier to women succeeding in science is their own limiting self-beliefs and low self-esteem, as well as the unconscious bias that exists within most organisations. The GE intervention "support to career development" is a series of activities that support career planning and development. The introduction of coaching, mentoring, advising, counselling and training initiatives may help overcome the obstacles to women's career progression. Career development is a lifelong process involving psychological, sociological, educational, economic and physical factors that interact to influence the career of an individual (Hackney & Cormier 2005, 14). Career guidance and counselling programmes are comprehensive developmental programmes designed to assist employees in making and implementing informed occupational choices by developing their competencies in self-knowledge, educational and occupational exploration, and career planning.
Goal More women in research and development More women in research and development leadership Research performance
Output The measure's short-term output aims at introducing career development activities such as advising, counselling, coaching, mentoring and training programmes which seek to address individuals' wellness, personal growth, and career development through various interventions and strategies (Hackney & Cormier 2005). Career strategies and tools include facilitating networking events, providing self-assessment tools and one-on-one career counselling relationships. Interventions such as role playing and solution-focused therapy are valuable tools used by the counselling profession. Role playing is often used for practicing interviews, preparing to talk to employers, and learning how to address potentially uncomfortable conversations.
Output dimension 2.2 Job satisfaction 2.3 Competitiveness/promotion and career
Output subdimension 2.2.2 Positive individual job rating 2.2.3 Overall work climate 2.3.1 Transparent, non-biased and flexible promotion/tenure criteria 2.3.2 Strengthened confidence for promotion and responsible positions 2.3.3 Improved support to advance research career
Output indicators short

Perception of people working in the area of R&I in regard to gender equality, e.g. percentage of women in R&I who believe they have equal opportunities to pursue their careers in comparison to men Confidence in own ability Revisions of career plan Received personal and professional support from institution Researchers trained (including PhD, post-docs, gender-balanced)
Outcome In the medium term, the measure aims to contribute to the attraction and retention of talented and competent females in science and in leadership positions. Career development programmes prepare individuals for the changing workplace of the 21st century by teaching labour market changes and complexity of the workplace. Career support activities, especially mentoring, can teach mentees about career 'paths, shortcuts and minefields' within research environments (Kalpazidou Schmidt & Faber 2016). By equipping talented female researchers with the confidence they need to thrive in their careers, counselling also makes women more visible in STEM and helps them up the ladder of success.
Outcome dimension 1.1 Positions 3.1 Leadership 3.2 Professional achievements
Outcome subdimension 1.1.2 Increased number of women in decision-making positions 3.1.1 Increased confidence and ability of leadership roles 3.2.1 Increased professional development of work skills (for career success) 3.2.2 Improvement of network building and use
Outcome indicators short Satisfaction with career Ability to apply and exercise learned leadership skills Attractiveness and personal motives to take up leadership positions Mentoring system from the very beginning when one enters the organisation Long-term career plan developed Clarity about own value as a scientist Knowledge about own career path and potential obstacles Ability to identify and access mentors Improved self-promotion skills Use of mentoring (promoting of career, obtaining of resources, useful advice, etc.) Benefits of coaching/mentoring
Impact The measure's long-term impact is promoting a fair and appropriate status of female scientific researchers. By broadening knowledge, skills and abilities, improving decision-making skills, increasing self-esteem and motivation, building interpersonal effectiveness, maximising career opportunities, improving employment marketability, promoting effective job placement, and strengthening employer relations, the intervention encourages and assists the capacity of scientific researchers to perform research in an enhanced spirit of responsibility.

Furthermore, the counsellors and managers of career development programmes may learn about the struggles of female researchers and gender challenges they have to face in the workplace. This feedback mechanism can be very beneficial, not only to the women who participate in the programmes, but also to the organisation, since it can bring about substantial changes in organisational culture. An increased awareness of gender issues contributes to better integration of women in the research environment, which in turn further enhances overall research performance and scientific outputs.
Impact dimension 4.1 Gender equality challenges/barriers 4.2 Organisational/cultural change with regard to GE 5.1 Research outputs and impacts
Impact subdimension 4.1.1 Decrease of GE barriers 4.2.1 Organisational/cultural change with regard to GE 5.1.1 Scientific outputs 5.1.3 Training/human capital
Impact indicators short Proportion of women on (company/university) boards, members and leaders Percentage of women in advisory committees Percentage of women in expert groups Proportion of women in leadership positions Acknowledgement of gender issues Percentage of women taking part in research mobility programmes Percentage of women that are first authors of research papers Strengthened human potential in R&D in business and academia (including gender balance) across EU countries
Conditions of effectiveness In some cases, female researchers might need gender-specific programmes to bring out their best professional self and performance. A planned sequence of activities and experiences is needed to achieve specific competencies such as self-appraisal, decision-making, goal-setting and career planning. Qualified leadership, effective management, accountability and programme improvement based on the results of process/outcome evaluations are key components of successful career guidance. Furthermore, counselling programmes require a team approach where certified counsellors are central to the programme. Counsellors should continuously update their professional knowledge and skills and conduct regular follow-ups with their clients. Finally, adequate facilities, materials and resources are also needed for effective career support.

Impact story 6

Impact story Activities to make women (and their research) visible
Measure definition Many of the women working in STEM today go unnoticed and unremarked, despite their valuable contributions to scientific research. The serious problem of female invisibility in STEM might be a natural consequence of the low number of women in these fields, but it also leads to a lack of women role models, job dissatisfaction and poorly perceived career prospects, thus perpetuating the insufficient female representation in STEM. Breaking this vicious circle requires measures that enhance the status of women in science (Gowaty 2015). The GE intervention "activities to make women (and their research) visible" means launching of initiatives to shed light both on women excelling in STEM and on their work. Special events, programmes, awards and other activities should be planned, developed, carried out and communicated in order to highlight the scientific accomplishments of women.
Goal More women in research and development More women in research and development leadership Responsible research and innovation Research performance
Output The measure's short-term output aims at creating and implementing actions that help to make women in STEM and their scientific results more noticeable and, therefore, more valued. The introduction of awards reserved for women scientists, travel grants for female researchers, exhibitions, fairs and other events held to publicise the work of women in science, celebration days of achievements of women in STEM, press events, etc., can all be means of making women scientists and their performance more perceptible and available both to fellow researchers and to the public.
Output dimension 2.2 Job satisfaction
Output subdimension 2.2.1 Appropriate respect/recognition for (academic/scientific/leadership) work 2.2.2 Positive individual job rating
Output indicators short Number of activities to make women visible Range of implemented activities (e.g. number of visitors of events, print run of publications, etc.) Number of women who were made visible
Outcome Activities to make women and their research more visible give a sense of being appreciated and valued. This kind of recognition may strengthen the self-confidence of outstanding women in STEM and increase their job satisfaction (Gowaty 2015). If women researchers experience that their achievements are not being downplayed, it can boost their self-assurance as researchers and motivate them to reach their full professional potential. This results in a smoother and more fulfilling career.

Therefore, in the medium term, the measure can increase the profile of women in the scientific field and, in doing so, support women already working in STEM. Thus, it contributes to recruitment and retention of women in science and to increasing the proportion of females in leadership positions.

Outcome dimension

1.1 Positions

1.2 Recruitment capacity

2.3 Competitiveness/promotion and career

Outcome subdimension

1.1.1 Increased number of women in academic and other RTDI positions

1.2.1 Improved recruitment of talented women

2.3.3 Improved support to advance research career

Outcome indicators short

Composition of academic positions per team

Reaction to female supporting treatment

Perception of own improvement of profession

Description of academic future

Perceived challenges to get a scientific position

Received personal and professional support from unit/team

Range of respect by boss/colleagues/students

Changes in salary and position from entry to exit/current position

Award or honour by institution

Events to create visibility and credibility and specific types of recognition for women

Equality of attention

Satisfaction with career

Impact

In the long term, the measure can create new role models who will encourage more girls to pursue STEM careers. Outstanding women can function as inspirational examples of success, illustrating the kinds of achievements that are possible for women around them. They demonstrate that it is possible to overcome traditional gender barriers, indicating to other women that high levels of success are indeed attainable (Lockwood 2006). Thus, the measure contributes to the recruitment and retention of women in the scientific field and to increasing the proportion of females in leadership positions. By providing role models and encouraging both adult female researchers and young girls considering scientific careers, the measure helps to address the leaky pipeline problem at more than one stage, thus contributing to increased research performance and to the elimination of gender equality barriers in research organisations and in the society (Blickenstaff 2005).

Furthermore, the measure raises awareness of gender issues not only in teams, but at the organisational level as well, thus contributing to better integration of women in the research environment and to a favourable change in organisational structures and culture in the long run. By reflecting a genuine commitment to gender equality, activities to make women and their research more visible can also contribute to increased gender awareness in the society as a whole.

Impact dimension

3.3 Awareness of/commitment to gender equality

4.1 Gender equality challenges/barriers

4.2 Organisational/cultural change with regard to GE 5.1 Research outputs and impacts 5.5 Responsible research and innovation (RRI)
Impact subdimension 3.3.1 Increased gender awareness 4.1.1 Decrease of GE barriers 4.2.1 Organisational/cultural change with regard to GE 5.1.3 Training/human capital 5.1.4 Strengthened R&I capacities/excellence 5.5.1 Gender equality
Impact indicators short Concernment in terms of gender awareness/knowledge Motivation and confidence in actively promoting gender equality Perception of gender-oriented reception of attention Value of gender-promoting measures Level of visibility Perceived extent and pace of cultural change Strengthened human potential in R&D in business and academia (including gender balance) across EU countries Reputation and excellence of Europe in scientific and technological research (modernisation of research institutions, vitality of research environment, quality of research outputs in basic and applied research) Active support of female colleagues within the teams
Conditions of effectiveness The measure is about male and female researchers having an equal level of visibility. Therefore, the aim of the initiative should not be to create an undue advantage for women, but simply to remove barriers to a level playing field. Endeavours to make women researchers visible do not imply that the mere presence of women is enough to boost other women's performance and self-evaluation, or to encourage young girls to consider careers in STEM. There are many other factors that play a role in women's success as researchers and leaders. Consequently, the measure should be accompanied by other actions to support outstanding female researchers. It is also of great importance that the focus should stay on real performance and research should remain excellence-based.

Impact story 7

Impact story
Schemes for women returners
Measure definition
The knowledge required in fast-moving and competitive sectors such as RTDI can be complex and subject to constant change. Work cultures are frequently focused on high-speed projects and long hours. Constant training, productivity and publications are of major importance. The typical career path in RTDI is based on the male life course: a linear course of full-time employment without breaks. Therefore, making it in science is hard for anyone, and even more so for female scientists who wish to return to their research careers after a break. Career breaks can occur for several reasons, such as raising children, accommodating spouses' careers, caring for elderly or disabled family members, recovering from an illness, etc. (Hewlett 2007). The great difficulties which women scientists face in balancing family responsibilities with work largely contribute to their insufficient participation and slow advancement in knowledge-based sectors (Mavriplis et al. 2010). The GE intervention “schemes for women returners” intends to address this persistent problem by initiating arrangements to retain women in the scientific field, e.g. flexible working hours and contract arrangements. Research leaders and decision-makers need to instigate policy and practice to facilitate women’s return from a STEM career break. Specific measures to smooth female professionals’ way back to their career track include catch-up opportunities, for instance in career development, as well as systemic changes, e.g. in parental leave policies.
Goal
More women in research and development More women in research and development leadership Responsible research and innovation
Output
The measure’s aim in the short term is to launch initiatives which help women re-enter scientific careers. The immediate results of the measure may include initiatives such as career development workshops and trainings, networking opportunities, part-time work opportunities, longer-term secure contracts, reduced fees for society memberships and conferences, changes in the way résumés are reviewed by faculty search committees, changes in the design and implementation of parental leave and childcare policies. The output is indicated through an increase in the implemented measures and in the number of women who benefit from these measures.
Output dimension
2.1 Work-life balance
Output subdimension
2.1.1 Improved compatibility of family and career
Output indicators short
Implemented measures Number of women who benefit from implemented measures
Outcome

The measure's outcome aims at supporting female employees to reach a healthier work-life balance and return to science after voluntary or involuntary career breaks. Encouraging women returners helps retain talented and competent researchers in the scientific field, which has direct positive effects on women's participation in RTDI, thus addressing the leaky pipeline phenomenon (Etzkowitz & Ranga 2011). Schemes for women returners also give opportunity for flexible career planning that takes into account major life events like childbirth, caring for relatives or further education (Laursen et al. 2015). A higher level of gender equality and a sense of being appreciated in RTDI boost the confidence of female employees in the sector and lead to increased job satisfaction and well-being.
Outcome dimension 1.1 Positions 1.2 Recruitment capacity 2.2 Job satisfaction
Outcome subdimension 1.1.1 Increased number of women in academic and other RTDI positions 2.2.2 Positive individual job rating
Outcome indicators short Extent of experienced work-family conflict Perceived challenges in balancing private life and work Perception of influence of career break on career progress Rate of change in composition of faculty Distribution of staff across genders Success rates of men and women applicants to positions Satisfaction with career Perception of people working in the area of R&I in regard to gender equality Extent of experienced work-family conflict Perceived challenges in balancing private life and work Support for returners Percentage of women who return to their jobs after parental leave
Impact The long-term broader impact of the measure aims at tackling the obstacles that hinder gender awareness and gender equality in RTDI. This leads to an elevated level of professional well-being and satisfaction of employees. Besides, by showing young girls that a healthy work-life balance is attainable for female scientists, schemes for women returners might increase the number of girls considering a career in STEM, which, in turn, might contribute to a more equal proportion of women in RTDI, thus leading to more responsible research and innovation policies and practices, able to address major societal challenges (European Commission 2010).
Impact dimension 3.3 Awareness of/commitment to gender equality 4.1 Gender equality challenges/barriers 4.2 Organisational/cultural change with regard to GE 5.2 Responsible research and innovation (RRI)
Impact subdimension 3.3.1 Increased gender awareness

4.1.1 Decrease of GE barriers 4.2.1 Organisational/cultural change with regard to GE 5.2.1 Reduced gender segregation 5.2.2 Revision of existing organisational arrangements to progressively eliminate barriers impeding women's advancement to top positions and factors inducing women to drop out of science
Impact indicators short Scale of personal commitment to gender diversity Concernment in terms of gender awareness/knowledge Perceived commitment of the university/institution to promote equality and diversity Acknowledgement of gender issues in team Percentage of women who are principal investigators on a project Percentage of women in projects throughout the whole life cycle Share of female researchers by sector Number and share of female inventors and authors
Conditions of effectiveness Research states that the pipeline metaphor can lead to the perception that any woman leaving the scientific field is a tragedy. A goal of 100 % retention is unrealistic and potentially coercive: people change fields and interests throughout their lives (Etzkowitz & Ranga 2011). Moreover, if only later leaks in the pipe are patched, there will still be a relatively small number of women leaders at the end, because of earlier leaks from the pipeline. It is also important to state that equal opportunities for women who have taken voluntary or involuntary career breaks should not mean discrimination of men or women who have had a linear course of full-time employment. Finally, schemes for women returners should be accompanied by other GE policies. The success of the measure may be impeded by a lack of harmonisation with other policy elements that aim to address gender inequalities in the scientific field.

Impact story 8

Impact story Care services and facilities
Measure definition The ability to reconcile work and family responsibilities is of key importance for female labour force participation in general, as well as in RTDI. Over the past decades, women's roles have changed dramatically, yet the social organisation of work and family life has not changed much. The typical gendered division of labour, based on the male breadwinner model, in which men have the primary responsibility to earn and women to care for young children and for elderly or disabled family members, is still valid in most EU member states (Lewis 2001). Due to the unequal gender distribution of care within the family, the impact of having children on the employment is positive for men, but negative for women (Sainsbury 1999). The “motherhood penalty” manifests itself in systematic disadvantages in pay, perceived competence, etc. In the scientific field, these can discourage talented women from pursuing research careers. The aim of the GE intervention “care services and facilities” is to help (female) employees with the burden of care obligations towards family members, thus providing solutions to the problem of work-family conflict, which occurs when experiences and commitments in the family interfere with work. For this purpose, care institutions, facilities and services are made available to support women earners.
Goal More women in research and development More women in research and development leadership Responsible research and innovation Research performance
Output In the short term, the measure aims to smooth the incompatible demands between work and family roles that make participation in both roles more difficult, thus helping women who are re-entering the workforce after having a family, and supporting families to reach a healthier work-life balance (Ahmad 2008). Immediate technical results of the measure include available and affordable care services and facilities for children, the elderly and the disabled, such as home care possibilities (e.g. in-home care providers with a regular and more involved relationship with the family, live-in care providers); daycare centres that offer learning and social development opportunities; family daycare possibilities; on-site childcare at the workplace; encouragement of relative care and childcare swap; daycare services for people with disabilities; nursing home services; support centres; volunteer care programmes; older adult and geriatric care institutions; etc.
Output dimension 2.1 Work-life balance
Output subdimension 2.1.1 Improved compatibility of family and career
Output indicators short Number of care facilities Availability of care services and facilities (e.g. opening hours, costs, etc.)
Outcome

In the medium term, the measure makes it possible for women to return to their jobs after parental leave, to work more hours, to change earlier from part-time to full-time employment, etc. By trying to minimise the conflict between work and family responsibilities and to encourage the participation of people with children in the labour market without discouraging reproduction, the measure contributes to female employees' feeling of contentment. A decreasing level of experienced work-family conflict results in increased job satisfaction. An improved ability to reconcile work and family obligations leads to a more positive individual job rating, and the institutional support for women to advance their research careers may contribute to strengthened confidence of female scientists.
Outcome dimension 2.1 Work-life balance 2.2 Job satisfaction 2.3 Competitiveness/promotion and career
Outcome subdimension 2.1.1 Improved compatibility of family and career 2.2.2 Positive individual job rating 2.3.2 Strengthened confidence for promotion and responsible positions 2.3.3 Improved support to advance research career
Outcome indicators short Satisfaction with career Perception of people working in the area of R&I in regard to gender equality, e.g. percentage of women in R&I who believe they have equal opportunities to pursue their careers in comparison to men Perception of own improvement of profession Received personal and professional support from institution
Impact The measure's long-term impact aims at an increase in the number of women in STEM. If talented female researchers are not held back by the lack of help with care work, it enables easier career planning that takes into account major life events like childbirth, care work for relatives, etc. (Greenhaus & Beutell 1985). This, in turn, might prevent career interruptions and disruptions that occur because of family care responsibilities and obligations.
Impact dimension 1.1 Positions 5.3 Economic outputs and impacts (incl. entrepreneurships) 5.5 Responsible research and innovation (RRI) 5.7 Societal and environmental impacts
Impact subdimension 1.1.1 Increased number of women in academic and other RTDI positions 5.3.1 Achieved gender equality in research process 5.5.1 Gender equality 5.7.1 Societal impacts
Impact indicators short Composition of academic positions per team Women's participation in paid work Relative probability between men and women reaching a top position

Success rates of men and women applicants to positions Gender balance in research team/research team composition Active support of female colleagues within the teams Improvement of societal awareness, understanding and engagement to tackle societal challenges through R&I Improved quality of life Extent of experienced work-family conflict Perceived challenges in balancing private life and work Satisfaction with current work-life balance Ability to balance work and life On-site childcare Range of institutional support
Conditions of effectiveness In order to be fully effective and relevant, the measure must be applied in a flexible manner. One of the key aspects of the intervention is availability. It is of great importance that the care facilities, institutions and services in question should be affordable for anyone who needs them. Equal access to care possibilities should be guaranteed for people in different life situations: female and male employees, single parents, couples, young scientists with children and older professionals who have to take care of a sick or disabled relative, etc. Furthermore, though care facilities and services represent a substantial element of family-related policies, they must be accompanied by several other kinds of support for working parents to encourage participation in the labour force. Care possibilities should always be harmonised with leave policies.

Impact story 9

Impact story Flexible working time
Measure definition From the gender equality point of view, flexible working time is introduced to integrate the working and personal lives of the employees to enable them to take care of their children and the elderly (Eurofound 2012, 13; Wilke 2014, 26; Hill et al. 2001, 50). Full-time employment is considered to be one of the essential mechanisms for the gendered allocation of work and housework. Therefore, shorter working time and the possibility of individual working time arrangements are often seen as essential steps to allow fathers the increasingly expected participation in the care of their children and to enable women to work more stably. Redistributing reproductive work to men will increase the time available for female labour market participation (Hielscher 2000, 51; Steinrücke & Jürgens 2003, 138). There are numerous variants of flexible working hour models (e.g. flextime, time banking, sabbaticals); the flexibility is normally regulated by defining the minimum/maximum of daily and weekly hours, core working hours, as well as overtime credits and overtime compensation possibilities (Klein-Schneider 1999, 39). Flexible working time arrangements that contribute to gender equality must be worker-led and not employer-led. Worker-led flexibility consists of working practices in which workers have some degree of autonomy to vary when they do their work, work from home, etc. (Fagan et al. 2012, 28).
Goal More women in research and development More women in research and development leadership
Output The measure's short term output is the number of employees using flexible working hours and part-time regulations to reconcile work and private life (Stolz-Willig 2004, 71). This output can be measured by the change of share of part-time employees by sex, while taking into account the hourly rate of part-time work, because flexible working hours that contribute to gender equality should allow part-time work from which one can live. In addition, shorter parental leave periods of women may be an output of the measure as mothers can return to work earlier if fathers reduce working hours to contribute to childcare.
Output dimension 2.1 Work-life balance
Output subdimension 2.1.1 Improved compatibility of family and career
Output indicators short Average duration of parental leave periods by sex Employment by full-time and part-time status and sex
Outcome

Flexible working time allows parents to adjust their working hours to their children's schedule and share the care work (Shockley & Allen 2010, 139; Steinrücke & Jürgens 2003, 137; Linne 2002, 28; Hill et al. 2001, 55; Hielscher 2000, 48; Jürgens 2002, 18). They can better deal with unexpected childcare situations like illness and, generally, flexible working time helps reduce stress in everyday life and work-family conflict (Linne 2002, 28; Golden 2015, 3; Russell et al. 2009, 86; Jürgens 2002, 18; Hill et al. 2001, 55). This also has a positive effect on health and leads to less sickness absence (Lott 2017, 8–9; Eurofound 2012, 55; Eurofound 2017, 39). Also, individual needs in other stages of life can be better coordinated, like social engagement, training, stays abroad or care for the elderly, which is still, similarly to childcare, predominantly undertaken by women (Ulich & Wiese 2011, 57; Jürgens 2002, 20; Peplinski 2007, 248; Lange & Heitkötter 2007, 191–192; Linne 2002, 44; Schieman & Glavin 2008, 610; Clark 2000, 755; Hildebrandt 2004, 342; Eurofound 2013, 47). These improved working conditions show an indirect effect on productivity because employees are more motivated and more loyal to their employees (Eurofound 2012, 37ff) and can do their work when they are most productive (Hill et al. 2001, 55).
Outcome dimension 2.1 Work-life balance 2.2 Job satisfaction 5.3 Economic outputs and impacts
Outcome subdimension 2.1.1 Improved compatibility of family and career 2.2.2 Positive individual job rating 5.3.1 Economic impacts
Outcome indicators short Extent of experienced work-family conflict Perceived challenges in balancing private life and work Satisfaction with current work-life balance Number of sick days Fluctuation at the department Turnover of company/number of employees
Impact In the long run, flexible working time presents a significant benefit for employees, especially regarding the reconciliation of work and family and, therefore, may be a crucial step towards gender equality and dissolution of the traditional division of labour (Golden 2015, 3; Brinkmann & Fehre 2009, 174; Peplinski 2007, 247; Lange & Heitkötter 2007, 190; Hielscher 2000, 51; Linne 2002, 44). It can also increase the labour market participation of women, as it allows both parents with small children and persons with care responsibilities gainful employment. At the organisational level, the measure can contribute to increasing the attractiveness of the employer. The described positive impacts are highly dependent on how and for what purpose flexible working time is implemented (see conditions of effectiveness).
Impact dimension 1.1 Positions 2.1 Work-life balance
Impact subdimension 1.1.1 Increased number of women in academic and other RTDI positions 2.1.1 Improved compatibility of family and career

Impact indicators short

Women's participation in paid work

Share of entitled men and women using parental leave

Employment by full-time and part-time status by sex

Conditions of effectiveness

Some conditions have to be fulfilled for flexible working time to be effective as a gender equality measure. There may be a downside to the approach: flexible working hours are subject to a constant conflict of the employer's and employee's interests. A long-term dominance of the employer's interest combined with growing individual responsibility can lead to more multi-tasking, overtime, constant availability, stress and even burnout (Schieman & Glavin 2008, 609–610; Gerst 2003, 65; Janke, Stamov-Roßnagel & Scheibe 2014, 98, 101; Haipeter et al. 2002, 366; Hielscher 2000, 58; Stolz-Willig 2004, 72; Schieman & Young 2010, 1405). This risk of a work-home conflict due to an employer-oriented working schedule has presented itself even higher for female employees, while men benefit more from flexible working hours (Lott 2017, 23; Eurofound 2012, 17). Another very important potential risk is that if only women pursue "flexibility", then this may contribute to the devaluation of the female part of the workforce and construe an image of women as merely "partly" or "sometimes" contributing fully to work and production.

Flexible working time therefore contributes to gender equality only if it means time sovereignty for employees, but not if working time is organised purely according to the needs of the employer.

Impact story 10

Impact story
(Targeted) funding to improve the integration of gender dimension in research
Measure definition
Studies have demonstrated that mainstream research, technology development and innovation have been gender-blind for decades (European Commission 2013b; Spanier 1995), which means that gender or sex were not taken into account and that potential differences between men and women were therefore not perceived as relevant for specific research projects. But in many cases sex/gender dimensions are neglected (based on stereotypical assumptions) because subconsciously the white man is perceived as the norm; however, no sound empirical research has been conducted on this issue. Therefore, the integration of gender in research content is still often missing or implemented superficially, sometimes due to a lack of understanding of the concept of sex and gender (European Commission 2009a, 13–14; Alpízar et al. 2010, 40; Keuken, Haafkens & Klazinga 2007, 7). This shortcoming can be economically, socially and personally harmful as research results are partial and potentially biased, e.g. when medical studies fail to include female participants or subjects by not considering the differences between male and female anatomy, hormones, or socio-cultural lifestyle differences, etc. (Research Council of Norway 2014, 8; Irish Research Council 2016, 12; European Commission 2011, 10). Implementing gender in research content can therefore be seen as a democratic issue, as the results of research should reflect and benefit the whole population. Recently, it was documented that multiple research projects from different scientific disciplines successfully delivered better research results and innovations by integrating sex/gender analysis (European Commission 2013b; Schiebinger 2008, Schiebinger & Schraudner 2011). Applying sex/gender analysis in research projects "has the potential to enhance human knowledge and technical systems by opening them to new perspectives, new questions and new missions" (Schiebinger 2008, 4). It therefore contributes to gender-responsible science and technology which leads to better quality, innovative and relevant research and, consequently, to enhanced excellence (European Commission 2011, 15; European Commission 2013a, 33; European Commission 2016, 3; Schiebinger & Schraudner 2011). Ideally, gender is addressed in all scientific disciplines in all phases of the research process, from ideas and hypotheses over project design and research methodology, research implementation to the dissemination phase (European Commission 2011). Therefore, research funding organisations are taking measures to promote the integration of the gender dimension into research content. One strategy is to establish explicit funding schemes for gender-specific research; another is to mainstream the inclusion of sex/gender analysis into already existing funding programmes (e.g. by including a specific criterion on the gender dimension in the selection procedure or by indicating the relevance of research results with respect to gender issues); furthermore, RFOs are offering instructions on how to include gender in various research contexts (Johnson et al. 2014, 2; FFG & bmvit 2010, 7; Gender-NET 2015, 6–7, 29–30; Keuken et al. 2007, 13).
Goal
Gender dimension in research content & curricula Responsible research and innovation Research performance
Output

The short-term, immediate outputs of this measure are gender-sensitive research projects and researchers who collaborate on these projects – often in interdisciplinary teams (Schiebinger & Schraudner 2011). Furthermore, budget that is allocated to funding gender-sensitive research projects can be compared to budget allocated to non-gender-sensitive research projects. Another output of targeted funding to improve the integration of gender dimension in research content is revised evaluation and selection procedures of such funding programmes, such as panel composition, gender-sensitive evaluation criteria or procedures and trainings for researchers and peer reviewers (Gender-NET 2016, 27–29; Research Council of Norway 2014, 9; Keuken et al. 2007, 8; Johnson et al. 2014, 7).

Output dimension

5.4 Gender-sensitive research

5.3.2 Research quality: integration of a gender dimension/perspective in research and content, in research projects, patents, and agreements

5.3.3 Contributions to strengthening gender sensitive research

Output subdimension

Number of gender-sensitive research projects

Number of researchers working in gender-sensitive research projects

Interdisciplinary research teams

Budget allocated to gender-sensitive research projects

Success rates of gender-sensitive research projects

Gender-tagged research projects and/or topics

Gender awareness trainings/briefings for reviewers

Gender-sensitive evaluation procedures and selection of reviewers (panel composition)

Gender-sensitive evaluation criteria

Output indicators short

Number/percentage of research projects including gender analysis/gender dimensions in the content of research

Share of RFOs promoting gender content in research

Measures addressing the integration of gender dimension in research

Outcome

Results of research projects with a consideration for gender may be considered an outcome of funding schemes which require the incorporation of gender/sex analysis. Wroblewski (2016, 24) reports three effects of a targeted funding programme promoting the inclusion of gender in research content: anchoring gender knowledge in (application-oriented) research; raising the awareness of the relevance of gender research and establishing gender competence in research producing organisations (RPOs); contributing to higher standards of quality assurance in research. With respect to gender equality, raised gender awareness and competence of researchers working on these projects can therefore be seen as one kind of outcome (Wroblewski 2016, 24).

Other outcomes are the gender-sensitive research methodologies and approaches developed and applied throughout the research project, as well as the gender-sensitive scientific knowledge and gender-sensitive technological solutions or organisational forms generated in its course. In addition, numerous case studies of gendered innovation projects (European Commission 2013b) have made evident that gender-sensitive research approaches are contributing to increased quality and better research results.

Therefore, it can be assumed that gender equality outcomes and research quality are very strongly connected (European Commission 2017b, 11). According to Schiebinger and Schraudner (2011, 154, 158), with respect to research performance, more interdisciplinary research, better quality and excellent research results are the expected outcomes of gender-sensitive research. Although there is evidence that the number of female project leaders is higher in gender-sensitive research projects and funding programmes (Wroblewski 2016, 35), it is not an intended effect. Therefore, it is not considered as an outcome here.
Outcome dimension 5.4 Gender-sensitive research 5.2 Innovation outputs and impacts (incl. technological impacts) 5.1 Research outputs and impacts
Outcome subdimension 5.3.2 Research quality: integration of a gender dimension/perspective in research and content, in research projects, patents, and agreements 5.2.3 Incorporation of knowledge about sex and gender into engineering innovation processes 5.3.3 Making of contributions to strengthening gender-sensitive research 5.1.1 Scientific outputs 5.1.4 Strengthened R&I capacities/excellence
Outcome indicators short *Gender equality and research quality:* Considering gender aspects in the research design Using gender-sensitive language in publications Explicitly dealing with gender issues in research projects Gender-neutral, non-sexist language is used Sex differences have been analysed Needs and expectations of research subjects as well as power relationships and gender assumptions (of researchers and research subjects) have been considered and included Existence/absence of knowledge on sex and gender in research field Development of user-driven innovation/design innovation Awareness on market and end-user needs *Scientific output/excellence:* New, altered or improved research tools and techniques, models and simulations New advanced capabilities, methods, systems, infrastructures and technologies Percentage of publications from projects which are among the top 1 % highly cited Number of publications in peer-reviewed high impact journals Percentage of publications published in the top 10 % impact ranked journals Publication's interdisciplinarity Number of citations/field-specific citation rates Scientific collaboration across disciplines on new, high risk ideas
Impact

There is hardly any research available on the long-term effects of targeted funding programmes to promote the integration of gender dimension in research. These are formulated on a very abstract and general level: that the new gender-sensitive methodologies, knowledge and technological solutions/innovations should contribute to enhancement of gender equality in the society as a whole. More gender-sensitively developed products, innovations and technologies should reduce existing gender gaps in health risks, technology use, etc., and thereby contribute to a more equal and fair society (European Commission 2017b, 11). But measuring the effects of targeted funding programmes on this very general impact level is hardly possible.

Therefore, impact indicators need to reflect the concrete topic and content of gender-sensitive research projects to model long-term effects. For instance, the development of crash test dummies representing a higher diversity of people with respect to height and weight had a significant impact on vehicle safety for men and women. It therefore reduced the risk of injuries for car drivers significantly. These long-term effects are quite different from gender-sensitive urban planning and design which, for instance, consider gender-specific usages of public spaces.

Furthermore, targeted funding for gender-sensitive research can also contribute to making research more responsive to society and its needs or challenges (Schiebinger & Schraudner 2011, 155; European Commission 2017b, 11). It might also lead to new research priorities and forms of public engagement. However, there is no evidence yet to prove this and to establish empirically grounded causal links.

Another expected impact is that gender-sensitive products and innovations generate new market potential and are able to enlarge the existing market (FFG & bmvit 2017). Therefore, gendered innovations can enhance the economic competitiveness and performance of companies.

Impact dimension

5.5 Responsible research and innovation (RRI)

5.7 Societal and environmental impacts

Impact subdimension

5.5.1 Gender equality

5.5.3 Public engagement

5.7.1 Societal impacts

Impact indicators short

Better innovation capability of EU firms

Improved cost-effectiveness and sustainability of solutions

More effective promotion of GE and the gender dimension in research and innovation content

Better societal acceptance of innovative solutions

Conditions of effectiveness

There is hardly any research or evaluation studies on targeted funding to improve the integration of gender dimension in research, indicating factors of success or barriers that hamper its effectiveness.

Wroblewski (2016, 19–22) reports the following factors supporting the inclusion of gender dimensions in research content:

- Inclusion of gender expertise in gender-sensitive research projects
- Strong position of gender expertise within the project consortium
- Clear definition of responsibilities and tasks of gender experts
- Establishment of spaces for self-reflection, discussion and learning

Furthermore, the following aspects have to be considered as conditions to enhance effectiveness. If funding is allocated with a requirement of integrating gender/sex analysis, follow-up (monitoring) should also be employed to demonstrate that gender issues are of high importance and priority, and that policy is not merely for show. Also, sanctions in the case of not taking gender into account should be considered to enhance compliance.

Within academia, universities should establish gender research departments/consortiums/(at least) networks in order to facilitate knowledge development, sharing and collaboration and to emphasise once again that gender research has high priority and value (and not just to gender researchers). Such gender research departments can then also serve as assistance if/when researches from other fields have to do gender analysis for the first time.

The above may also, at the cultural level, lead to an improvement of the perceived prestige or significance among scholars of the gender research field.

Impact story 11

Impact story Gender-sensitive human resources development
Measure definition Existing gendered disadvantages in the labour market are often being individualised, i.e. treated as the individual's problem, while actually they should be recognised as a systematic issue and hence be addressed as such (Müller, Schreiber & Vomberg 2015, 24–25). The GE intervention "gender-sensitive human resources development" represents an approach that takes into account the individual situations of all employees in order to enable all genders to achieve their objectives in terms of career and family. This implies a systematic consideration of gender issues in all areas of HR (Bessin & Malsburg 2014, 148–149; Krell, Mückenberger & Tondorf 2011, 97–98). Due to the structural, multidimensional nature of the approach, it addresses gendered issues in the institutional, but also the epistemic, the interactional and the internalised dimensions of the organisation concerned (Müller et al. 2015, 25). With respect to the institutional dimension, concrete measures can be implemented, amongst others, in the areas of hiring, pay, gender statistics or training; for example, by using gender-neutral language in job descriptions or revealing disadvantages by analysing sex-disaggregated data (e.g. regarding salary or promotion) (Bessin & Malsburg 2014, 150; Drube et al. 2015, 8; Fischer, Scambor & Scambor 2008, 10; Rustad & Rødland 2010, 21). The interactional dimension concerns, for instance, structured and gender-sensitive one-to-one meetings between employees and supervisors or mentoring programmes. The epistemic and internalised dimensions can be targeted by initiating a process of reflection regarding gender imagery in organisational communications, as well as regarding division of labour, also with respect to unpaid tasks such as social committees, in the organisational culture by offering unconscious bias courses or inspecting the external and internal image of the organisation (e.g. advertising) for a possible gender bias (Bessin & Malsburg 2014, 155; Müller et al. 2015, 24–25; Bräutigam, Scharfenorth & Schröer 2015, 11; Schäfer 2013).
Goal More women in research and development More women in research and development leadership Responsible research and innovation
Output The measure's main short-term output is the number of activities that are put in place to implement gender-sensitive personnel development at institutional and individual levels in order to ensure that activities are formalised and strongly anchored within processes and culture. In addition to the number of activities, the number of people or participants reached by the activities, number of workshops, trainings, meetings, etc., can also be measured. If the development and implementation of guidelines (e.g. for gender-sensitive recruiting) is part of the gender-sensitive human resources development programme, it is part of the short-term output.
Output dimension 4.2 Organisational/cultural change 3.3 Awareness of/commitment to GE 3.1 Leadership
Output subdimension

4.2.1 Organisational/cultural change with regard to GE 3.3.1 Increased gender awareness 3.1.1 Increased confidence and ability for leadership roles
Output indicators short Adaptations in guidelines, employee rights, spousal appointments Capacity building as to GE Establishment of institutional data gathering Implementation of leadership development programme Mentoring system Assessing deans/chairs/committee leaders by assessment criteria Number of trainings Number of participants (in relation to all employees or by level of hierarchy) Number of mentors and mentees Number of men/women who get coaching
Outcome Organisations that implement gender-sensitive human resources development expect a higher level of job satisfaction and an increase in employee motivation (Hanappi-Egger & Köllen 2005, 60) because transparency is increased and discrimination counteracted and, thereby, career prospects of women are improved. Another important outcome is the assurance of organisational legitimacy and image-building. Gender equality policies are publicly reported to underline the organisation's pioneering role (Trenkmann 2017, 156). Moreover, a goal of gender-sensitive personnel development is improvement of gender sensitivity and gender competence in the organisation (BuKoF 2007, 39). Gender-sensitive personnel development is expected to lead to improved gender sensitivity in the organisation, such as recognising sexism and unconscious biases, and gender competence, such as adequately addressing sexism and counteracting bias.
Outcome dimension 2.2 Job satisfaction 4.1 Gender equality challenges/barriers 4.2 Organisational/cultural change 3.1 Leadership
Outcome subdimension 2.2.2 Positive individual job rating 2.2.1 Appropriate respect/recognition for (academic/scientific/leadership) work 4.1.1 Decrease of GE barriers 4.2.1 Organisational/cultural change with regard to GE 3.1.1 Increased confidence and ability of leadership roles
Outcome indicators short Satisfaction with career Involvement in unit/team decision-making Percentage of women who believe they have equal opportunities to pursue their careers in comparison to men Respect from boss/colleagues Transparent promotion system

Salary compared to colleagues Equality of attention Experienced sex discrimination/sexist remarks Gender pay gap Acknowledgement of gender issues General organisational consciousness and messages with symbolic value Organisational views of the advancement of women by structural features
Impact In the long run, gender-sensitive human resources development aims at increasing the share of women in the organisation and in leadership positions through gender-sensitive recruiting, retention and promotion strategies (Schäfer 2013). Gender-sensitive human resources development will make the company an attractive employer, thereby expanding their talent pool and reducing recruitment costs by retaining and developing employees (Hanappi-Egger & Köllen 2005, 60–61). Moreover, gender-sensitive HR development leads to an institutionalisation process that is completed when gender equality policies and values are structurally and culturally anchored and self-evident in the organisation (Trenkmann 2017, 155). At this stage, the organisation also has optimal conditions for dealing with other dimensions of diversity. Teams can then better deal with the integration of different cultures, nationalities, religions, etc., and potential can be used more effectively (Herpers 2013, 277–278).
Impact dimension 1.1 Positions 2.1 Work-life balance 3.3 Awareness of/commitment to gender equality 4.1 Gender equality challenges/barriers 4.2 Organisational/cultural change
Impact subdimension 1.1.1 Increased number of women in academic and other RTDI positions 1.1.2 Increased number of women in decision-making positions 2.1.1 Improved compatibility of family and career 3.3.1 Increased gender awareness 4.1.1 Decrease of GE barriers 4.2.1 Organisational/cultural change with regard to GE
Impact indicators short Distribution of staff across gender Composition of boards and committees Percentage of professional staff at employment level, proportion of women in leadership positions Composition of search committees and applicant pool Fluctuation at the department/sex Scale of organisational commitment to gender diversity Acceptance of cultural change Sustainability of GE initiatives GE-dedicated administrative staff Integration of GE in KPIs Value of gender-promoting measures

Perceived extent and pace of cultural change at organisational level
Conditions of effectiveness Some conditions have to be fulfilled for the positive effects of HR development described above to occur, as well as to avoid gender-sensitive HR becoming mere 'lip service', i.e. insincere support followed by limited or no action, and to decrease the risk of resistance. There must be powerful support from the organisation's management (top-down) (Kobel 2016, 74), but there must also be engagement and interest by as many employees as possible, who act as promoters and multipliers (bottom-up) (Krell, Ortlieb & Sieben 2011, 34–35). To avoid lip service, organisations must ensure that women are part of recruitment and retention committees, and that women as well as men actively employ the gender-sensitive guidelines developed (Trenkmann 2017, 153). For executives, concrete incentives should be set to motivate them to implement the measures, preferably quantitative target agreements followed by continuous monitoring and reporting progress (Trenkmann 2017, 151; Krell, Ortlieb & Sieben 2011, 34–35).

Impact story 12

Impact story Gender budgeting
Measure definition Budgeting decisions are often portrayed as neutral and objective and, therefore, devoid of gender bias. Research into gender inequalities in academia, however, highlights how gendered power hierarchies within academic institutions "tend to privilege men and the masculine and devalue women and the feminine, and manifest themselves in the financial system and organisational practices of academic institutions" (Steinthorsdottir et al. 2016, 5). The Council of Europe (2005) defines gender budgeting as "an application of gender mainstreaming in the budgetary process. It means a gender-based assessment of budgets, incorporating a gender perspective at all levels of the budgetary process and restructuring revenues and expenditures in order to promote gender equality." This means that the budgetary allocation process must be "transparent and gender-fair, women and men must have equal access to every financial endowment and the financial means should be assigned in order to improve gender equality" (Rothe et al. 2008, 14). Gender budgeting in research can be implemented at ministry or institutional level in RPOs or RFOs and is linked to the following areas of gender inequalities in science: - Allocation/distribution of research grants/time/space - Financial resources for PhD students and duration of PhD programme - State funding to academic institutions (income per student/discipline) - Horizontal and vertical segregation - Overrepresentation of men in STEM; women more likely to work in social sciences and humanities - Gender imbalance in highest management and decision-making positions: most managerial and financial decision-making lies in the hands of men - Evaluation of the work of academics - Gender wage gap and lack of data thereon
Goal More women in research and development More women in research and development leadership Research performance
Output The main aim of gender budgeting in science institutions is the establishment of an unbiased resource allocation process. Outputs may include assessment and revision of current resource allocation and decision-making processes; guidelines and training for effective gender budgeting; a revised evaluation process (recruitment and promotion); information in the form of studies and reports on available data (including gaps) on resource allocation, human resources (horizontal and vertical segregation), gender pay gap and university processes and procedures that may lead to a gender-biased distribution of resources. Possible indicators may include: rating of transparency regarding decision-making bodies and criteria; establishment of gender equality structures and procedures; budget spent on GE measures; proportion of women receiving a grant; distribution of project funds among men and women [systematic consideration of gender equality in resource allocation processes].
Output dimension

4.2 Organisational/cultural change with regard to GE
4.4 Funding for structural transformation

Output subdimension

4.2.1 Organisational/cultural change with regard to GE
4.4.1 Increased funding to achieve structural transformation

Output indicators short

Rating of transparency regarding decision-making bodies and criteria
Establishment of gender equality structures and procedures
Budget spent on GE measures
Proportion of women receiving a grant
Distribution of project funds among men and women
Systematic consideration of gender equality in resource allocation processes

Outcome

The direct effects of gender budgeting may include improved information on the potential different situations and needs of women and men and improved information on the distributional effects and impacts of resources on women and men (EIGE 2016c). The Icelandic factsheet on gender budgeting acknowledges increased awareness of gender equality and improved knowledge as direct effects of gender budgeting (Icelandic Ministry of Finance and Economic Affairs 2012, 2).

In terms of job satisfaction, the appropriate respect/recognition for (academic/scientific/leadership) work is important to examine – one indicator of such is a transparent promotion system. The allocation of workload is another important subdimension which can be examined by looking at the composition of faculty workload (in terms of number of taught courses and supervised graduate students); workload by gender; share of hours spent on research/teaching/other activities per sex.

In terms of actual workplace, the distribution of workspace/facilities and researchers' access to the necessary facilities and workspace to carry out their work must be considered. Further workplace indicators are the gender resource gap; study of actual space allocation of faculty at organisational level (access to the lab, square footage, proximity to electrical power, years since last renovation, services) and study of perceived space allocation of faculty.

Another outcome of gender budgeting is linked to the institution’s awareness of/commitment to gender equality and can be gauged by the budget allocated to GE monitoring and whether or not there is a dedicated person/department/team in charge of GE monitoring. Regarding funding to promote gender equality in terms of female careers, an important indicator is the distribution of project funds among men and women.

Outcome dimension

2.2 Job satisfaction
2.4 Workplace
3.3 Awareness of/commitment to gender equality
3.4 Funding to promote GE in terms of female careers

Outcome subdimension

2.2.1 Appropriate respect/recognition for (academic/scientific/leadership) work
2.2.4 Allocation of workload
2.4.1 Equal workspace/facilities allocation
3.3.1 Increased gender awareness

3.4.1 Increased funding to promote GE
Outcome indicators short Transparent promotion system Composition of faculty workload (in terms of number of taught courses and supervised graduate students) Workload by gender Share of hours spent on research/teaching/other activities per sex Access to necessary facilities and workspace Gender resource gap Study of actual space allocation of faculty at organisational level (access to the lab, square footage, proximity to electrical power, years since last renovation, services) Study of perceived space allocation of faculty Budget allocated to GE monitoring Dedicated person/department/team in charge of GE monitoring Distribution of project funds among men and women Institutional installation of persons with gender competence on all academic planning and controlling levels and in the budgeting process Composition of budget committees (number, proportion of women and men), differentiated according to hierarchic and power structures (professors, mid-level faculty, etc.) (Rothe et al. 2008)
Impact EIGE (2016) highlights that gender budgeting leads to better and more evidence-based decision-making, more effective use of public funds, and increased transparency. Gender budgeting projects can increase efficiency as they often lead to improved working methods, better access to information, transparency, etc. One of the impacts can be a redesign of the evaluation of work of academics (research/teaching/administrative work) and a more diverse knowledge production (Steinthorsdottir et al. 2016, 6). The long-term effects of pursuing a gender budgeting measure depends on what percentage of the budget is subject to gender budgeting and whether or not this includes personnel (Steinthorsdottir et al. 2016.) If gender budgeting in the institution includes the budget for personnel, it could lead to an increased number of women in academic and other RDTI positions with the potential to make inroads into the gender pay gap and glass ceiling. Relevant indicators could include horizontal/vertical segregation in positons; a comparison between the proportion of female faculty during the most recent academic year to the promotion hired in the period of the past three years; rate of change in composition of faculty; share of female heads of RPOs; Dissimilarity Index; Glass Ceiling Index; gender wage gap; composition of boards or committees. An unbiased distribution of research grants would also lead to a larger percentage of women in leadership positions (promotion). Regarding recruitment capacity, gender budgeting can improve the recruitment of talented women by acting as a catalyst for transparency. Relevant indicators are the fairness of evaluation as well as facts about contracts of newly hired faculty.

Regarding working conditions – specifically competitiveness/promotion and career – the following indicators are useful to consider: the assessment of the number of submitted tenure applications and number of awarded tenures; assessment of number of promotion applications and number of admissions; assessment of fixed-term contracts vs. permanent positons contracts; development of the proportion of women ISCED 6 graduates differentiated by narrow fields of study; strengthened human potential in R&D in business and academia (incl. gender balance) across EU countries.
Impact dimension 1.1 Positions 1.2 Recruitment capacity 2.2 Job satisfaction 2.4 Workplace 3.1 Leadership 3.3 Awareness of/commitment to gender equality 4.2 Organisational/cultural change with regard to GE 4.4. Funding for structural transformation 5.1.3 Training/human capital
Impact subdimension 1.1.1 Increased number of women in academic and other RTDI positions 1.1.2 Increased number of women in decision-making positions 1.2.1 Improved recruitment of talented women 2.3.1 Transparent and flexible promotion/tenure criteria 2.3.3 Improved support to advance research career 5.1.3 Training/human capital
Impact indicators short Relevant indicators could include horizontal/vertical segregation in positons; a comparison between the proportion of female faculty during the most recent academic year to the promotion hired in the period of the past three years; rate of change in composition of faculty; share of female heads of RPOs; Dissimilarity Index; Glass Ceiling Index; gender wage gap; composition of boards or committees; fairness of evaluation about contracts of newly hired faculty; assessment of number of submitted tenure applications and number of awarded tenures; assessment of number of promotion applications and number of admissions; assessment of fixed-term contracts vs. permanent positons contracts; development of the proportion of women ISCED 6 graduates differentiated by narrow fields of study; strengthened human potential in R&D in business and academia (incl. gender balance) across EU countries.
Conditions of effectiveness The research carried out by Rothe et al. (2008) highlights how the impact of gender budgeting in scientific organisations particularly depends on different national funding systems. They also underline the importance of involving management in the process of integrating gender equality into financial systems. Trends towards new public management which entail increasingly concentrated power within universities' management could be seen as a double-edged sword for gender budgeting: if top management are committed, there is potential for real change. But conversely, if gender equality is not a priority for top management, it can be easily dropped (Rothe et al. 2008, 9). Other conditions for effectiveness are levels of awareness and gender competence; transparency of the budgeting process and the resources/power to successfully implement gender budgeting (Rothe et al. 2008).

The long-term effects of pursuing a gender budgeting measure depend on what percentage of the budget is subject to gender budgeting and whether or not this includes personnel. If it does include personnel, it can potentially have a positive impact on the number of women in academic and other RTDI positions, as well as in decision-making and leadership positions.

Structural aspects and influencing factors for gender budgeting opportunities, or rather necessary conditions as stated in Rothe et al. (2008, 93–95) are listed in the following.

Culture:

- Openness for organisational learning
- Bottom-up processes to complement top-down processes
- Culture of equal opportunities and promotion of women

State level:

- Clear legal requirements and enforceable GE objectives linked to budgetary allocations
- Link of gender sensitive goal achievements with financial sanctions
- Gender sensitisation

Organisational set-up:

- Individual promoters with motivation, power and sufficient resources
- Clear and enforceable objectives for GE and implementation of gender budgeting (top-down)

Stakeholders:

- Networking of gender-interested stakeholders
- Good contact between external experts and insiders
- Committed insiders with good knowledge of internal processes
- Stakeholders with legal power and resources

Processes:

- Transparency of the budgetary process
- Top-down requirements
- Transparent decision-making

Management instruments:

- Orientation towards outcomes of budgets
- Transparent decision-making
- Linking financial consequences to the achievement of agreed gender equality objectives

Impact story 13

Impact story Gender studies
Measure definition Schiebinger's (2008) three categories of 'knowledge issues' succinctly describe the impact of gender studies on science: - Participation of women in science and engineering - Gender in the cultures of science and engineering - Gender in the results of science and engineering Women's representation in science is characterised by both horizontal and vertical segregation. The former is where women and men tend to be concentrated in different disciplines. For instance, men are more than two times more likely than women to choose engineering, manufacturing and construction, and women are twice as likely to pursue an education degree (European Commission 2016, 1). The latter highlights the lack of women in leadership positions and on decision-making boards and committees. Current policy interventions that attempt to remedy this situation take an institutional transformation approach which concentrates on tackling those institutional processes and procedures that tend to reproduce bias against women. Women's studies and gender studies can also combat the invisibility of women and their contributions to science. There is a large evidence base that demonstrates the persistence of gender bias and androcentrism in science which frames the content, the methods and often the agenda of research as well as that of the curriculum. In the 1980s, however, with the emergence and development of women studies, feminist studies, and gender studies, the undersupplied women's standpoints in knowledge began to be taken into consideration (Miroiu 2011, 231). Gender studies can make visible areas of research that have been traditionally marginalised and explain why research areas often considered 'soft' areas of research may be undervalued as they may be associated with feminist epistemologies and methodologies. As well as providing an academic 'space' to address some of the above issues (amongst others), gender studies can also act as a catalyst for a less-biased and therefore better-quality science in other disciplines by providing a specialised source of expertise that can be tapped into. Gender perspectives integrated into medical sciences have highlighted how sometimes assumptions regarding the extent to which clinical samples can be generalised, or the absence of information about the sex of research participants, result in the absence of knowledge about the effects of medication on women; or the use of male animals in pre-clinical research contributes to flawed science (European Commission 2012a; UAB & EGERA 2016). Gender studies scholars can help to pinpoint these gaps – by identifying where science has been 'gender-blind' or whether assumptions have been made based on sex and gender differences that are not scientifically grounded but are built on stereotypes.
Goal Gender dimension in research content & curricula Responsible research and innovation Research performance More women in research and development More women in research and development leadership
Output

The main outputs related to gender studies can be divided into those linked to horizontal and vertical segregation or teaching and those more directly related to research content. Regarding horizontal and vertical segregation – an indicator of whether a research institution (including universities) is using gender knowledge (perhaps from gender studies) for institutional transformation could be the existence of a gender equality plan and its subsequent monitoring. Teaching outputs may include gender studies curricula to be taught on academic courses at degree level, Master's level and at doctorate level (gender studies). Other teaching outputs might include revised textbooks, revised curricula including specific gender modules (compulsory or not compulsory). Research and innovation outputs may include research projects and programmes as well as reports, working papers, conference papers and published articles that have as its main focus developing gender knowledge or those which integrate the gender dimension into different disciplines.
Output dimension 1.1 Positions 5.1 Research outputs and impacts 5.2 Innovations outputs and impacts 5.3 Economic outputs and impacts 5.4 Gender-sensitive research 5.5 Responsible research and innovation
Output subdimension 1.1.1 Increased number of women in academic and other RTDI positions 1.1.2 Increased number of women in decision-making positions 5.1.3 Training/human capital 5.1.5 Strengthened R&I capacities/excellence 5.2.3 Incorporation of knowledge about sex and gender into engineering innovation processes 5.4.2 Research quality: integration of the gender dimension/perspective in research and content, in research projects, patents, and agreements 5.3.3 Making of contributions to strengthening gender-sensitive research 5.5.1 Gender equality
Output indicators short Horizontal/vertical segregation in positions Researchers trained (incl. PhD, post-docs, gender-balanced) Composition of gendered product development Innovations and technologies serving certain groups of women or men more than others Development of user-driven innovation/design innovation Percentage of research projects including gender analysis/gender dimensions in the content of research Existence/absence of knowledge on sex and gender in research field Increase of scientific knowledge about gender Percentage of research institutions (including universities) that a) have gender equality plans and b) provide documentation of their implementation
Outcome

The main outcome of gender studies is increased knowledge of gender (in-)equalities and gender relations in various different spheres. This knowledge operates on different levels from the more abstract philosophical level with discussions of feminist epistemologies to the much more concrete applied level that can impact on practice and affect institutional change (i.e. unconscious bias training for recruitment panels). This knowledge can be documented, disseminated and transferred in a variety of ways and should result in a greater number of research projects and research programmes effectively including the gender dimension as well as effective GE plan implementation and monitoring.

In terms of research outputs and impacts specifically regarding training/human capital, we are able to observe how researchers are trained (incl. PhD and post-docs). Gender studies' students may gain knowledge about the difference between sex and gender; social construction of gender; standpoint theory (the importance of location, situated knowledge); intersectionality of race, class, gender, ethnicity, sexuality, interlocking oppression; variations in women's and men's experiences across nations, cultures, time, class, race, sexual orientation, etc.; privilege and women's contribution to history, culture, politics and science. They may also gain skills in critical thinking, social science methodologies, using gender as a category for analysis.

The outcomes of gender studies include increased gender-sensitive research specifically strengthening research quality by integrating a gender dimension/perspective in research and content, in research projects, patents, agreements. Relevant indicators might be the appearance of gender in studies of any subject and the existence/absence of knowledge on sex and gender in research fields. Contributions to strengthening gender-sensitive research are also made and the relevant indicator would be the increase of scientific knowledge about gender.

Outcome dimension

5.1 Research outputs and impacts

5.4 Gender-sensitive research

Outcome subdimension

5.1.3 Training/human capital

5.4.2 Research quality: integration of the gender dimension/perspective in research and content, in research projects, patents, and agreements

5.4.3 Making of contributions to strengthening gender-sensitive research

Outcome indicators short

Researchers trained (inc. PhD, post-docs, gender-balanced)

Percentage of research projects including gender analysis/gender dimensions in the content of research

Appearance of gender in studies of any subject

Existence/absence of knowledge on sex and gender in research field

Increase of scientific knowledge about gender

Impact

The mid- or long-term effects of gender studies may include the level of reflectiveness of research in terms of factoring in power relations as well as increasing scientific knowledge about gender. It may also increase awareness about which groups of people may benefit from or be excluded from certain research projects, innovations and technology.

Gender studies may also have a wider impact at the institutional level in a variety of different ways. It may provide input by way of expertise needed to develop a gender equality plan for the institution or to help scholars from other disciplines effectively integrate the gender dimension into research projects and teaching/curricula. Gender studies scholars should be seen as providing gender competence for various different activities within and beyond the institution, including providing support for gender-sensitive research at system level. Gender studies can also be seen as an indicator of the institution's commitment to promote equality and diversity which has been flagged up as key in the search to attract talent.
Impact dimension 3.3 Awareness of/commitment to gender equality 4.2 Organisational/cultural change with regard to GE 5.2 Innovation outputs and impacts (incl. technological impacts) 5.4 Gender-sensitive research
Impact subdimension 3.3.1 Increased gender awareness 4.1.1 Decrease of GE barriers 4.2.1 Organisational/cultural change with regard to GE 4.3.1 Equal treatment 5.2.3 Incorporation of knowledge about sex and gender into engineering innovation processes 5.4.1 Achieved gender equality in research process 5.4.2 Research quality: integration of the gender dimension/perspective in research and content, in research projects, patents, and agreements 5.4.3 Making of contributions to strengthening gender-sensitive research
Impact indicators short Needs and expectations of research subjects as well as power relations and gender assumptions have been considered and included Level of scientific reflection of research projects Increase of scientific knowledge about gender Innovations and technologies serving certain groups of women or men more than others Reconsiderations of the significance of scientific validity in order to visibilise hidden hierarchy of organisations Definition of research priorities considering who will benefit/be ignored by research projects Inclusion of the gender dimension in teaching/curricula Capacity-building as to GE Awareness of and support to gender-sensitive research at system level Percentage of research projects including gender analysis/gender dimension in the content of research Percentage of research institutions that provide training/support for researchers in regard to the inclusion of the gender dimension in research content Perceived general gender equalitarianism Perceived commitment of the university/institution to promoting equality and diversity Institution's commitment to promoting equality and diversity
Conditions of effectiveness

Trends towards new public management in higher education have seen the allocation of resources away from 'softer' social sciences and humanities to a greater focus on those disciplines that are more readily able to attract private finance – i.e. STEM subjects. Gender studies may be adversely affected if it is unable to demonstrate its potential for generating effective revenue.

The extent to which gender studies scholars are able to network, work on an interdisciplinary basis and provide useful input into how researchers from other disciplines are able to integrate the gender dimension into their disciplines is more difficult to realise than it sounds. Real interdisciplinary work is difficult – researchers speak different disciplinary 'languages' which is compounded by the current academic system which tends to penalise interdisciplinary work. National evaluation systems tend to reward disciplinary specialism. Real interdisciplinary work tends to be underfunded and happens in spite of a lack of infrastructure and real incentives that would facilitate the effectiveness of this work.

Impact story 14

Impact story
Gender equality action plan
Measure definition
Research has demonstrated that despite various policy initiatives and support at the EU level for gender equality in science and research, women still face persistent barriers in pursuing careers and reaching decision-making positions in these fields even when they are well-represented at entry level (Caprile et al. 2012; European Commission 2016c, 110). Gender equality plans have been promoted by the European Commission as the main tool to effect systematic institutional change in RPOs. A GEP is a consistent set of provisions and actions aimed at ensuring gender equality (Wroblewski et al. 2015, 63). The European Commission defines a GEP as a set of actions aimed at: - conducting impact assessment/audits of procedures and practices to identify gender bias; - identifying and implementing innovative strategies to correct any bias; and - setting targets and monitoring progress via indicators. This is achieved by targeting human resources development strategies, institutional governance, research funding allocation, institutional leadership and decision-making, as well as research programmes.
Goal
More women in research and development More women in research and development leadership Gender dimension in research content and curricula Responsible research and innovation
Output
At the institutional level, the main output of a GEP is the actual adoption of the GEP and the implementation of the planned measures. EIGE (2016, 8) highlights that the scope of a GEP depends on the type of research performing organisation, the institutional context in which it is implemented, the disciplines addressed, and the type of gender biases identified in the audit process. GEPs thus vary in terms of the specific measures that they detail – therefore, outputs depend on the specific actions that these institutions decide to undertake. For example, if a specific GEP is concerned with revising the recruitment process, 'revised recruitment process' may be a GEP output. Another action might be unconscious bias training for recruitment panels – in this case, the output would be the conduct of training sessions delivered to members of the recruitment panels.[20]
Output dimension
4.1 Gender equality challenges/barriers

[20] A GEP is not only a 'measure' or intervention that produces outputs; an analysis of a country's proportion of RPOs with a GEP in place is also indicative of the pro-activeness of a country's research institutions in challenging gender inequality and, therefore, the GEP can also be conceived as an 'input' (Wroblewski et al. 2015, 63). For example, the ERA (2014) survey used the following indicators: proportion of RPOs that adopted gender equality plans, and proportion of R&D personnel working in organisations that adopted gender equality plans. The first indicator represents a first step towards understanding how widespread the adoption of such plans is within the European Research Area. The second indicator "represents a first step towards understanding how common it is for R&D personnel to work in RPOs that have adopted such plans and thus made a formal commitment to gender equality. It provides an insight into the working conditions within the European Research Area (in the respondent RPOs)" (European Commission 2016c, 112).

4.2 Organisational/cultural change with regard to GE
Output subdimension 4.1.1 Decrease of GE barriers 4.2.1 Organisational/cultural change with regard to GE
Output indicators short Gender monitoring/reporting in regular monitoring instruments Adoption of GEPs
Outcome The main outcomes of GEPs include implemented measures to create an institution free from bias and therefore a more attractive work environment that will benefit both women and men. EIGE (2016) states the following outcomes for a GEP: compliance with domestic and EU regulations; creating better work environment; attracting and retaining talent; economic benefits; excellence and research quality; effectiveness and efficiency of the research, and a leverage for organisational change. GEPs can positively affect the compatibility of family and career through a range of institutional support mechanisms (childcare; partner/spousal hiring; health accomodations; career planning, etc.) and create improvements in the overall work climate through targeted measures to improve work practices. GEPs can also have a positive outcome on the promotion and career opportunities of women through the strengthening of confidence for promotion and responsible positions. At the institutional level, this can be measured through the personal and professional support received and the existence of rewards and incentives. For example, the University of Copenhagen's action plan includes financial incentives for faculty and departments hiring female senior researchers. In effect, this is built around a reward principle releasing extra professorships (woman or man) for faculties appointing female professors (Nielsen 2017). Other outcomes include the increased institutional awareness of and commitment to gender diversity which may be measured through an examination of the institution's regulations, contract reformulation, and founding of new initiatives. The establishment of institutional data gathering and inclusion of the gender dimension in teaching/curricula; budget allocated to GE monitoring; and dedicated person/department/team in charge of GE monitoring and the share of staff/researchers who have received training on IGAR are also important indicators of the institutional commitment to gender equality. Another major outcome of the successful implementation of a GEP is a decrease of gender equality barriers which can be determined through gender monitoring/reporting in regular monitoring instruments and the existence of GE-dedicated administrative staff. Organisational and cultural change is the main outcome of a GEP which can be identified through the establishment of gender equality structures and procedures; general organisational consciousness and messages with symbolic value; assessment of the effectiveness of existing equal opportunity/anti-discrimination legislation/measures. GEPs may also have direct effects on research performance; for example, the inclusion of the gender dimension into research content makes for better research (GenSET 2010). This can be observed through mapping the existence/absence of knowledge on sex and gender in research field.
Outcome dimension 2.1 Work-life balance 2.2 Job satisfaction 2.3 Competitiveness/promotion and career 3.3 Awareness of/commitment to gender equality 4.1 Gender equality challenges/barriers

4.2 Organisational/cultural change with regard to GE 5.2 Innovation outputs and impacts (incl. technological impacts) 5.4 Gender-sensitive research
Outcome subdimension 2.1.1 Improved compatibility of family and career 2.2.3 Overall work climate 2.3.2 Strengthened confidence for promotion and responsible positions 3.3.1 Increased gender awareness 4.1.1 Decrease of GE barriers 4.2.1 Organisational/cultural change with regard to GE 5.2.3 Incorporation of knowledge about sex and gender into engineering innovation processes 5.4.2 Research quality: integration of a gender dimension/perspective in research and content, in research projects, patents, and agreements
Outcome indicators short Range of institutional support (childcare; partner/spousal hiring; health accommodations; career planning) Measures on work environment/work practices Existence of rewards and incentives Scale of organisational commitment to gender diversity (measurement through regulations, contract reformulation, founding of new initiatives) Establishment of institutional data gathering Inclusion of the gender dimension in teaching/curricula Share of staff/researchers who have received training on IGAR Budget allocated to GE monitoring Dedicated person/department/team in charge of GE monitoring Gender monitoring/reporting in regular monitoring instruments GE-dedicated administrative staff Establishment of gender equality structures and procedures General organisational consciousness and messages with symbolic value Assessment of the effectiveness of existing equal opportunity/anti-discrimination legislation/measures Existence/absence of knowledge on sex and gender in research field
Impact The direct impact of GEP implementation should be more women in research in critical disciplines (i.e. in those disciplines in which they are particularly underrepresented) and at the higher echelons of the academic career ladder. The impact of a GEP should therefore minimise horizontal and vertical segregation across a range of disciplines and positions. The increase of women in leadership positions can be measured by examining the take up of leadership positions such as rector, associate professor, dean/associate dean, centre director, head of department or leader of research. For example, the University of Copenhagen through its plan has set up a central bonus pool offering additional rewards for each of the faculties increasing the ratio of of newly hired female professors by five percentage points in comparison to the year prior to the plan (Nielsen 2017).

Regarding decision-making, the composition of boards or committees is a useful indicator. The above occurs through enacting a change process in organisational structures and practices by removing cultural and institutional barriers that directly or indirectly discriminate against women in scientific careers and decision-making (Lipinsky 2014, 12). Fairness of evaluation can be achieved through data gathering on the application process and a more transparent promotion system. Improved compatibility of family and career can be determined through an examination of modified duties in response to personal needs and the share of entitled men and women using parental leave. Regarding job satisfaction, an improved support to advance researchers' careers and the received personal and professional support from the institution are appropriate indicators. Regarding the allocation of workload, the share of hours spent on research/teaching/other activities per sex is important to examine. The received personal and professional support from the institution and access to necessary facilities and work space are also key indicators. Also, as EIGE (2016) points out regarding the impacts of GEPs, "bringing a gender dimension in research and innovation content improves the overall quality of research design, hypotheses, protocols and outputs in an ample variety of fields." In this instance, a key indicator is existence/absence of knowledge on sex and gender in research field.
Impact dimension 1.1 Positions 1.2.1 Recruitment capacity 2.1 Work-life balance 2.2 Job satisfaction 2.3 Competitiveness/promotion and career 2.4 Workplace 5.4 Gender-sensitive research
Impact subdimension 1.1.1 Increased number of women in academic and other RTDI positions 1.1.2 Increased number of women in decision-making positions 1.2.1 Improved recruitment of talented women 2.1.1 Improved compatibility of family and career 2.2.1 Appropriate respect/recognition for (academic/scientific/leadership) work 2.2.2 Positive individual job rating 2.2.4 Allocation of workload 2.3.2 Strengthened confidence for promotion and responsible positions 2.4.1 Equal workspace/facilities allocation 5.4.2 Research quality: integration of a gender dimension/ perspective in research and content in research projects, patents, and agreements
Impact indicators short Horizontal/vertical segregation in positions Taken up leadership positions such as rector, associate professor, dean/associate dean, centre director, head of department, leader of research Composition of boards or committees Fairness of evaluation Modified duties in response to personal needs Share of entitled men and women using parental leave

Received personal and professional support from institution
Effect of data gathering on the application process
Transparent promotion system
Perception of people working in the area of R&I who believe they have equal opportunities to pursue their careers in comparison to men
Share of hours spent on research/teaching/other activities per sex
Received personal and professional support from institution
Access to necessary facilities and work space
Existence/absence of knowledge on sex and gender in research field

Conditions of effectiveness

Whilst GEPs are recognised as an essential tool for structural change, an EC-commissioned report acknowledges that a plan it itself is not sufficient – it identifies three essential conditions that need to be met to achieve institutional change (European Commission 2012b).

- Knowing the institution – collecting baseline data at the institutional level;
- Securing top-level support as a crucial component of effective implementation of institutional change; and
- Generating effective management practices – raising awareness and building gender competence of key decision-makers and human resource managers to understand how apparently gender-neutral processes like recruitment and advancement may disadvantage women and how subtle gender bias may be effectively counteracted.

Despite the need to demonstrate the impact of GEPs, institutional change is a slow process and until now has been difficult to document. For example, Sansonetti et al. (2017, 10) note that the lack of a detailed monitoring and evaluation process often makes assessing the effective impact of GEPs a difficult process.

Impact story 15

Impact story
Monitoring appointments, promotions, or attributions of tasks
Measure definition
Based on a concrete case (that of Copenhagen University), an impact story on monitoring appointments, promotions or attributions of tasks is described. For more than a decade, Copenhagen University (CU) has implemented consecutive programmes and initiatives with the objective of improving the gender balance in top research and leadership positions, one of which is described within this document – the Gender Equality (GE) Action Plan of 2008–2013 (Copenhagen University 2013a). The 2008 action plan was based on recommendations proposed by a taskforce mandated by the CU directorate at the time (Copenhagen University 2013b). The 2008 action plan reflected, in CU's own words, "a need to employ new measures in order to achieve the goal" and was, in many respects, a progressive, new step within the Danish university context. The measure consisted of a financial incentive structure which implied that if the faculties of theology, law and pharmacology recruited a female professor, they would be rewarded an additional professorship the following year. Further, if the faculties of arts and social sciences recruited two female professors each, they would be rewarded an additional professorship the following year, and if the faculties of science and health recruited three female professors each, they would be rewarded an additional professorship the following year (Copenhagen University 2013a). Furthermore, if the faculties managed to raise their share of women professors by five percentage points by the end of the duration of the action plan in 2013, they would be granted a financial bonus from a central fund specifically created for the purpose. They all managed to do so. The financial incentive initiative aimed to ensure and prolong managerial commitment to the GE agenda, based on the assumption that money is the strongest motivating factor for management (Copenhagen University 2013b). Research further stresses that ensuring a lasting commitment and actual progress with respect to improving the gender balance in top research and leadership positions within universities requires continuous monitoring and reporting (Nielsen et al. 2017). As such, the 2008 action plan stated that individual faculties were expected to establish target figures for their desired shares of women within top research and leadership positions, as well as develop individual GE actions plans taking their respective professional contexts into consideration. Progress was subsequently closely monitored by means of continuous reporting from faculty level to a central GE body. In practice, monitoring typically involves the collection of gender-segregated data on recruitment and promotions, which are submitted to a central monitoring body followed by information about how implemented interventions have contributed to the progress indicated by the data. Lack of progress may be followed by a reprimand or, in some cases, concrete sanctions until shortfalls are rectified (Cacace et al. 2016).
Goal
More women in research and development More women in research and development leadership Responsible research and innovation
Output

Immediate technical output of the CU monitoring scheme included the establishment of the central GE committee, which was responsible for monitoring progress at faculty level with respect to fulfilment of targets and objectives of gender equality action plans, i.e. appointments and promotions (Copenhagen University 2013b).
At faculty level, outputs included gathering gender-segregated data on recruitment and promotions, as well as developing and submitting written reports. Output of the financial incentives initiatives involves the establishment of a central pool from which funding for additional professorships and bonuses is rewarded to the faculties.

Output dimension

4.1 Gender equality challenges and barriers
4.2 Organisational/cultural change
4.3 Preferential treatment
4.4 Funding for structural transformation

Output subdimension

4.1.1 Decrease of GE barriers
4.2.1 Organisational/cultural change with regard to GE
4.3.1 Equal treatment
4.4.1 Increased funding to achieve structural transformation

Output indicators short

4.1.1 Integration of GE in KPIs
Gender monitoring/reporting in regular monitoring instruments
4.2.1 Establishment of gender equality structures and procedures
4.3.1 GE unit/committee in place
4.4.1 Budget spent on GE measures

Outcome

Outcomes of the financial incentives structure in combination with consistent progress monitoring ensure faculty managements' retained commitment towards increasing the number of female professors (Copenhagen University 2013b). In turn, increasing the number of female professors will improve diversity in positions of decision-making authority as well as professional seniority, which will balance out research team composition and increase the likelihood that gender and sex analysis may be included in research projects (Nielsen et al. 2017). Moreover, more female professors will serve as positive role models for younger female researchers. Finally, by employing a measure such as the financial incentives scheme and following up and monitoring appointments and promotions further sends a strong signal to internal as well as external stakeholders about the level of priority and significance attributed to issues of gender by CU.

Outcome dimension

1.1 Position
3.3 Awareness of/commitment to gender equality
4.1 Funding to improve gender equality in terms of female careers
4.2 Organisational change
5.3 Gender-sensitive research

Outcome subdimension

1.1.1 Increased number of women in academic and other RTDI positions
1.1.2 Increased number of women in decision-making positions

3.2.2 Improvement of network building and use 3.3.1 Increased gender awareness 4.1.1 Decrease of GE barriers 4.2.1 Organisational/cultural change with regard to GE 5.3.2 Research quality: integration of the gender dimension/perspective in research and content, in research projects, patents, and agreements 5.3.3 Making of contributions to strengthening gender-sensitive research
Outcome indicators short 1.1.1 Composition of academic positions per team Horizontal/vertical segregation in positions Number of newly appointed full professors (hired or promoted) 1.1.2 Taken up leadership positions such as rector, associate professor, dean/associate dean, centre director, head of department, leader of research 3.2.2 Share of women researchers who are considered as mentors 3.3.1 Perceived commitment of the university/institution to promote equality and diversity 4.1.1 Engagement of decision makers Sustainability of gender equality initiatives 4.2.1 General organisational consciousness and messages with symbolic value 5.3.2 Percentage of research projects including gender analysis/gender dimensions in the content of research 5.3.3 People/employees feel empowered making research more participatory, creative and inclusive
Impact Although universities, as key societal institutions, may be expected to reflect the diversity among the general population (Copenhagen University 2013a, 5), balancing women's representation among professors and university managers is not pursued due to ethical obligation alone. Rather, diversity is expected to positively impact research and education, because diverse norms, preferences and competencies are able to challenge taken-for-granted and self-evident assumptions and lead to synergies which may result in new discoveries (Nielsen et al. 2017). Finally, diversity is likely to attract talent and contribute to the creation of a better working environment that both women and men will find attractive, which, in turn, will increase employee satisfaction and individuals' professional development (Copenhagen University 2013b).
Impact dimension 2.2 Job satisfaction 4.2 Organisational/cultural change 5.1 Research outputs and impacts 5.3 Economic outputs and impacts (incl. entrepreneurships)
Impact subdimension 2.2.2 Positive individual job rating 2.2.3 Overall work climate 4.2.1 Organisational/cultural change with regard to GE 5.1.1 Scientific outputs 5.3.1 Economic impacts 5.3.2 Entrepreneurship

5.3.3 Strengthened framework conditions for R&I
Impact indicators short 2.2.2 Involvement in unit/team decision-making Perception of people working in the area of R&I in regard to gender equality, e.g. percentage of women in R&I, who believe they have equal opportunities to pursue their careers in comparison to men 2.2.3 Cultural/professional features of work environment Perceptions of work climate 4.2.1 General organisational consciousness and messages with symbolic value 5.1.1 New advanced capabilities, methods, systems, infrastructures and technologies New, altered or improved research tools and techniques, models and simulations 5.3.1 Research has included or fostered participation of all agents in the process of investigation 5.3.2 Percentage of research projects including gender analysis/gender dimensions in the content of research 5.3.3 Perception of rebalancing of power, especially in relation to women at national level
Conditions of effectiveness First, it must be noted that the two specific measures described in this story, financial incentives and monitoring, are merely two aspects of an entire programme consisting of a multitude of strategies and interventions, at university as well as faculty level, which in unison are expected to lead to the desired outcomes. For instance, ensuring broad job advertisements as well as requiring gender-balanced recruitment committees in combination with the financial incentives initiative and the follow-up process through monitoring recruitment and promotion and, lastly, progress reporting are more likely to deliver the intended results, than each measure on their own. From the above, it further follows that assessing and describing the impact of one or two out of a variety of interrelated and mutually supportive interventions is highly challenging as well as problematic. Second, in their action plan, CU describes no potential sanctions or consequences which the failure to live up to requirements may imply (Copenhagen University 2015). Lack of sanctions may give the impression that policy requirements are mere 'window-dressing' and should not be taken seriously and strictly followed. Third, gender-segregated statistical data on recruitment and promotion (i.e. 'counting people') is a method for monitoring output/outcome; i.e. tracking whether CU sees the intended increase in women in top positions. However, gender-segregated statistical data says nothing about, for instance, whether the organisational culture has been sufficiently transformed in order to also include and retain those women professors and leaders who are recruited or promoted, and to fully exploit and benefit from the talent and competencies which those women bring.

Fourth, CU's 2008 action plan and its financial incentives constituted a radical and, at the time, hitherto unseen initiative within the Danish context, which caused significant controversy and debate within the Danish academia as well as in the general public (Bonde & Ravnkilde 2015a; Copenhagen University 2013a, 13). Although the incentive structure successfully achieved the intended effect on the representation of female professors (Copenhagen University 2013a, 2), CU decided to abolish the financial incentives initiative in the action plan of 2015 which succeeded that of 2008 (Copenhagen University 2015), perhaps due to negative publicity caused by critics of affirmative GE interventions. That the financial incentives initiative ended up being a 'one-hit wonder' is problematic, since research suggests that organisations are more likely to experience the positive impacts associated with diversity (see 'Impacts' above) if interventions and initiatives installed with the objective of improving diversity among staff are strongly anchored within long-term strategic and values-based management (Danish Research and Innovation Authorities 2007).

Impact story 16

Impact story Definition of targets regarding gender balance in decision-making positions, in particular as to mobility of researchers (case VINNMER)
Measure definition Based on a concrete case, the VINNMER programme in Sweden, an impact story on mobility is presented. Mobility allows young researchers to grow professionally, by experiencing and learning from new and different academic environments, their cultures and work methods. A long stay abroad and the international network which it fosters, is a prerequisite to achieving a career as a researcher and, ultimately, a leader within academia. However, requirements of international mobility typically coincide with the time of people's lives during which they start a family. In families with small children, stability and job security are highly needed, and such considerations may weigh more heavily in the minds of women researchers than men (Jöns 2011). Other obstacles to female researchers' international mobility include the strain of absence on the spouse's or partner's career and financial concerns, for instance, if the spouse is the main 'breadwinner' (Danish Ministry of Higher Education and Science 2015). Although male researchers are also increasingly limited with respect to international mobility due to dual-career relationships, traditional gender roles and gendered patterns of distribution of home and family responsibilities still constitute greater constraints upon women's mobility than they seem to do upon that of men (Jöns 2011). Therefore, the VINNMER programme operates by financially bolstering opportunities for women's leadership qualification through increased national (e.g. university-private sector research collaboration) and international mobility for women in research fields of strategic importance to Sweden. The programme concerns both Swedish out-bound researchers and non-Swedish researchers coming to Swedish research institutions. VINNOVA covers half the salary of the researcher while the sending and/or receiving research institution is expected to cover the remainder. VINNOVA also reimburses the expenses associated with any accompanying family. The background for the initiative, at the time of its inception, was that a lot of senior researchers were retiring, within the coming years, which provided the opportunity to improve the gender balance and creating organisational change through the entry of a new generation of researchers (VINNMER 2007d).
Goal More women in research and development (R&D) More women in R&D leadership Responsible research and innovation
Output The VINNMER programme's direct output includes an increase in the availability of funding for research mobility that explicitly targets women, which is likely to encourage more women to apply, thereby enabling more women to go on research stays abroad and at other research organisations within Sweden. Other direct output consists of female researchers' strengthened perception of their own chances of progressing in their research careers, incl. occupying leadership positions, due to better opportunities of qualification through research mobility.
Output dimension 2.3 Competitiveness/promotion and career

3.1 Leadership 3.4 Funding to promote GE in terms of female careers 4.1 Gender equality challenges/barriers
Output subdimension 2.3.2 Strengthened confidence for promotion and responsible positions 2.3.3 Improved support to advance research career 3.1.1 Increased confidence and ability of leadership roles 3.4.1 Increased funding to promote GE 4.1.1 Decrease GE barriers 3.2.1 Increased professional development of work skills (for career success)
Output indicators short 2.3.2 Gender-specific research funding programme in place 2.3.3 Perception of own improvement of profession 3.1.1 Attractiveness and personal motives to take up leadership positions 3.4.1 Grants for early career development Proportion of women receiving a grant 4.1.1 Percentage of women taking part in research mobility programmes 4.3.1 Perception of likelihood of male/female success in academia 3.2.1 Perceived challenges to get a scientific position Confidence in and preparedness for long- and short term goals/path
Outcome Long international research stays abroad are expected to benefit both home and host research institutions by ensuring collaboration, knowledge transfer and sharing (Jöns 2011). More specifically, outcomes of research stays ideally include concrete publications, networking, participation in conferences, as well as strengthened leadership capabilities, which are assumed to promote women's qualification routes whereby research career progression is fostered (VINNMER 2007c).
Outcome dimension 3.1 Leadership 5.1 Innovation and innovative approaches 5.5 Responsible research and innovation
Outcome subdimension 3.1.1 Increased confidence and ability for leadership roles 5.1.1 Research priorities and outcomes in terms of GE 5.1.2 Networks 5.5.6 RRI
Outcome indicators short 3.1 Ability to apply and exercise learned leadership skills Strength of identification as a female leader 5.1.1 Number of publications in peer-reviewed high impact journals Conferences/workshops papers and proceedings 5.1.2 Cross-country (also beyond EU) and cross-disciplinary research and innovation networks (incl. SMEs) 5.5.6 Number of collaborative RRI projects
Impact

VINNMER is part of the VINNOVA project which “regards the financing of needs-driven R&D as an investment which, in the long run, will promote sustainable growth in Sweden” (VINNMER 2007a, 2). VINNOVA promotes research leadership qualification for people running needs-driven research within VINNOVA’s fields of activity, which is being conducted in collaboration between academia, industry and/or the public sector (VINNMER 2007c). The VINNMER programme’s long-term impact resides in the presence of significantly more qualified individuals who can become future leaders of RPOs, which will result in“generational changes in Swedish research” (VINNMER 2007c, 3). Subsequently, increasing the representation of women in leadership is likely to improve research performance through, among other things, enhanced problem-solving (Woolley et al. 2010), employee well-being (Hunt 2015), innovation (Börjeson & Nielsen 2016), provided that women achieve a critical mass within the leadership team (Cain & Leahey 2014).
Impact dimension 1.1 Positions 3.1 Leadership 4.1 Gender equality challenges/barriers 5.1 Innovation and innovative approaches 5.2 Innovation outputs and impacts (incl. technological impacts) 5.5 Responsible research and innovation
Impact subdimension 1.1.2 Increased number of women in decision-making positions 3.1.1 Increased confidence and ability for leadership roles 4.1.1 Decrease of GE barriers 5.1.2 Networks 5.2.2 Diffusion of innovation in products, services, processes 5.5.6 RRI
Impact indicators short 1.1.2 Taken up leadership positions such as rector, associate professor, dean/associate dean, centre director, head of department, leader of research 3.1.1 Women with leadership positions 4.1.1 Acknowledgement of gender issues Acceptance of cultural change 5.1.2 Cross-country (also beyond EU) and cross-disciplinary research and innovation networks (incl. SMEs) 5.2.2 All forms of innovation that enable the transition to more sustainable economies fostered incl. through digital systems Improved cost-effectiveness and sustainability of solutions Improved sustainability across the entire product-service lifecycle 5.5.6 Number of collaborative RRI projects
Conditions of effectiveness

Women's unequal participation in international research stays starts in the gendered structural disadvantages of the academic system experienced by women researchers (Jöns 2011), in terms of biases and expectations concerning scientific productivity as well as household tasks, etc. As such, gender inequality in international mobility cannot be discussed or addressed independently from the manifestations and causes of other gender inequalities in research as well as in the private sphere (Jöns 2011). For instance, at earlier career stages, female scholars appear to be very mobile and later in their careers less so, with both life periods being conditioned by their private circumstances (Jöns 2011) as unmarried scholars generally are more mobile than their married counterparts (Leeman 2010).

Furthermore, the problem of women's unequal participation in international mobility is circular, as a prerequisite for increasing the share of young female researchers who go on research stays abroad is to increase the number of female host professors. At the same time, increasing the number of young female researchers who go on research stays abroad will contribute to increasing the number of female professors who may become hosts in the future. In addition, increasing the number of female host professors might not only improve the share of female visiting scholars but also improve the experience of the visiting female scholars, based on the assumption of shared experiences and mutual understanding between women (as opposed to between men and women) (Jöns 2011).

In terms of practicalities, a successful international mobility scheme requires taking care of the families of researchers, i.e. ensuring accommodation and childcare and finding employment for the partner, at the destination as well as upon return, all of which requires significant financial resources and administrative assistance. If the host research organisation does not have an 'international office' to assist incoming researchers with visas, permits, accommodation and more, the home organisation (or the funding agency) of the researcher should step in (Leeman 2010).

Impact story 17

Impact story Empowerment schemes – preferential funding allocation
Measure definition Based on a concrete case, the YDUN programme in Denmark, an impact story on empowerment is presented. A significant strand of research suggests 1) the existence of gender biases in research funding allocation processes, 2) gender differences in success rates when applying for research funding in favour of men, and 3) differences in behaviour of male and female funding applicants. For instance, women apply and re-apply for funding less often than men, women target less prestigious funding agencies than men, the research projects with which women apply have shorter durations than those of men, and women apply for smaller amounts of funding than men (European Commission 2009a). Therefore, in 2013–2014, the Independent Research Foundation Denmark (DFF) awarded DKK 110 mln, approximately 10 % of its yearly budget, to 17 female researchers as part of the YDUN programme. Both women and men could apply, but in case of candidates with equal qualifications, women would be favoured (DFF 2014). It should be noted that there is limited information available about the YDUN programme, describing its concrete output and outcomes. This lack of explicit intended output and outcomes may be explained with reference to prevailing Danish political discourses on GE. In Denmark, the lack of acknowledgement of gender discimination operating on the structural, institutional or cultural level means that YDUN is justified from an optimal use of talent perspective and is a relatively isolated intervention. The only legitimate argument for realising a programme like YDUN seems to be the wish to improve use of 'talent' (Nielsen 2014). Obviously, assuming that gender discrimination does not occur, changing the mechanisms and dynamics causing discrimination, which would have been explained as intended output and outcomes, becomes superfluous. As such, stand-alone initiatives such as YDUN have the odds of success against them, because lack of expected output and outcomes implies abstaining from tackling those inequality mechanisms which make the programme necessary to begin with. YDUN was a welcome attempt to widen Denmark's talent pool, but it managed to level the playing field for only one year, and only for the DFF (Watson & Hjorth 2015). YDUN may successfully support the careers of those specific individual researchers who were awarded grants; however, its contribution to achieving the intended impact (the strengthening of talent exploitation in Danish research by improving the gender balance in research environments) is likely limited as the problems causing imbalance remain.
Goal More women in research and development (R&D) More women in R&D leadership Responsible research and innovation Integrating gender into research content
Output The YDUN programme's direct output includes a revised gender-sensitive grant allocation process and an increase in the availability of funding which explicitly targets women and thus gender equality. As female applicants would be favoured over male, it is likely to assume that the intention of DFF was to encourage more women to apply.

Although this is not described anywhere, the argument for having a preference for women probably was an attempt to introduce a grant in which the risk of gender biases against women in the grant allocation process would be ruled out. From a qualitative point of view, direct output might consist in female researchers' increased confidence in their chances of being awarded funding, and thus a strengthened perception of their own chances of progressing in their research careers.
Output dimension 2.3 Competitiveness/promotion and career 3.4 Funding to promote GE in terms of female careers 4.1 Gender equality challenges/barriers
Output subdimension 2.3.2 Strengthened confidence for promotion and responsible positions 3.4.1 Increased funding to promote GE 4.1.1 Decreased GE barriers 3.2.1 Increased professional development of work skills (for career success)
Output indicators short 2.3.2 Gender-specific research funding programme in place 3.4.1 Grants for early career development Reasons for potential applicants not to apply/to apply for funding Proportion of women receiving a grant 4.1.1 Acknowledgement of gender issues 4.3.1 Perception of likelihood of male/female success in academia 3.2.1 Perceived challenges to get a scientific position Confidence and preparedness in long-and short term goals/path
Outcome Furthermore, DFF states that YDUN intended to motivate more women to take on the role as research project leaders in their proposals, this way improving leadership skills and increasing women's representation within decision-making positions. An additional outcome lies in the creation of more women role models, the presence of which is assumed to encourage and inspire other young female researchers to aspire towards successful scientific careers and leadership responsibility.
Outcome dimension 1.1 Positions 5.5 Gender equality 2.3 Competitiveness/promotion and career 3.1 Leadership
Outcome subdimension 1.1.2 Increased number of women in decision-making 2.3.2 Strengthened confidence for promotion and responsible positions 5.5.1 Gender equality 3.1.1 Increased confidence and ability of leadership roles
Outcome indicators short 1.1.2 Increase in leadership positions by women who participated in the programme 5.5.1 Percentage of women that are principal investigators on a project 3.1.1 Contribution to the participant's self-perception as a primary investigator/project leader

Ability to apply and exercise learned leadership skills Strength of identification as a female leader 2.3.2. Confidence in own ability
Impact According to the YDUN funding call, the impact of the programme consists of strengthening talent exploitation in Danish research by improving the gender balance in research environments (DFF 2013a; 2013b; 2014). YDUN may have contributed to ensuring this aim in more ways than allocating grants to women, since the YDUN evaluation further points to how the programme motivated more women than previously to apply for subsequent DFF research projects (with no gender preferences) in the autumn of 2014 (Damvad Analytics 2015). Moreover, such schemes have a direct impact on publication outcomes and the inclusion of the gender dimension in research activities (Nielsen et al. 2017).
Impact dimension 1.1 Positions 5.1 Innovation and innovation approaches 5.4 Gender-sensitive research
Impact subdimension 1.1.1 Increased number of women in academic and other RTDI positions 5.1.1 Scientific output 5.4.1 Achieved gender equality in research process 5.4.2 Research quality: integration of the gender dimension/perspective in research and content, in research projects, patents, and agreements
Impact indicators short 5.4.1 Gender balance in research team/re-search team composition Number of projects lead by women Research has included or fostered participation of all agents in the process of investigation 5.4.2 Percentage of research projects including gender analysis/gender dimensions in the content of research 1.1.1 Horizontal/vertical segregation in positions 5.1.1 Number of publications in peer-reviewed high impact journals Percentage of women that are first authors of research papers New, altered or improved research tools and techniques, models and simulation New advanced capabilities, methods, systems, infrastructures and technologies
Conditions of effectiveness First, preferential funding allocation based on gender is illegal in Denmark (Danish Act on Gender Equality); therefore, to realise the YDUN programme, exemption from the legal requirements had to be sought and granted (DFF 2013a; 2013b; 2014). Second, preferential funding allocation may have different consequences for the grant takers. For instance, applicants describe unusually high levels of pressure from superiors to apply, creating competition between colleagues (Damvad Analytics 2015). According to the literature, successful grant recipients may later experience an adverse “Mathew effect”, i.e. a claim on their time and skills from many sides, as high-ranking members of a minority group, which makes it hard to sustain high research activity levels in the long run (European Commision 2009, 13).

Furthermore, since preferential funding allocation clashes with assumption of 'academic meritocracy' and 'fair competition', grant takers risk facing backlash in the research environment (stigmatisation), i.e. comments or allusions e.g. that the recipients were awarded the funding on unfair terms, one gender being excluded from consideration, thereby stating that these female researchers would not have been successful in 'ordinary' funding calls (Nielsen 2014). However, according to the evaluation, most YDUN funding recipients avoided such backlash, since many applied and competition was fierce, and were thus generally met with encouragement and praise. Nevertheless, the YDUN programme caused significant outrage and controversy in public debate (e.g. Bonde & Ravnkilde 2015b). DFF chairman Peter Munch Christiansen even declared that "DFF will never try an initiative like YDUN again" (quoted by Watson & Hjort 2015).

Following the typology introduced by Benschop and Verloo (2012) and Benschop and van den Brink (2014), preferential funding allocation may be categorised as a 'radical' gender equality initiative. Being radical implies that its implementation into a very gender unequal organisation (or, in this case, institution), which, in a sense, is not prepared to accept and recognise the necessity of a radical intervention, will result in counter-optimal effects, incl. strong resistance and backlash (Benschop & van den Brink 2014).

Annex V. Smart practice examples

Programme	GE measure	Source
Advance IT	Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (ADVANCE) founded by NSF. The programme has three tracks with distinct purposes, but the evaluation at hand focus on the Institutional Transformation (IT) track.	Laursen et al. (2015)
AKKA – Akademiska Kollegors Ansvar (Academic Colleagues' Responsibility)	AKKA is a gender-integrated leadership programme at Lund University. The programme started in 2004 and is still running every second year (AKKA I, II, III, IV and V).	Lövkrona & Widén (2012)
Athena SWAN	The Athena SWAN Charter award scheme operates by allocating Gold (significant sustained progress and achievement), Silver (significant record of achievement and progress) and Bronze (solid foundation of policies and practices to eliminate gender bias and an inclusive culture that values female staff) awards at both institutional and departmental level twice per year. Furthermore, it provides workshops, guidance and opportunities to share effective practices via its website. Any (mainly UK-based) HEI that is committed to the advancement of careers of women in STEMM can become a member of the Charter.	Munir et al. (2013)
Earth Science Women's Network (ESWN)	It is a women-only grassroots organisation intended to contribute to the mentoring of women in the atmospheric sciences. The ESWN was established in 2002 and grew to international membership of over 2 000 women in Earth sciences, spanning more than 50 countries (2015). The actual activities of ESWN are mainly 1) an online forum and electronic network, 2) in-person networking events at national meetings and workshops (1–3 hours), 3) intensive professional development workshops (1–3 days); 4) and informal meal or get-together events.	Archie & Laursen (2013)
Leadership Development for Women (LDW)	The programme creates different learning spaces which include interactive workshops, individual readings, mentoring, and peer support groups. The Charles Sturt University's LDW programme has three broad learning components: 1) The core workshop programme consists of an initial four–day workshop, a two-day leadership skill development workshop mid-year, and a one-day workshop at the end of the year. Participants	Davidson (2013)

	are directed to a set of readings which are referred to in the workshops. 2) Self-learning peer groups which select their own learning goal and strategy. 3) Mentor relationship where participants are able to identify their preferred mentor, and every effort is made to match to the participant's preference.	
Leadership Education for Advancement and Promotion (LEAP)	LEAP's main goal is the advancement of female faculty in STEM; the LEAP components were also offered to men and non-STEM faculty members.	Hassi & Laursen (2008)
University of Michigan (UM)	The evaluation focuses on one of UM ADVANCE Project's interventions: the creation of a faculty committee called Science and Technology Recruiting to Improve Diversity and Excellence (STRIDE), which was designed to improve the recruitment and hiring of women through a process of peer education conducted by senior science and engineering faculty members.	Stewart et al. (2004)
Higher education in the Netherlands (NL)	The study is a meta-evaluation analysing the effect of all gender equality measures implemented within higher education in the Netherlands during the period 2000–2007. It identified 29 different GE policy measures in official documents obtained from 14 universities. The measures were classified either as applying an individual, cultural or structural perspective. However, through surveys and conducting interviews with 27 HR staff members across the universities, it was only sufficiently evident that 19 measures were actually implemented.	Timmers et al. (2010)
New Zealand Women in Leadership (NZWIL)	The programme was designed by women for women, consisting of 20 participants per cohort from the eight universities of New Zealand. The target population is women at upper-middle levels in universities in academic and general staff positions and catered for women who are in, or aspire to be in, leadership positions. It provides opportunities for participants to examine leadership attributes and reflect on strategies; increase knowledge of a range of management competencies relevant to higher education, the tertiary education sector, and of the research funding environment to develop strategies for securing grants; and build personal and national networks.	Harris & Leberman (2011)
Rice University	Rice University in Texas has for two decades implemented several gender equality initiatives and evaluated those continuously. In 2006, it received a five-year National Science Foundation-funded ADVANCE Institutional Transformation grant. This programme both sustained and extended the existing initiatives as well as established new ones.	O'Brien et al. (2015)

Stanford University	Establishment of the McCormick Faculty Awards to provide women assistant professors with funding for protected time to pursue research. Three awards of USD 60 000 for two years are made each year. A total of 12 awards were given out during 2006–2010, serving approximately 8 % of women assistant professors.	Valantine et al. (2014)
Toolkit for Advance IT	Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (ADVANCE) founded by NSF. The programme has three tracks with distinct purposes, but the evaluation at hand focuses on the Institutional Transformation (IT) track.	Frehill et al. (2005)
Leadership development programme for women at Uppsala University	The programme consists of 2 two-days off-site workshops, a number of full-day seminars, individual coaching, and subsequently a mentor platform. In the period covered by the evaluation, 55 women have participated in and completed the programme.	Neu Morén (2012)
VINNMER programme	The measure operates by financially bolstering opportunities for researcher qualification through increased national and international mobility for women in fields of strategic importance to Sweden.	Anaya-Carlsson (2012)
Younger women devoted to a university career (YDUN)	The actual implementation of the measure took the form of 17 research grants of maximum 4 years of length and up to DKK 4.5 million. YDUN's main objective was to support women, but men were also allowed to apply. However, only women were awarded grants.	Damvad Analytics (2015)
Gender in EU-funded research: Toolkit and training	The toolkit and training, commissioned by the European Commission, build capacity for integrating gender perspectives into research and for exploring ways to promote GE in R&I. The toolkit and training sessions provide practical tools to integrate gender perspectives, including equal opportunities for women and men researchers in project teams and gender sensitivity to R&I. The toolkit examines the link between gender-conscious research content and research excellence and analyses case studies based on concrete examples drawn from nine specific research fields at DG Research and Innovation: health; food, agriculture and biotechnology; nanosciences, materials and new production technologies; energy; environment; transport; socioeconomic sciences and humanities; science in society; and specific activities of international cooperation.	Yellow Window Management Consultants (2017) UAB & EGERA (2016)
Laura Bassi Centres of	The Laura Bassi Centres of Expertise (LBC) programme, commissioned by the Federal Ministry of Science, Research and Economy, establishes centres of excellence at the interface	Heckl & Dörflinger (2014)

Expertise (LBC) programme	between academic and industrial research under the leadership of female scientists and seeks to increase visibility of female accomplishments in science as well as increase female participation in the long run. The development and implementation of the programme was a response to the low number of female directors of research centres focused on applied science research in cooperative research fields.	
Programmes for Advancing Women's Leadership in Medical Schools	The University of Pennsylvania increased recruitment of women physicians by including information about the University's broad goals and public health mission in job descriptions, as well as providing information about the University's family-friendly policies (such as daycare facilities and mentoring programmes) in "resource packets" for both women and men applicants. This strategy tripled the representation of women in surgery over eight years.	Sheridan et al. (2010) Morton et al. (2008)
Promotion of research and teaching on gender issues at the University of Milan	Courses on Gender Medicine for students at the Faculty of Medicine were organised. A pilot course at the Policlinico Hospital Unit was replicated and extended to include the San Paolo and the Sacco Hospitals. A number of professors and researchers involved as teachers in the courses included a gender medicine perspective in their own courses.	Cacace et al. (2015)
Database of Women Scientists	The Centre of Excellence Women and Science (CEWS) in Germany has created a database that contains the contact information of several thousand German-speaking women scientists for research and management positions.	GESIS (n.d.)

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